

# FSO-EXT (UREA) – flange type, extended diaphragm

## Design description

The FSO-EXT is typically used in combination with (differential) pressure transmitters for level, flow and pressure measurement, in those applications where the diaphragm need to be flush with the vessel wall or where insulation layers need to be passed. The FSO-EXT is recommended when extended seals are required fully in exotic materials and/or when special grade cover flanges are required for pressure temperature rating. The FSO-EXT lens type seal has a screwed connection into the flange. The seal body is made of bar stock or forged material. Its pressure rating is defined by the back-up flange and as such it can be used for pressure ratings determined by the licensor. This design is often used in UREA and fertilizer industry.



## Size, rating and facings

Size	Rating	Facing	Roughness
2", 3" and 4"	160K	Lens	Ra 6.3 µm

## Body vs Diaphragm combinations

The diaphragm is TIG-welded to the flange 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

Body Material	Diaphragm material		
	General name	UNS	Wst.
AISI 316(L)	AISI 316L	S31603	1.4404
AISI 310 MoLn	25-22-2 LMN	S31050	1.4466
AISI 316 UG	AISI 316 UG	S31600	1.4435
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
Zirconium 702	Zirconium 702	R60702	-

## Flange materials

The threaded flange can be supplied in several materials. Some of the standard materials are:

General name	UNS	Wst.
AISI 316L	S31603	1.4404
254 SMO (6Mo)	S31254	1.4547
Duplex 2205	S32205	1.4462
Super Duplex 2507	S32750	1.4410
A105	K03504	1.0482

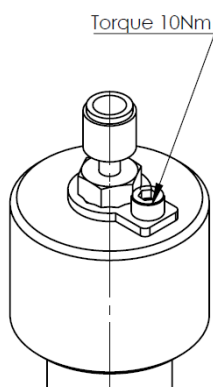
## Capillary tube and armor (protection)

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 consists of 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"

## Material limitations

Zirconium and Titanium versions of the FSO-EXT UREA cannot be welded with stainless steel. This results in a screwed connection, something Badotherm tries to prevent. For this occasion we developed a special connection based on the high pressure connection. Because screwed connections are subject for accidental loosening Badotherm adds a locking mechanism. This locking mechanism prevents accidental loosening of the capillary connection.



## Gaskets

Gaskets are not in the scope of supply however on page 6 is a table for reference purposes.

## 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 to customer requirements and cleaning specifications.

## 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 manufacturer's 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.

## Leak testing

All seals are helium tested according to 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"

## Cyclic pressure testing

Urea type seals are used in the harsh conditions. Next to the standard pressure test at the URV an optional fatigue pressure cycle test can be assigned. Common cyclic pressure test values are 240 times from atmospheric to a percentage of the URV at ambient temperature. This way all welds, gaskets and other constructions are fatigue tested.

## 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
32mm	11 bar	1850 mbar
72mm	155 mbar	30 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.

## Extension length and diameter

Length and diameter can be selected in random dimensions. In the dimension tables the standard diameters are given, however variation can be made upon request. The length of the extension is always customer selected. Most common length of extensions are 50mm, 100mm, and 150mm.

## Design conditions

Design conditions are set by the licensors when following material and design codes from that specific licensor. Design specifications:

Based on A105 flange material:

Snamprogetti®	Pressure	Temperature
STD.TB.HPU.5002 / rev 2012	292 bar	80°C
	268 bar	160°C
	221 bar	250°C

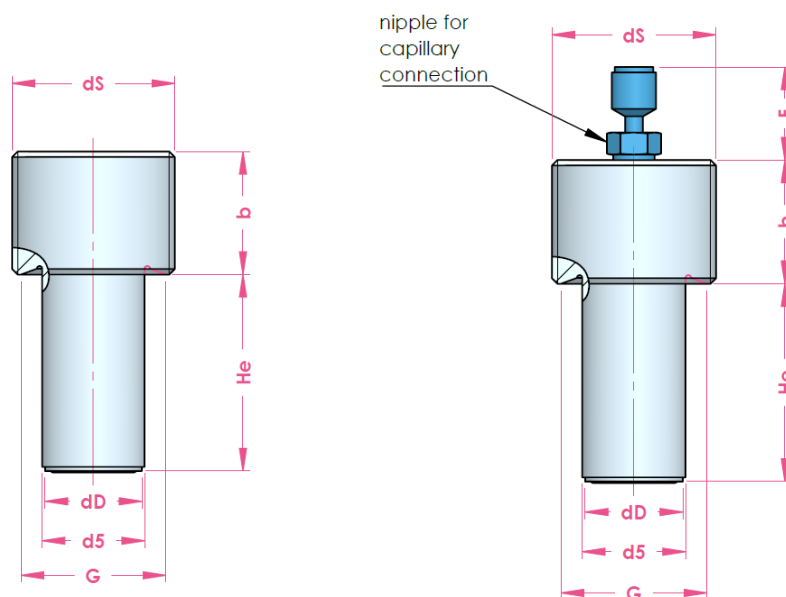
Snamprogetti®	Pressure	Temperature
STD-TB-HPU-5002 / TS-COR-ENG-PIPMT-002-E	315 bar	128°C
	280 bar	219°C

Snamprogetti® is a registered trademark of Saipem S.p.a.

Based on AISI316L UG flange material:

Urea Casale	Pressure	Temperature
8486-30-E-INR-101/111	200 kg/cm <sup>2</sup>	150°C
	162 kg/cm <sup>2</sup>	225°C

## Dimensions table: Seal with threaded connection and lens gasket



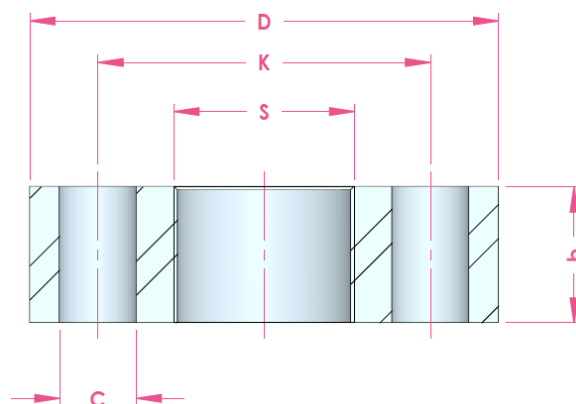
size	dD	ds	d5	G	b	F <sup>*1</sup>	He	Snamprogetti®
2"	32	2" NPSM	37.5	53.0	45.0	33.0	various	STD-SM-HPU-5002_E
3"	47	3" NPSM	57.0	85.0	66.0			
4"	72	4" NPSM	76.0	103.0	75.0			

size	dD	ds	d5	G	b	F <sup>*1</sup>	He	Urea Casale
DN50 (2")	32	M65x2	38.0	47.0	70.0	33.0	various	8486-30-E-INR-101
DN100 (4")	72	M125x4	82.0	107.0	85.0			8486-30-E-INR-111

All dimensions in mm

\*1: Size F only applicable for Zirconium and Titanium version.

## Dimensions table: Threaded flange

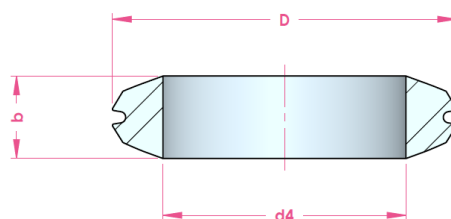


size	D	S	b	K	C / pcs	Snamprogetti®
2"	155.0	2" NPSM	45.0	110.0	25.4 / 4x	STD-TB-HPU-5002 / rev 2012
3"	200.0	3" NPSM	60.0	145.0	25.4 / 8x	
4"	250.0	4" NPSM	75.0	185.0	31.8 / 8x	

size	D	S	b	K	C / pcs	Snamprogetti®
2"	175.0	2" NPSM	45.0	130.0	25.4 / 4x	STD-TB-HPU-5002 / TS-COR-ENG-PIPM-T-002-E
3"	215.0	3" NPSM	60.0	160.0	25.4 / 8x	
4"	260.0	4" NPSM	75.0	175.0	31.8 / 8x	

size	D	S	b	K	C / pcs	Urea Casale
DN50 (2")	155.0	M65x2	46.0	165.0	29.0 / 4x	8486-10-SDP-001
DN100 (4")	311.0	M125x4	70.0	241.5	35.0 / 8x	

## Dimensions table: Gasket lens type



size	D	d4	b	Snamprogetti®
2"	56.0	39.3	11.0	STD-TB-HPU-5002
3"	83.0	58.4	14.0	
4"	108.0	77.2	18.0	

size	D	d4	b	Urea Casale
2"	61.0	42.85	14.5	8486-30-E-SDP-001
4"	118.0	87.32	23.5	

**Authorised Distributor:**

**NATIONWIDE  
OIL & GAS**

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

Email: [nog@nog.com.my](mailto:nog@nog.com.my)

Website: [www.nog.com.my](http://www.nog.com.my)

DSS 7030 – 5<sup>th</sup> of July 2022

## Change log

Date	Change

Holland – Romania – India – Thailand – Dubai – USA

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