

# BRF type seal - flush diaphragm facing covered diaphragm

## Diaphragm Seal Type description

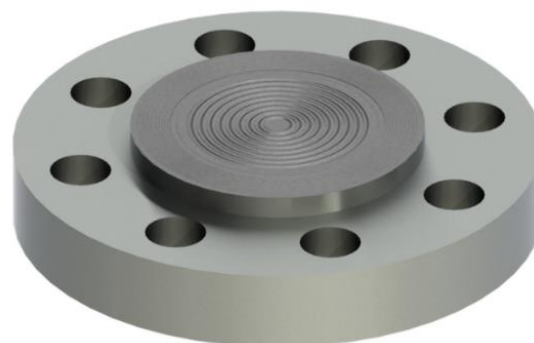
The BRF type is a flanged construction with the diaphragm flush in the process. The seal body is made of a blind flange and this design has the diaphragm sheet material covering the complete wetted parts. This design is typically used as a cost effective design with full wetted parts in exotic material compared to a full body in exotic material. BRF is typically used in combination with (differential) pressure transmitters for applications such as level, flow and (absolute) pressure measurement.

Related designs: FSO-BRF

## Diaphragm in exotic materials

The unique feature of the BRF is the Badotherm resistance-weld technology. The stainless steel body (non-wetted) has its wetted parts (diaphragm and raised face area) covered by sheet material in the required exotic material. The standard thickness of diaphragm foil is 0.075mm, for some materials other thickness may be available.

Flange Material	Diaphragm material		
	General name	UNS	Wst.
AISI 316(L)	AISI 304L	S30400	1.4306
	AISI 321	S32100	1.4541
	AISI 316 UG	S31603	1.4435
	AISI 347	S34700	1.4550
	25-22-2 LMN	S31050	1.4466
	AISI 904L	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
	254 SMO (6Mo)	S31254	1.4547
	Duplex 2205	S32205	1.4462
	Super Duplex 2507	S32750	1.4410
	Nickel 201	N02201	2.4068
	Tantalum	R05200	-
	Titanium Gr. 1	R50250	2.7025
	Zirconium 702	R60702	-



## Flange size, rating and facings - ASME B16.5

ASME B16.5			
Size	Rating	Facing	Roughness
1" to 4"	cl. 150 - cl. 2500	RF, LMF, FF	Ra 3.2-6.3 µm
		SMF	Ra <3.2 µm

## Flange size, rating and facings - EN 1092-1

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

## Flange size, rating and facings – JIS B2220

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

## Gold Coating


Due to its design, gold coating on the BRF designed is not recommended.

-> See [datasheet "Gold coatings"](#)

## Polymer Solutions

Polymer solutions come in several types. Additional specifications of the polymer solutions (thickness, temperature limitation, and more) can be found in datasheet "polymer solutions". Due to its design, BRF has only a few options available:

- PTFE coating (low cure temperature applied)
- PTFE sheet

 The PTFE sheet contains a silicone adhesive layer and as such not suitable for oxygen applications.

-> 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 Alloy 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"](#)

## 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](#)

## Cooling options

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

-> See [datasheet "cooling devices"](#)

## Lifting handles

Larger sizes and ratings of diaphragm seals can weigh up to 50 kg. Handling and installation can become a challenge. As from 15kg it is recommended to apply a set of lifting handles, welded on the sides of the flange of the seal. This can be used to handle it easier and install it in a safer way or have attach lifting tools to it.

-> See [datasheet "Lifting Handles"](#)

## 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.*

## Flange Marking & Traceability

All flanges are marked by the forging 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. Seals are also marked with CE logo when required.

## 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 EN 13185 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

For the BRF soft gaskets are advised, such as camprofil (grooved) 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 flanges 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 flanges 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

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	Pipe flanges and flanged fittings
ASME B16.20	Metalic gaskets for flanges
EN 1092-1	Circular flanges for pipes
EN 1514-2	Dimensions of gaskets
JIS B2220	Japanese Flange Standard

### Test Standards

Standard	Description
EN 13185	Non-destructive testing - Leak testing - Tracer gas method

### Material Standards

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

### Certification Standards

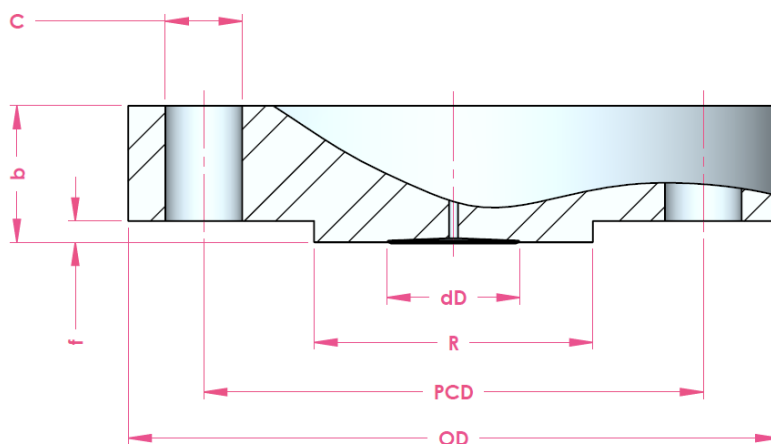
Standard	Description
EN 10204	Inspection documents

## 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

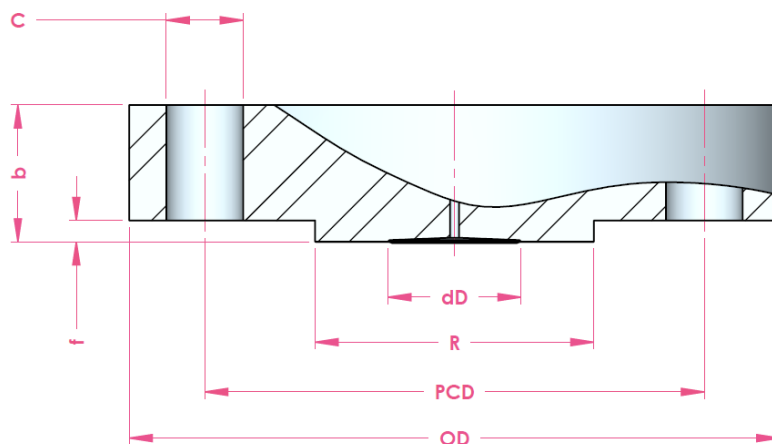
### Dimensions table: ASME 16.5 RF facing



size	rating	OD	b	PCD	C / pcs	dD	R	f	weight
1"	cl. 150	108.0	14.2	79.2	15.9 / 4x	23.5	50.8	1.5	0.9 kg
	cl. 300	124.0	17.2	88.9	19.1 / 4x				1.4 kg
	cl. 400-600	149.0	23.9	101.6	25.4 / 4x			6.4	1.6 kg
	cl. 900-1500	159.0	34.8	108.0	25.4 / 4x				3.6 kg
1.25"	cl. 150	117.0	17.9	88.9	15.9 / 4x	32.0	63.5	1.5	1.2 kg
	cl. 300	133.0	19.5	98.6	19.1 / 4x				1.8 kg
	cl. 400-600	159.0	27.7	111.1	25.4 / 4x			6.4	2.2 kg
	cl. 900-1500	184.0	35.6	130.20	28.6 / 4x				4.1 kg
1.5"	cl. 150	127.0	17.9	98.6	15.9 / 4x	44.0	73.0	1.5	1.5 kg
	cl. 300	155.0	21.1	114.3	22.3 / 4x				2.7 kg
	cl. 400-600	178.0	29.3	124.0	28.6 / 4x			6.4	3.3 kg
	cl. 900-1500	203.0	38.8	146.0	31.8 / 4x				5.8 kg
2"	cl. 150	152.0	19.5	120.6	19.1 / 4x	57.0	91.9	1.5	2.4 kg
	cl. 300	165.0	22.7	127.0	19.1 / 8x				3.2 kg
	cl. 400-600	216.0	32.4	165.1	25.4 / 8x			6.4	4.2 kg
	cl. 900-1500	235.0	45.1	171.4	28.6 / 8x				10.1 kg
3"	cl. 150	190.0	24.3	152.4	19.1 / 4x	81.0	127.0	1.5	15.6 kg
	cl. 300	210.0	29.0	168.1	22.3 / 8x				4.9 kg
	cl. 400-600	241.0	38.8	190.5	25.4 / 8x			6.4	6.8 kg
	cl. 900	267.0	54.7	203.2	31.8 / 8x				8.4 kg
	cl. 1500	305.0	73.7	228.6	34.9 / 8x				13.1 kg
	cl. 2500	311.0	83.2	241.3	34.9 / 8x				19.1 kg
4"	cl. 150	229.0	24.3	190.5	19.1 / 8x	81.0	156.6	1.5	34.8 kg
	cl. 300	254.0	32.2	200.2	22.3 / 8x				7.0 kg
	cl. 400	273.0	42.0	215.9	25.4 / 8x			6.4	11.5 kg
	cl. 600	292.0	51.5	235.0	31.8 / 8x				14.8 kg
	cl. 900	311.0	61.0	241.3	34.9 / 8x				17.3 kg
	cl. 1500	356.0	83.2	273.0	41.3 / 8x				26.9 kg
	cl. 2500							29.9 kg	
									53.9 kg

All dimensions in mm

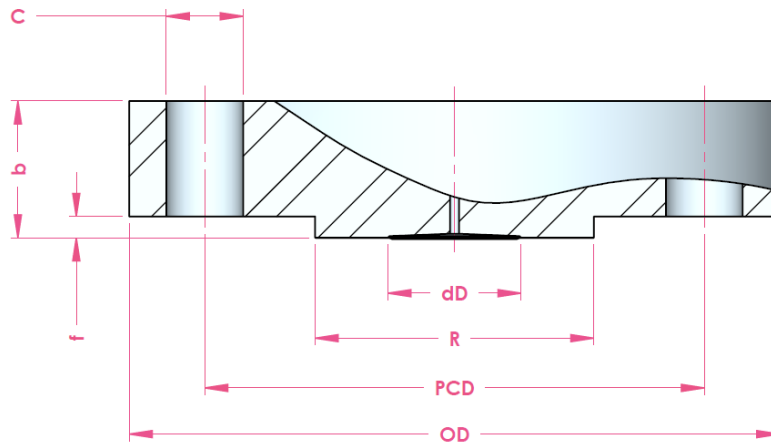
### Dimensions table: EN 1092-1 B1 type



size	rating	OD	b	PCD	C / pcs	dD	R	f	Weight
DN20	PN10-40	105.0	18.0	75.0	14.0 / 4x	23.0	58.0	2.0	1.0 kg
	PN63-100	130.0	22.0	90.0	18.0 / 4x				2.0 kg
DN25	PN10-40	115.0	18.0	85.0	14.0 / 4x	32.0	68.0	2.0	1.0 kg
	PN63-100	140.0	24.0	100.0	18.0 / 4x				2.5 kg
	PN160		28.0	105.0	22.0 / 4x				2.7 kg
	PN250	150.0	34.0	115.0	26.0 / 4x				3.6 kg
	PN320	160.0	38.0	130.0	26.0 / 4x				5.2 kg
	PN400	180.0	48.0	165.0	30.0 / 4x				7.5 kg
DN32	PN10-40	140.0	18.0	100.0	18.0 / 4x	32.0	78.0	2.0	2.0 kg
	PN63-100	155.0	24.0	110.0	22.0 / 4x				3.0 kg
DN40	PN10-40	150.0	18.0	110.0	18.0 / 4x	44.0	88.0	3.0	2.0 kg
	PN63-100	170.0	26.0	125.0	22.0 / 4x				4.0 kg
	PN160		28.0	125.0	22.0 / 4x				4.4 kg
	PN250	185.0	34.0	135.0	26.0 / 4x				6.7 kg
	PN320	195.0	38.0	145.0	26.0 / 4x				8.7 kg
	PN400	220.0	48.0	165.0	30.0 / 4x				14.1 kg
DN50	PN10-40	165.0	20.0	125.0	18.0 / 4x	57.0	102.0	3.0	3.0 kg
	PN63	180.0	26.0	135.0	22.0 / 4x				4.5 kg
	PN100	195.0	28.0	145.0	26.0 / 4x				6.0 kg
	PN160		30.0	145.0	26.0 / 4x				6.4 kg
	PN250	200.0	38.0	150.0	26.0 / 8x				8.2 kg
	PN320	210.0	42.0	160.0	30.0 / 8x				10.7 kg
DN80	PN10-40	235.0	52.0	180.0	30.0 / 8x	81.0	138.0	3.0	16.7 kg
	PN10-40	215.0	24.0	160.0	18.0 / 8x				5.0 kg
	PN63		28.0	170.0	22.0 / 8x				6.5 kg
	PN100	230.0	32.0	180.0	26.0 / 8x				9.0 kg
	PN160	230.0	36.0	180.0	26.0 / 8x				10.3 kg
	PN250	255.0	46.0	200.0	30.0 / 8x				16.5 kg
DN100	PN320	275.0	55.0	220.0	30.0 / 8x	81.0	162.0	3.0	25.4 kg
	PN400	305.0	68.0	240.0	33.0 / 8x				38.4 kg
	PN10-16	220.0	20.0	180.0	18.0 / 8x				4.5 kg
	PN25-40	235.0	24.0	190.0	22.0 / 8x				6.5 kg
	PN63	250.0	30.0	200.0	26.0 / 8x				9.0 kg
	PN100	265.0	36.0	210.0	30.0 / 8x				13.0 kg
	PN160		40.0	210.0	30.0 / 8x				15.3 kg
	PN250	300.0	54.0	235.0	33.0 / 8x				27.2 kg
PN320	335.0	65.0	265.0	36.0 / 8x	42.5 kg				
PN400	370.0	80.0	295.0	39.0 / 8x	67.3 kg				

All dimensions in mm

### Dimensions table: JIS 2220 RF



Size	rating	OD	dD	b	PCD	Cb / pcs	R	f	Weight		
25	10K	125.0	32.0	15.0	90.0	19.0 / 4x	67.0	1.0	1.2 kg		
	16K			17.0				1.0	1.3 kg		
	20K			17.0				1.0	1.4 kg		
32	10K	135.0	44.0	18.0	100.0	19.0 / 4x	76.0	2.0	1.7 kg		
	16K			20.0				2.0	1.7 kg		
	20K			20.0				2.0	1.7 kg		
40	10K	140.0	44.0	18.0	105.0	19.0 / 4x	81.0	2.0	1.8 kg		
	16K			20.0				2.0	1.8 kg		
	20K			20.0				2.0	1.9 kg		
50	10K	155.0	57.0	18.0	120.0	19.0 / 8x	96.0	2.0	2.2 kg		
	16K			20.0				2.0	2.2 kg		
	20K			20.0				2.0	2.2 kg		
80	10K	185.0	81.0	20.0	150.0	23.0 / 8x	126.0	2.0	3.5 kg		
	16K	200.0		22.0	160.0			132.0	2.0	4.4 kg	
	20K			24.0				132.0	2.0	4.6 kg	
90	10K	195.0	81.0	20.0	170.0	19.0 / 8x	136.0	2.0	3.9 kg		
	16K	210.0		22.0				170.0	145.0	2.0	4.9 kg
	20K			26.0					145.0	2.0	5.7 kg
100	10K	225.0	81.0	20.0	175.0	19.0 / 8x	151.0	2.0	4.6 kg		
	16K			24.0				185.0	160.0	2.0	6.3 kg
	20K			26.0						160.0	2.0

All dimensions in mm

## Product code ASME B16.5 BRF seals

Code								
Example code:	<b>BRF A</b>	08	A1	RF	CATA	S316	S363	C25H
<b>Standard</b>								
ASME B16.5	A							
<b>Size</b>								
1"	02							
1.5"	04							
2"	05							
3"	08							
4"	10							
<b>Class</b>								
cl. 150	A1							
cl. 300	A2							
cl. 400 <sup>*1</sup>	A3							
cl. 600	A4							
cl. 900 <sup>*2</sup>	A5							
cl. 1500	A6							
cl. 2500	A7							
<b>Facing</b>								
Raised Face ◀	RF							
Flat Face	FF							
Small Male Face	SMF							
Large Male Face	LMF							
<b>Capillary connection</b>								
Capillary top (axial) ◀	CATA							
Capillary side (radial)	CASR							
<b>Material</b>								
AISI 304L	S304							
AISI 310 MoLn	S310							
AISI 316 UG	U316							
AISI 321	S321							
AISI 347	S347							
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							
<b>Options</b>								
See tables 1, 2 ◀								

\*1: For size ≥3"

## Product code EN 1092-1 BRF seals

Code		BRF	E	27	D4	B1	CATA	S316	S363	C25H
Example code:										
<b>Standard</b>										
EN 1092-1	E									
<b>Size</b>										
DN25	24									
DN40	26									
DN50	27									
DN80	29									
DN100	30									
<b>Class</b>										
PN 10-16 *1	D2									
PN 25-40 *1	D3									
PN 10-40	D4									
PN 63	D5									
PN 100	D6									
PN 250	D7									
PN 400	D8									
<b>Facing*2</b>										
Raised Face ◀	B1									
Raised Face smooth finish	B2									
Flat Face	A									
Recess face	F									
<b>Capillary connection</b>										
Capillary top (axial) ◀	CATA									
Capillary side (radial)	CASR									
<b>Material</b>										
AISI 304L	S304									
AISI 310 MoLn	S310									
AISI 316 UG	U316									
AISI 321	S321									
AISI 347	S347									
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									
<b>Options</b>										
See tables 1, 2 ◀										

\*1: For size ≥DN100



## Product code JIS B2220 BRF seals

Code									
Example code:	<b>BRF J</b>	27	J1	RF	CATA	S316	S363	C25H	
<b>Standard</b>									
JIS B2220	J								
<b>Size</b>									
DN25	24								
DN40	26								
DN50	27								
DN80	29								
DN90	31								
DN100	30								
<b>Class</b>									
10k	J1								
16K	J2								
25K	J3								
<b>Facing</b>									
Raised Face ◀	RF								
<b>Capillary connection</b>									
Capillary top (axial) ◀	CATA								
Capillary side (radial)	CASR								
<b>Material</b>									
AISI 304L	S304								
AISI 310 MoLn	S310								
AISI 316 UG	U316								
AISI 321	S321								
AISI 347	S347								
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								
<b>Options</b>									
See tables 1, 2 ◀									

**Table 1: 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* <sup>1</sup>	_LTPS
2.1 Pressure leak test certificate acc PED 2014/68/EU* <sup>1</sup>	_LTCE
2.1 Penetrant test certificate* <sup>2</sup>	_PT1
2.2 Positive Material Identification	_PMI
2.2 Welding documents (WPS/PQR)* <sup>2</sup>	_WPS

\*1: For fitted and welded accessory

\*2: Only for welded accessory

**Table 2: Options**

Option (start options with X_)	code
PTFE Coating low cure type	CPTF_L

Note: Coatings on BRF type can give a convoluted effect on the facing area. This will have no effect on functioning

## Change log

Date	Change
11-12-2020	Added code tables
	Added active links in text to other datasheets
	Removed double text diaphragm 304L
	Added AISI 347 to diaphragm foil material
8-3-2021	Updated dimension table ASME B16.5:2020
	Added standards table and roughness conversion table.

Holland – Romania – India – Thailand – Dubai – USA

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