

SJ type seal – Extended flush diaphragm bolted type

Design description

SJ is typically used in combination with pressure transmitters for pressure measurement, in those applications where the diaphragm need to be flush with the pipe wall. This can be obtained by either mounting the SJ seal part in a saddle type that is welded on top of the piping or in a flow through block that can be welded into the piping or mounted by means of flanges. Typical applications are pressure and flow measurements of highly viscous media



Housing / diaphragm combinations

Body Material	Diaphragm material		
(Lower part)	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

All upper part materials are standard AISI 316(L) except for Titanium versions where the upper part is Titanium as well.

Process connection

	Type	Connection	Sizes
Saddle type	SJ-S	Run pipe	2" (DN50)... 6" (DN150)
Block type	SJ-IS	Socket weld	½" (DN15) ...2" (DN50)
	SJ-IB	Butt weld	
Flanged type	SJ-IF	Flanged	½" (DN15)...6" (DN150)
Steam Jacket type	SJ-ST	Butt weld	½" (DN15) ...2" (DN50)

Gold coatings

Two types of gold coating thickness can be applied on the SJ seals, both suitable for corrosion protection and hydrogen permeation. The selection possibilities are:

- 25 µm thickness
- 40 µm thickness

-> See datasheet “Gold coatings”

Polymer solutions

Polymer solutions come in several executions and forms. The technical data on thickness and temperature limitation can be found in datasheet “polymer solutions”. The upper part of the SJ can be executed with:

- PTFE coating
- PFA coating
- PTFE sheet

The lower parts of the SJ is not suitable for coating because of the welded constructions. Except the SJ-IF flanged execution can be polymer coated.

-> 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”

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”

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.

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.

Retaining bolts & nuts

The retaining bolts between upper and lower part can be selected in different materials and are in the size M8 or M12. The bolts are hexagon socket head cap screws according ISO 4762 (DIN 912)

Grade bolt	Grade nut	Material
ISO 3506-1 A2-70	ISO 3506-2 A2	AISI 304
ISO 3506-1 A4-70	ISO 3506-2 A4	AISI 316

Torque

The closing between upper part and lower part is done with 8 bolts, depending on the pressure rating.

Grade bolt	Size	Torque
A2-70	M8	19 Nm (14 ft-lb).
A2-70	M12	43 Nm (31.7 ft-lb).

Gaskets

For the SJ a gasket is supplied for the closing between the upper and the lower part of the SJ. The gaskets are virgin PTFE.

Material	Operating temperature
Virgin PTFE	-200 / +260°C

Pressure

The maximum working pressure of the SJ is limited. The maximum allowed operating pressure (MAOP) of the upper and lower construction is limited to 250 bar at 20°C. The maximum pressure of the assembly is depending on the selection and quantity of bolts and gasket and lower part pressure class.

Size	Grade	MAOP @ 20°C	MAOP @ 250°C
8 x M8	ISO 3506-1 A2/A4-70	100 bar	75 bar
8 x M12		250 bar	190 bar

Based on the assumption bolts and body materials has same expansion coefficients. Some materials are limited by material specification and are not able to meet 250°C.

Replecement parts

When the SJ seal is injected during shutdown or repaired by a Badotherm facility it is wise to replace the gaskets and retaining screws. You can order them with below item numbers.

SJ

Material	Item number	Quantity needed
Virgin PTFE	9225990033	1 piece
ISO 3506-1 A2-70	9239010689	8 pieces

SJ-HP

Material	Item number	Quantity needed
Virgin PTFE	9225040083	1 piece
ISO 3506-1 A2-70	74000580	8 pieces

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.

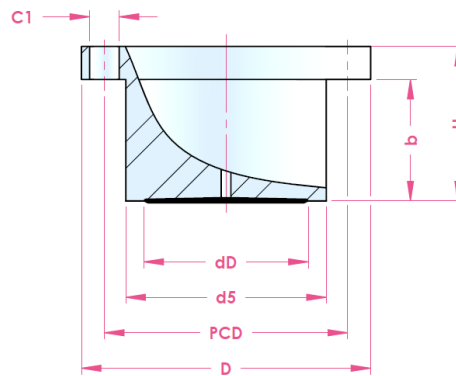
Minimum span table

dD	AP/GP	DP
44mm	1575 mbar	255 mbar
50mm	1200 mbar	205 mbar

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

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

Dimensions table: SJ seal



SJ Standard

size	rating	D	dD	d5	PCD	b	H	C1
std	PN 100	88.0	50.0	61.0	74.0	37.0	47.0	8x9mm

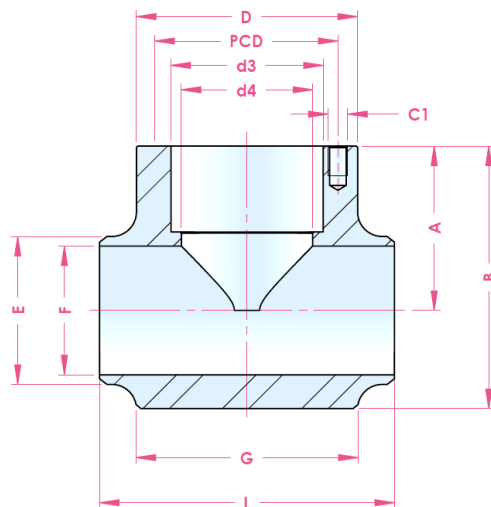
All dimensions in mm

SJ High Pressure

size	rating	D	dD	d5	PCD	B	H	C1
High pressure	PN 250	120	44.0	70.0	94.0	34.0	59.0	8x12.5mm

All dimensions in mm

Dimensions table: SJ-IB



SJ-IB Standard

size	E	F (S40)	A	B	G	L	d3	d4	PCD	C1
0,5" (DN15)	21.4	15.8	48.0	69.0	90.0	120.0	62.0	53.5	74.0	M8/8x
0,75" (DN20)	26.7	20.9	50.0	74.0						
1" (DN25)	33.4	26.6	54.0	81.0						
1,5" (DN40)	48.3	40.9	61.0	95.0						
2" (DN50)	60.3	54.7	67.0	107.0						

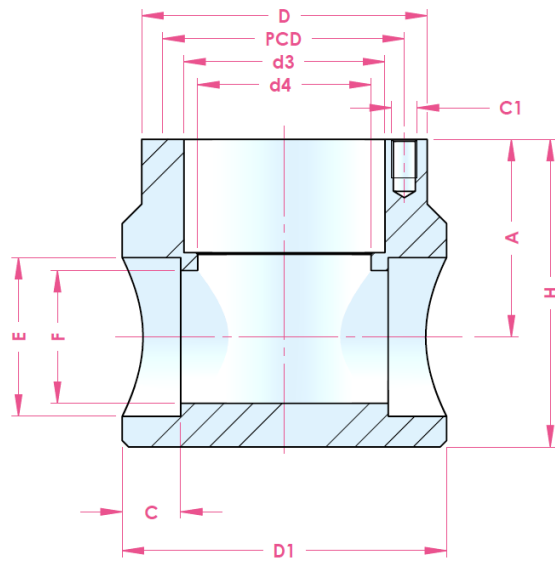
All dimensions in mm. F size based on Schedule 40. Other Schedule sizes available.

SJ-IB High Pressure

size	E	F (S160)	A	B	G	L	d3	d4	PCD	C1
0,5" (DN15)	21.4	11.8	48.0	69.0	120.0	150.0	71.0	49.0	94.0	M12/8x
0,75" (DN20)	26.7	15.6	50.0	74.0						
1" (DN25)	33.4	20.7	54.0	81.0						
1,5" (DN40)	48.3	34.0	61.0	95.0						
2" (DN50)	60.3	51.6	67.0	107.0						

All dimensions in mm. F size based on Schedule 160. Other schedule sizes available.

Dimensions table: SJ-IS



SJ-IS Standard

Size	D	D1	E	F	C	A	H	d3	d4	C1	PCD
0,5" (DN15)	88.0	95.0	22.0	16.0	13.0	53.0	70.0	62.0	53.5	M8/8x	74.0
0,75" (DN20)			27.0	21.0		55.0	75.0				
1" (DN25)		100.0	34.0	27.0	16.0	59.0	85.0				
1,5" (DN40)			49.0	41.0	18.0	66.0	100.0				
2" (DN50)			61.0	53.0	21.0	72.0	110.0				

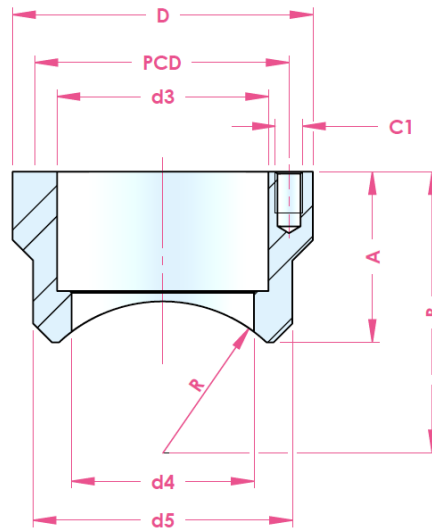
All dimensions in mm. F size based on Schedule 40. Other schedule sizes available.

SJ-IS High Pressure

Size	D	D1	E	F	C	A	H	d3	d4	C1	PCD
0,5" (DN15)	120.0	140.0	22.0	11.5	13.0	70.0	90.0	71.0	49.0	M12/8x	94.0
0,75" (DN20)			27.0	15.5		75.0	95.0				
1" (DN25)			34.0	20.5	16.0	80.0	105.0				
1,5" (DN40)			49.0	34.0	18.0	85.0	120.0				
2" (DN50)			61.0	43.0	21.0	92.0	130.0				

All dimensions in mm. F size based on Schedule 160. Other schedule sizes available.

Dimensions table: SJ-S



SJ-S Standard

size		OD	A	B	d3	d4	d5	R	C1	PCD
2"	DN50	88.0	50.0	38.0	62.0	38.0	64.0	30.15	M8/8x	74.0
2,5"	DN65			77.0		37.0				
3"	DN80		83.0	44.5						
4"	DN100		47.0	95.0		53.5	76.0	57.2		
5"	DN125		46.0	109.0		70.0				
6"	DN150		44.0	122.0		84.2				

All dimensions in mm.

SJ-IS High Pressure

size			A	B	d3	d4	d5	R	C1	PCD
2,5"	DN65	120	65	102.0	71.0	49.0	120.0	37.0	M12/8x	94.0
3"	DN80			108.0				44.5		
4"	DN100		62.0	120.0				57.2		
5"	DN125		61.0	134.0				70.0		
6"	DN150		59.0	147.0				84.2		

All dimensions in mm.

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