BHS type seal – Hub connector type, flush diaphragm

Design description

Badotherm Hub seal is a special design of diaphragm seal based on high pressure clamp hub connectors. This design is based on and manufactured in according with the leading manufactures, such as Destec®, Vector-Techlok®, Grayloc® or Galperti®. These type of connectors are designed for high pressure applications (>400 bar) where standard flanges cannot be used or only with extreme heavy weight, since another advantage of the Hub connector is the relative small design with a far lower load on the process installation. BHS seals can be used for either pressure measurement or differential pressure measurement (level, flow) where high static pressure occurs. The BHS can be produced with an internal diaphragm (smaller hub sizes) or a flush diaphragm (larger hub sizes), this depends on the specific application

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

Body Material	Diaphragm material		
	General name	UNS	Wst.
AISI 316(L)	AISI 316L	S31603	1.4404
	Alloy C276	N27600	2.4810
AISI 321	AISI 321	S32100	1.4541
Alloy 400	Alloy 400	N04400	2.4360
Alloy 625	Alloy 625	N06625	2.4856
Alloy 825	Alloy 825	N08825	2.4858
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

Pipe size, rating and facings – Destec®

G - range				
Range	Pipe size	Rating	Facing	Hub size
Standard	0.5" to 4”	S40 … XXS	Groove	G1 - G4
Heavy duty				GB - GD

Pipe size, rating and facings – Grayloc®

G - range				
Range	Pipe size	Rating	Facing	Hub size
Standard	0.5" to 4”	S40 … XXS	Groove	1GR - 4GR
Heavy duty				B20 – D31

Pipe size, rating and facings – Vector®

Techlok ®			
Pipe size	Rating	Facing	Hub size
0.5" to 4”	S40 … XXS	Groove	1in/ - 4in/

Pipe size, rating and facings – Galperti®

G - range				
Range	Pipe size	Rating	Facing	Hub size
Standard	0.5" to 4”	S40 … XXS	Groove	1GR - 4GR
Heavy duty				B20 – D34

Gold coatings

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

- 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 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 lines"

Limitations

There are some limitations to hubs that need to be mentioned.

- ≤1.5" are made with a nozzle and a welded seal.
- Coating in grooves can damage after tightening the clamps

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.

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 hub manufacturers including manufacturing name, size, heatnumber and material. A Badotherm reference is added to the hubs for traceability.

Clamps and gaskets

Clamps and gaskets are out of the scope of supply. However when the specifications are clear Badotherm can support and include them in the delivery.

Standards used

Design Standards

Standard	Description
Manufacturing standards	All manufacturer design are respected

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_2S-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

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.

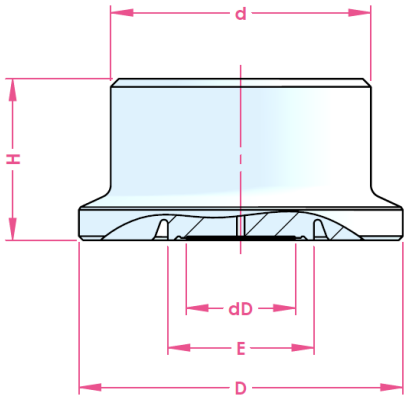
Minimum span table

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

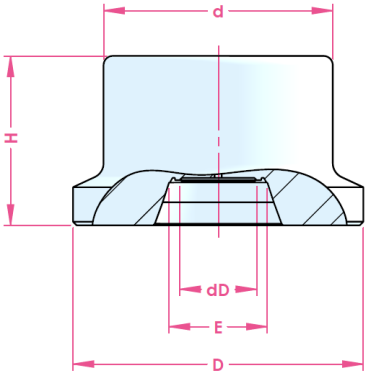
Pressure transmitter; ambient temperature -10…+30°C; process temperature 100°C with BSO 22 fill fluid; 3 meter capillary; ID 1mm, DP both sides mounted with seal

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

Dimensions table: Hub connectors



Front Face



Recessed

Destec® G-range

Hub size	dD front face	dD recessed	d	D	H	E*2
G2-14	32	23	73.0	92.1	50.8	38.2
G2-16						42.9
G2-20			102.0	127.0	63.5	49.3
G3-23	50	44				58.4
G3-25						66.7
G4-25			127.0	152.0	73.0	
G4-27	57					77.9
G4-31		50				80.1

Galperti G-LOK®

Hub Size	dD front face	dD recessed	d	D	H	E*2
2 GR14	32	23	73.0	92.1	44.5	38.2
2 GR16						42.9
2 GR20						49.3
3 GR23	50	44	101.6	127.0	47.6	58.4
3 GR25						66.7
4 GR25						
4 GR27	57	50	127.0	152.4	54.0	77.9
4 GR31						80.1

Grayloc®

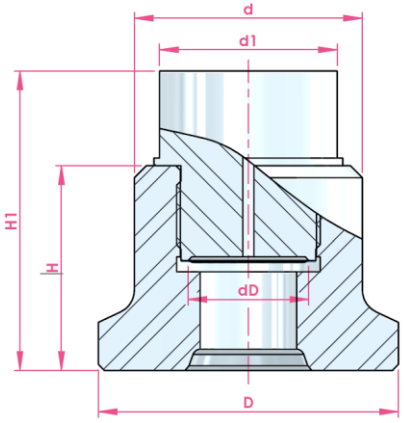
Hub Size	dD front face	dD recessed	d	D	H	E*2
2 GR14	32	23	73.0	92.1	50.8	38.2
2 GR16						42.9
2 GR20						49.3
3 GR23	50	44	101.6	127.0	63.5	58.4
3 GR25						66.7
4 GR25						
4 GR27	57	50	127.0	152.4	73	77.9
4 GR31						80.1

Vector Techlok®

Hub Size	dD front face	dD recessed	d	D	H	E*2
2in/14	32	23	73.0	92.1	50.8	38.2
2in/16						42.9
2in/20						49.3
3in/23	50	44	101.6	127.0	63.5	58.4
3in/25						66.7
4in/25						
4in/27	57	50	127.0	152.4	73	77.9
4in/31						80.1

* 1: Can vary depending on the execution (recessed vs front face)
2: indicative dimension of maximum bore of the hub.
All dimensions in mm

Dimensions table: Hub connectors – smaller sizes



Destec® G-range

Hub Size	dD	d	d1	D	H	H1
G1-5	32	60.3	47	50.8	100*1	123*1
G1-7						
G1-11						
G1.5-11				79.4	54	79
G1.5-14						

* 1: Can vary depending on the hub supplier standard
All dimensions in mm

Grayloc®

Hub Size	dD	d	d1	D	H	H1
1 GR5	32	60.3	47	50.8	100*1	123*1
1 GR7						
1 GR11						
1.5 GR7				79.4	54	79
1.5 GR11						

* 1: Can vary depending on the hub supplier standard
All dimensions in mm

Galperti G-LOK®

Hub Size	dD	d	d1	D	H	H1
1 GR5	32	60.3	47	50.8	100*1	123*1
1 GR7						
1 GR11						
1.5 GR7				79.4	54	79
1.5 GR11						

* 1: Can vary depending on the hub supplier standard
All dimensions in mm

Change log

Date	Change
6-2-2023	Added solution for smaller sizes connection
11-7-2023	Added extra sizes to the dimension tables