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Technical Information
iTHERM TT411

Welded thermowell

Use in hygienic and aseptic applications in the food & beverages and pharmaceutical industries

Applications

- Specially designed for use in hygienic and aseptic applications in the Food & Beverages and Life Sciences industries
- Pressure range up to 40 bar (580 psi)
- For increased protection requirements of the temperature sensor regarding physical and chemical effects
- For use in pipes and containers or tanks
- Ideally suited to all measuring points that require regular recalibration by simply replacing the insert in closed processes

Your benefits

- iTHERM QuickNeck – cost and time savings thanks to simple, tool-free recalibration of the insert used
- Over 50 hygienic process connections
- Global portfolio with metric and imperial versions
- International certification: 3-A Sanitary Standard, EHEDG, ASME BPE, FDA, TSE Certificate of Suitability
- Optional: 1.4435 material, delta ferrite content < 0.5%
- Fast response time owing to reduced tips with thin walls
- State of the art T-pieces and elbow pieces, no welds and dead legs with best-in-class hygienic design

Endress+Hauser
People for Process Automation

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Mounting

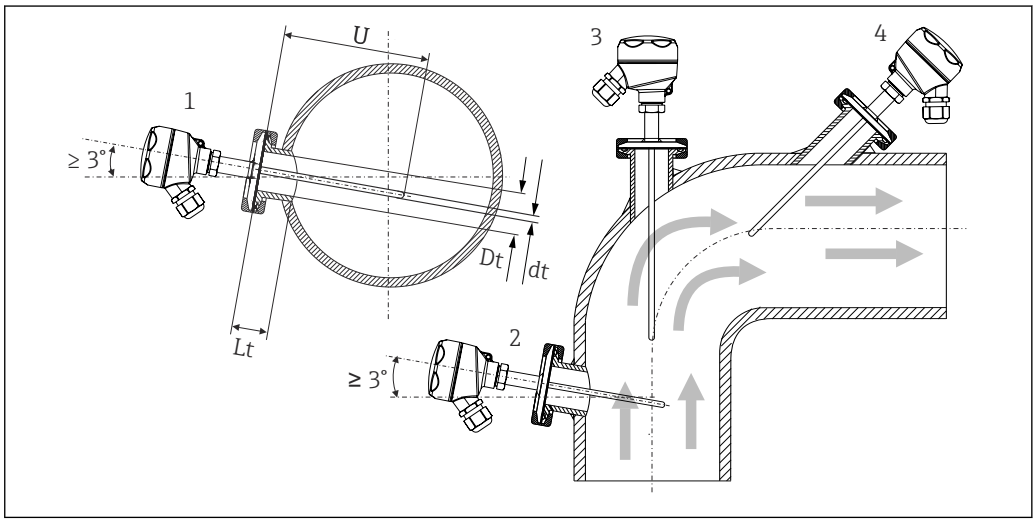
Orientation

No restrictions. However, self-draining in the process must be guaranteed. If there is an opening to detect leaks at the process connection, this opening must be at the lowest possible point.

Installation instructions

The immersion length of the thermometer can influence the accuracy. If the immersion length is too small then errors in the measurement are caused by heat conduction via the process connection and the container wall. If installing in a pipe, the immersion length should ideally correspond to half of the pipe diameter.

Installation possibilities: pipes, tanks or other plant components



1 *Installation examples*

1, 2 Perpendicular to the flow direction, installed at a min. angle of 3° to ensure self-draining
3 On elbows
4 Inclined installation in pipes with a small nominal diameter
U Immersion length

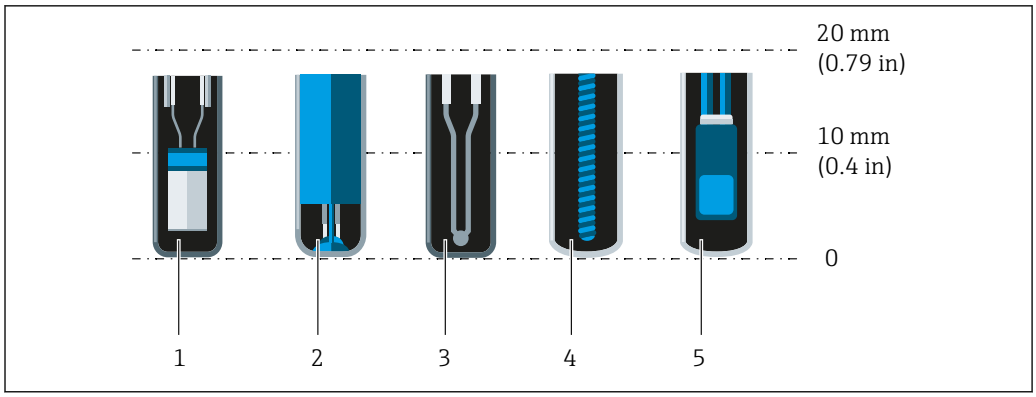
In the case of pipes with a small nominal diameter, it is advisable for the tip of the thermometer to project well into the process so that it extends past the pipe axis. Installation at an angle (4) could be another solution. When determining the immersion length or installation depth, all the parameters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

The requirements of the EHEDG and the 3-A Sanitary Standard must be adhered to.

Installation instructions EHEDG/cleanability: Lt ≤ (Dt-dt)

Installation instructions 3-A/cleanability: Lt ≤ 2(Dt-dt)

Pay attention to the exact position of the sensor element in the thermometer tip.

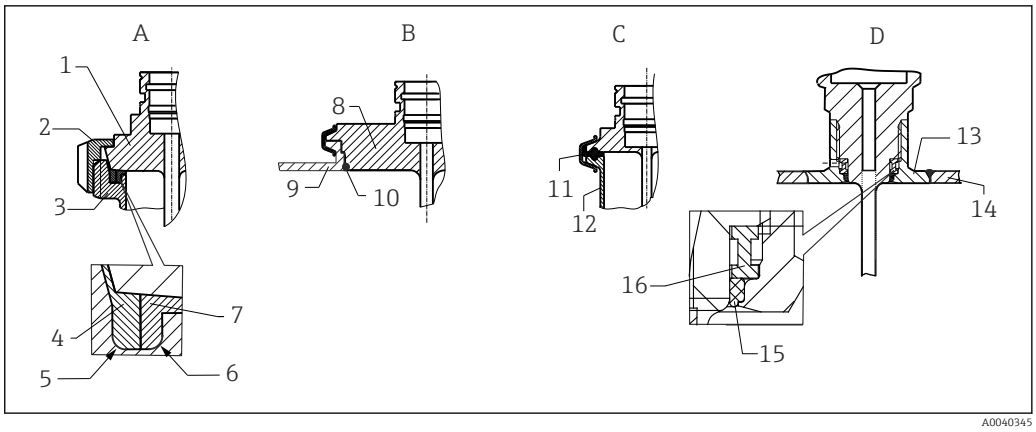


1 StrongSens or TrustSens at 5 to 7 mm (0.2 to 0.28 in)
2 QuickSens at 0.5 to 1.5 mm (0.02 to 0.06 in)
3 Thermocouple (not grounded) at 3 to 5 mm (0.12 to 0.2 in)
4 Wire wound sensor at 5 to 20 mm (0.2 to 0.79 in)
5 Standard thin-film sensor at 5 to 10 mm (0.2 to 0.39 in)

To keep the influence of heat dissipation to a minimum and to achieve the best possible measurement results, 20 to 25 mm (0.79 to 0.98 in) should be in contact with the medium in addition to the actual sensor element.

This results in the following recommended minimum immersion lengths
- TrustSens or StrongSens 30 mm (1.18 in)
- QuickSens 25 mm (0.98 in)
- Wire wound sensor 45 mm (1.77 in)
- Standard thin-film sensor 35 mm (1.38 in)

It is particularly important to take this into consideration for T-pieces, as the immersion length is very short on account of their design, and the measured error is higher as a result. It is therefore recommended to use elbow pieces with QuickSens sensors.



2 *Detailed installation instructions for hygiene-compliant installation (depends on the version ordered)*

A Milk pipe connection according to DIN 11851, only in connection with EHEDG certified and self-centering sealing ring
1 Sensor with milk pipe connection
2 Groove slip-on nut
3 Counterpart connection
4 Centering ring
5 R0.4
6 R0.4
7 Sealing ring
B Varivent® process connection for VARINLINE® housing
8 Sensor with Varivent connection
9 Counterpart connection
10 O-ring
C Clamp according to ISO 2852
11 Gasket seal
12 Counterpart connection
D Process connection Liquiphant-M G1", horizontal installation
13 Weld-in adapter
14 Vessel wall
15 O-ring
16 Thrust collar

NOTICE

The following actions must be taken if a sealing ring (O-ring) or seal fails:

- The thermometer must be removed.
- The thread and the O-ring joint/sealing surface must be cleaned.
- The sealing ring or seal must be replaced.
- CIP must be performed after installation.

The counterpieces for the process connections and the seals or sealing rings are not included in the scope of delivery for the thermometer. Liquiphant M weld-in adapters with related seal kits are available as accessories. .

In the case of weld-in connections, exercise the necessary degree of care when performing the welding work on the process side:

1. Use suitable welding material.
2. Flush-weld or weld with welding radius ≥ 3.2 mm (0.13 in).
3. Avoid crevices, folds or gaps.
4. Ensure the surface is honed and mechanically polished, Ra ≤ 0.76 µm (30 µin).

1. As a general rule, the thermometers should be installed in such a way that does not impact their ability to be cleaned (the requirements of the 3-A Sanitary Standard must be observed).

2. The Varivent® and Liquiphant-M weld-in adapter and Ingold (+ weld-in adapter) connections enable flush-mounted installation.

For the requirements for installation according to the EHEDG and 3-A Sanitary Standard, see the Operating Instructions for the modular hygienic thermometers.

Operating Instructions BA02023T

Process

Process temperature range

Maximum −200 to +650 °C (−328 to +1 202 °F) → 14

Thermal shock

Thermal shock resistance in CIP/SIP process with a temperature increase and decrease from +5 to +130 °C (+41 to +266 °F) within 2 seconds.

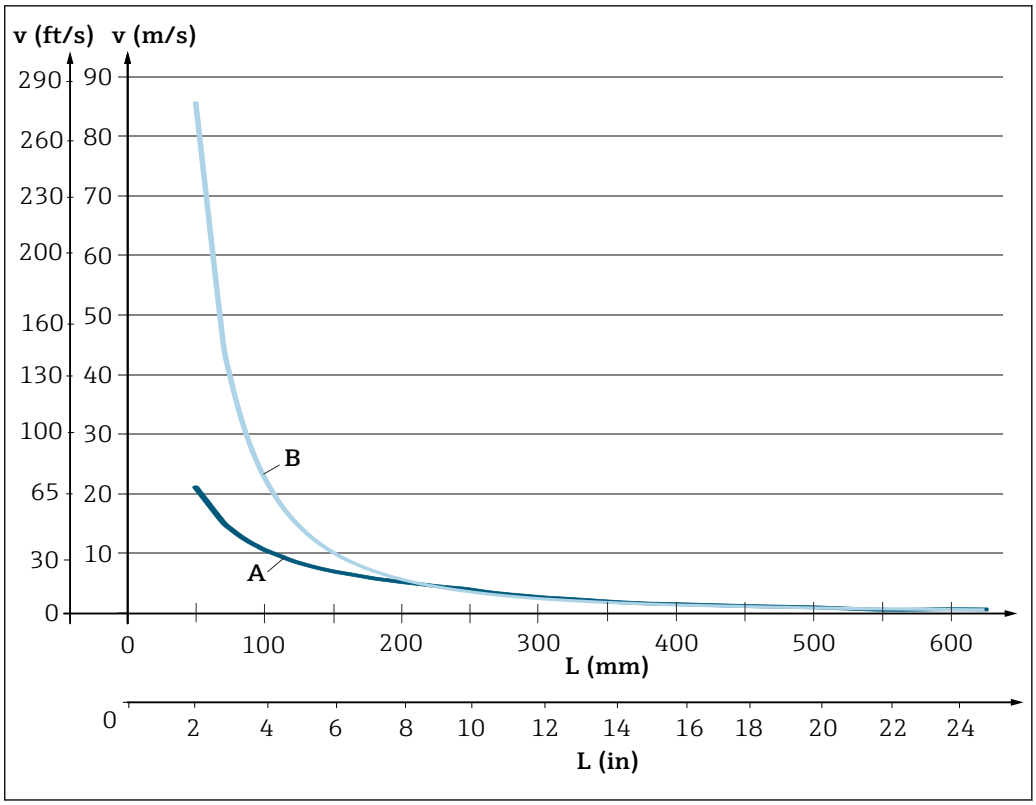
Process pressure range

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. → 14

It is possible to check the mechanical loading capacity as a function of the installation and process conditions online in the TW Sizing Module for protection tubes in the Endress+Hauser Applicator software. This is valid for DIN thermowell calculations. See 'Accessories' section.

Example of the permitted flow velocity depending on the immersion length and process medium

The highest flow velocity tolerated by the protection tube diminishes with increasing insert immersion length exposed to the stream of the fluid. In addition, it is dependent on the diameter of the tip of the protection tube, the medium type, process temperature and process pressure. The following figures exemplify the maximum permitted flow velocities in water and superheated steam at a process pressure of 40 bar (580 PSI).



3 Permitted flow velocities, protection tube diameter 9 mm (0.35 in)

A Medium water at T = 50 °C (122 °F)
B Medium superheated steam at T = 160 °C (320 °F)
L Immersion length exposed to flow
v Flow velocity

Medium - state of aggregation

Gaseous or liquid (also with high viscosity, e.g. yogurt).

Mechanical construction

Design, dimensions

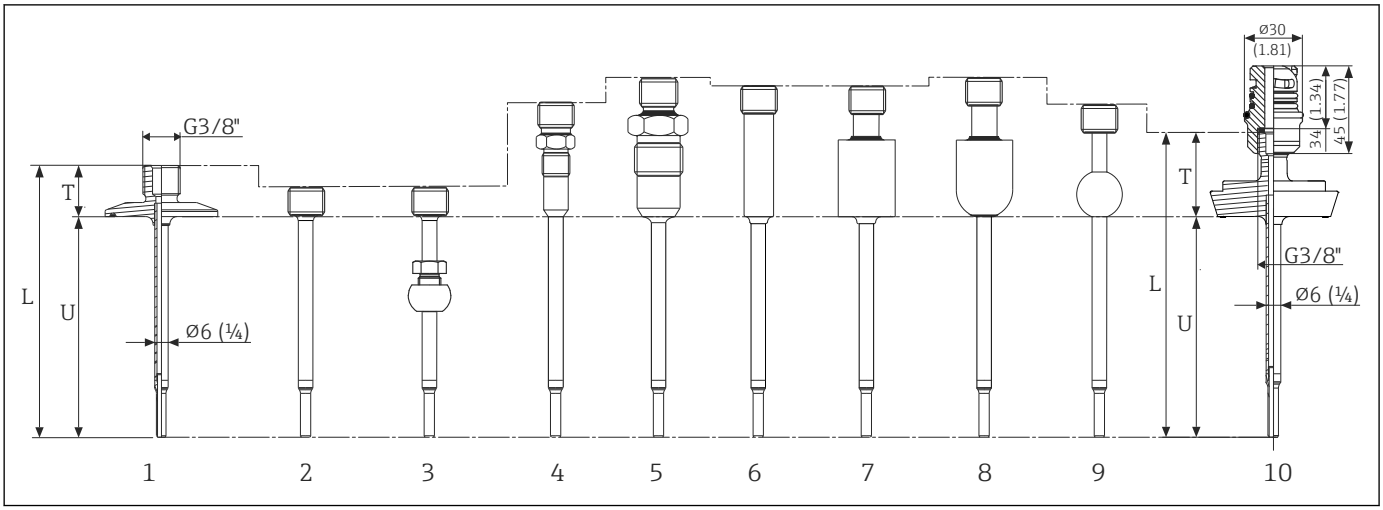
All dimensions in mm (in). The design depends on the thermowell version:
- Diameter 6 mm (¼ in)
- Diameter 9 mm (0.35 in)
- Diameter 12.7 mm (½ in)
- T-piece and elbow piece thermowell version as per DIN 11865/ASME BPE for weld-in

Various 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:

Position	Description
L	Thermowell length (U+T)
B	Thermowell base thickness: predefined, depends on thermowell version (see also the individual table data)
T	Length of thermowell lagging: variable or predefined, depends on thermowell version (see also the individual table data)
U	Immersion length: variable, depending on the configuration

Thermowell diameter 6 mm (¼ in)



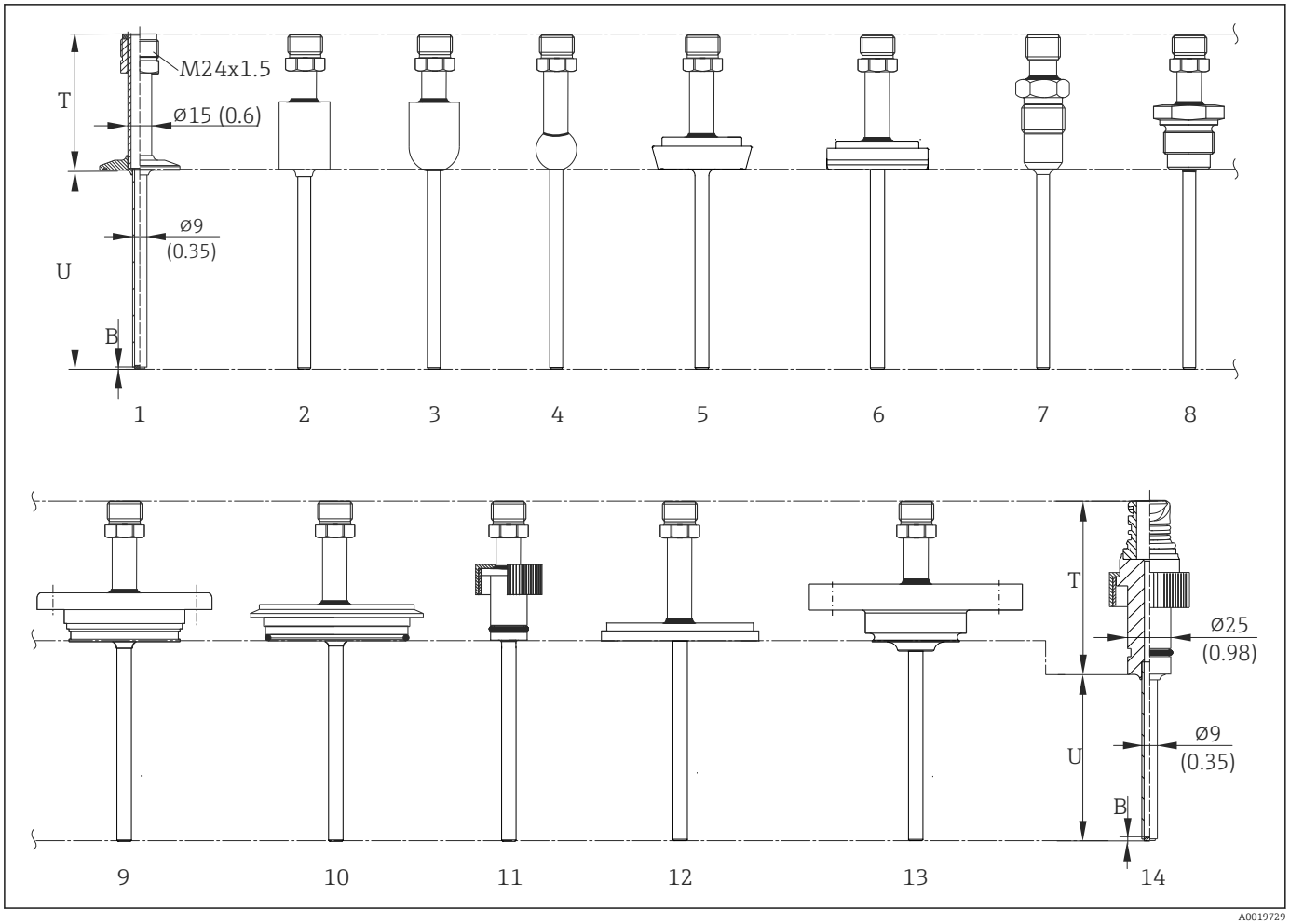
4 *Thermowell with extension neck connection G3/8" and various process connection versions:*

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 Φ12 x 40 mm
7 Cylindrical weld-in adapter Φ30 x 40 mm
8 Spherical-cylindrical weld-in adapterΦ30 x 40 mm
9 Spherical weld-in adapter Φ25 mm
10 Milk pipe connection according to DIN 11851 with threaded bottom part iTHERM QuickNeck, torque 5 Nm (3.69 lbf ft), glued with loctite® 270.

Position	Version	Length
Length of thermowell lagging T [1]	Metal sealing system M12x1	46 mm (1.81 in)
	Metal sealing system G½"	60 mm (2.36 in)
	Tri-clamp (0.5"-0.75")	24 mm (0.94 in)
	Microclamp (DN8-18)	23 mm (0.91 in)
	Clamp DN12 according to ISO 2852	24 mm (0.94 in)
	Clamp DN25/DN40 according to ISO 2852	21 mm (0.83 in)
	Sanitary connection DN25/DN32/DN40 according to DIN 11851	29 mm (1.14 in)
	Spherical-cylindrical weld-in adapter	58 mm (2.28 in)
	Cylindrical weld-in adapter Φ12 mm (0.47 in)	55 mm (2.17 in)
	Without process connection (only G3/8" thread)	11 mm (0.43 in)
	Cylindrical weld-in adapter	55 mm (2.17 in)
	Spherical weld-in adapter	47 mm (1.85 in)
Immersion length U	Independent of the version	Variable, depending on the configuration
Base thickness B	Reduced tip Φ4.3 mm (0.17 in)	2 mm (0.08 in)

1) Depends on the process connection

Thermowell diameter 9 mm (0.35 in)



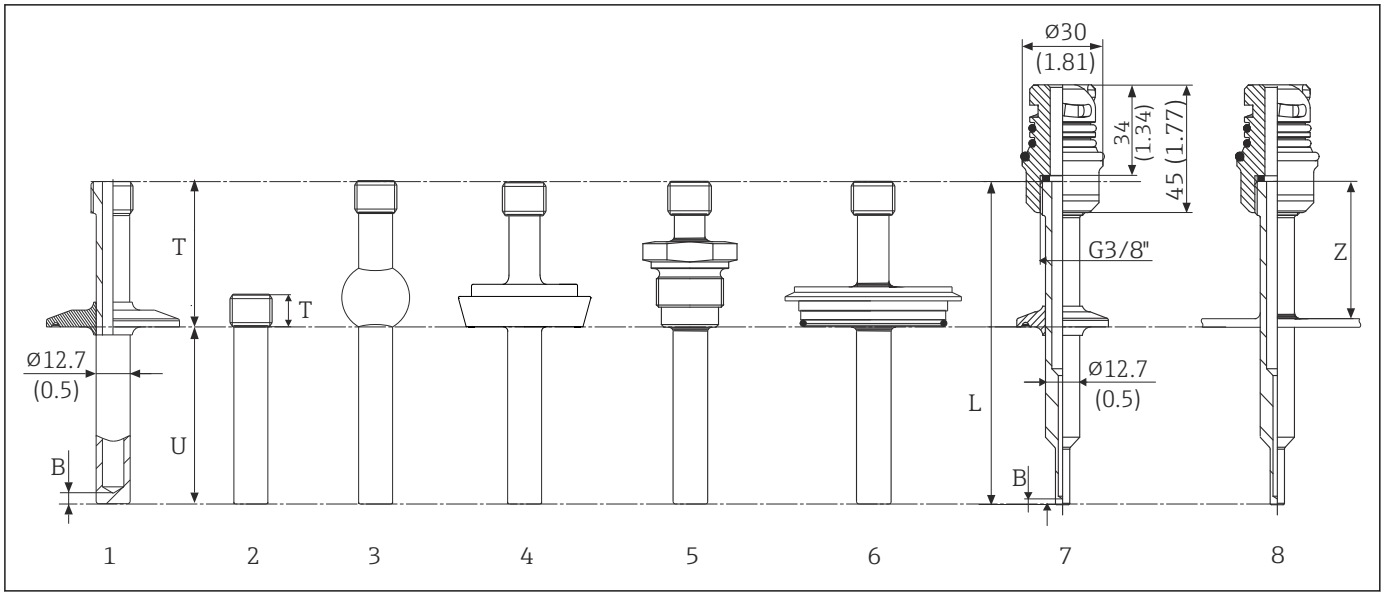
5 Thermowell with M24x1.5 connection thread and the following process connection versions:

1 Clamp as per ISO2852
2 Cylindrical weld-in adapter Φ30 x 40 mm
3 Spherical-cylindrical weld-in adapterΦ30 x 40 mm
4 Spherical weld-in adapter Φ25 mm
5 Milk pipe connection according to DIN 11851
6 Aseptic pipe union according to DIN 11864-1 Form A
7 Metal sealing system G½"
8 Thread according to ISO 228 for Liquiphant weld-in adapter
9 APV Inline
10 Varivent®
11 Ingold connection
12 SMS 1147
13 Neumo Biocontrol
14 Ingold connection, for example with bottom part iTHERM QuickNeck

Position	Version	Length
Length of thermowell lagging T, without quick-fastening iTHERM QuickNeck		Variable, depending on the configuration
With quick-fastening iTHERM QuickNeck, depending on the process connection	SMS 1147, DN25	40 mm (1.57 in)
	SMS 1147, DN38	41 mm (1.61 in)
	SMS 1147, DN51	42 mm (1.65 in)
	Varivent®, type F, ΦD = 50 mm (1.97 in)	52 mm (2.05 in)
	Varivent®, type N, ΦD = 68 mm (2.67 in)	
	Varivent®, type B, ΦD = 31 mm (1.22 in)	56 mm (2.2 in)

Position	Version	Length
	G1" thread according to ISO 228 for Liquiphant weld-in adapter	77 mm (3.03 in)
	Spherical-cylindrical weld-in adapter	70 mm (2.76 in)
	Cylindrical weld-in adapter	67 mm (2.64 in)
	Aseptic pipe union according to DIN11864-A, DN25	42 mm (1.65 in)
	Aseptic pipe union according to DIN11864-A, DN40	43 mm (1.7 in)
	Sanitary connection according to DIN 11851, DN32	47 mm (1.85 in)
	Sanitary connection according to DIN 11851, DN40	
	Sanitary connection according to DIN 11851, DN50	48 mm (1.89 in)
	Clamp according to ISO 2852, DN12	
	Clamp according to ISO 2852, DN25	37 mm (1.46 in)
	Clamp according to ISO 2852, DN40	39 mm (1.54 in)
	Clamp according to ISO 2852, DN63.5	
	Clamp according to ISO 2852, DN70	
	Microclamp (DN8-18)	47 mm (1.85 in)
	Tri-clamp (0.5"-0.75")	46 mm (1.81 in)
	Ingold connection Φ25 mm (0.98 in) x 30 mm (1.18 in)	78 mm (3.07 in)
	Ingold connection Φ25 mm (0.98 in) x 46 mm (1.81 in)	94 mm (3.7 in)
	Metal sealing system G½"	74 mm (2.91 in)
	APV-Inline, DN50	51 mm (2.01 in)
Immersion length U	Independent of the version	Variable, depending on the configuration
Base thickness B	Reduced tip Φ5.3 mm (0.21 in) x 20 mm (0.79 in)	2 mm (0.08 in)
	Tapered tip Φ 6.6 mm (0.26 in) x 60 mm (2.36 in)	
	Straight tip	

Thermowell diameter 12.7 mm (½ in)



6 Thermowell with extension neck connection G3/8" and various process connection versions:

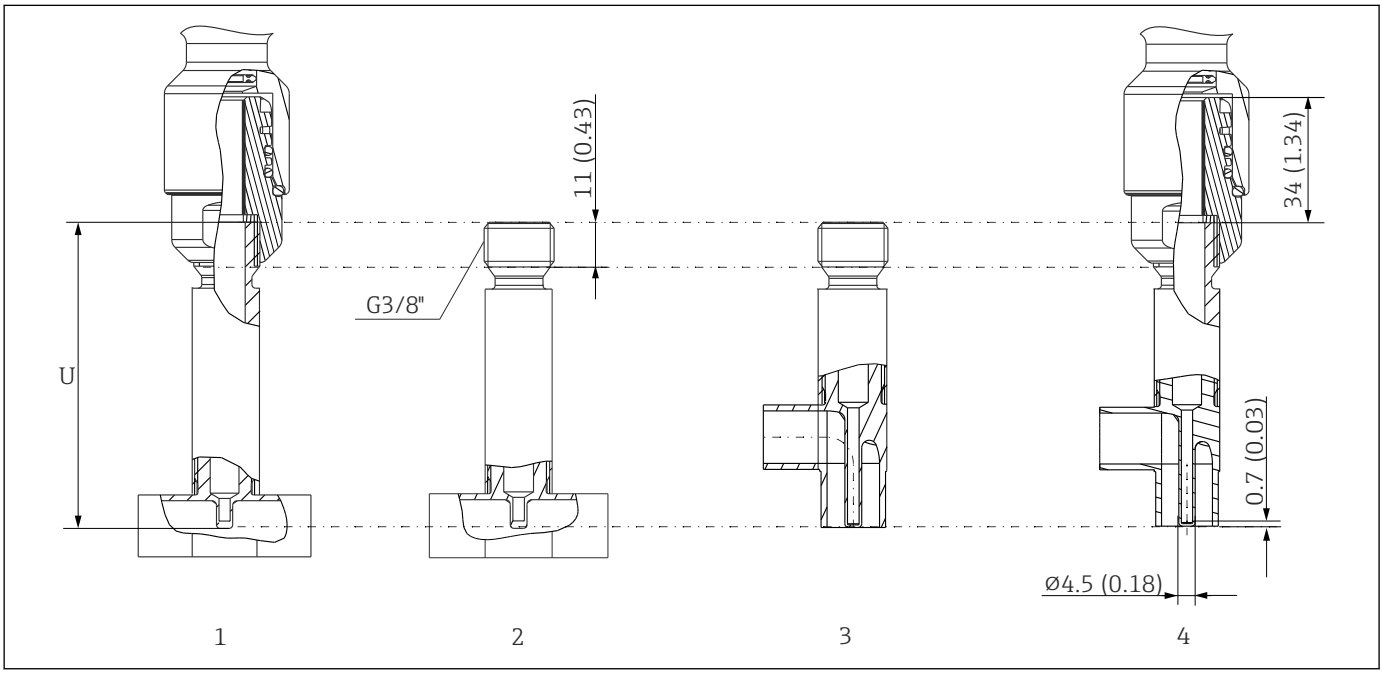
1 Clamp version
2 Cylindrical weld-in adapter Φ12.7 mm (0.5 in)
3 Spherical weld-in adapter Φ25 mm
4 Milk pipe connection according to DIN 11851
5 Thread according to ISO 228 for Liquiphant weld-in adapter
6 Varivent®
7 Microclamp, threaded with QuickNeck bottom part, torque 5 Nm (3.69 lbf ft), and glued with loctite® 270, and reduced tip
8 Cylindrical weld-in adapter with QuickNeck bottom part

Welded thermowell at the tip

Position	Version	Length
Length of thermowell lagging T	Weld-in adapter, cylindrical, Φ12.7 mm (½ in)	12 mm (0.47 in)
	All other process connections	65 mm (2.56 in)
Immersion length U	Independent of the process connection	Variable, depending on the configuration
Base thickness B	Reduced tip Φ5.3 mm (0.21 in) x 20 mm (0.79 in)	2 mm (0.079 in)
	Reduced tip Φ8 mm (0.31 in) x 32 mm (1.26 in)	4 mm (0.16 in)
	Straight tip	6 mm (0.24 in)
Minimum distance Z	Weld-in adapter, cylindrical, Φ12.7 mm (½ in)	65 mm (2.56 in) With this version, the minimum distance from the welding seam to the QuickNeck bottom part must be observed as otherwise the gluing and sealing function in the QuickNeck cannot be guaranteed.

Thermowell version as T-piece or elbow piece, optimized

No welds, no dead legs



7 *Thermowell as per DIN 11865 or ASME BPE*

1 *T-piece with threaded QuickNeck bottom part, torque 5 Nm (3.69 lbf ft), and glued with threadlocking adhesive*
2 *T-piece with extension neck connection G3/8"*
3 *Elbow piece with extension neck connection G3/8"*
4 *Elbow piece with threaded QuickNeck bottom part, torque 5 Nm (3.69 lbf ft), and glued with threadlocking adhesive*
U *Immersion length*

- Pipe sizes as per DIN 11865 series A (DIN), B (ISO) and C (ASME BPE) → 19
- 3-A marked for nominal diameters >= DN25 for 3-A, EHEDG and ASME BPE
- EHEDG certified for nominal diameters >= DN25 for 3-A, EHEDG and ASME BPE
- ASME BPE-compliant for nominal diameters >= DN25 for 3-A, EHEDG and ASME BPE
- IP69K protection class
- 1.4435+316L material, delta ferrite content < 0.5%
- Temperature range: −60 to +200 °C (−76 to +392 °F)
- Pressure range: PN25 as per DIN11865

Due to the short immersion length U in the case of small pipe diameters, the use of iTHERM QuickSens inserts is recommended.

As a general rule, the longer the immersion length U the better the accuracy. For small pipe diameters it is advisable to use elbow pieces to enable a maximum immersion length U.

Suitable immersion lengths for the following thermometers:
- Easytemp TMR35: 83 mm (3.27 in)
- iTHERM TM411: 85 mm (3.35 in)
- iTHERM TM311: 85 mm (3.35 in)
- TrustSens TM371: 85 mm (3.35 in)

Possible combinations of the thermowell versions with the available process connections

Process connection and size	Thermowell diameter			iTHERM QuickNeck for ϕ9 mm (0.35 in) [1]
	6 mm (¼ in)	9 mm (0.35 in)	12.7 mm (½ in)	
Without process connection (for installation with compression fitting)	☑	-	-	-
Weld-in adapter				
Cylindrical ϕ12.7 mm (½ in)	-	-	☑	-
Cylindrical ϕ30 x 40 mm	☑	☑	-	☑
Cylindrical ϕ12 x 40 mm		-	-	-
Spherical-cylindrical ϕ30 x 40 mm	☑	☑	-	☑
Spherical ϕ25 mm (0.98 in)	☑	☑	☑	-
Clamp according to ISO 2852				
Microclamp/Tri-clamp DN18 (0.75 in)	☑ [2]	☑	-	☑
DN12 - 21.3			☑	
DN25 -38 (1 - 1.5 in)	☑	☑	☑	☑
DN40 - 51 (2 in)				
DN63.5 (2.5 in)	-	☑	☑	☑
DN70 - 76.5 (3 in)				
Milk pipe connection according to DIN 11851				
DN25	☑	☑	☑	-
DN32, DN40				☑
DN50	-			
Aseptic pipe union according to DIN 11864-1 Form A				
DN25, DN40	-	☑	-	☑
Metal sealing system				
M12x1	☑	-	-	-
G½"		☑		☑
Thread according to ISO 228 for Liquiphant weld-in adapter				
G¾" for FTL20, FTL31, FTL33	-	☑	☑	-
G¾" for FTL50				-
G1" for FTL50				☑
APV Inline				
DN50	-	☑	-	☑
Varivent®				
Type B, ϕ31 mm; type F, ϕ50 mm ; type N, ϕ68 mm	-	☑	☑	☑
Ingold connection				
25 x 30 mm or 25 x 46 mm	-	☑	-	☑
SMS 1147				
DN25, DN38, DN51	-	☑	-	☑
Neumo Biocontrol				
D25 PN16, D50 PN16, D65 PN16	-	☑	-	-

1) In the case of 6 mm (¼ in) and 12.7 mm (½ in) diameters, the iTHERM QuickNeck is available for all process connection versions.
2) Microclamp/Tri-clamp DN8 (0.5") only possible in conjunction with a thermowell diameter = 6 mm (¼ in).

Weight

0.5 to 2.5 kg (1 to 5.5 lbs) for standard options.

Material

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 compressive load. The maximum operating temperatures can be reduced considerably in cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Designation	Short form	Recommended max. temperature for continuous use in air	Properties
AISI 316L (corresponds to 1.4404 or 1.4435)	X2CrNiMo17-13-2, X2CrNiMo18-14-3	650 °C (1202 °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 ▪ The wetted part in a protective tube is made of 316L or 1.4435+316L passivated with 3% sulfuric acid.
1.4435+316L, delta ferrite < 1% or < 0.5%	With regard to analytical limits, the specifications of both materials (1.4435 and 316L) are met simultaneously. In addition, the delta ferrite content of the wetted parts is limited to <1% or <0.5% ≤3% at weldings (following Basel Standard II)		

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

Surface roughness

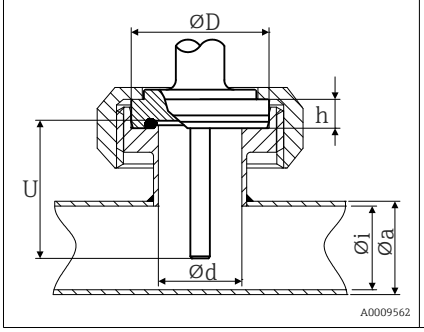
Values for wetted surfaces:

Standard surface, mechanically polished [1]	R_a ≤ 0.76 µm (30 µin)
Mechanically polished [1], buffed [2]	R_a ≤ 0.38 µm (15 µin)
Mechanically polished [1], buffed and electropolished	R_a ≤ 0.38 µm (15 µin)+ electropolished

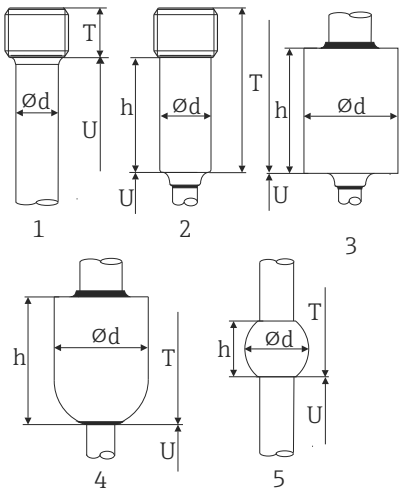
1) Or any other finishing method that meets the R_a max
2) Not compliant with ASME BPE

Process connections

All dimensions in mm (in).

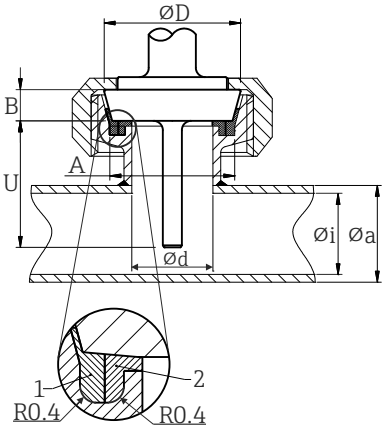
Type	Version	Dimensions					Technical properties
		ϕd	ϕD	ϕi	ϕa	h	
Aseptic pipe union according to DIN 11864-1, Form A 	DN25	26 mm (1.02 in)	42.9 mm (1.7 in)	26 mm (1.02 in)	29 mm (1.14 in)	9 mm (0.35 in)	▪ $P_{max.}$ = 40 bar (580 psi) ▪ 3-A marked and EHEDG certified ▪ ASME BPE compliance
	DN40	38 mm (1.5 in)	54.9 mm (2.16 in)	38 mm (1.5 in)	41 mm (1.61 in)	10 mm (0.39 in)	

For welding in

Type	Version	Dimensions	Technical properties
Weld-in adapter 	1: Cylindrical [1]	Φd = 12.7 mm (½ in), U = immersion length from lower edge of thread, T = 12 mm (0.47 in)	▪ $P_{max.}$ depends on the weld-in process ▪ 3-A marked and EHEDG certified ▪ ASME BPE compliance
	2: Cylindrical [2]	Φd x h = 12 mm (0.47 in) x 40 mm (1.57 in), T = 55 mm (2.17 in)	
	3: Cylindrical	Φd x h = 30 mm (1.18 in) x 40 mm (1.57 in)	
	4: Spherical-cylindrical	Φd x h = 30 mm (1.18 in) x 40 mm (1.57 in)	
	5: Spherical	Φd = 25 mm (0.98 in) h = 24 mm (0.94 in)	

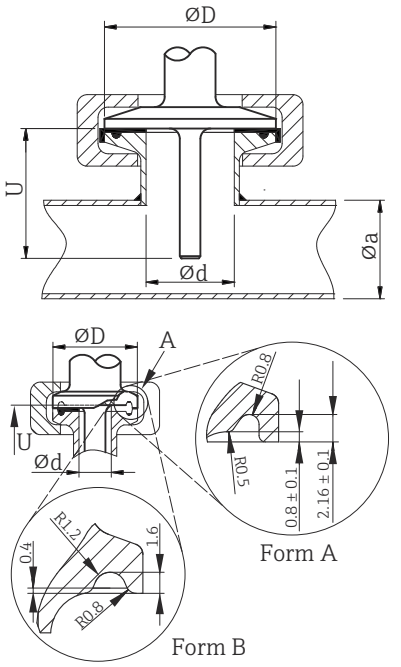
1) For protection pipe Φ12.7 mm (½ in)
2) For protection pipe Φ6 mm (¼ in)

Releasable process connection

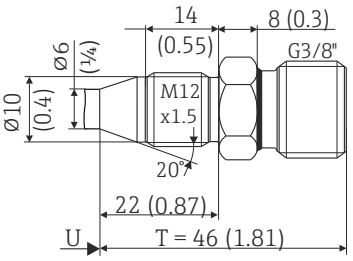
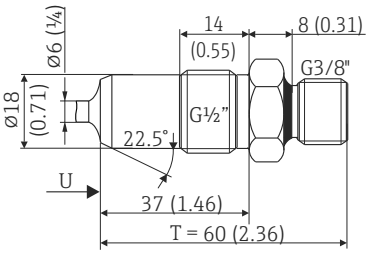
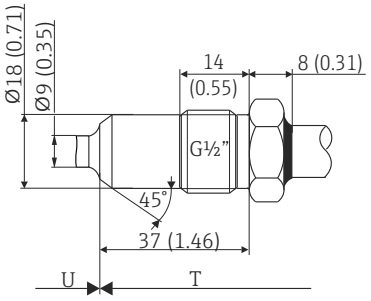
Type	Technical properties
Sanitary connection according to DIN 11851  *1 Centering ring* *2 Sealing ring*	▪ 3-A marked and EHEDG certified (only with EHEDG-certified and self-centering sealing ring). ▪ ASME BPE compliance

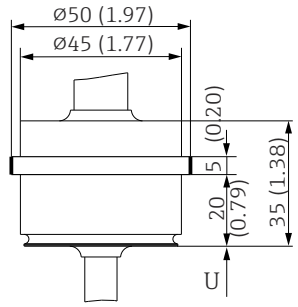
Version [1]	Dimensions					$P_{max.}$
	ΦD	A	B	Φi	Φa	
DN25	44 mm (1.73 in)	30 mm (1.18 in)	10 mm (0.39 in)	26 mm (1.02 in)	29 mm (1.14 in)	40 bar (580 psi)
DN32	50 mm (1.97 in)	36 mm (1.42 in)	10 mm (0.39 in)	32 mm (1.26 in)	35 mm (1.38 in)	40 bar (580 psi)
DN40	56 mm (2.2 in)	42 mm (1.65 in)	10 mm (0.39 in)	38 mm (1.5 in)	41 mm (1.61 in)	40 bar (580 psi)
DN50	68 mm (2.68 in)	54 mm (2.13 in)	11 mm (0.43 in)	50 mm (1.97 in)	53 mm (2.1 in)	25 bar (363 psi)

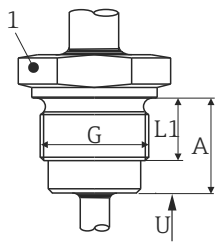
1) Pipes in accordance with DIN 11850

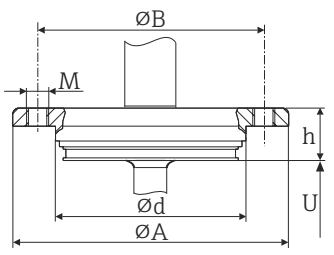
Type	Version	Dimensions		Technical properties	Conformity
	ϕd [1]	ϕD	ϕa		
Clamp according to ISO 2852  Form A: In compliance with ASME BPE Type A Form B: In compliance with ASME BPE Type B and ISO 2852	Microclamp [2] DN8-18 (0.5"-0.75") [3], Form A	25 mm (0.98 in)	-	▪ $P_{max.}$ = 16 bar (232 psi), depends on clamp ring and suitable seal ▪ 3-A marked	-
	Tri-clamp DN8-18 (0.5"-0.75") [3], Form B		-		Based on ISO 2852 [4]
	Clamp DN12-21.3, Form B	34 mm (1.34 in)	16 to 25.3 mm (0.63 to 0.99 in)		ISO 2852
	Clamp DN25-38 (1"-1.5"), Form B	50.5 mm (1.99 in)	29 to 42.4 mm (1.14 to 1.67 in)	▪ $P_{max.}$ = 16 bar (232 psi), depends on clamp ring and suitable seal ▪ 3-A marked and EHEDG certified (in connection with Combifit seal) ▪ Can be used with "Novaseptic Connect (NA Connect)" which enables flush-mount installation	ASME BPE Type B; ISO 2852
	Clamp DN40-51 (2"), Form B	64 mm (2.52 in)	44.8 to 55.8 mm (1.76 to 2.2 in)		ASME BPE Type B; ISO 2852
	Clamp DN63.5 (2.5"), Form B	77.5 mm (3.05 in)	68.9 to 75.8 mm (2.71 to 2.98 in)		ASME BPE Type B; ISO 2852
	Clamp DN70-76.5 (3"), Form B	91 mm (3.58 in)	> 75.8 mm (2.98 in)		ASME BPE Type B; ISO 2852

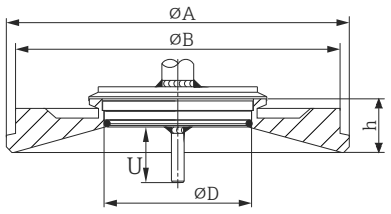
1) Pipes in accordance with ISO 2037 and BS 4825 Part 1
2) Microclamp (not in ISO 2852); no standard pipes
3) DN8 (0.5") only possible with protection pipe diameter = 6 mm (¼ in)
4) Groove diameter = 20 mm

Type		Version	Technical properties
Metal sealing system		Protection pipe diameter 6 mm (¼ in)	$P_{max.}$ = 16 bar (232 psi) Maximum torque = 10 Nm (7.38 lbf ft)
M12x1.5	**G½"**		
			
-		Protection pipe diameter 9 mm (0.35 in)	$P_{max.}$ = 16 bar (232 psi) Maximum torque = 10 Nm (7.38 lbf ft)

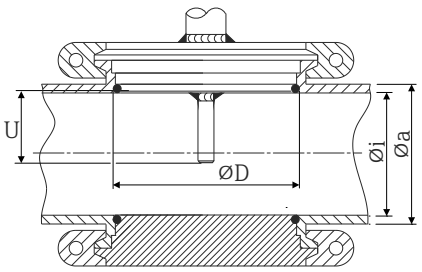
Type	Version	Technical properties
Process adapter 	D45	-

Type	Version G	Dimensions			Technical properties
		L1 thread length	A	1 (SW/AF)	
Thread according to ISO 228 (for Liquiphant weld-in adapter) 	G¾" for FTL20/31/33 adapter	16 mm (0.63 in)	25.5 mm (1 in)	32	▪ $P_{max.}$ = 25 bar (362 psi) at max. 150 °C (302 °F) ▪ $P_{max.}$ = 40 bar (580 psi) at max. 100 °C (212 °F) ▪ Information about hygienic compliance in connection with FTL31/33/50 adapter see TI00426F
	G¾" for FTL50 adapter				
	G1" for FTL50 adapter	18.6 mm (0.73 in)	29.5 mm (1.16 in)	41	

Type	Version	Dimensions					Technical properties
		ϕd	ϕA	ϕB	M	h	
APV Inline 	DN50	69 mm (2.72 in)	99.5 mm (3.92 in)	82 mm (3.23 in)	2xM8	19 mm (0.75 in)	▪ $P_{max.}$ = 25 bar (362 psi) ▪ 3-A marked and EHEDG certified ▪ ASME BPE compliance

Type	Version	Dimensions				Technical properties	
		ϕD	ϕA	ϕB	h	$P_{max.}$	
Varivent® 	Type B	31 mm (1.22 in)	105 mm (4.13 in)	-	22 mm (0.87 in)	10 bar (145 psi)	▪ 3-A marked and EHEDG certified ▪ ASME BPE compliance
	Type F	50 mm (1.97 in)	145 mm (5.71 in)	135 mm (5.31 in)	24 mm (0.95 in)		
	Type N	68 mm (2.67 in)	165 mm (6.5 in)	155 mm (6.1 in)	24.5 mm (0.96 in)		

The VARINLINE® housing connection flange is suitable for welding into the conical or torispherical head in tanks or containers with a small diameter (≤ 1.6 m (5.25 ft)) and up to a wall thickness of 8 mm (0.31 in).

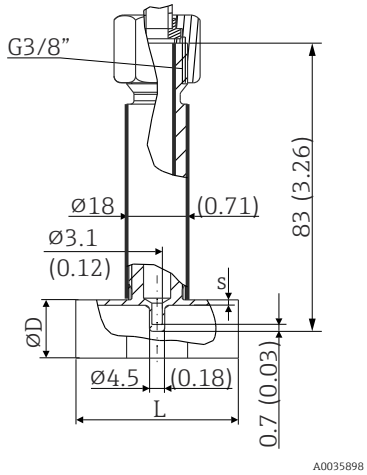
Type	Technical properties
Varivent® for VARINLINE® housing for installation in pipes 	▪ 3-A marked and EHEDG certified ▪ ASME BPE compliance

Version	Dimensions			$P_{max.}$
	ϕD	ϕi	ϕa	
Type N, according to DIN 11866, series A	68 mm (2.67 in)	DN40: 38 mm (1.5 in)	DN40: 41 mm (1.61 in)	DN40 to DN65: 16 bar (232 psi)
		DN50: 50 mm (1.97 in)	DN50: 53 mm (2.1 in)	
		DN65: 66 mm (2.6 in)	DN65: 70 mm (2.76 in)	
		DN80: 81 mm (3.2 in)	DN80: 85 mm (3.35 in)	DN80 to DN150: 10 bar (145 psi)
		DN100: 100 mm (3.94 in)	DN100: 104 mm (4.1 in)	
		DN125: 125 mm (4.92 in)	DN125: 129 mm (5.08 in)	
		DN150: 150 mm (5.9 in)	DN150: 154 mm (6.06 in)	
Type N, according to EN ISO 1127, series B	68 mm (2.67 in)	38.4 mm (1.51 in)	42.4 mm (1.67 in)	42.4 mm (1.67 in) to 60.3 mm (2.37 in): 16 bar (232 psi)
		44.3 mm (1.75 in)	48.3 mm (1.9 in)	

Type				Technical properties
		56.3 mm (2.22 in)	60.3 mm (2.37 in)	
		72.1 mm (2.84 in)	76.1 mm (3 in)	76.1 mm (3 in) to 114.3 mm (4.5 in): 10 bar (145 psi)
		82.9 mm (3.26 in)	42.4 mm (3.5 in)	
		108.3 mm (4.26 in)	114.3 mm (4.5 in)	
Type N, according to DIN 11866, series C	68 mm (2.67 in)	OD 1½": 34.9 mm (1.37 in)	OD 1½": 38.1 mm (1.5 in)	OD 1½" to OD 2½": 16 bar (232 psi)
		OD 2": 47.2 mm (1.86 in)	OD 2": 50.8 mm (2 in)	
		OD 2½": 60.2 mm (2.37 in)	OD 2½": 63.5 mm (2.5 in)	
Type N, according to DIN 11866, series C	68 mm (2.67 in)	OD 3": 73 mm (2.87 in)	OD 3": 76.2 mm (3 in)	OD 3" to OD 4": 10 bar (145 psi)
		OD 4": 97.6 mm (3.84 in)	OD 4": 101.6 mm (4 in)	

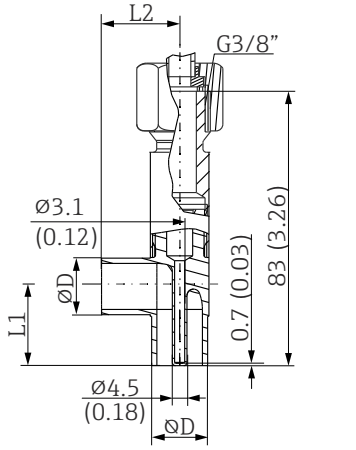
Due to the short immersion length U, the use of iTHERM QuickSens inserts is recommended.

T-piece, optimized (no welding, no dead legs)

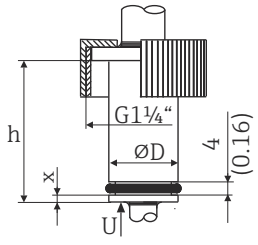
Type	Version		Dimensions in mm (in)			Technical properties
			ØD	L	s [1]	
T-piece for weld-in as per DIN 11865 (series A, B and C) 	Series A	DN10 PN25	13 mm (0.51 in)	48 mm (1.89 in)	1.5 mm (0.06 in)	• $P_{max.}$ = 25 bar (362 psi) • 3-A marked [2] and EHEDG certified [2] • ASME BPE compliance [2]
		DN15 PN25	19 mm (0.75 in)			
		DN20 PN25	23 mm (0.91 in)			
		DN25 PN25	29 mm (1.14 in)			
		DN32 PN25	32 mm (1.26 in)			
	Series B	DN13.5 PN25	13.5 mm (0.53 in)		1.6 mm (0.063 in)	
		DN17.2 PN25	17.2 mm (0.68 in)			
		DN21.3 PN25	21.3 mm (0.84 in)			
		DN26.9 PN25	26.9 mm (1.06 in)			
		DN33.7 PN25	33.7 mm (1.33 in)		2 mm (0.08 in)	
	Series C	DN12.7 PN25 (½")	12.7 mm (0.5 in)		1.65 mm (0.065 in)	
		DN19.05 PN25 (¾")	19.05 mm (0.75 in)			
		DN25.4 PN25 (1")	25.4 mm (1 in)			
		DN38.1 PN25 (1½")	38.1 mm (1.5 in)			

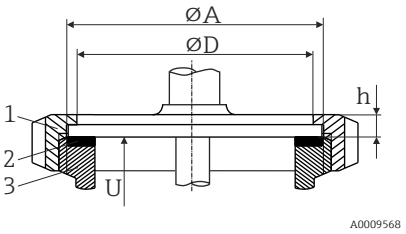
1) Wall thickness
2) Applies to ≥ DN25. The radius ≥ 3.2 mm (⅛ in) cannot be maintained for smaller nominal diameters.

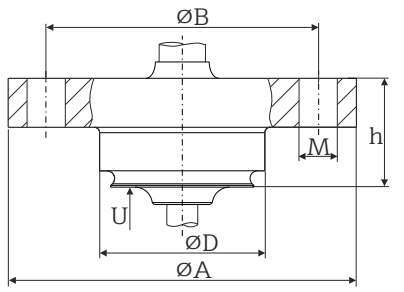
Elbow piece, optimized (no welding, no dead legs)

Type	Version		Dimensions				Technical properties
			⌀D	L1	L2	s [1]	
Elbow piece for weld-in as per DIN 11865 (series A, B and C) 	Series A	DN10 PN25	13 mm (0.51 in)	24 mm (0.95 in)		1.5 mm (0.06 in)	▪ $P_{max.}$ = 25 bar (362 psi) ▪ 3-A marked [2] and EHEDG certified [2] ▪ ASME BPE compliance [2]
		DN15 PN25	19 mm (0.75 in)	25 mm (0.98 in)			
		DN20 PN25	23 mm (0.91 in)	27 mm (1.06 in)			
		DN25 PN25	29 mm (1.14 in)	30 mm (1.18 in)			
		DN32 PN25	35 mm (1.38 in)	33 mm (1.3 in)			
	Series B	DN13.5 PN25	13.5 mm (0.53 in)	32 mm (1.26 in)		1.6 mm (0.063 in)	
		DN17.2 PN25	17.2 mm (0.68 in)	34 mm (1.34 in)			
		DN21.3 PN25	21.3 mm (0.84 in)	36 mm (1.41 in)			
		DN26.9 PN25	26.9 mm (1.06 in)	29 mm (1.14 in)			
		DN33.7 PN25	33.7 mm (1.33 in)	32 mm (1.26 in)		2.0 mm (0.08 in)	
	Series C	DN12.7 PN25 (½")	12.7 mm (0.5 in)	24 mm (0.95 in)		1.65 mm (0.065 in)	
		DN19.05 PN25 (¾")	19.05 mm (0.75 in)	25 mm (0.98 in)			
		DN25.4 PN25 (1")	25.4 mm (1 in)	28 mm (1.1 in)			
		DN38.1 PN25 (1½")	38.1 mm (1.5 in)	35 mm (1.38 in)			

1) Wall thickness
2) Applies to ≥ DN25. The radius ≥ 3.2 mm (⅛ in) cannot be maintained for smaller nominal diameters.

Type	Version, dimensions ⌀D x h	Technical properties
Ingold connection 	⌀25 mm (0.98 in) x 30 mm (1.18 in) x = 1.5 mm (0.06 in)	$P_{max.}$ = 25 bar (362 psi) A seal is included in the scope of delivery. V75SR material: Complies with FDA, 3-A Sanitary Standard 18-03 Class 1 and USP Class VI
	⌀25 mm (0.98 in) x 46 mm (1.81 in) x = 6 mm (0.24 in)	

Type	Version	Dimensions			Technical properties
		ΦD	ΦA	h	
SMS 1147  *1 Coupling nut* *2 Sealing ring* *3 Counterpart connection*	DN25	32 mm (1.26 in)	35.5 mm (1.4 in)	7 mm (0.28 in)	$P_{max.}$ = 6 bar (87 psi)
	DN38	48 mm (1.89 in)	55 mm (2.17 in)	8 mm (0.31 in)	
	DN51	60 mm (2.36 in)	65 mm (2.56 in)	9 mm (0.35 in)	
The counterpart connection must fit the sealing ring and fix it in place.					

Type	Version	Dimensions					Technical properties
		ΦA	ΦB	ΦD	Φd	h	
Neumo Biocontrol  	D25 PN16	64 mm (2.52 in)	50 mm (1.97 in)	30.4 mm (1.2 in)	7 mm (0.28 in)	20 mm (0.79 in)	
	D50 PN16	90 mm (3.54 in)	70 mm (2.76 in)	49.9 mm (1.97 in)	9 mm (0.35 in)	27 mm (1.06 in)	▪ $P_{max.}$ = 16 bar (232 psi) ▪ 3-A marked
	D65 PN25	120 mm (4.72 in)	95 mm (3.74 in)	67.9 mm (2.67 in)	11 mm (0.43 in)		

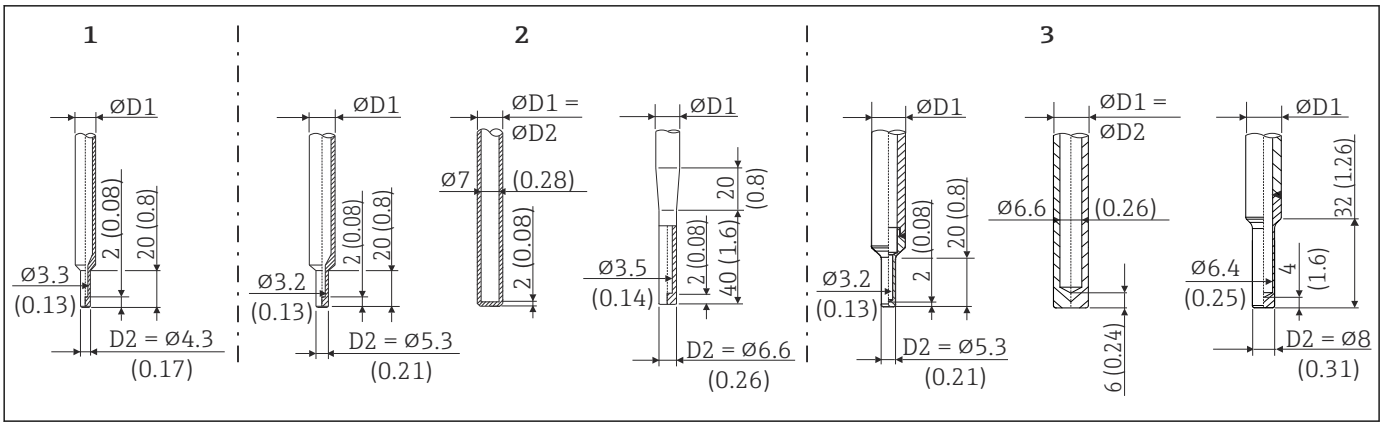
The 316L compression fittings can only be used once due to deformation. This applies to all the components of the compression fittings! A replacement compression fitting must be attached in a different position (grooves in the protection pipe). PEEK compression fittings must never be used at a temperature that is lower than the temperature present when the compression fitting is secured. This is because the fitting would no longer be leak-tight as a result of heat contraction of the PEEK material.

SWAGELOCK or similar fittings are strongly recommended for higher requirements.

Tip shape

The thermal response time, the reduction of the flow cross-section and the mechanical load that occurs in the process are the criteria that matter when selecting the shape of the tip. Advantages of using reduced or tapered thermometer tips:

- A smaller tip shape has less impact on the flow characteristics of the pipe carrying the medium.
- The flow characteristics are optimized, thereby increasing the stability of the thermowell.
- Endress+Hauser offers users a range of thermowell tips to meet every requirement:
  - Reduced tip with Ø4.3 mm (0.17 in) and Ø5.3 mm (0.21 in): walls of lower thickness significantly reduce the response times of the overall measuring point.
  - Tapered tip with Ø6.6 mm (0.26 in) and reduced tip with Ø8 mm (0.31 in): walls of greater thickness are particularly well suited to applications with a higher degree of mechanical load or wear (e.g. pitting, abrasion etc.).



8 *Thermowell tips available (reduced, straight or tapered)*

Item No.	Thermowell (ØD1)		Insert (ØID)
1	Ø6 mm (¼ in)	Reduced tip	Ø3 mm (⅛ in)
2	Ø9 mm (0.35 in)	▪ Reduced tip with Ø5.3 mm (0.21 in) ▪ Straight tip ▪ Tapered tip with Ø6.6 mm (0.26 in)	▪ Ø3 mm (⅛ in) ▪ Ø6 mm (¼ in) ▪ Ø3 mm (⅛ in)
3	Ø12.7 mm (½ in)	▪ Reduced tip with Ø5.3 mm (0.21 in) ▪ Straight tip ▪ Reduced tip with Ø8 mm (0.31 in)	▪ Ø3 mm (⅛ in) ▪ Ø6 mm (¼ in) ▪ Ø6 mm (¼ in)

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

Certificates and approvals

Current certificates and approvals that are available for the product can be selected via 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**.

Hygiene standard

- EHEDG certification, type EL CLASS I. EHEDG certified/tested process connections. → 14
- 3-A authorization no. 1144, 3-A Sanitary Standard 74-07. Listed process connections. → 14
- ASME BPE, certificate of conformity can be ordered for indicated options
- FDA-compliant
- All surfaces in contact with the medium are free of animal derived ingredients (ADI/TSE) and do not contain any materials derived from bovine or animal sources.

Materials in contact with food/product (FCM)

The materials of the thermometer in contact with food/product (FCM) comply with the following European regulations:

- (EC) No. 1935/2004, Article 3, paragraph 1, Articles 5 and 17 on materials and articles intended to come into contact with food.
- (EC) No. 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.
- (EU) No. 10/2011 on plastic materials and articles intended to come into contact with food.

CRN approval

The CRN approval is only available for certain thermowell versions. These versions are identified and displayed accordingly during the configuration of the device.

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

1. Select the country
2. Select Downloads
3. In the search area: select Approvals/approval type
4. Enter the product code or device
5. Start the search

Surface cleanliness

- Free from oil and grease for O_2 applications, optional
- PWIS-free (PWIS = paint-wetting impairment substances as per DIL0301), optional

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.

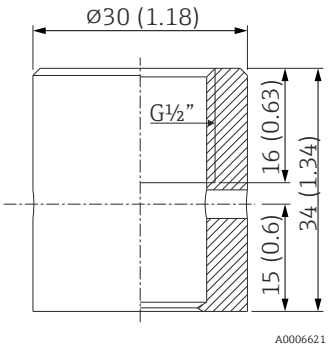
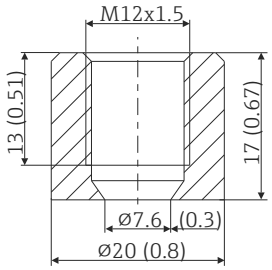
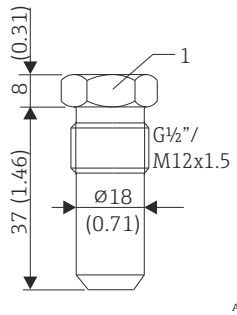
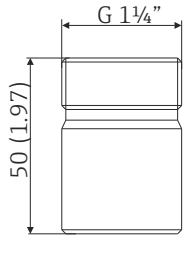
Product Configurator - the tool for individual product configuration

- 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

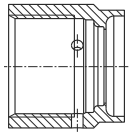
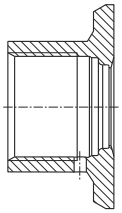
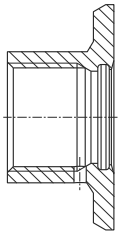
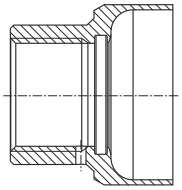
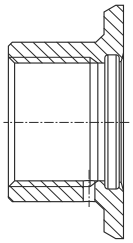
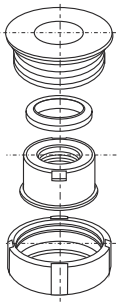
Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Device-specific accessories

Accessories	Description
Welding boss with sealing taper (metal - metal)  	Welding boss for G½" and M12x1 thread Metal-sealing; conical Material of wetted parts: 316L/1.4435 Max. process pressure 16 bar (232 PSI) **Order number:** ▪ 71424800 (G½") ▪ 71405560 (M12x1)
Dummy plug  *1 Size across flats SW22*	Dummy plug for G½" or M12x1 conical metal-sealing welding boss Material: SS 316L/1.4435 **Order number:** ▪ 60022519 (G½") ▪ 60021194 (M12x1)
Weld-in adapter for Ingold process connection (OD25 mm (0.98 in)x46 mm (1.81 in) 	Material of wetted parts: 316L/1.4435 Weight: 0.32 kg (0.7 lb) Adapter for Ingold process connection with 3.1 material certificate, **order number:** 71531585 Adapter for Ingold process connection, **order number:** 71531588 O-ring seal set ▪ Silicone O-ring in accordance with FDA CFR 21 ▪ Maximum temperature: 230 °C (446 °F) ▪ **Order number:** 60018911

Weld-in adapter

For more information about order codes and hygienic compliance of the adapters and spare parts, see Technical Information (TI00426F).

Weld-in adapter	 A0008246	 A0008251	 A0008256	 A0011924	 A0008248	 A0008253
	G ¾", d=29 for pipe-mounting	**G ¾", d=50 for vessel-mounting**	**G ¾", d=55 with flange**	**G 1", d=53 without flange**	**G 1", d=60 with flange**	**G 1" adjustable**
Material	316L (1.4435)	316L (1.4435)	316L (1.4435)	316L (1.4435)	316L (1.4435)	316L (1.4435)
Roughness µm (µin) process side	≤1.5 (59.1)	≤0.8 (31.5)	≤0.8 (31.5)	≤0.8 (31.5)	≤0.8 (31.5)	≤0.8 (31.5)

Maximum process pressure for the weld-in adapters:
- 25 bar (362 PSI) at maximum 150 °C (302 °F)
- 40 bar (580 PSI) at maximum 100 °C (212 °F)

Supplementary documentation

The following document types are available in the Downloads section of the Endress+Hauser website (www.endress.com/downloads):

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate

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 guide
These 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.

Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

Functional Safety Manual (FY/SD)

Depending on the SIL approval, the Functional Safety Manual (FY/SD) is an integral part of the Operating Instructions and applies in addition to the Operating Instructions, Technical Information and ATEX Safety Instructions.

The different requirements that apply for the protective function are described in the Functional Safety Manual (FY / SD).

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