



Operating instructions

Thermowells for thermometers

P9 000002R/01/05.16

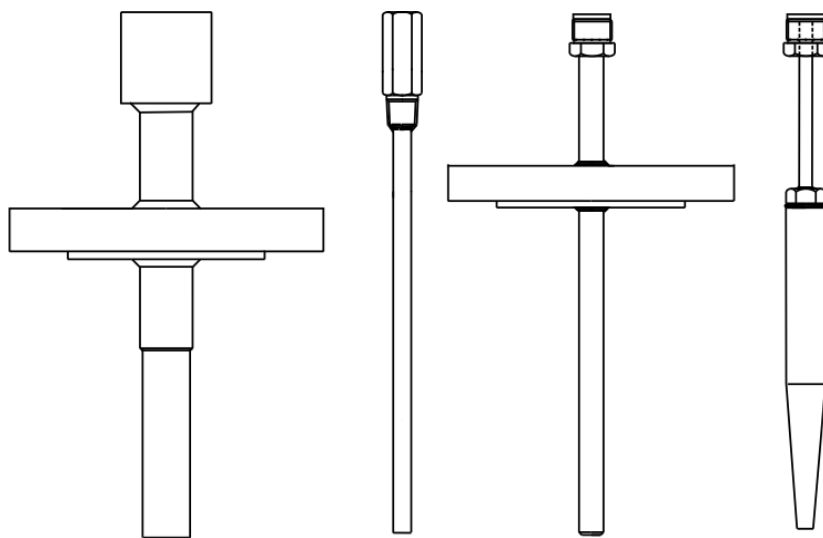


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1 Scope and benefits

1.1 Scope

Thermowells are used for the following purposes:

- To protect thermometers from mechanical and chemical influences of the processes.
- To protect thermometers from influences of pressure in pipelines, reactors and tanks.

1.2 Benefits

- Thermowells are made from bar stock and from pipe.
- Process connection can be threaded, flanged, welded and clamp.
- Thermowells are made of different materials that provide corrosion resistance in any of the process.
- Possibility of calibration, repair and maintenance of thermometer without stopping of the process.

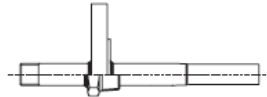
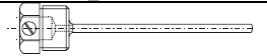
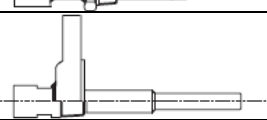
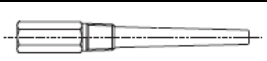
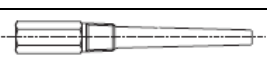
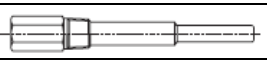
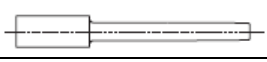
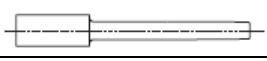
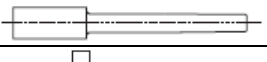
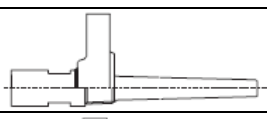
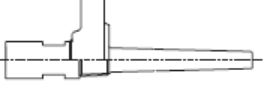
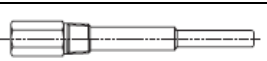
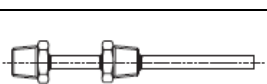
2 Construction

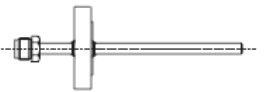
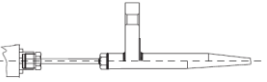
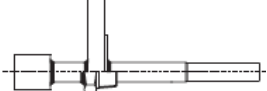
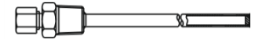
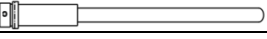
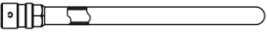
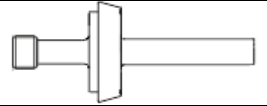
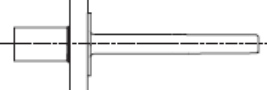
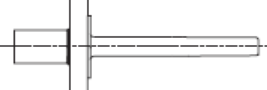
2.1 General information

Endress+Hauser offers a complete range of standardized thermowells. Its construction covers a very large amount of industrial standards as DIN, Dow Chemical, Du Pont, ENI, etc.

Two different types of thermowell construction are available: from drilled bar stock and from pipe.

Herein you can find general information about thermowells.

Thermowell model		Type	Material ¹	Process connection	max. process pressure, MPa ²
TA541		Welded extension pipe	AISI 316, 316L, A105, 446	Flange DN 25; 50	10
TA414			AISI 316Ti	Thread G1/2"	1
TA540			AISI 316, 316L, A105, 446	Flange DN 25; 50	10
TA556		Bar stock	AISI 316, 316L	Flange DN 25; 50	30
TA560			AISI 304, 316, 316L, 316Ti	Thread 3/4"NPT	30
TA565			AISI 316, 316L, 316Ti	Thread 1"NPT	30
TA566				Thread 1"NPT	30
TA570			AISI 316, 316L, 316Ti, 321	Socket weld-in	30
TA571					30
TA572					30
TA575			AISI 316, 316L, 316Ti, A105	Flange DN 25; 50	10
TA576				Flange DN 25; 50	30
TA535		Welded extension pipe	AISI 316L	Threads 1/2", 3/4"	7,5
TA550		Bar stock	AISI 316, 316L	Flange DN 25; 50	30
TA555				Flange DN 25; 50	30
TA557				Flange DN 25; 50	30
TA562			AISI 316, 316L, 316Ti	Threads 1/2", 3/4"	30
TW10		Welded extension pipe	AISI 316L, 316Ti, Hastelloy C	Threads 1/2", 3/4"	7,5

TW11		Welded extension pipe	AISI 316L, 316Ti	Threads 1/2", 3/4"	7,5
TW12				Compression fitting	4
TW13			AISI 316L, 316Ti, Hastelloy C276, Inconel 600, PTFE, PVDF, Tantalum	Flange DN 25; 50	7,5
TW15			AISI 316Ti, A182, A105, Hastelloy C276, Titanium, Duplex SAF2205, 1.5415, 1.7380	Flange DN 25; 50	30
TW45			AISI 316L	Hygienic adapters up to 2"	4
TW47		Bar stock		Socket weld-in	4
MLTWS01		Welded extension pipe	AISI 316Ti	Flange DN 25	6,3
TW251			AISI 316L	Socket weld-in, Threads 1/4", 1/2"	5
TWF11			AISI 316L, 310, 304, 446, Inconel 600, 601, Incoloy 800, Hastelloy X, Kanthal AF, сплав NiCO, керамические материалы: C610, SiC сплав, Kanthal Super, SiN сплав	Compression fitting	0,5
TWF16					0,5
TT411		Welded extension pipe / Bar stock	AISI 316L, 1.4435+316L	Hygienic adapters up to 2"	0,1
TT511		Bar stock	AISI 316, A105, 316Ti	Flange DN 25; 50	0,1
TTSP-WT****		Special version, any construction	Any of materials	Any of connections	Any of pressure

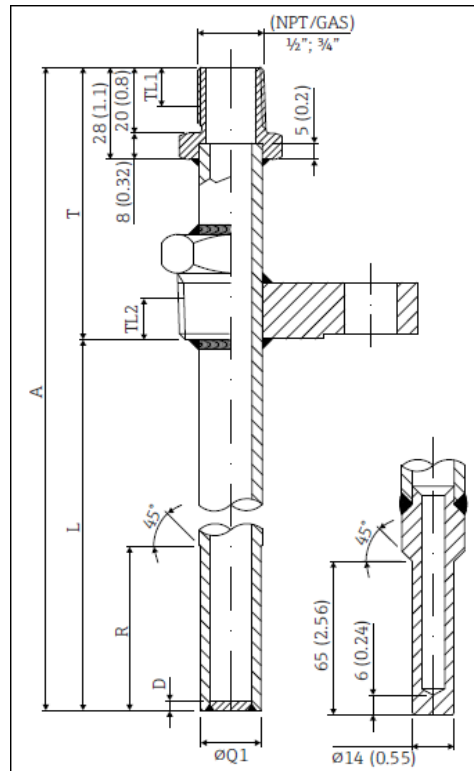
¹ – depends of ordercode, for special version can be different² – depends of ordercode

2.2 Process temperature range

Process temperature range depends of thermowell material, herein you can find maximum process temperature ranges:

Thermowell material	Max. process temperature, C
AISI 316	650
AISI 316Ti	700
AISI 316L	650
AISI 321	650
AISI 446	1100
A105 (C22.8)	450
Hastelloy C276	1100
Inconel 600	1100
Tantalum	250
PTFE	200
PVDF	280
Titanium	600
Duplex SAF2205	300
1.5415	530
1.7380	550
AISI 304	850
AISI 310	1100
Inconel 601	1200
Incoloy 800	1100
Hastelloy X	1100
Kanthal AF	1300
NiCo	1200
SiC	1650
Kanthal Super	1700
SiN	1400
C530	1400
C610	1500
C799	1800

2.3 Mechanical construction of TA541

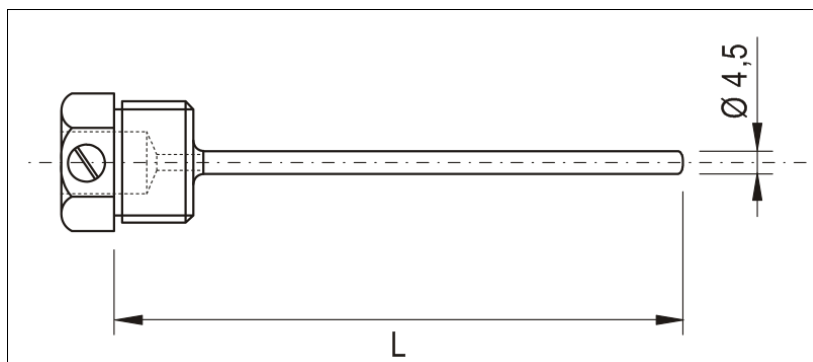


Pic. 1 – thermowell TA541 – dimensions in mm (in)

Position	Description		
A	Total length ($A=T+L$)		
L	Immersion length		
øQ1	Diameter protection tube tip		
R	Length of protection tube tip		
T	Extension		
D	Bottom thickness		
TL1	Thread length for thread connection on thermometer	Length in mm	Thread
		20	G $\frac{1}{2}$ ", G $\frac{3}{4}$ "
		8	$\frac{1}{2}$ " NPT
		8,5	$\frac{3}{4}$ " NPT
TL2	Thread length for thread connection on process	Length in mm	Thread
		8,5	$\frac{3}{4}$ " NPT
		10	1" NPT
		10,5	1 $\frac{1}{2}$ "NPT

Thermowell TA541 is made from pipe with bottom thickness 5 mm, outer diameter 13,7mm, 21,34mm or 26,67mm (depends of ordercode), threaded or flanged process connections.

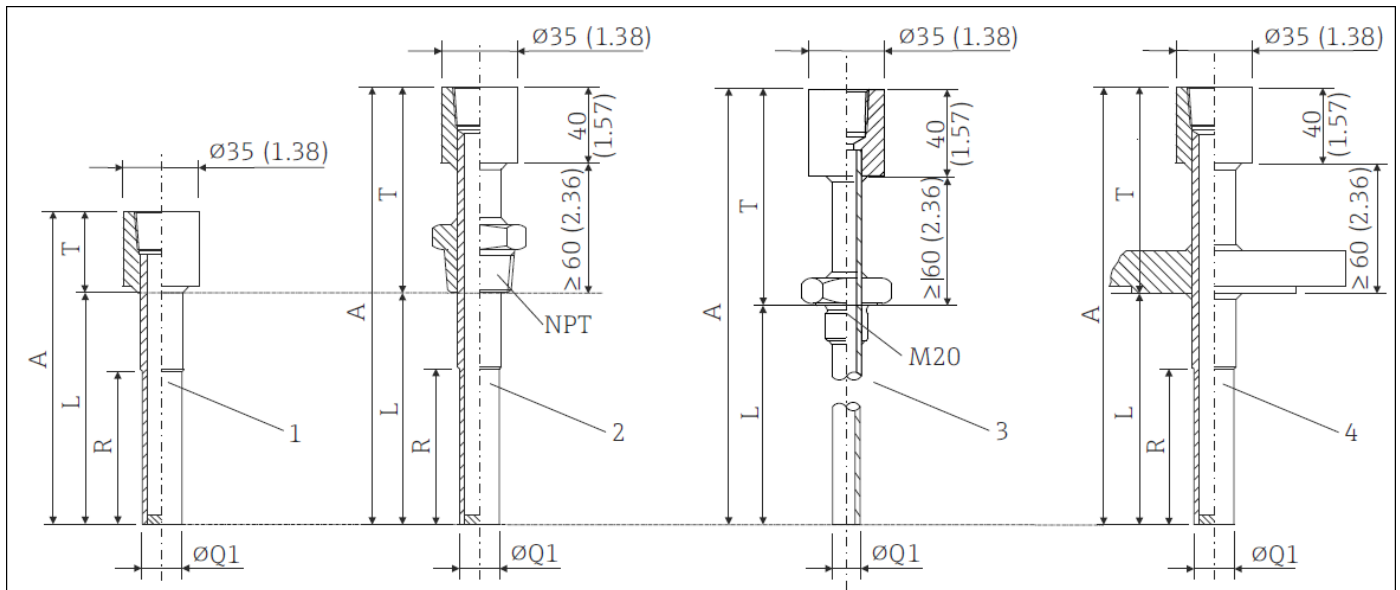
2.4 Mechanical construction of TA414



*Pic.2 – thermowell TA414 – dimensions in mm
L – immersion length*

Thermowell TA414 is made from pipe with bottom thickness 3 mm, outer diameter 4,5mm, threaded process connections, thermowell is used for thermometers with diameter of measuring insert 3 mm.

2.5 Mechanical construction of TA540



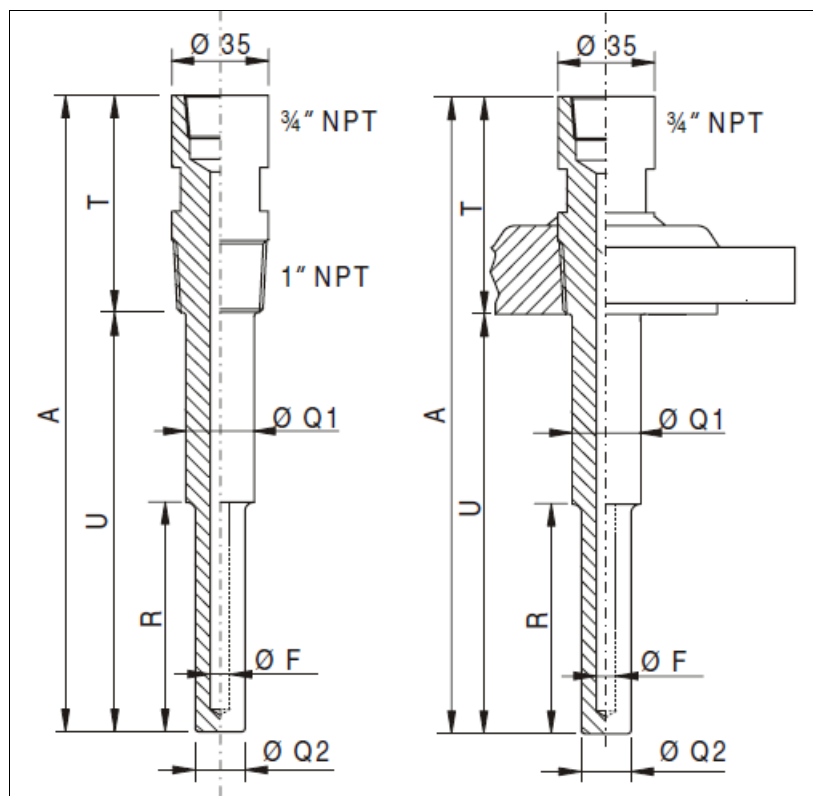
Pic. 3 – thermowell TA540 – dimensions in mm (in)

- 1 without process connection
- 2 thread NPT
- 3 thread M20
- 4 flanged process connection

Position	Description
A	Total length ($A=T+L$)
L	Immersion length
ØQ1	Diameter protection tube tip
R	Length of protection tube tip
T	Extension

Thermowell TA540 is made from pipe with bottom thickness 5 mm, outer diameter 13,7mm, 21,34mm or 26,67mm (depends of ordercode), threaded or flanged process connections.

2.6 Mechanical construction of TA556

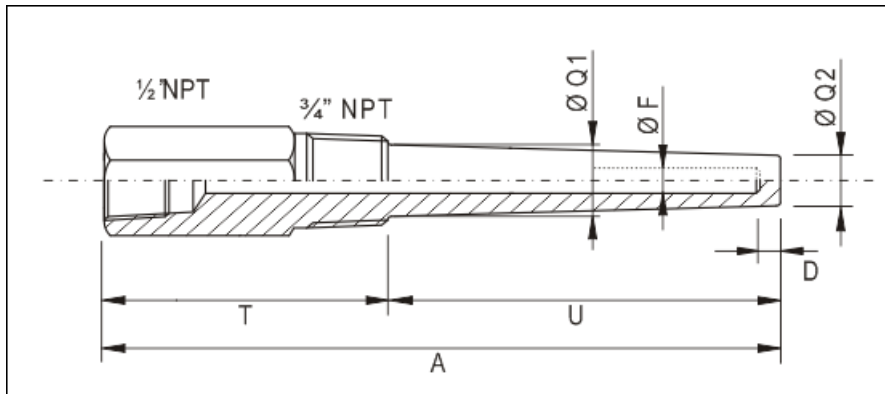


Pic. 4 – thermowell TA556 - dimensions in mm (in)

Position	Description
A	Total length ($A=T+U$)
U	Immersion length
øQ1	Outer diameter
øQ2	Diameter protection tube tip
R	Length of protection tube tip
T	Extension
øF	Bore diameter

Thermowell TA556 is made from round bar stock (drilled) with bore diameter 10 mm or 14mm (special version for other diameters), cylindrical form with straight or tapered bottom shape, threaded or flanged process connections.

2.7 Mechanical construction of TA560

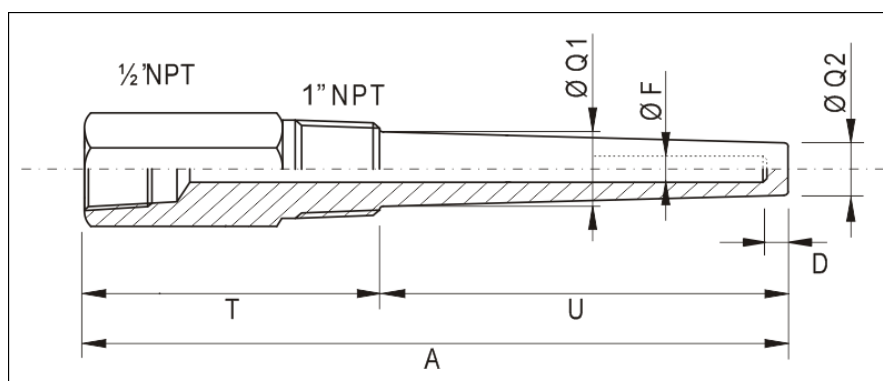


Pic. 5 – thermowell TA560

Position	Description
A	Total length ($A=T+U$)
U	Immersion length
$\varnothing Q1$	Outer diameter
$\varnothing Q2$	Diameter protection tube tip
T	Extension
$\varnothing F$	Bore diameter
D	Bottom thickness

Thermowell TA560 is made from round bar stock (drilled) with bore diameter 6.5 mm or 10 mm (special version for other diameters), cylindrical form with straight or tapered bottom shape, threaded process and thermometer connections.

2.8 Mechanical construction of TA565

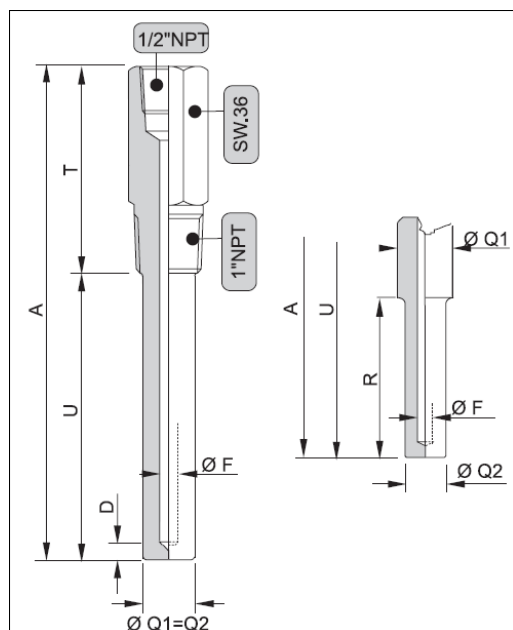


Pic. 6 – thermowell TA565

Position	Description
A	Total length ($A=T+U$)
U	Immersion length
$\varnothing Q1$	Outer diameter
$\varnothing Q2$	Diameter protection tube tip
T	Extension
$\varnothing F$	Bore diameter
D	Bottom thickness

Thermowell TA565 is made from round bar stock (drilled) with bore diameter 6.5 mm or 10 mm (special version for other diameters), cylindrical form with straight or tapered bottom shape, threaded process and thermometer connections.

2.9 Mechanical construction of TA566

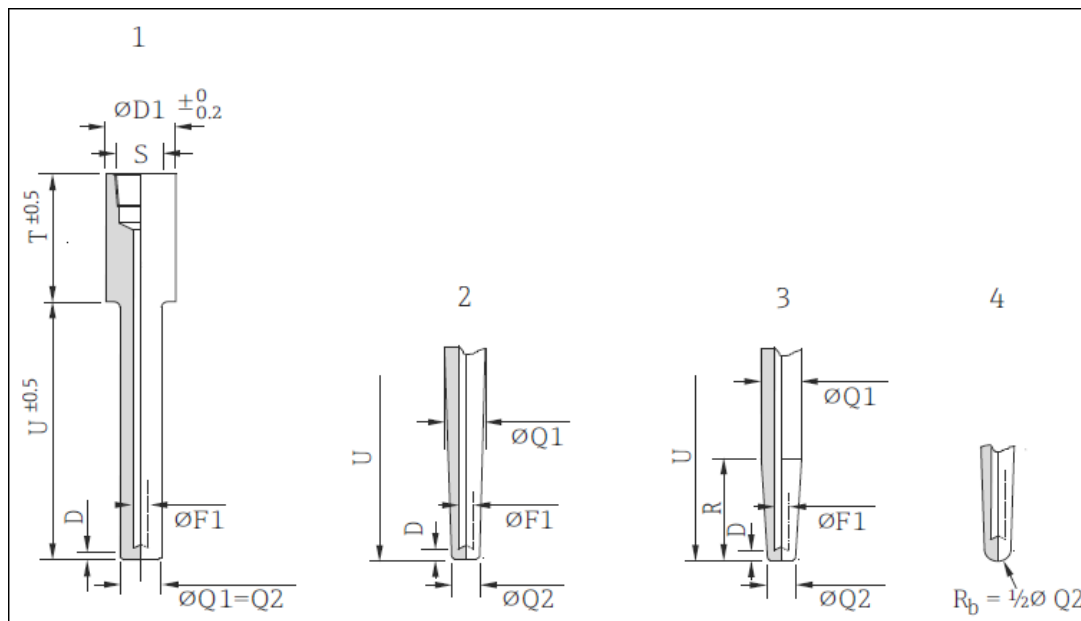


Pic. 7- thermowell TA566

Position	Description
A	Total length ($A=T+U$)
U	Immersion length
$\varnothing Q1$	Outer diameter
$\varnothing Q2$	Diameter protection tube tip
T	Extension
$\varnothing F$	Bore diameter
D	Bottom thickness
R	Length of protection tube tip

Thermowell TA566 is made from round bar stock (drilled) with bore diameter 6.5 mm or 13 mm (special version for other diameters), cylindrical form with straight or tapered bottom shape, threaded process and thermometer connections.

2.10 Mechanical construction of TA570, TA571, TA572

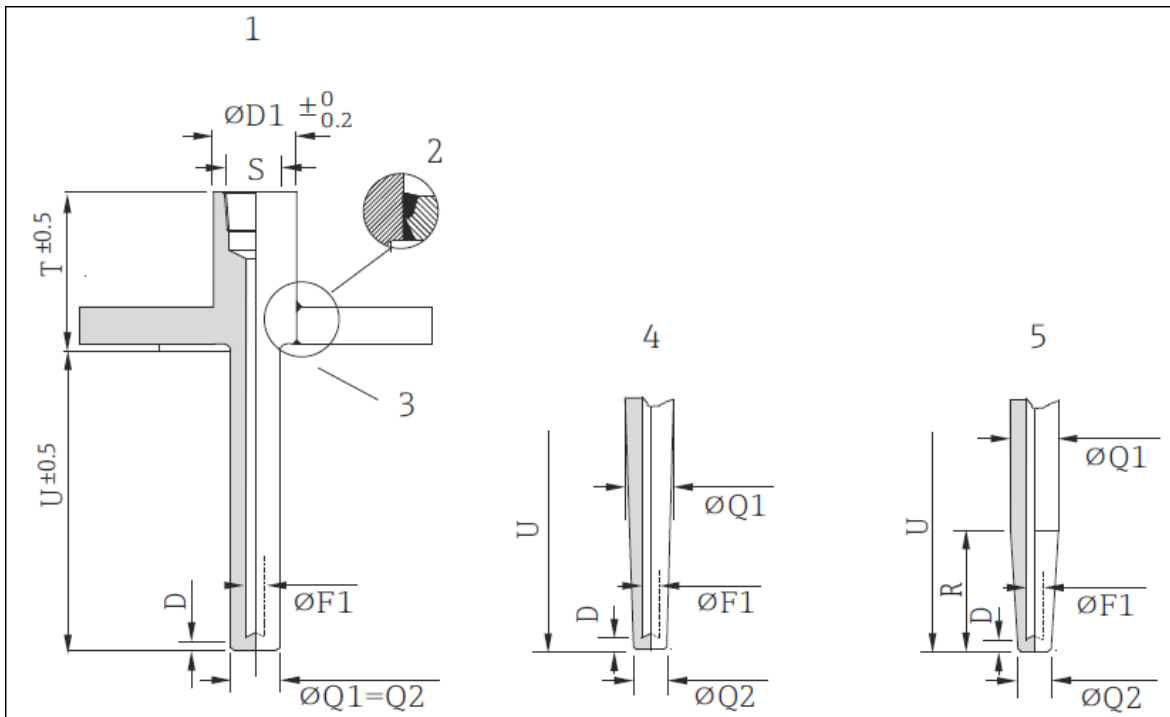


Pic. 8 – thermowells TA570, TA571, TA572
 1 Continuous straight shape, flat bottom shape
 2 Conical tip shape, flat bottom shape
 3 Conical tapered tip shape, flat bottom shape
 4 Round bottom shape

Position	Description	TA570	TA571	TA572
U	Immersion length			
øQ1 øQ2	Diameter thermowell tip, specification see ordering information Min. wall thickness 3 mm (0.12 in), $(Q2-F1)/2 \geq 3$ mm			
T	Extension			
øF1	Bore diameter			
D	Bottom thickness			
R	Tapered tip length			
S	Thermometer connection thread			
øD1	Diameter(extension)	35...49 mm	30...35 mm	25...29 mm

Thermowells TA570, TA571 and TA572 are made from round bar stock (drilled) with bore diameter from 7 mm and outer diameter up to 27 mm, cylindrical or conical form (depends of ordercode) with welded process connection.

2.11 Mechanical construction of TA575, TA576



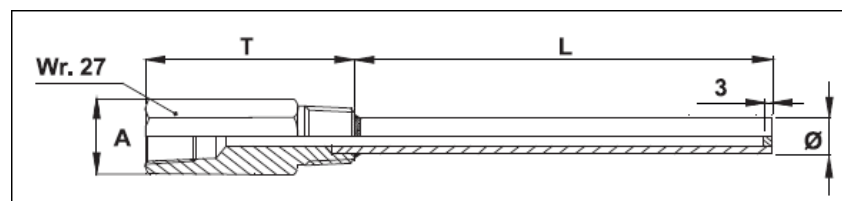
Pic. 9 – thermowells TA575, TA576

1. Continuous straight shape, flat bottom shape
2. Full penetration welding
3. Standard welding
4. Conical tip shape, flat bottom shape
5. Conical tapered tip shape, flat bottom shape

Position	Description
U	Immersion length
øQ1	Outer diameter
øQ2	Diameter protection tube tip
R	Tapering length, if R = 0 tip shape is straight or completely conical
T	Extension
øF1	Bore diameter
D	Bottom thickness
S	Connection for thermometer

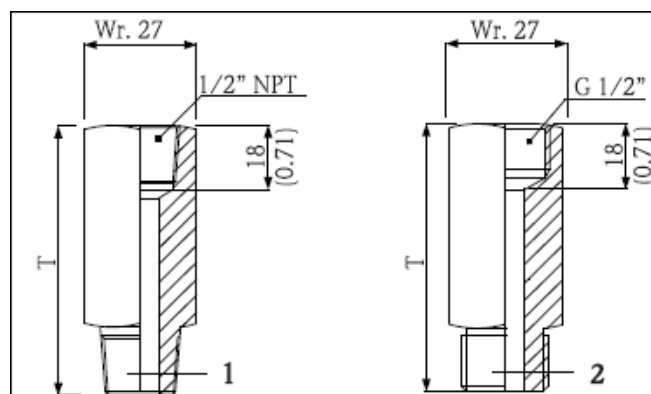
Thermowells TA575 and TA576 are made from round bar stock (drilled) with bore diameter from 6,5 mm and outer diameter up to 27 mm (TA575) and to 28 mm (TA576), cylindrical or conical form (depends of ordercode) with flanged process connection.

2.12 Mechanical construction of TA535



Pic. 10 – thermowell TA535

Position	Description
A	Thread
Ø	Outer diameter
T	Extension
L	Immersion length

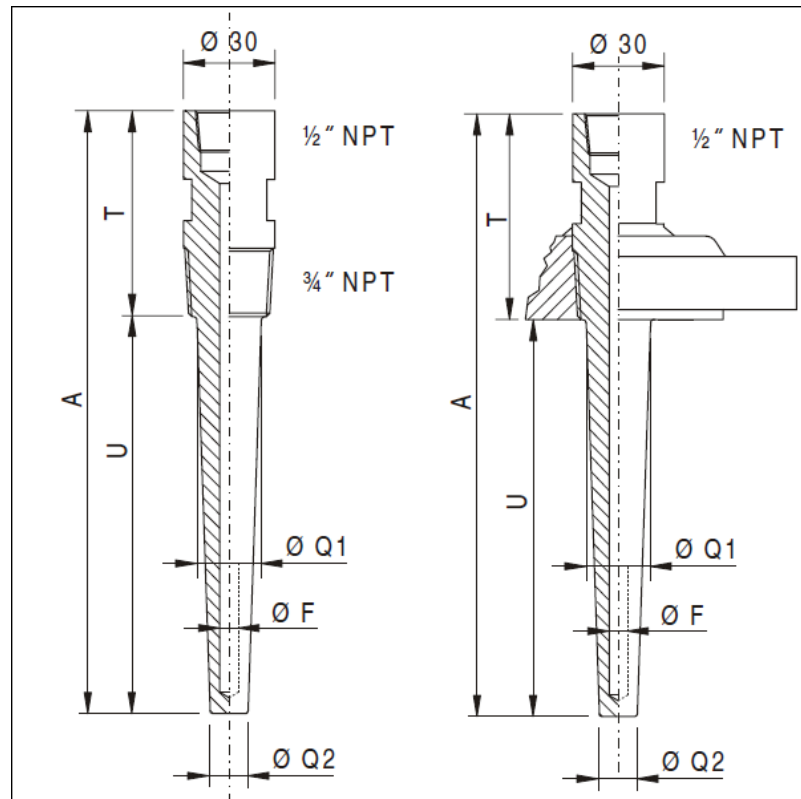


Pic. 11 – extension – dimensions in mm (in)

- 1 Process connections: 1/2" NPT or 3/4" NPT
- 2 Process connections: G1/2", G3/4" or M20×1,5
- T Extension

Thermowell TA535 is made from pipe with bottom thickness 3 mm, inner/outer diameter 9/6,5, 10/6,4 or 12/8 mm (depends of ordercode), threaded process and thermometer connections.

2.13 Mechanical construction of TA550

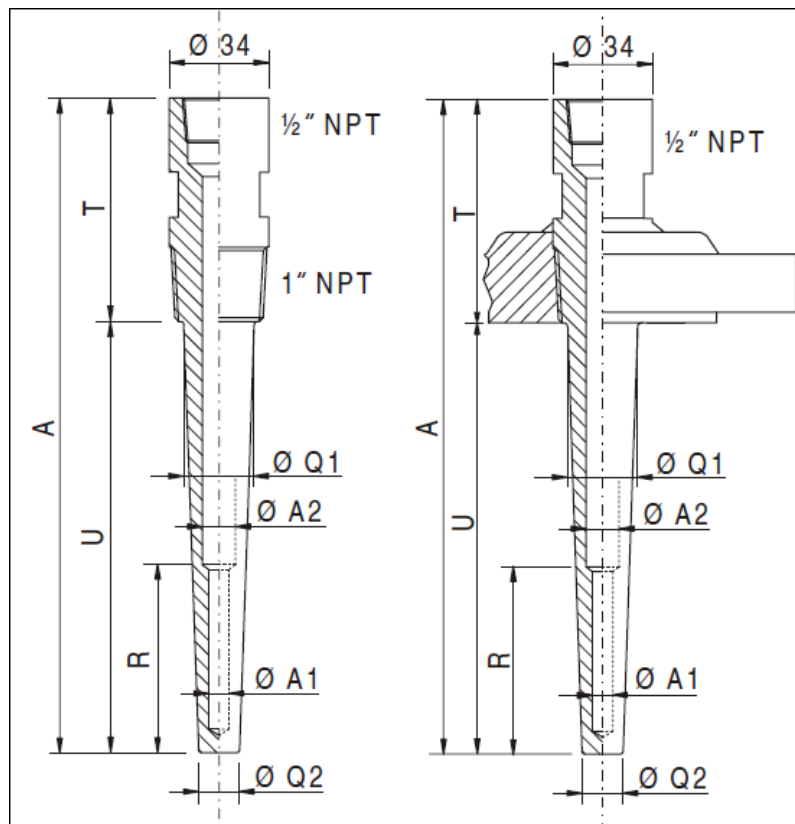


Pic. 12 – thermowell TA550 – dimensions in mm

Position	Description
A	Total length ($A=T+U$)
U	Immersion length
ØQ1	Outer diameter
ØQ2	Diameter protection tube tip
T	Extension
ØF	Bore diameter

Thermowell TA550 is made from round bar stock (drilled) with bore diameter 7 mm or 8 mm, outer diameter 20 mm and 16 mm (special version for other diameters), threaded or flanged process connections.

2.14 Mechanical construction of TA555

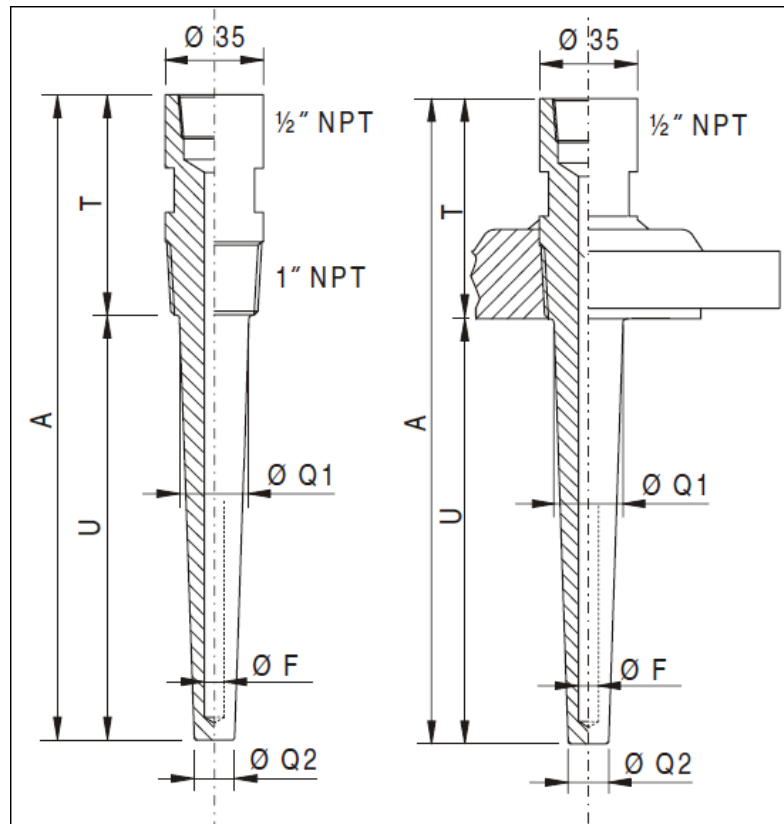


Pic. 13 – thermowell TA555 - dimensions in mm

Position	Description
A	Total length ($A=T+U$)
U	Immersion length
$\varnothing Q1$	Outer diameter
$\varnothing Q2$	Diameter protection tube tip
T	Extension
$\varnothing A1$	Bore diameter of protection tube tip
R	Length of protection tube tip
$\varnothing A2$	Bore diameter

Thermowell TA555 is made from round bar stock (drilled) with bore diameter 6,5 mm, 7 mm or 8 mm, outer diameter 24 mm and 14 mm (special version for other diameters), threaded or flanged process connections.

2.15 Mechanical construction of TA557

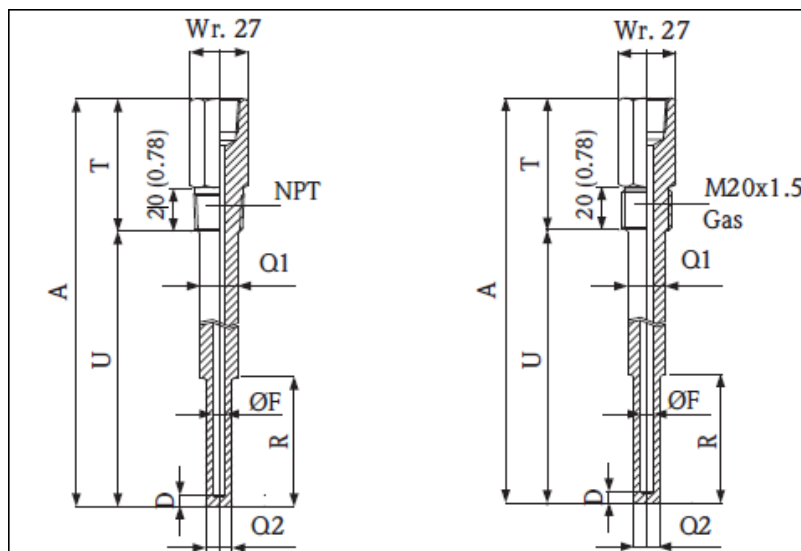


Pic. 14 – thermowell TA557 - dimensions in mm

Position	Description
A	Total length ($A=T+U$)
U	Immersion length
øQ1	Outer diameter
øQ2	Diameter protection tube tip
T	Extension
øF	Bore diameter

Thermowell TA557 is made from round bar stock (drilled) with bore diameter 8 mm, outer diameter 25 mm and 14 mm (special version for other diameters), threaded or flanged process connections.

2.16 Mechanical construction of TA562

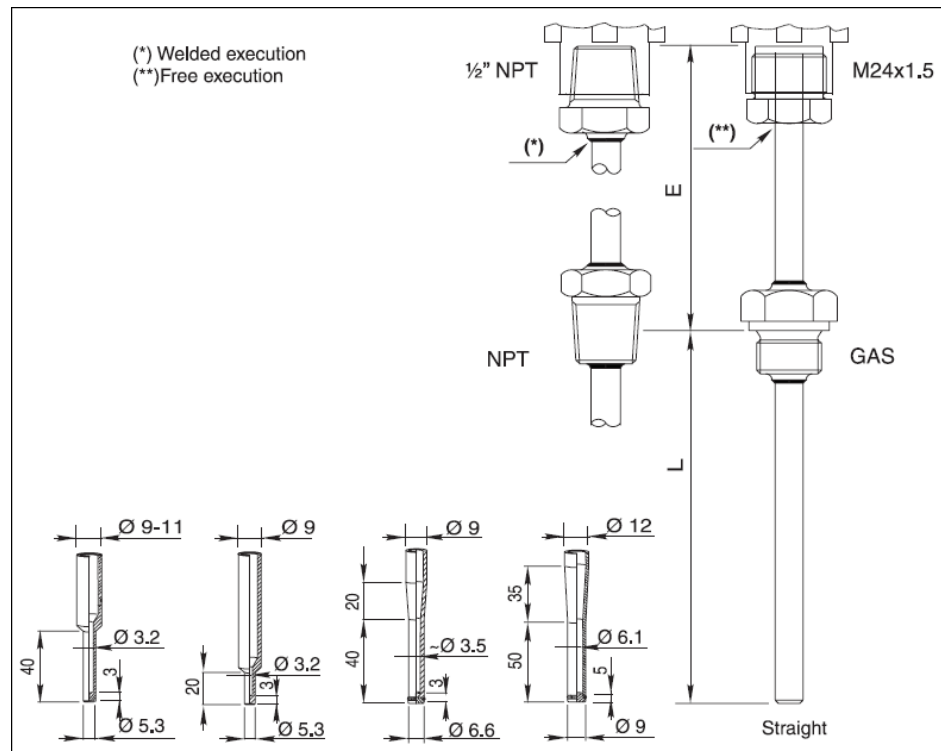


Pic. 15- thermowell TA562 – dimensions in mm

Position	Description
A	Total length ($A=T+U$)
U	Immersion length
$\varnothing Q1$	Outer diameter
$\varnothing Q2$	Diameter protection tube tip
T	Extension
$\varnothing F$	Bore diameter
D	Bottom thickness
R	Length of protection tube tip

Thermowell TA562 is made from round bar stock (drilled) with bore diameter 6.5 mm or 10 mm (special version for other diameters), cylindrical form with straight or tapered bottom shape, threaded process and thermometer connections.

2.17 Mechanical construction of TW10



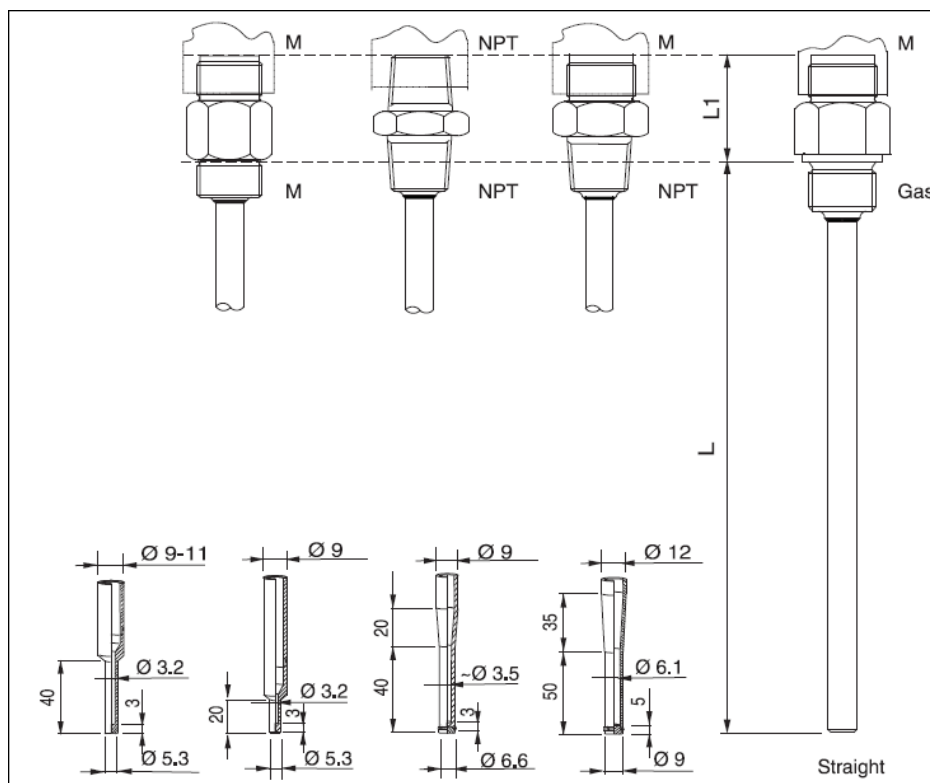
Pic. 16- thermowell TW10 – dimensions in mm

L – immersion length

E – extension

Thermowell TW10 is made from pipe with outer diameter 9, 11, 12, 14 or 15 mm, threaded process connections.

2.18 Mechanical construction of TW11



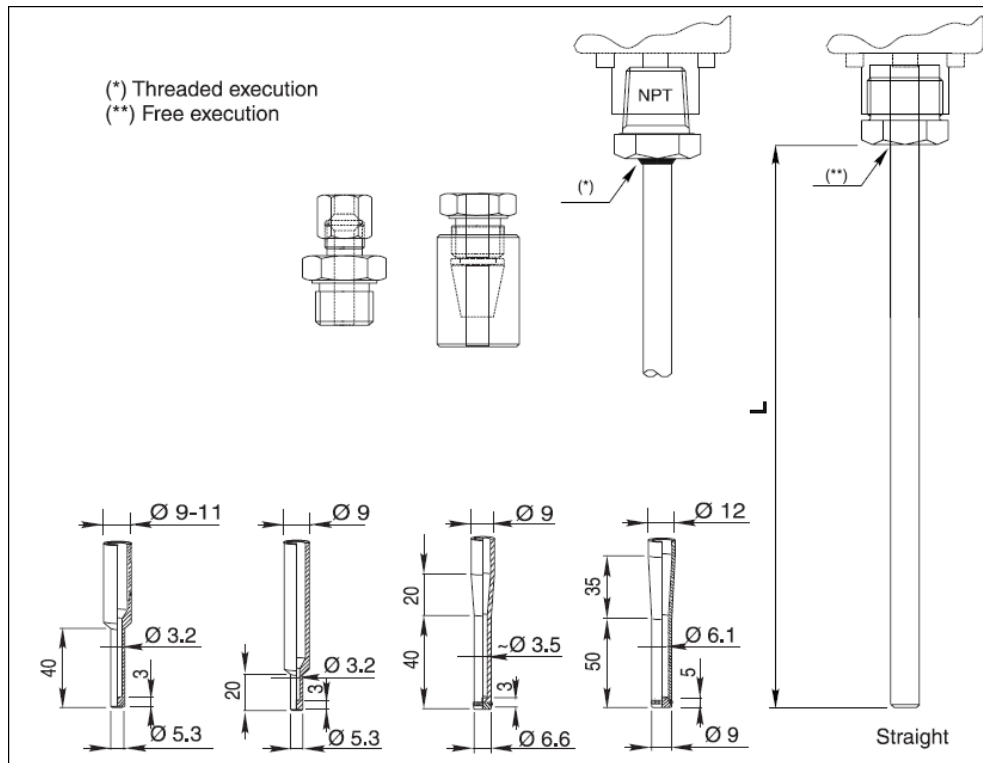
Pic. 17- thermowell TW11 – dimensions in mm

L – immersion length

$L1$ – thread length

Thermowell TW11 is made from pipe with outer diameter 8, 9, 11, 12, 14 or 15 mm, threaded process connections.

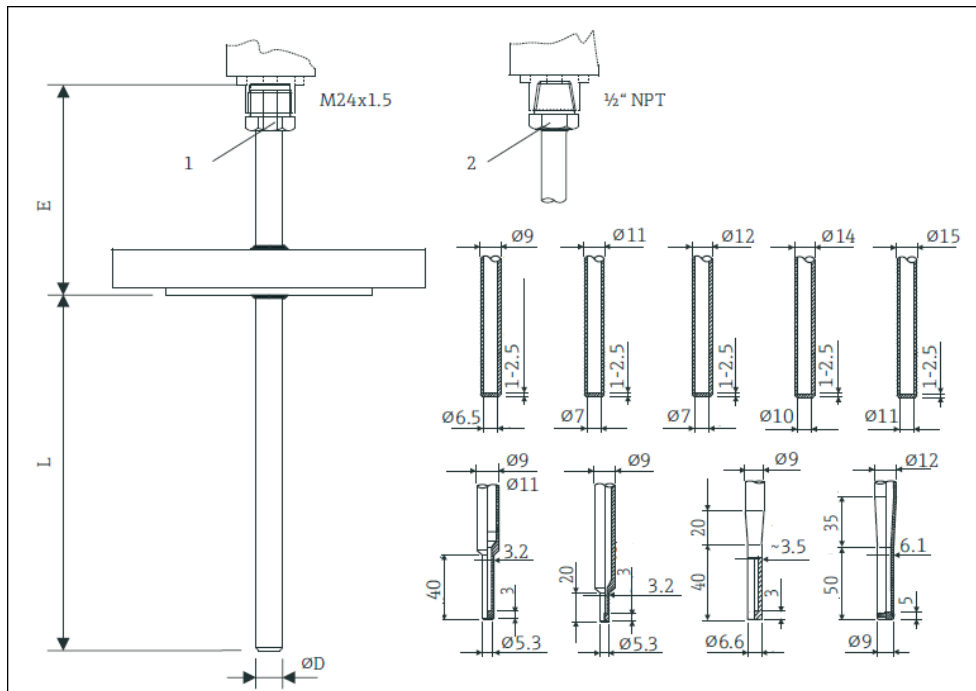
2.19 Mechanical construction of TW12



Pic. 18– thermowell TW12 – dimensions in mm, L – immersion length

Thermowell TW12 is made from pipe with outer diameter 9, 11, 12, 14 or 15 mm, as process connection is used compression fitting.

2.20 Mechanical construction of TW13



Pic. 19– thermowell TW13 – dimensions in mm

1 M24×1,5 connection; sliding on the neck

2 1/2"NPT connection; welded, not sliding on the neck

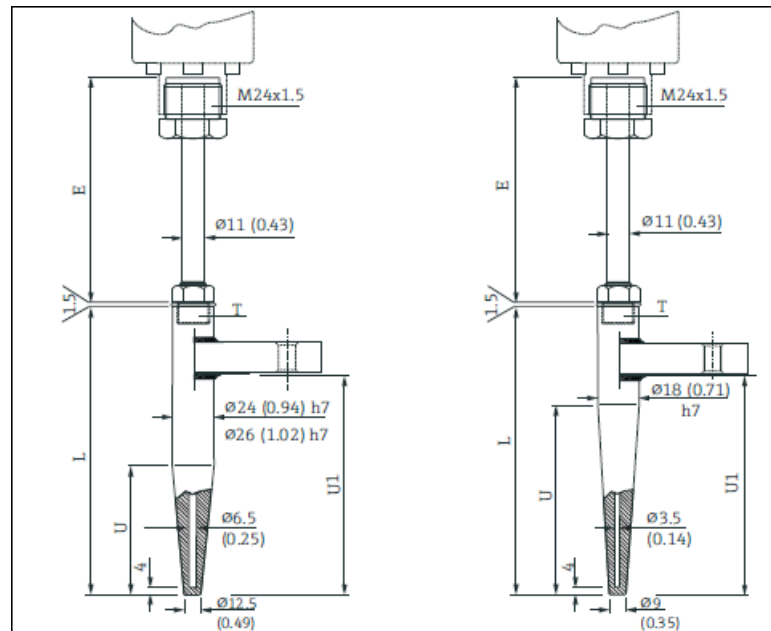
E Neck tube length

L Immersion length

ØD Diameter

Thermowell TW13 is made from pipe with outer diameter 9, 11, 12, 14 or 15 mm, flanged process connections.

2.21 Mechanical construction of TW15

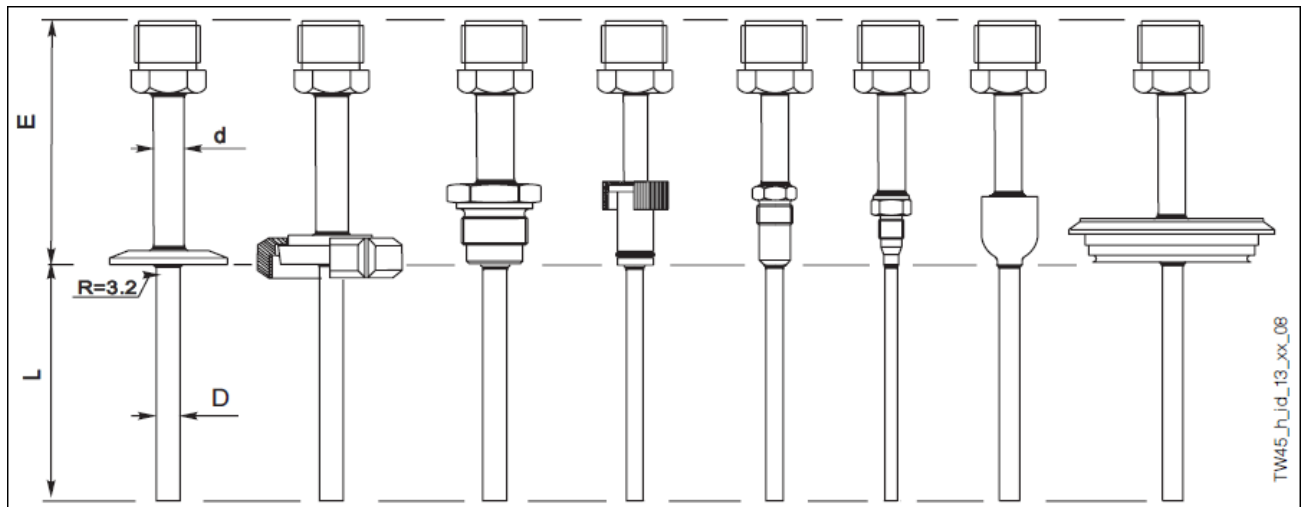


Pic. 20 – thermowell TW15 – dimensions in mm (in)

Position	Description
T	Thread neck tube connection to thermowell
L	Immersion length
U	Length of conical tip
U1	Immersion length; length of the part of the thermowell in contact with the process from the tip to the sealing surface of the flange
E	Neck tube length

Thermowell TW15 is made from round bar stock (drilled) with outer diameter 24 mm or 18 mm, inner diameter 6,5 mm flanged or welded process connections.

2.22 Mechanical construction of TW45



Pic. 21 – thermowell TW45

E Neck tube length

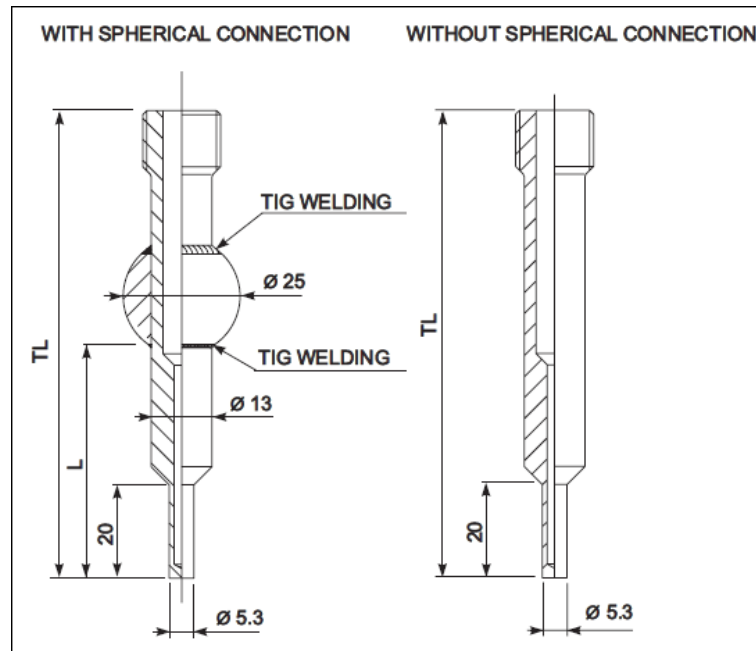
L Immersion length

$\varnothing D$ Pipe diameter

$\varnothing d$ Neck tube diameter

Thermowell TW45 is made from pipe with bottom thickness 3 mm with outer diameter 9 mm: threaded, clamp, flanged and other hygienic process connections.

2.23 Mechanical construction of TW47



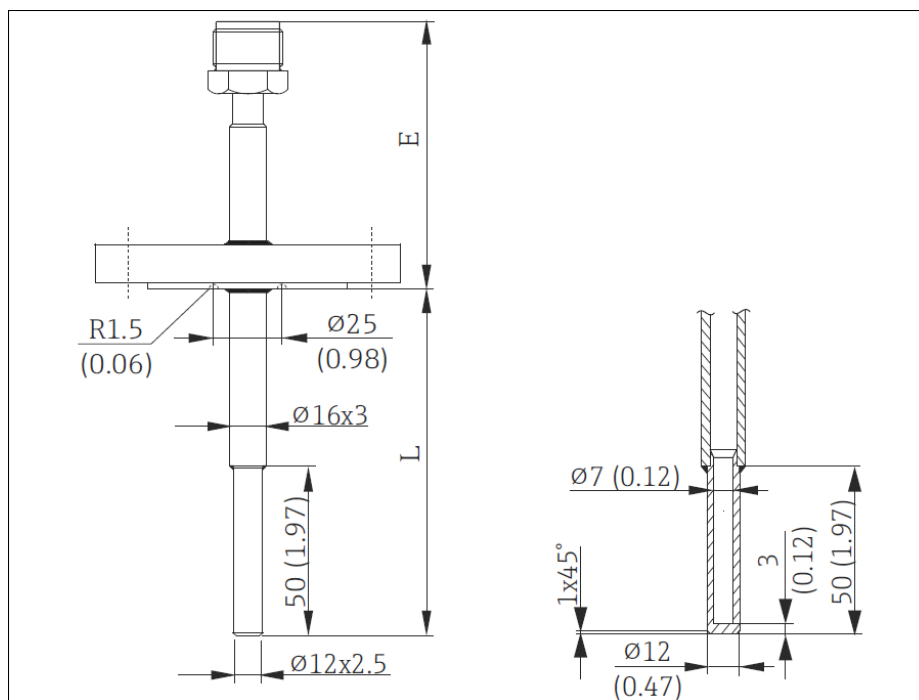
Pic. 22 – thermowell TW47– dimensions in mm

TL – total length

L – immersion length

Thermowell TW47 is made from round bar stock (drilled) with outer diameter 13 mm and 5,3 mm (special version for other diameters), welded process connections.

2.24 Mechanical construction of MLTWS01



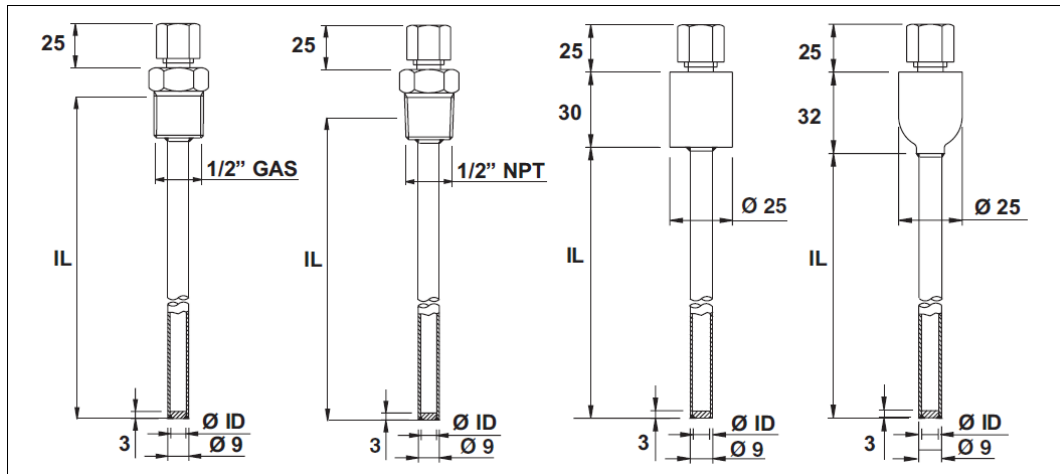
Pic. 23 – thermowell MLTWS01 – dimensions in mm (in)

E – neck length

L – immersion length

Thermowell MLTWS01 is made from pipe with outer diameter 16 mm with flanged process connections.

2.25 Mechanical construction of TW251



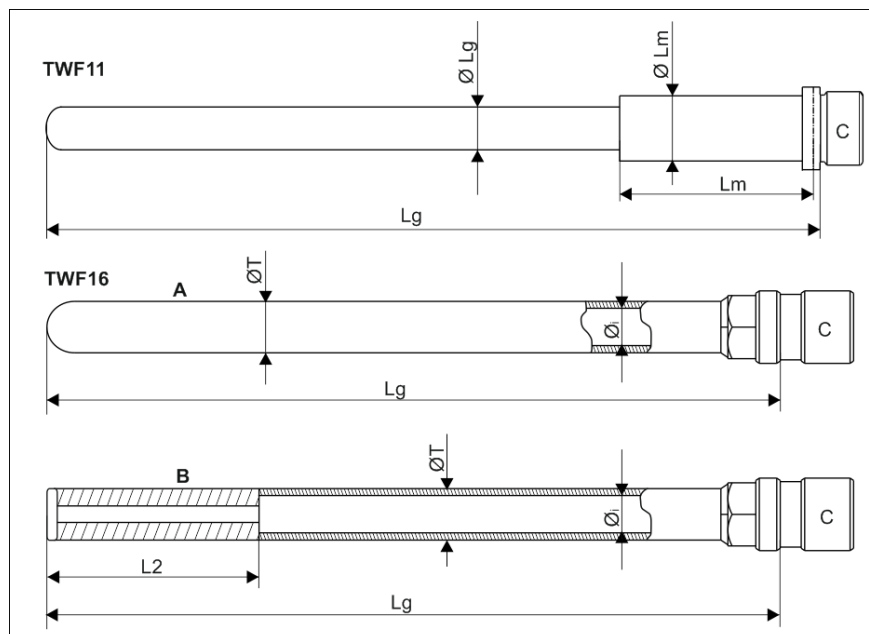
Pic. 24 – thermowell TW251 – dimensions in mm

ID – inner diameter

IL – immersion length

Thermowell TW251 is made from round bar stock (drilled) with diameter 6 mm and 9 mm with threaded or welded process connections.

2.26 Mechanical construction of TWF11 и TWF16

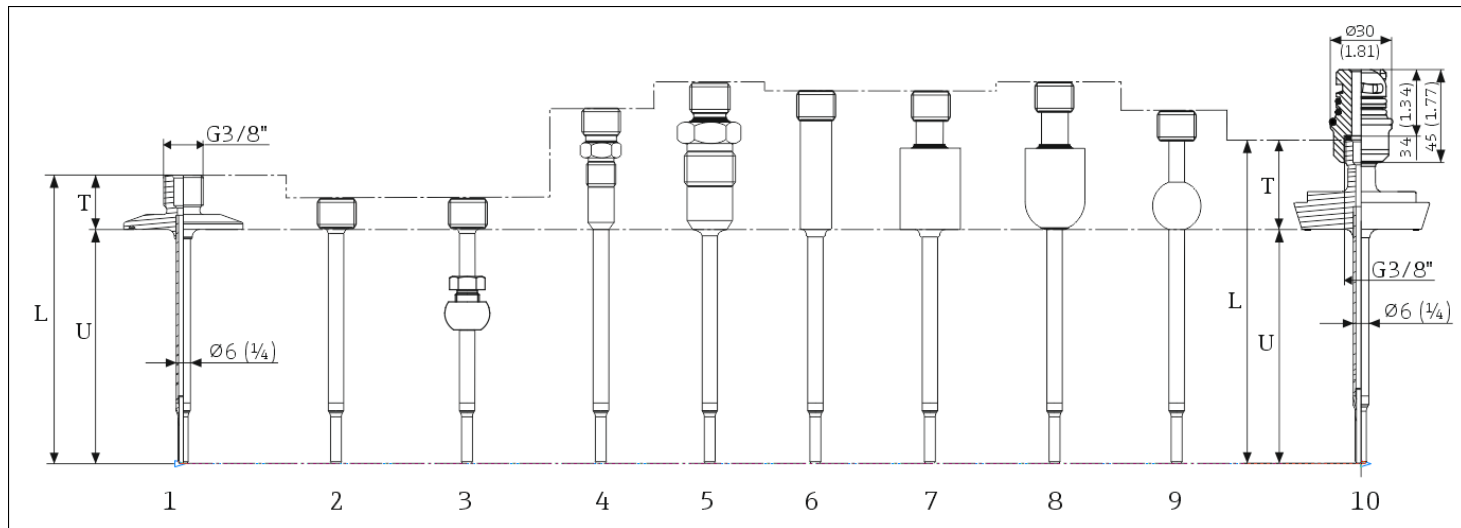


Pic. 25 – thermowells TWF11 and TWF16

Position	Description
Lg	Immersion length
ØLg	Sheath diameter
Lm	Sleeve length
ØLm	Sleeve diameter
ØT	Thermowell outer diameter
Ø _i	Thermowell inner diameter
C	Terminal head connection
A	Version thermowell made from tube
B	Version thermowell made from tube and bar stock tip
L2	Length bar stock tip

Thermowells TWF11 and TWF16 are made from metallic or ceramic round bar stock (drilled) with outer diameter from 14 mm and 26,7 mm (special version for other diameters) for installation in adjustable or stop flange, or in threaded assembly.

2.27 Mechanical construction of TT411



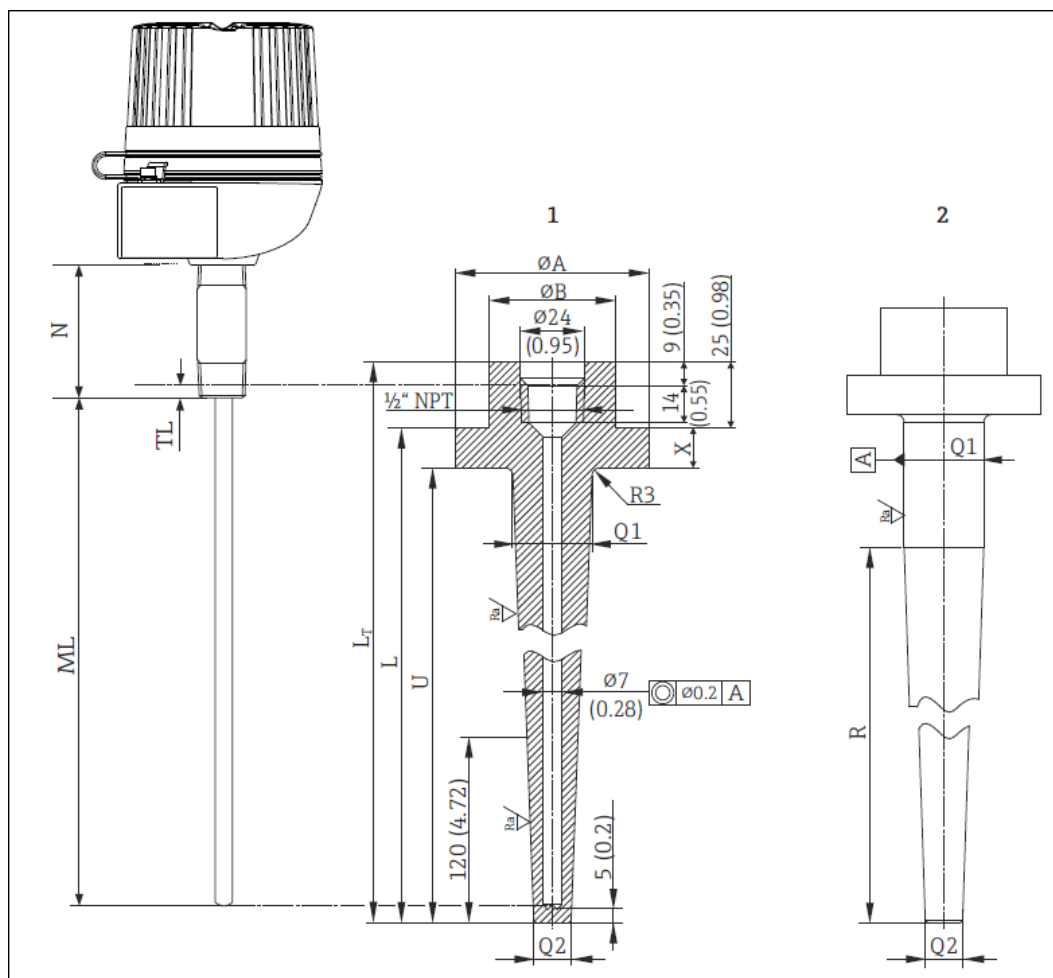
Pic. 26 – thermowell TT411 – dimensions in mm (in)

- 1 Clamp version
- 2 Without process connection
- 3 Spherical compression fitting TK40
- 4 Metal sealing system M12x1
- 5 Metal sealing system G½"
- 6 Cylindrical weld-in adapter $\phi 12 \times 40$ mm
- 7 Cylindrical weld-in adapter $\phi 30 \times 40$ mm
- 8 Spherical-cylindrical weld-in adapter $\phi 30 \times 40$ mm
- 9 Spherical weld-in adapter $\phi 25$ mm
- 10 Sanitary connection according to DIN 11851 with threaded base part iTHERM QuickNeck

Position	Description
L	Total length (U+T)
U	Immersion length
T	Length of protection tube shaft

Thermowell TT411 is made from pipe and round bar stock (drilled) with outer diameter from 6 mm to 12,7 mm (special version for other diameters), hygienic and welded process connections.

2.28 Mechanical construction of TT511

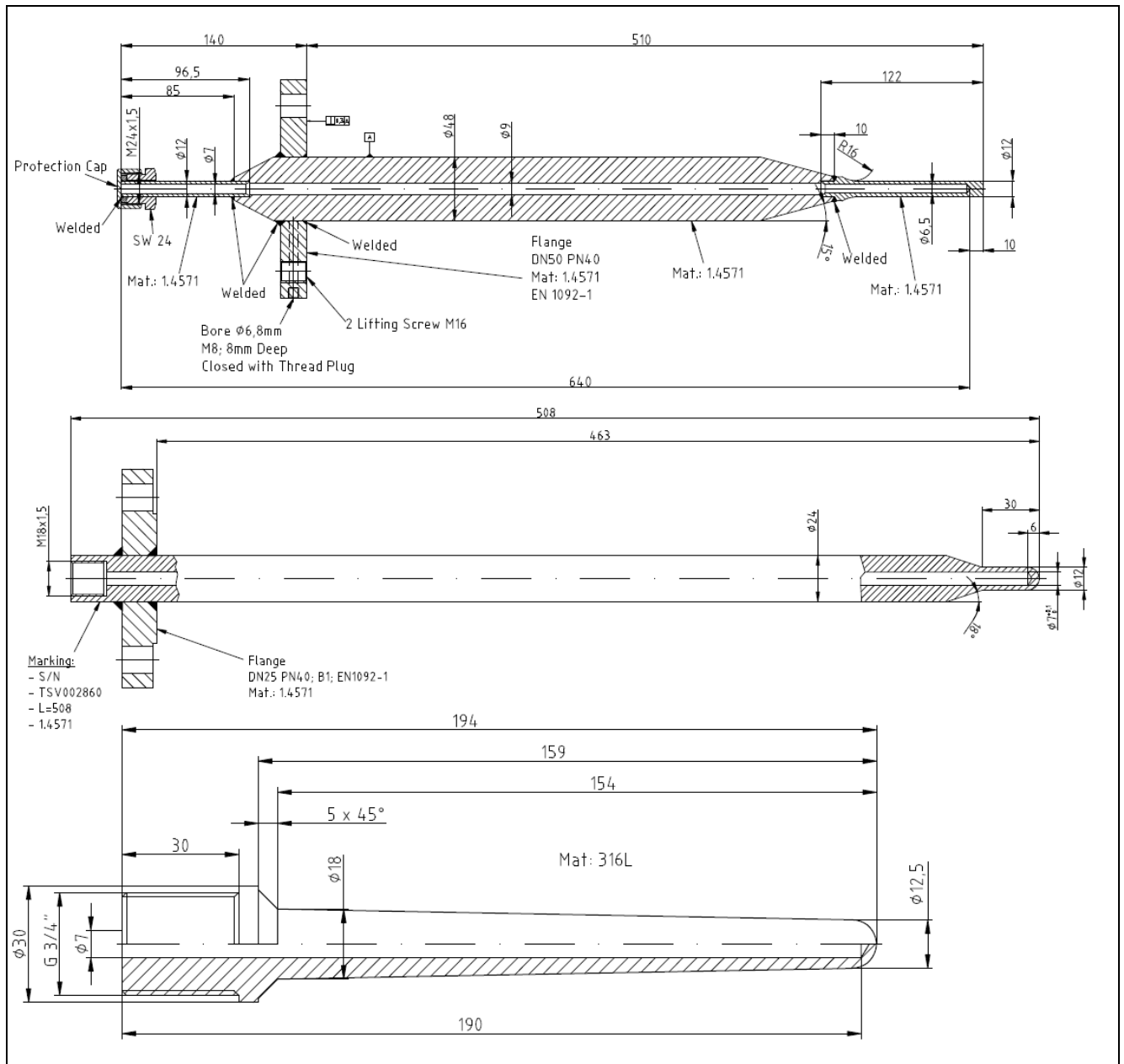


Pic. 27 – thermowell TT511 – dimensions in mm (in)
 1 Version DN40 (NPS 1-½") or DN50 (NPS 2"), tapered
 2 Version DN40 (NPS 1-½") for $L > 300$ mm (11.81 in): straight with tapered tip

Position	Description
L	Standard length
U	Immersion length
L_T	Complete thermowell length (L+U)
TL	Thread length
ML	Insertion length
N	Extension neck length
R	Length of tapered tip
$\phi Q1$	Outer diameter
$\phi Q2$	Diameter protection tube tip

Thermowell TT511 is made from round bar stock (drilled) with bore diameter 7 mm and outer diameter 19 mm b 30 mm(special version for other diameters), lap joint flange process connections.

2.29 Mechanical construction of TTSP

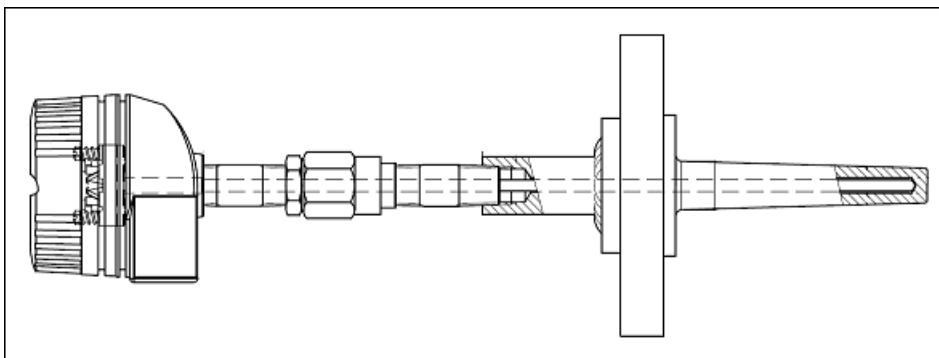


Pic. 27 – examples of construction of thermowell TTSP – dimensions in mm

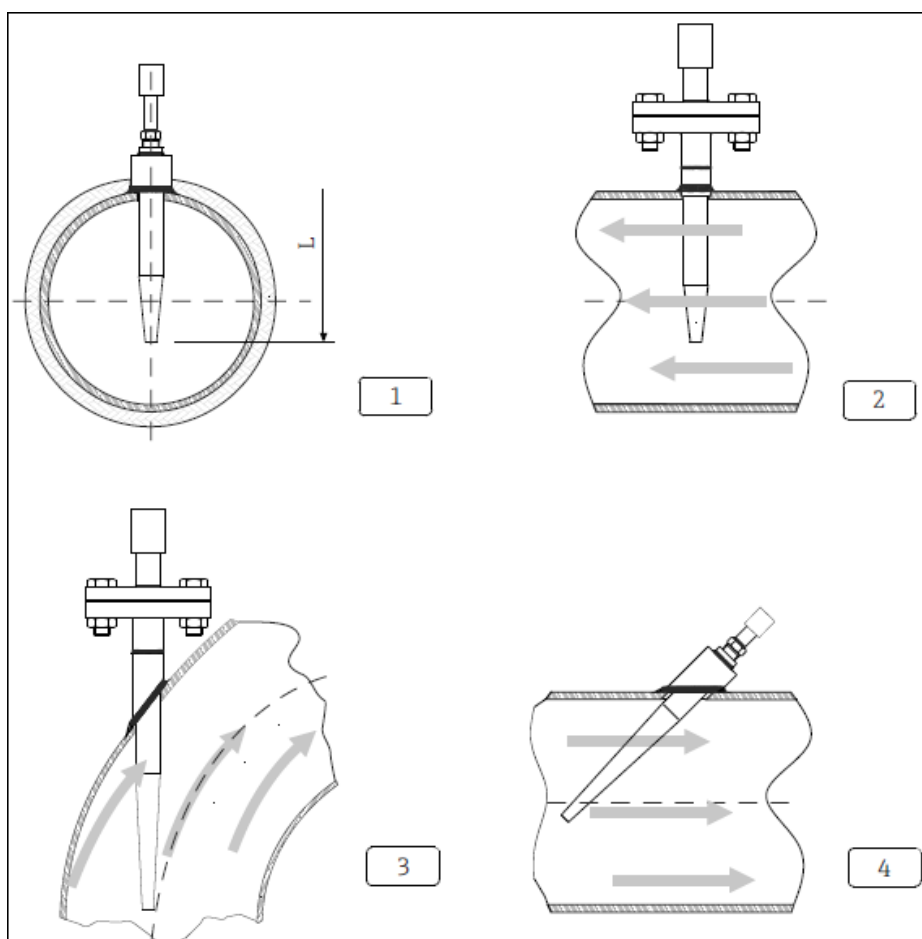
TTSP is a special version thermowell made according to customer specification, can be constructed by any method, with any dimensions and process connections.

3 Installation

Installation of thermowells should be carried out only by qualified and authorized specialists in the complete absence of pressure at the installation point. Thermowells can be installed on pipes, tanks and any other parts of the equipment where it is necessary. Seals and gaskets for process connection are usually not included in the delivery set and customer should provide it separately.



Pic. 28 – thermometer TR62 in connection with thermowell TA576



Pic. 29 – installation examples in pipes

4 Comissioning

After mounting of thermowells it is necessary to check tightness of connection on the installation point.

5 Maintenance and repair

Thermowells doesn't require any special actions for maintenance and repair.

6 Storage and transport

- Transport thermowells to the installation point in original packaging
- Store in a dry and dust-free place
- Storage temperatures: -60...+85°C

7 Conservation

Conservation of thermowells is carried out upon removal from the facility for long term storage. For conservation it is necessary to eliminate traces of the measured liquid from the surface of the thermowell and remaining oil from the inside, and then install plugs on it. Conservation of thermowells should be performed according to GOST 9.014-78.

8 Assigned indicators

Assigned storage time	2 years
Assigned lifetime	20 years

9 Limit state criteria

The following limit states for operating conditions for thermowells are unacceptable:

- Loss of thermowell tightness
- Occurrence of cracks on the surface of thermowell

10 Occurrence of critical failures

Description and cause of accident	Personnel action
Leakage of the working medium (violation of integrity of the welds between the submerged part of thermowell and process connection)	Re-weld the leakage point or replace with a new thermowell
Leakage of the working medium through seals (wear of seals the weakening of the threaded connections)	Tighten threaded connections or replace gasket
Corrosive or abrasive wear of thermowell (damage, abrasion, occurrence of holes on the submersible part due to incorrect choice of material)	It is necessary to replace it with thermowell produced of another material, which will ensure its resistance to mechanical or corrosive exposure of the working medium.

11 Dismantling

In the case if a thermowell reached its limit state, it is necessary to dismantle it, making sure that the system pressure is shut down.

12 Disposal

The disposal process of thermowells and recycling of materials should be organized so as to prevent pollution of air, soil and water bodies with harmful substances. Dispose of materials and waste according to the local regulations.

In general, the safety process for recycling and/or disposal should be provided by:

- Automation and mechanization of technological processes.
- Conduct technological processes in strict compliance with the technical and standard.
- The use of local and general ventilation.

Disposed thermowells do not pose any danger to life, health and the environment. Flowmeters do not contain any chemical, biological or radioactive elements that could be harmful to human health or the environment.

13 Marking

On thermowell is mentioned its order code, thread type (flange), hole diameter, material of thermowell, lengths (immersion length, length of conical or truncated tip), the trademark of the manufacturer.

Construction of thermowells doesn't allow to apply on its surface a uniform mark of production circulation at the market of member States of the Eurasian economic Union, therefore, this sign is applied to technical documentation package (technical passport, operating instructions).

14 Manufacturer

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