Slip on flanged thermowell bar stock design

Design description

Badotherm thermowell model TW233 is a bar stock, solid machined type thermowell suitable for a Lap Joint Flange 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.

Design

The FSO design is a Vanstone based thermowell for heavy industrial used. This design complies with the heavy duty Shell design and in accordance with the S38.113 and the S38.114 dimensions. The thermowell is machined from forged bar stock material

Wetted part materials

Material common name	UNS	Wst.
AISI 316(L)	S31603	1.4404
Alloy 400	N04400	2.4360
Alloy 625	N06625	2.4856
Alloy 825	N08825	2.4858
Alloy C-276	N10276	2.4810
Duplex F51/F60	S32205	1.4462
Duplex F55	S32750	1.4410

Flange standard, size, rating and facings

ASME B16.5			
Size	**Rating**	**Facing**	**Roughness**
1.5”	cl. 150 - cl. 1500	RF	Ra 3.2-6.3 µm
2”	cl. 150 - cl. 2500		

Bore sizes

Standard bore size
7 mm as per Shell S38.113 & S38.114 rev E standard.

Standard design insert length

Shell drawing code	Size L	Size U	Size U1
S38.113	230	215	na
	255	240	
	305	290	240
	355	340	
	405	390	
	455	440	
S38.114	230	210	na
	255	235	

insert length other than the above are possible however these are not compliant with the MESC specifications.

Flow rates

The permissible flow rate for the Shell specification is a Vmax of 12 m/s for both liquids and gases. When the fluid velocity exceeds this value a calculation according the ASME PTC 19.3 TW-2016 is required.

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 thermowells are marked by the forging shop 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.

Flanges and origin

The flanged parts are made from forged 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 FSO thermowells are tested by means of an internal pressure test of 1.5x the maximum allowed working pressure with a maximum of 500 bar. The test media of with which the thermowell is pressure tested is water with a chloride level <30 ppm. Internal testing is optionally available.

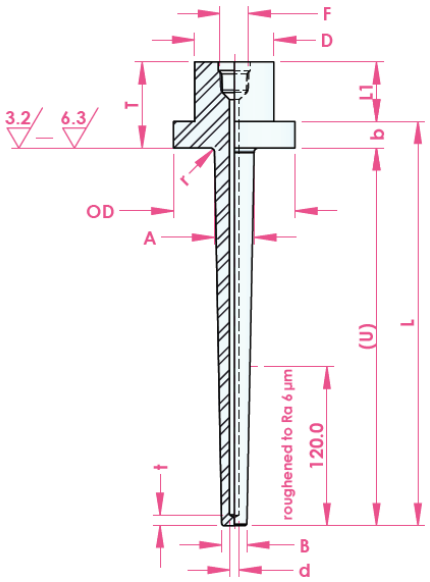
Cleanliness of the wetted parts

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.

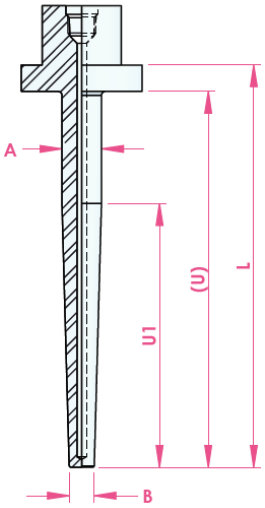
Thermocal performance calculation

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.

Dimensions table:



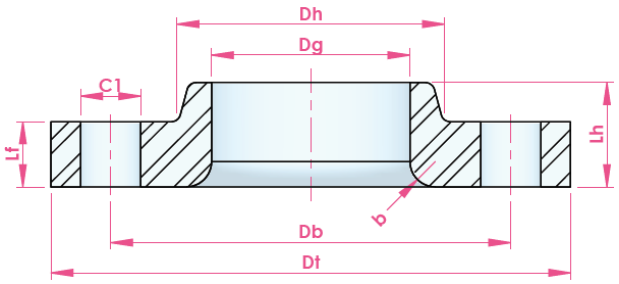
Standard L: 230 and 255mm



Standard L: 305, 355, 405, 455mm

size	F	D	OD	L	U	U1	b	t	r	d	T	L1	A	B
1.5" (DN40) S38.113	½"NPT-f	48.0	73.0	230	215	-	15	5.0	3.0	7.0	40.0	25.0	30.0	19.0
				255	240									
				305	290	240								
				355	340									
				405	390									
				455	440									
2" (DN50) S38.114		60.0	91.9	230	210	-	20				45.0			
				255	235									

All dimensions in mm, weight in kg



ASME 16.5 lapped flange size

size	rating	Dt	Lf	Db	C1 / pcs	Dg	Dh	r	weight
1.5"	cl. 150	127.0	22.0	98.6	15.9 / 4x	50.0	65.0	6.0	1.5
	cl. 300	155.0	30.0	114.3	22.3 / 4x		70.0		2.7
	cl. 400-600		32.0						3.3
	cl. 900-1500	178.0	44.0	124.0	28.6 / 4x				5.8
2"	cl. 150	152.0	25.0	120.6	19.1 / 4x	62.5	78.0	8.0	2.4
	cl. 300	165.0	33.0	127.0	19.1 / 8x		84.0		3.2
	cl. 400-600		37.0						4.2
	cl. 900-1500	216.0	57.0	165.1	25.4 / 8x		105.0		10.1
	cl. 2500	235.0	70.0	171.4	28.6 / 8x		95.0		15.6

BADOTHERM®

Thermowell selection

Selection	Suffix	Description
Thermowell type	BDTW233	Tapered stem - FSO bar stock thermowell
Flange standard	A	ASME B16.5 sizing
Size	04	1.5"
	05	2"
Facing type	RF	Raised Face◄
Instrument connection	N12F	½" NPT female

Insertion length	L size	U (S38.113)	U (S38.114)	
	L230	215	210	L size is according the Shell S38.113 and 114. The U length is the actual insertion length
	L255	240	235	
	L305	290	285	
	L355	340	335	
	L405	390	385	
	L455	440	435	
	U…			Non standard U length

Bore diameter	B70	7.0mm	Bore diameter is standardised.
Root diameter	30mm	Diameter of the S38.113 rev E, S38.114 rev E	
	..mm	Non standard diameter	
Tip diameter	19mm	Standard tip diameter S38.113 rev E, S38.114 rev E	
	..mm	Non standard diameter	

Material selection of wetted parts			
S316	AISI 316(L)	S31600/S31603	
A400	Alloy 400	S04400	
A625	Alloy 625	S06625	
A825	Alloy 825	S08825	
A276	Alloy C-276	S10276	
DF51	Duplex F51/F60	S31803/S32205	
DF53	Duplex F53	S32750	
DF55	Duplex F55	S32760	

Selection	Suffix	Description
Lapped cover flange	Cover flange	Lapped execution
Flange standard	A	ASME B16.5 sizing
Size	04	1.5"
	05	2"
Class	A1	Cl. 150
	A2	Cl. 300
	A4	Cl. 600
	A6	Cl. 1500
	A7	Cl. 2500 (only for the 2" (S38.114))

Material selection of wetted parts			
S316	AISI 316(L)	S31600/S31603	
A105	ASTM A105	K03504	
A350	ASTM A350 LF2	K03011	
DF51	Duplex F51	S31803	

option selection

Options		
Accessory	PCH	Plug and chain mounted to the thermowell
Coating and treatments	K1	Cleaned from oil and grease
	CPTS	PTFE Coating of ± 30µm thickness
	CPTT	PTFE Coating of ± 80µm thickness
	CPFS	PFA Coating ± 35µm thickness
	CPFS	PFA Coating ± 90µm thickness
	CHAL	ECTFE Coating ± 600µm thickness
	CFEP	FEP Coating ± 35µm thickness
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 flange 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

Authorised Distributor:

NATIONWIDE OIL & GAS

46, Jalan SS 22/21, Damansara Jaya,
47400 Petaling Jaya,
Selangor Darul Ehsan, Malaysia.

Email: nog@nog.com.my
Website: www.nog.com.my

DTW 9233 - 30 March 2022

Change log

Date	Change