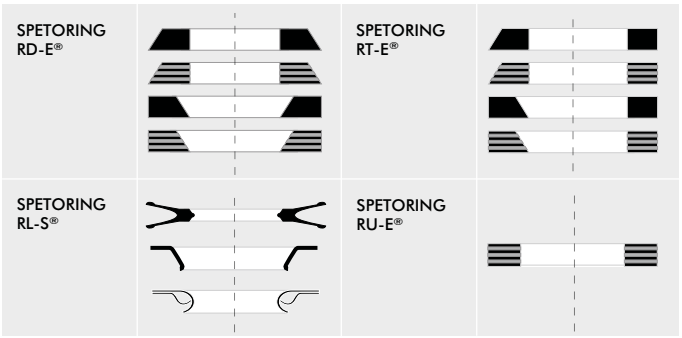
SPETORING RDE®, RTE®

Offset Seals for Butterfly Valves

SPETECH®



Modern butterfly valves are used as cut-off and regulating fittings frequently in many high-temperature applications. One of the serious challenges in this type of applications is the internal sealing of the disc. On one hand the seal should remain flexible, on the other should also be resistant to erosion and wear resulting from the conditions of its use.
Often the basic soft sealing materials (elastomers, PTFE) do not fulfil these requirements due to: -their fast ageing in the increased temperature, -their wear decreasing the life of the seal and the periods between maintenance. This led to the development of metal and metal-graphite offset seals which from one hand secure resistance to erosion and working temperature and in the same time guarantee longer life time of entire valve.
The most popular form of these seals is a graphite-metal laminated structure made of alternately combined layers of foil made of expanded graphite (characterized by specified quality, thickness and density) and inter-layers made of flat metal elements.
The geometry of the seal and its material characteristics are determined in detail by the manufacturer of the fittings. This way, the specified leakage rate, durability, drive and structure of the valve is determining the selection of:
- the number of metal layers (in general, the layers may vary in terms of thickness – their number is usually between 2 and 12mm and their thickness is usually between 0.5 and 3.00 mm). The most common materials that can be applied have been presented in **table 1**.
- the number and the thickness of the graphite layers (also in this case the layers may vary in thickness – their thickness is usually between 0.25 and 1.00 mm, while their density is between 0.7 and 1.3 g/ccm). Graphite foils that can be applied have been provided in **table 2**.

Above laminates may be:
- 'disc mounted' if installed on the disk of butterfly valve,
- 'body mounted' if installed in the body of the butterfly valve.
Depending on the case, the offset conical sealing surface is given either on the external surface (in case of 'disc mounted') or internal surface of the laminate (in case of 'body mounted'). As the complementary products, SPETECH® can also supply corresponding solid offset parts:
- offset solid metal ring to be mounted in the disc and work together with offset laminate seat,
- offset solid metal seat to be mounted in the body and work together with offset laminate seal.
Standard sealing rings are capable of moving within the housing laterally, which facilitates their positioning in relation to the opposite sealing surface. Such solution, however, requires the application of secondary sealing which enables such movements. For this purpose other styles of customized SPETECH® back-up seals are available such as: spiral wounds, die-pressed graphite rings, self-energized seals, etc.

In terms of the kinematics of the butterfly valve disc movement, double-eccentric SPETORING®RD-E and triple-eccentric SPETORING®RT-E seals may be distinguished. This structural characteristic has a significant impact on the geometry of the sealing surface
(see fig. 1). The purpose of the multi-eccentric valve structures is to minimize the friction in the area of sealing while closing and opening the butterfly valve.
This is especially important issue for seals containing metal inside, due to the low flexibility of these seals (in compare to rubber based materials) and the real risk of wear due to

*See Spetech Static Seals catalogue

grinding.
Irrespective of whether the butterfly valve is double- or triple-eccentric, the sealing surface may assume different contours, especially round or elliptical **(see fig. 1)**.
The selection of the outline results either from the technological optimization or the optimization of flow decided by valve designer. Therefore offset seals are always made according to a precise documentation of the manufacturer of the butterfly valve.
The range of dimensions of the internal metal laminate seals for butterfly valves is as follows:
-double eccentric seals: Spetoring RD-E DN50 - DN3000
(NPS 2" - NPS 120")
-triple eccentric seals: Spetoring RT-E DN50 - DN2000
(NPS 2" - NPS 78").

Alternatively to RD-E and RT-E seals presented above, inside butterfly valves another solution may be installed. An optional solution available both for 2-offset and 3-offset valves is especially shaped elastic metal ring called SPETORING® RL-S. Shape of the SPETORING® RL-S can be given either by spinning or by machining. Springiness, mechanical strengths and other features may be modified by specific construction, shape and wide choice from many available materials. SPETORING® RL-S is normally installed in the body of the valve and (what is different from sandwich construction of RD-E and RT-E rings) RL-S seal is resistant to any potential erosion due to lack of any soft material inside. But in the same moment (and in some of construction options), the RL-S seal is performing with much higher elasticity and self-energizing effect. Such features make the this solution very useful to work in high / frequently changing pressure and temperature.
Details of this SPETORING® RL-S (construction / geometry / material used) always are settled in co-operation between SPETECH® and valve manufacturer. Such solution we deliver for valves with size up DN3000 (or 120" adequately).

Tab.1 Common materials used for the metal interlayers

Common name	Werkstoff No.	UNS	EN
Stainless steel			
Stainless Steel 304	1.4301	S30400	X5CrNi18-10
Stainless Steel 304L	1.4307	S30403	X2CrNi19-11
Stainless Steel 316	1.4401	S31600	X5CrNiMo17-12-2
	1.4404	S31603	X2CrNiMo17-12-2
Stainless Steel 316L UG (Urea Grade)	1.4435	S31603	X2CrNiMo18-14-3
Stainless Steel 317L	1.4438	S31703	X2CrNiMo18-14-4
Stainless Steel 904L	1.4439	N08904	X1NiCrMoCu25-20-5
Stainless Steel 321	1.4541	S32100	X6CrNiTi18-10
Stainless Steel 347	1.4550	S34700	X6CrNiNb18-10
Stainless Steel 316Ti	1.4571	S31635	X6CrNiMoTi17-12-2
Heat Resistant Statinles Steel 309	1.4828	S30900	X15CrNiSi20-12
Incoloy 800 (800H)	1.4876	N08800	X10NiCrAlTi32-20
Duplex - type stainless steel			
Duplex Steel F51 (2205) 318 LN	1.4462	S32205/S31803	X2CrNiMoN22-5-3
Duplex Steel F53 (2507)	1.4410	S32750	X2CrNiMoN25-7-4
Duplex Steel F55 (4501)	1.4501	S32760	X2CrNiMoCuWN25-7-4
Duplex Steel 310Mo LN	1.4466	S31050	X2CrNiMoN25-2-2
Nickel alloys			
Nickel 201	2.4068	N02201	Lc-Ni 99
Monel 400	2.4360	N04400	NiCu 30 Fe
Hastelloy C-22	2.4602	N06022	NiCr21Mo14W
Hastelloy C-59	2.4605	N06059	NiCr23Mo16Al
Inconel 600	2.4816	N06600	NiCr 15 Fe
Hastelloy C-276	2.4819	N10276	NiMo16Cr15W
Inconel 625	2.4856	N06625	NiCr22Mo9Nb
Incoloy 825	2.4858	N08825	NiCr21Mo

Many other materials on request

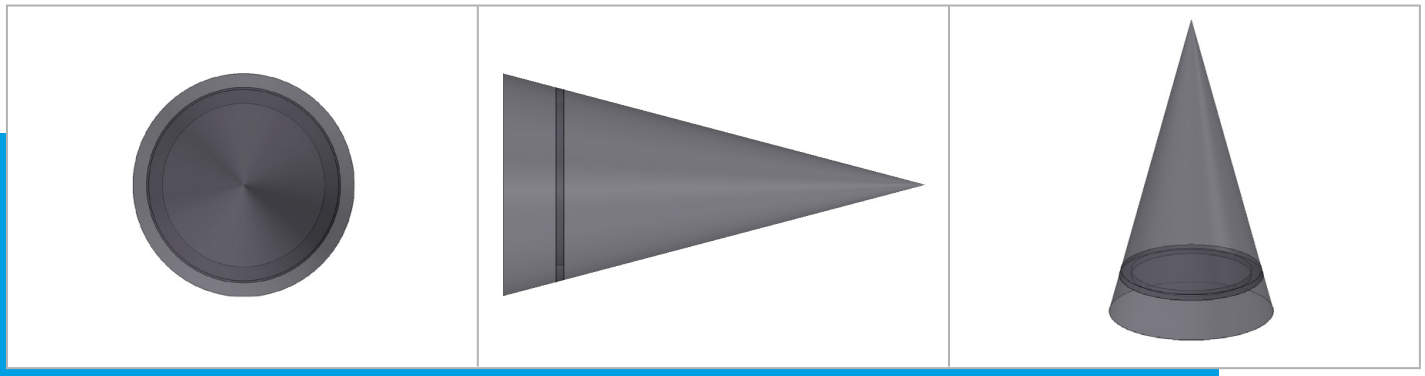
Tab.2 Common soft materials used for laminates

Type of soft material	Carbon content	Chloride content	Sulphur content	Additives
Expanded graphite **Sigraflex C** (standard purity)	≥98	≤25	<300	———
Expanded graphite **Sigraflex Z** (nuclear purity)	≥99,85	≤10	<300	———
Expanded graphite **Sigraflex ZX**	≥98	≤20	<300	Corrosion Inhibitor
Expanded graphite **Sigraflex APX**	≥98	≤25	<300	Oxidation Inhibitor
Expanded graphite **Sigraflex APX2**	≥98	≤25	<300	Improved Oxidation inhibitor

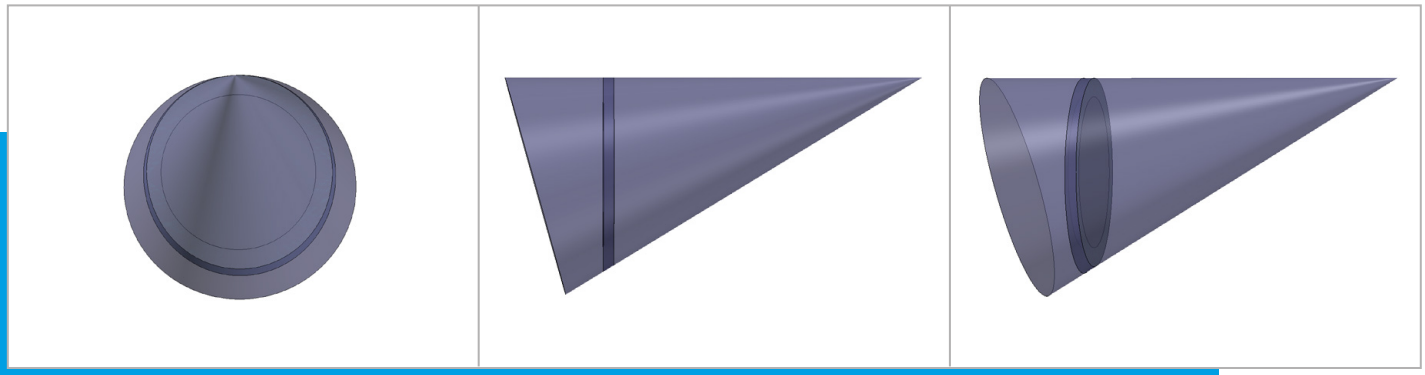
Other soft materials on request

Fig.1 Shapes and contours of eccentric seals

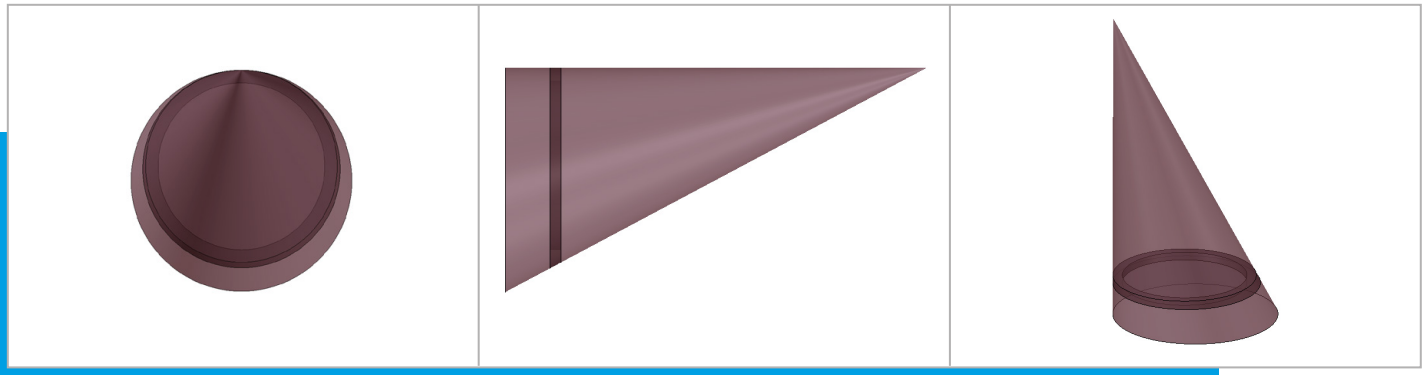
Double-eccentric seals



Triple-eccentric seals with elliptical outline



Ttriple-eccentric seals with circular outline



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