Threaded thermowell bar stock design

Design description

Badotherm thermowell models TW211, W221, the W231 and are a bar stock, solid machined type thermowell with a threaded process connection. The construction is available with straight, stepped, or tapered stem. The standard material is AISI 316(L) and optionally various exotic materials are available. Thermowells are designed to protect the temperature bulb from corrosive effect, extreme pressure, or other process conditions. It also allows replacing the temperature instrument without disturbing the process.

Wetted part materials

Material common name	UNS	Wst.
AISI 316(L)	S31603	1.4404
AISI 304L	S30400	1.4306
AISI 310 MoLn	S31050	1.4466
AISI 316 UG	S31600	1.4435
AISI 321	S32100	1.4541
AISI 904(L)	N08904	1.4539
Alloy 20	N08020	2.4660
Alloy 400	N04400	2.4360
Alloy 600	N06600	2.4816
Alloy 625	N06625	2.4856
Alloy 825	N08825	2.4858
Alloy B2	N10665	2.4617
Alloy C-22	N06022	2.4602
Alloy C-276	N10276	2.4810
Duplex F44	S31254	1.4547
Duplex F51/F60	S32205	1.4462
Duplex F53	S32750	1.4410
Duplex F55	S32750	1.4410
Nickel 201	N02201	2.4068
Titanium Gr. 2[*1]	R50250	2.7025
Zirconium 702[*1]	R60702	-

Process connection

Standard	Male thread
ISO 228-1 (BSP)	G 1/2 A – G 3/4 A
ANSI B 1.20.1 (NPT)	1/2” NPT – 3/4” NPT

Instrument connection

Standard	Female thread
ISO 228-1 (BSP)	G 1/2 – G 3/4
ANSI B 1.20.1 (NPT)	1/2” NPT – 3/4” NPT

Material Certification

Material traceability and related certification are applicable for all process wetted parts. Material certification possibilities depend on the type of seal, the assembly construction and the materials used. Material certification is in accordance with EN10204 3.1.

Additional material certification and testing can be provided on request, such as Positive Material Identification (PMI), Intergranular corrosion (IGC) testing, material certification in accordance with EN10204 3.2, NACE conformity for ISO-15156 (MR-0175) and/or ISO-17945 (MR-0103), NORSOK M-630 and many more.

-> Please note that the responsibility for material selection always rests with the user.

Marking & Traceability

All parts are marked with heat number, material designation, size, and rating. Badotherm adds a Badotherm reference number, heat number of the stem and the manufacturers name to the flange for traceability purposes.

Materials and origin

All materials according to the applicable standards. The standard sourcing of flanges is of international origin. Optionally regional preference can be requested, for example materials from EU origin.

Testing

All thermowells are tested by means of an internal pressure test of 1.5x the maximum allowed working pressure of the flange taking the material into account. The test media of with which the thermowell is pressure tested is water with a chloride level <30 ppm.

Cleanliness of the wetted parts

All parts are standard cleaned from excessive oil and grease. When additional requirements are needed, the parts can be cleaned according customer requirements and cleaning specifications.

Thermocal performance calculation

For critical applications it is recommended to perform a performance calculation for the thermowell. The in-house developed Wake Frequency Calculator “Thermocal” gives the result according to the calculations of the ASME PTC 19.3 TW-2016 including engineering recommendations when the thermowell exceeds the allowed stress.

Dimensional limits

The ASME PTC 19.3 TW-2016 prescribes several limits. Outside these limits the WFC can not be generated. Thermowells outside restriction from below tables can be supplied without WFC calculation.

Straight and tapered thermowells

Description	Symbol	Minimum	Maximum
Unsupported length	L	63.5	610
Bore diameter	d	6.1	21.0
Tip diameter	B	12.6	46.5
Taper ratio	B/A	0.6	1.0
Bore ratio	d/B	0.16	0.71
Minimum wall thickness	(B-d)/2	3	

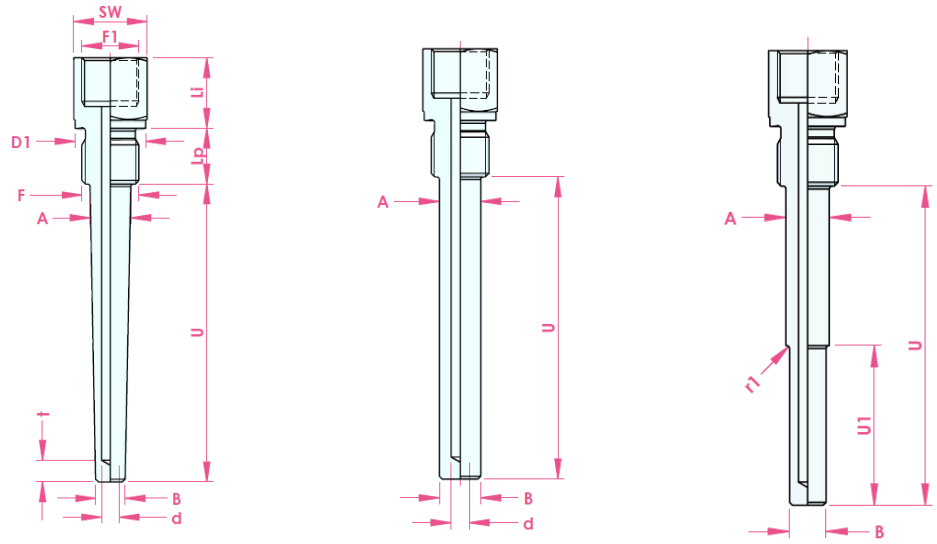
All dimensions in mm (except ratio)
For tapered executions L>240 of max 240mm. Rest of stem is straight (l-240)

Stepped thermowells

Description		Symbol	Minimum	Maximum
Unsupported length		L	127.0	610
Bore diameter		d	6.1	21.0
Step diameter ratio	B=12.70	B/A	0.5	0.8
	B=22.23		0.583	0.875
Length ratio		Ls/L	0	0.6
Minimum wall thickness		(B-d)/2	3	

All dimensions in mm (except ratio)

Dimensions table:



F	F1	Lp	Li	D	SW	t	d	A max	L
G ½ A (M20x1.5)	G ½ A (M20x1.5)	14	26.0	26 (25)	27	6.0	6.2	17.5	variable
							7		
							9		
							11		
G ¾ A (M27x2)		16		32	32		6.2	21	
							7		
							9		
							11		

All dimensions in mm, weight in kg

Thermowell selection

Selection	Sufffix	Description		
Thermowell type	BDTW211	Straight stem - threaded bar stock thermowell		
	BDTW221	Stepped stem - threaded bar stock thermowell		
	BDTW231	Tapered stem - threaded bar stock thermowell		
Process thread size	N12M	½" NPT		
	N34M	¾" NPT		
	G12M	G ½" A		
	G34M	G ¾" A		
Instrument thread size	N12F	½" NPT		
	N34F	¾" NPT		
	G12F	G ½"		
	G34F	G ¾"		
	M20F	M20		
Insertion length	U…	U length followed by U length in mm		
	U#….mm	U1 length for stepped executions only		
Bore diameter	B62	6.2mm	Bore diameter may be selected in all dimensions. Please check if the ratio's for wall thickness and bore ratio are in line with the tables for dimensional limits.	
	B65	6.5mm		
	B66	6.6mm		
	B70	7.0mm		
	B80	8.0mm		
	B85	8.5mm		
	B90	9.0mm		
	B10	10.0mm		
	B05	10.5mm		
	B11	11.0mm		
	B12	12.0mm		
	B25	12.5mm		
Root diameter	….mm	Diameter of the thermowell on the root of the thermowell		
Tip diameter	….mm	Diameter of the thermowell on the tip of the thermowell		
Radius at root	R3	3mm default radius from root to facing of the flange		
	R..	R followed by customized root in mm.		
Material selection of wetted parts	S316	AISI 316(L)	S31600/S31603	
	S304	AISI 304L	S30403	
	S310	AISI 310 MoLn	S31050	
	U316	AISI 316 UG	S31603 (mod)	
	S321	AISI 321	S32100	
	S904	AISI 904(L)	S08904	
	A020	Alloy 20	S 08020	
	A400	Alloy 400	S04400	
	A600	Alloy 600	S06600	
	A625	Alloy 625	S06625	
	A825	Alloy 825	S08825	
	AB02	Alloy B2	S10665	
	AC22	Alloy C-22	S06022	
	A276	Alloy C-276	S10276	
	DF44	Duplex F44	S31254	
	DF51	Duplex F51/F60	S31803/S32205	
	DF53	Duplex F53	S32750	
	DF55	Duplex F55	S32760	
	N201	Nickel 201	N02201	
	TG02	Titanium Gr. 2 *2	S R50400	
	Z702	Zirconium 702 *2	S R60702	

option selection

Options		
Accessory	PCH	Plug and chain mounted to the thermowell
Coating and treatments	K1	Cleaned from oil and grease
Certificates and testing*6	N75	2.1 NACE ISO 15156 (MR 01 75)
	LTPA	2.1 Static pressure leak test certificate acc ASME B16.5 (1.5 x MWP) *5
	LTCE	2.1 Static pressure leak test certificate acc PED 2014/68/EU (1.43 x MWP)*5
	PMI	2.2 Positive Material Identification
	IC32	3.2 Material certificate on materials
Special options	RD	Rush Delivery
	EU	European Origen materials

*5:MWP is limited by rating, MWP pressure instrument, and MWP seal construction. Lowest value is used in order to prevent permanent damage.
*6: Test report and 3.1 certificate on wetted parts is standard part of supply.

Order related options

Options on complete order		
Certificates and testing	PMI	2.2 Positive Material Identification
	3PI	Third party inspection of goods
Packing	SW	Seaworthy packing

Change log

Date	Change

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