

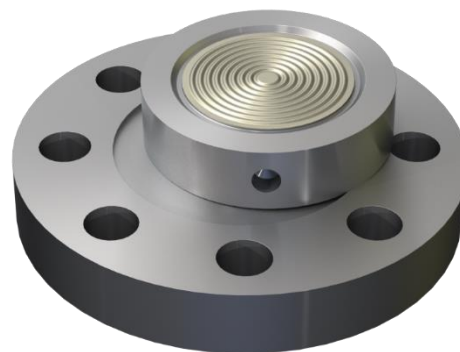
BC type seal – flush diaphragm - Wafer type

Design description

The BC construction has a seal body that is made of bar stock or forged material. The weld of the diaphragm to the seal body is a wetted part and therefore diaphragm materials are mostly chosen the same as the flange material. Its pressure rating is defined by the cover flange and as such it can be used for all pressure ratings in all facings.

Body diaphragm combinations

The diaphragm is TIG-welded to the body and is designed to have the best performance for the specific size. This means that the flexibility and shape is carefully tested and measured. The standard thickness of diaphragm foil is 0.075mm



Seal size, rating and facings - ASME B16.5

ASME B16.5			
Size	Rating	Facing	Roughness
1" to 4"	cl. 150 - cl. 2500	RF, LMF, FF, SGF	Ra 3.2-6.3 µm
		RJF, SFF	Ra <1.6 µm
		SMF, LTF, STF, LGF, LFF	Ra <3.2 µm

Seal size, rating and facings - EN 1092-1

EN 1092-1			
Size	Rating	Type	Roughness
DN20 to DN100	PN10-400	A, B1, E, F	Ra 3.2-12.5 µm
		B2, C, D, G, H	Ra <0.8-3.2 µm

Seal size, rating and facings - ISO 10423 (API)

API ISO 10423			
Size	Rating	Facing	Roughness
1-13/16" to 3-1/16"	69 – 138 MPa	6BX – RJF	Ra <1.6 µm
2-1/16" to 3-1/8"	13.8 – 34.5 MPa	6B-RJF	Ra <1.6 µm

Seal size, rating and facings - EN 1092-1

JIS B2220			
Size	Rating	Type	Roughness
DN25 to DN100	10-20K	RF	Ra 3.2-12.5 µm

Body Material	Diaphragm material		
	General name	UNS	Wst.
AISI 316(L)	AISI 316L	S31603	1.4404
	AISI 304L	S30400	1.4306
	AISI 321	S32100	1.4541
	AISI 316 UG	S31603	1.4435
	Alloy C276	N27600	2.4810
AISI 304L	AISI 304L	S30400	1.4306
AISI 310 MoLn	25-22-2 LMN	S31050	1.4466
AISI 316 UG	AISI 316 UG	S31600	1.4435
AISI 321	AISI 321	S32100	1.4541
AISI 904(L)	AISI 904L	N08904	1.4539
Alloy 20	Alloy 20	N08020	2.4660
Alloy 400	Alloy 400	N04400	2.4360
Alloy 600	Alloy 600	N06600	2.4816
Alloy 625	Alloy 625	N06625	2.4856
Alloy 825	Alloy 825	N08825	2.4858
Alloy B2	Alloy B2	N10665	2.4617
Alloy C-22	Alloy C-22	N06022	2.4602
Alloy C-276	Alloy C-276	N10276	2.4810
Duplex F44	254 SMO (6Mo)	S31254	1.4547
Duplex F51/F60	Duplex 2205	S32205	1.4462
Duplex F53	Super Duplex 2507	S32750	1.4410
Duplex F55	Super Duplex 2507	S32750	1.4410
Nickel 201	Nickel 201	N02201	2.4068
Titanium Gr. 2	Titanium Gr. 1	R50250	2.7025
Zirconium 702	Zirconium 702	R60702	-

Gold coatings

Several types of gold coating can be applied on the US-F seals. The selection possibilities are:

- 25 µm chemical resistance (diaphragm + facing)
- 40 µm chemical resistance (diaphragm + facing)
- 25 µm Hydrogen protection (diaphragm only)
- 40 µm Hydrogen protection (diaphragm only)

-> See datasheet "Gold coatings"

Polymer coatings

Polymer coatings come in several types. The technical data on thickness and temperature limitation can be found in datasheet "polymer solutions" The applicable selection on BF seals are:

- PTFE coating
- ECTFE (Halar®) coating
- PFA coating
- FEP coating
- PTFE sheet

-> See datasheet "Polymer solutions"

Capillary tube and armor (protection)

The standard capillary mounting position is top side (axial) of the seal. Alternatively, the capillary can be placed at the side of the seal (radial). The standard tube material is TP316 (316SS), optionally available in in Monel 400. There are three options in ID of the capillary; 2mm, 1mm, and 0.7mm. Badotherm capillaries are always protected against mechanical forces by armor. This doubled shielded armor consist is standard AISI 304, and optionally AISI 316. Additionally, the armor could be protected with a PVC sleeve in white, black, optionally with ATEX114 approval to protect against dust and water ingress and possibly corrosive ambient atmosphere.

-> See datasheet "Capillary lines"

Flush rings and flush flanges

Badotherm offers matching flush rings or flush flanges to their diaphragm seal. On request equipped with blind plugs, vent plug and or flushing / draining needle valves, which can be fitted or welded to the complete construction.

-> See datasheet flush rings

-> See datasheet flush flanges

-> See datasheet reducer flanges

Cooling options

There are several ways to protect your instrument from elevated temperatures such as the extended direct mount (EDM), a temperature reducer (TR) or by capillary.

-> See datasheet "cooling devices"

Cover Flange

The BC will be clamped to the process. This can be done with a standard blind flange. However positioning the seal in line with the flange and gasket will be challenging. Therefore Badotherm offers the option for a cover flange. This flange has a groove to fit the seal part and fixing holes to fix the seal into the flange. Details can be found in the dimensions section.

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 flanges and seals are marked shop with heat number, material designation, size, and rating. Badotherm adds a Badotherm reference number and the manufacturers name to the flange for traceability purposes.

Flanges and origin

The seal 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 seals are helium tested according the ISO 20485 test procedure A.3 up to 10⁻⁹ mbar l/s before used on a diaphragm seal application.

-> See datasheet "Diaphragm Seal testing"

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.

Gaskets

Sizes of the diaphragm area are designed to match the gaskets used between the process and seal or flush ring. For the ASME B16.5 RF seals the ASME B16.20 is used for dimension restriction to ensure both the spiral and grooved gaskets are fully supported by the serrated area. For the EN type B1 diaphragm seals the gasket dimensions are matching the sizes of the EN 1514-2. The size "G" in the tables refer to the start of the gasket surface.

Example performance calculation - Basecal

Whether a diaphragm seal can be used for a specific measurement, depends on the size of the diaphragm. That size is restricted by the size of the diaphragm seal.

For pressure transmitters, Badotherm offers an online performance calculation tool to calculate its performance and to ensure that the diaphragm size is suitable for your measurement.

The table below presents the minimum span of the respective diaphragm sizes with standard process conditions. As rule of thumb, a TPE of max 5% is often considered acceptable, but it depends per situation.

Minimum span table

dD	AP/GP	DP
23.5mm	17.5 bar	na
32mm	11 bar	1850 mbar
44mm	1575 mbar	255 mbar
57mm	415 mbar	70 mbar
72mm	155 mbar	30 mbar
81mm	110 mbar	20 mbar

Pressure transmitter; ambient temperature -10...+30°C; process temperature 100°C with BSO 22 fill fluid; 3 meter capillary; ID 1mm, DP both sides mounted with seal

See the general overview of all diaphragm sizes with several standard situations and in combination with Badotherm pressure gauges.

Standards used

Design Standards

Standard	Description
ASME B16.5 - 2020	Pipe flanges and flanged fittings
ASME B16.20 - 2017	Metalic gaskets for flanges
EN 1092-1 - 2018	Circular flanges for pipes
EN 1514-2 - 2021	Dimensions of gaskets
API ISO 10423 (API 6A) - 2010	International Standard for Petroleum and Natural Gas Industries
JIS B2220 - 2012	Japanese Flange Standard
GOST 33259 - 2015	Russian Flange Standard

Test Standards

Standard	Description
ISO 20485 - 2018	Non-destructive testing - Leak testing - Tracer gas method

Material Standards

Standard	Description
NACE MR0175/MR0103 ISO 15156 - 2020	use in H ₂ S-containing environments in oil and gas production
NORSOK M-630 - 2010	specification for use in pipelines
ASTM standards	Material specific standards

Certification Standards

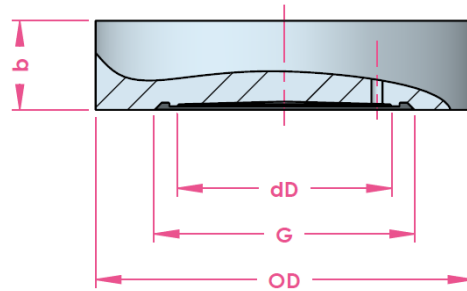
Standard	Description
EN 10204 - 2017	Inspection documents
ASME IX	Welding, Brazing, and Fusing Qualifications
ISO 15610	Specification and qualification of welding procedures for metallic materials

Roughness conversion

The specific flange norm all relate to specific roughness value for surface finish and flange finish. Below table can be used for conversion between the average roughness (Ra) in micrometres (µm) and microinch (µin)

µm	µin
0.8	32
1.6	63
3.2	125
6.3	250

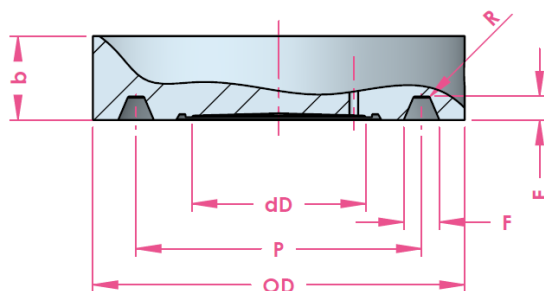
Dimensions table: ASME 16.5 RF facing



size	rating	OD	dD	b	G	weight
1"	cl. 150-2500	50.8	23.0	24.0	31.8	0.4 kg
1.5"	cl. 150-600	73.0	44.0		52.4	0.8 kg
	cl. 900-2500		32.0		41.5	0.8 kg
2"	cl. 150-600	91.9	57.0		70.2	1.3 kg
	cl. 900-2500		44.0		55.4	1.3 kg
3"	cl. 150-2500	127.0	81.0		93.0	2.4 kg
4"	cl. 150-2500	157.2		3.7 kg		

All dimensions in mm

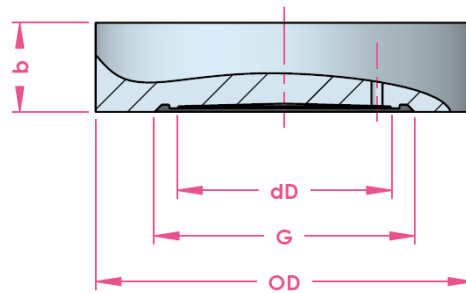
Dimensions table: ASME 16.5 RJF facing



size	rating	OD	dD	b	E	F	P	R	Ring #	weight			
1"	cl. 150	63.5	32.0	28.0	6.35	8.74	47.62	0.8	15	0.7 kg			
	cl. 300	69.8					50.80		16	0.9 kg			
	cl. 400-600	71.4					60.33		18	0.9 kg			
	cl. 900-1500	82.6					57.15		17	0.7 kg			
	cl. 2500	73.2					60.33		18	0.9 kg			
1.25"	cl. 150	79.2	44.0	28.0	7.92	11.91	72.24	0.8	21	1.3 kg			
	cl. 300	81.0					65.07		19	1.3 kg			
	cl. 400-600	82.6					68.28		20	1.4 kg			
	cl. 900-1500	90.4					7.92		11.91	23	2.3 kg		
1.5"	cl. 150	102.0	57.0	28.0	6.35	8.74	82.55	0.8	22	1.8 kg			
	cl. 300	108.0					95.25		23	2.1 kg			
	cl. 400-600	124.0					101.60		24	2.8 kg			
	cl. 900-1500	133.0					6.35		8.74	114.30	29	3.1 kg	
	cl. 2500	146.0					7.92		11.91	123.83	31	3.7 kg	
2"	cl. 150	156.0	81.0	30.0	9.53	13.49	136.53	1.5	35	5.0 kg			
	cl. 300	168.0					127.00		32	5.0 kg			
	cl. 400-600	171.0					6.35		8.74	149.22	0.8	36	5.8 kg
	cl. 900	175.0					7.92		11.91	161.92		37	5.5 kg
	cl. 1500	181.0					11.13		16.66	157.18		1.5	38
3"	cl. 150	203.0	81.0	30.0	7.92	11.91	149.22	0.8	37	5.5 kg			
	cl. 300	175.0					161.92		39	7.2 kg			
	cl. 400	181.0					11.13		16.66	157.18	1.5	38	7.9 kg
	cl. 600	194.0					7.92		11.91	149.22	0.8	37	5.5 kg
	cl. 900	194.0					11.13		16.66	157.18		1.5	38
4"	cl. 150	171.0	81.0	30.0	7.92	11.91	149.22	0.8	37	5.5 kg			
	cl. 300	175.0					161.92		39	7.2 kg			
	cl. 400	181.0					11.13		16.66	157.18	1.5	38	7.9 kg
	cl. 600	194.0					7.92		11.91	149.22	0.8	37	5.5 kg
	cl. 900	194.0					11.13		16.66	157.18		1.5	38

All dimensions in mm

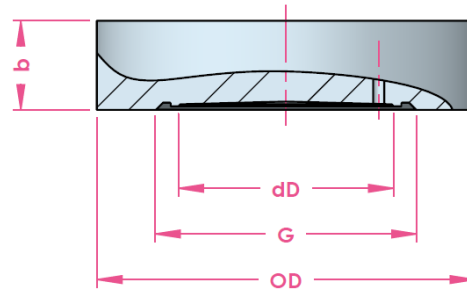
Dimensions table: EN 1092-1 B1 type



size	rating	OD	dD	G	b	weight
DN20	PN10-400	58.0	23.0	33.8	24.0	0.5 kg
DN25		68.0	32.0	41.0		0.7 kg
DN32		78.0	32.0	41.5		0.9 kg
DN40		88.0	44.0	55.4		1.2 kg
DN50		102.0	57.0	70.2		1.5 kg
DN80		138.0	93.0	2.9 kg		
DN100	PN10-16	158.0	81.0	101.0	3.8 kg	
	PN25-400	162.0			3.9 kg	

All dimensions in mm

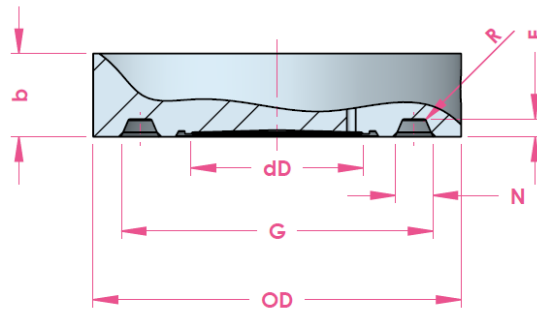
Dimensions table: JIS 2220 RF



size	rating	OD	dD	b	G	weight			
25	10K – 20K	67.0	32.0	24.0	40.0	0.7 kg			
32	10K – 20K	76.0	44.0		50.6	0.9 kg			
40	10K – 20K	81.0			55.4	1.0 kg			
50	10K – 20K	96.0	57.0		68.5	1.4 kg			
80	10K	126.0	81.0	24.0	93.0	2.4 kg			
	16-20K	132.0				2.6 kg			
90	10K	136.0			81.0	24.0	101.0	2.7 kg	
	16-20K	145.0						3.2 kg	
100	10K	151.0	81.0	24.0				101.0	3.4 kg
	16-20K	160.0							3.8 kg

All dimensions in mm

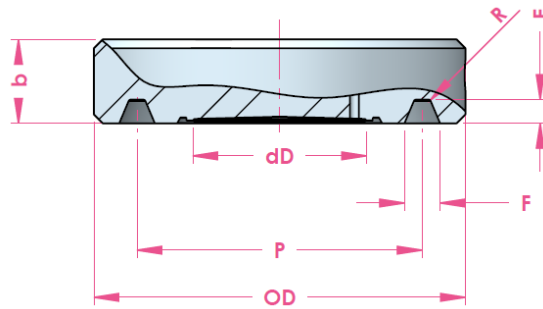
Dimensions table: ISO 10423 – Type 6BX



size	rating	OD	dD	b	E	N	G	ring	Weight
1-13/16"	69MPa	105.0	32.0	28.0	5.6	11.8	77.7	BX-151	1.9 kg
	103,5MPa	106.0							1.9 kg
	138MPa	117.0							2.5 kg
2-1/16"	69MPa	111.0	44.0		5.9	12.7	86.2	BX-152	2.1 kg
	103,5MPa	114.0							2.3 kg
	138MPa	132.0							3.0 kg
2-9/16"	69MPa	132.0	57.0		6.8	14.1	102.7	BX-153	3.0 kg
	103,5MPa	133.0							3.0 kg
	138MPa	151.0							3.9 kg
3-1/16"	69MPa	152.0	72.0		7.5	15.4	119.0	BX-154	3.9 kg
	103,5MPa	154.0							4.2 kg
	138MPa	171.0							5.1 kg

All dimensions in mm

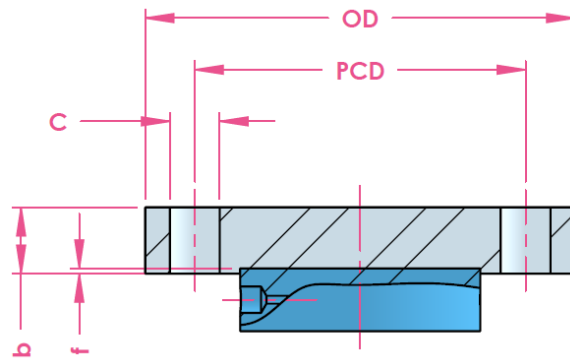
Dimensions table: ISO 10423 – Type 6B



size	rating	OD	b	dD	E	F	P	ring	Weight
2-1/16"	13.8MPa	108.0	28.0	44.0	7.9	11.9	82.6	R or RX-23	2.0 kg
	20.7MPa	124.0					95.2	R or RX-24	2.7 kg
	34.5MPa								
2-9/16"	13.8MPa	127.0	28.0	72.0	7.9	11.9	101.6	R or RX-26	2.8 kg
	20.7MPa	137.0					107.9	R or RX-27	3.3 kg
	34.5MPa								
3-1/8"	13.8MPa	146.0	28.0	81.0	7.9	11.9	123.8	R or RX-31	3.7 kg
	20.7Mpa	156.0					136.5	R or RX-35	4.2 kg
	34.5MPa	168.0							

All dimensions in mm

Dimensions table: ASME 16.5 Cover Flange (optional)



size	rating	OD	b	PCD	C / pcs	f	weight
1"	cl. 150	108.0	12.7	79.2	15.9 / 4x	2.0	0.9
	cl. 300	124.0	15.7	88.9	19.1 / 4x		1.4
	cl. 400-600		17.5				1.6
	cl. 900-1500	149.0	28.4	101.6	25.4 / 4x		3.6
cl. 2500	159.0	35.1	108.0	25.4 / 4x	5.0		
1.25"	cl. 150	117.0	15.7	88.9	15.9 / 4x		1.2
	cl. 300	133.0	17.5	98.6	19.1 / 4x		1.8
	cl. 400-600		20.6				2.2
	cl. 900-1500	159.0	28.4	111.1	25.4 / 4x		4.1
cl. 2500	184.0	38.1	130.0	28.6 / 4x	7.4		
1.5"	cl. 150	127.0	15.9	98.6	15.9 / 4x		1.5
	cl. 300	155.0	19.0	114.3	22.3 / 4x		2.7
	cl. 400-600		22.4				3.3
	cl. 900-1500	178.0	31.8	124.0	28.6 / 4x		5.8
cl. 2500	203.0	44.4	146.0	31.8 / 4x	10.4		
2"	cl. 150	152.0	17.5	120.6	19.1 / 4x		2.4
	cl. 300	165.0	20.6	127.0	19.1 / 8x		3.2
	cl. 400-600		25.4				4.2
	cl. 900-1500	216.0	38.1	165.1	25.4 / 8x		10.1
cl. 2500	235.0	50.8	171.4	28.6 / 8x	15.6		
3"	cl. 150	190.0	22.4	152.4	19.1 / 4x	4.9	
	cl. 300	210.0	26.9	168.1	22.3 / 8x	6.8	
	cl. 400-600		31.8			8.4	
	cl. 900	241.0	38.1	190.5	25.4 / 8x	13.1	
cl. 1500	267.0	47.8	203.2	31.9 / 8x	19.1		
4"	cl. 2500	305.0	66.5	228.6	35.0 / 8x	34.8	
	cl. 150	229.0	22.4	190.5	19.1 / 8x	7.0	
	cl. 300	254.0	30.2	200.2	22.3 / 8x	11.5	
	cl. 400		35.1			14.8	
	cl. 600	273.0	38.1	215.9	25.5 / 8x	17.3	
	cl. 900	292.0	44.5	235.0	31.8 / 8x	26.9	
cl. 1500	311.0	53.8	241.3	34.9 / 8x	29.9		
cl. 2500	355.0	76.2	273.0	41.3 / 8x	53.9		

All dimensions in mm

Product code ASME B16.5 BC seals

Code	
Example code:	BC A 08 A1 RF CATA S316 S363 C25H
Standard	
ASME B16.5	A
Size	
1"	02
1.5"	04
2"	05
3"	08
4"	10
Class¹	
cl. 150	A1
cl. 300	A2
cl. 400 ²	A3
cl. 600	A4
cl. 900 ^{*2}	A5
cl. 1500	A6
cl. 2500	A7
Facing³	
Raised Face ◀	RF
Ring Joint Face	RJF
Capillary connection	
Capillary side (radial)	CASR
Material	
AISI 316(L)	S316
AISI 316(L) with Alloy C276 diaphragm ^{*4}	S316N
AISI 304L	S304
AISI 310 MoLn	S310
AISI 316 UG	U316
AISI 321	S321
AISI 904(L)	S904
Alloy 20	A020
Alloy 400	A400
Alloy 600	A600
Alloy 625	A625
Alloy 825	A825
Alloy B2	AB02
Alloy C-22	AC22
Alloy C-276	A276
Duplex F44	DF44
Duplex F51/F60	DF51
Duplex F53	DF53
Duplex F55	DF55
Nickel 201	N201
Titanium Gr. 2	TG02
Zirconium 702	Z702
Options	
See tables 1, 2, 3 ◀	

*1: The seal will be marked with the range the selected class will fall in (eg: cl. 150 will be marked cl. 150 – cl. 2500 for a 3" size, and cl. 150 – cl. 600 for a 2")

*2: For size ≥3"

*3: Other facings than RF/ RJF, fill in facing code from table 1.

*4: Dissimilar materials as wetted parts are outside warranty on process compatibility.

Table 1: Additional Facing*ASME B16.5*

Description	code
Large Male Face	LMF
Small Male Face	SMF
Flat Face	FF
Large Tongue Face	LTF
Small Tongue Face	STF
Large Groove Face	LGF
Small Groove Face	SGF
Large Female Face	LFF
Small Female Face	SFF

EN 1092-1

Description	code
Flat Face	A
Raised face (smooth finish)	B2
Tongue	C
Groove	D
Spigot	E
Recess	F

For the Groove and Tongue Facings the instrument and process and side are the opposites
(eg Instrument side is LTF then Process side is LGF)

Table 4: Cover flange

Option (start options with X_)	code
Cover flange AISI 316 (L)	CFS316
Cover flange Duplex F51	CFDF51
Cover flange Duplex F55	CFDF55
Cover flange A 105	CFA105
Cover flange A 350 lf.2	CFA352

Table 2: Options

Option (start options with X_)	code
Cleaned from Oil and Grease	_K1
NACE ISO 15156 (MR 01 75)	_N75
3.1 material certificate	_IC31
2.1 Pressure leak test certificate standard pressure* ¹	_LTPS
2.1 Pressure leak test certificate acc PED 2014/68/EU* ¹	_LTCE
2.1 Penetrant test certificate* ²	_PT1
2.2 Positive Material Identification	_PMI
2.2 Welding documents (WPS/PQR)* ²	_WPS

*1: For fitted and welded accessory

*2: Only for welded accessory

Table 3: Options

Option (start options with X_)	code
PTFE Coating	CPTF
PFA Coating	CPFA
Halar Coating	CHAL
FEP Coating	CFEP
Gold coating diaphragm 25 µm	C25H
Gold coating diaphragm 40 µm	C40H
Gold coating all wetted parts 25 µm	C25W
Gold coating all wetted parts 40 µm	C40W

Change log

Date	Change
30-3-2020	1.25" added in dimension table RJF. / Decimals added.
16-6-2020	Cover flange table added for ASME.
8-3-2021	Added table with standards and roughness values Updated dimension tables according ASME B16.5:2020

Holland – Romania – India – Thailand – Dubai – USA

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