

蝶阀密封原理 Butterfly Valve Sealing Principle

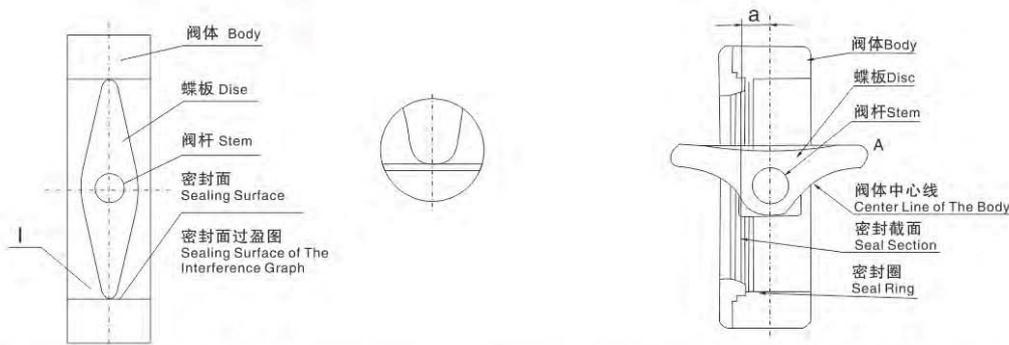
我公司生产的系列蝶阀的密封结构形式有以下几种：中线密封、单偏心密封、双偏心密封，三偏心密封，变偏心密封，各种结构类型蝶阀的密封原理简述如下：

Our butterfly valves are structured to centerline seal, single eccentric seal, double eccentric seal, triple eccentric seal and variable eccentric seal. The sealing principles of these structures are stated as following:

中线密封蝶阀的密封原理 Sealing Principle of Centerline Seal Butterfly Valve

蝶阀的蝶板密封中心和阀杆的回转中心重合，阀门依靠一定的过盈量在阀门与蝶板密封面间造成密封比压，保证阀门密封副的密封效果。此结构在阀体上衬胶，多适用于中小口径的蝶阀，由于是挤压变形，阀门在开关过程中，蝶板始终受到挤压，因此上下阀轴部分受到挤压较大，阀门的使用寿命受到影响；阀门的启闭力矩较大。缺点是由于蝶板与阀座始终处于挤压、刮擦状态、阻距大、磨损快。为克服挤压、刮擦、保证密封性能、阀座基本上采用橡胶或聚四氟乙烯等弹性材料、但也因而在使用上受到温度的限制、这就是为什么传统上人们认为蝶阀不耐高温的原因。

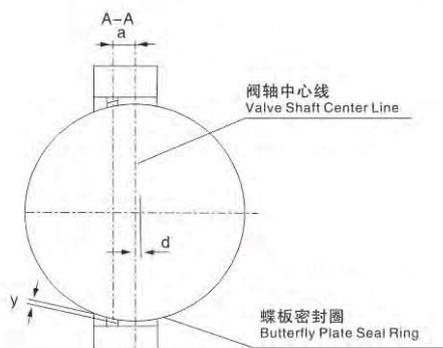
With the disc seal center of butterfly valve and rotation center of stem overlapped, sealing load will be produced between the sealing faces of seat and disc under certain magnitude of interference, thus to ensure effective seal of valve. Lined with rubber on the body, this structure is applicable for medium and small-bore butterfly valves. Due to the deformation under extrusion, during the process of opening and closing, disc is always under extrusion. So, the upper and lower valve shafts are seriously extruded, which can be bad to the service life of valve. And the open-close moment of valve is relatively high. The defect is that disc and seat are always under extrusion, scratch and to ensure the good seal, seat basically uses rubber or PTFE, or other elastic materials. However, the temperature can be the problem. That it why it is said that butterfly valves are conventionally ,not resistant to high temperature.



单偏心密封蝶阀的密封原理 Sealing Principle Of Single Eccentric Seal Butterfly Valve

由于蝶板的回转中心(即阀轴中心)与蝶板密封截面按a 偏心设计，使得蝶阀在开启过程中，蝶板密封面逐渐脱离阀座密封面，蝶板转动至15° -25° 时，蝶板密封面完全脱离阀座密封，完全开启时，两密封面之间形成间隙，从而使得蝶阀在启闭过程中，两密封面之间相对机械磨损及挤压大为降低，从而保证了蝶阀的密封原理。但由于整个开关过程中蝶板与阀座的刮擦现象并未消失、在应用范围上和同心蝶阀大同小异、故采用不多。

Because of the rotation center of the disc (i.e. valve shaft center) and the butterfly plate sealing section is designed according to a eccentric, making the valve in the opening process, the disc sealing surface gradually separates from the valve seat sealing surface, once the butterfly plate rotates to 15° - 25° degrees, the disc sealing surface separates completely from the valve seat seal once fully open, it forms a gap between the two sealing surface, so that the valve in the opening and closing process, the relative mechanical wear and extrusion between the sealing surface is greatly reduced, so as to ensure the sealing of butterfly valve. However as the scratch between the disc and seat doesn't disappear during the whole process of open and close. they are almost similar to concentric butterfly valves in the area of application, this is why they have not been popularly used.



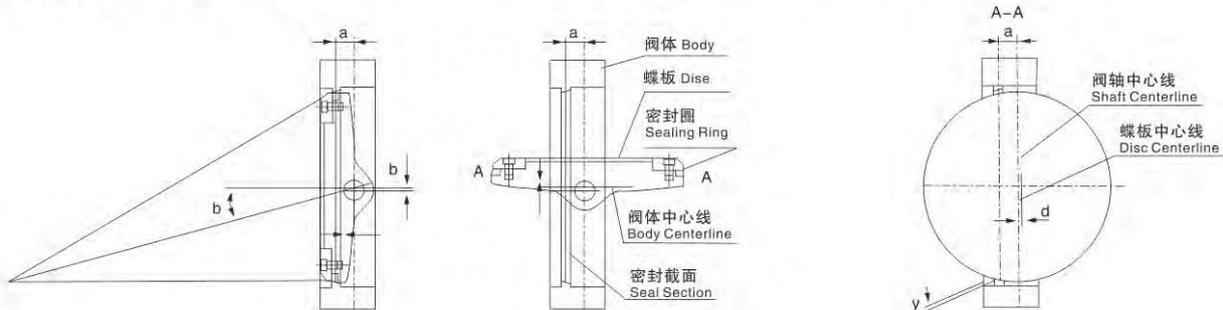
单偏心密封蝶阀密封副结构
Single Eccentric Butterfly Valve Sealing Structure

三偏心由于在双偏心蝶阀的基础上将阀座中心线再与阀体中心线形成一个 β 角偏置,使得蝶阀在启闭过程中,蝶板的密封面在开启瞬间立即脱离阀座密封面,而在关闭瞬间才会接触并压紧阀座密封面。当完全开启时,两密封面之间形成一个与双偏心密封蝶阀相同间隙 Y ,该类蝶阀的设计,彻底消除了两密封面之间的机械磨损和擦伤,使蝶阀的密封性能和使用寿命得到大大提高。阀门关闭时,密封圈受阀体密封面跟蝶板的挤压,产生了两个方向的弹性变形。密封面在长轴方向上受到了向外的张力,在短轴方向上受到向内的压应力,长短轴产生不同方向的弹性形变。从而使阀门密封面间的密封力逐渐达到最大值。

这一独特的偏心组合,即利用凸轮效应,又完全消除了摩擦,从而实现阀门 90° 行程中,阀座与蝶板上的密封圈之间无摩擦,去除了磨损和泄漏的可能。

A β eccentric is formed up between the centerline of seat and the centerline of body on the basis of double eccentric butterfly valve, making disc sealing face immediately disengaged from seat sealing face upon the opening or closing of butterfly valve, and in close contact with the seat sealing face upon closing. When fully opened, a gap "Y", which is same as that in double eccentric sealing butterfly valve, is formed upon the two sealing faces. This type design of butterfly valves has thoroughly eliminated the mechanical wear and scratch between the two sealing faces, making the sealing performance and service life of butterfly valves greatly improved. When the valve is closed, with sealing ring under the extrusion of body sealing face and disc, two upwards elastic deformations are produced. The sealing face is fallen under outward tension at long shaft and inward compressive stress at short shaft. The long and short shafts produce elastic deformation of different directions, thus to maximize the sealing force between the sealing faces of valves.

This distinctive eccentric combination not only uses cam effect, but also eliminates friction completely, thus to ensure no friction between seat and sealing ring on disc during 90° stroke.



三偏心密封蝶阀关闭状态图
Triple Eccentric Butterfly Valve Closed State Diagram

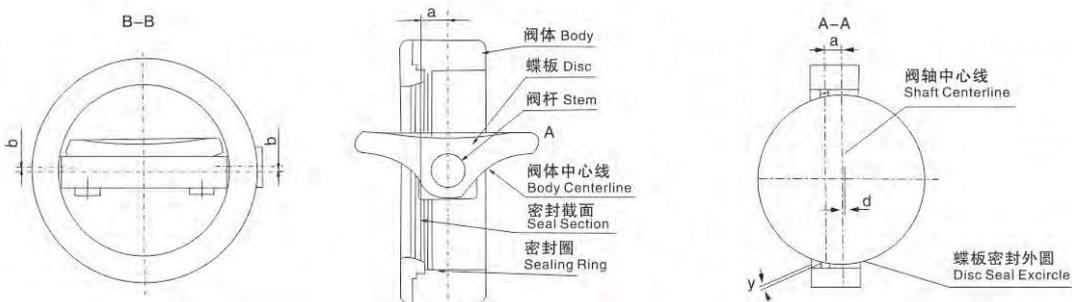
三偏心密封蝶阀开启状态图
Triple Eccentric Butterfly Valve Opening Diagram

三偏心密封蝶阀密封副结构
Triple Eccentric Butterfly Valve Sealing Pair Structure

变偏心密封的密封原理 The Sealing Principle of Variable Eccentric Sealing

变偏心蝶阀的独特之处在于安装蝶板的阀杆轴是一个三段轴式结构,此三段轴式阀杆两段轴段同心,而中间段轴中心线与两端轴线偏离一个中心距,蝶板就安装在中间轴段上。这样的偏心结构使得蝶板在全开位置时成为双偏心状,而在蝶板转动到关闭位置时则成为单偏心状。由于偏心轴的作用,在接近关闭时,蝶板向阀座的密封锥面内移进一个距离,蝶板与阀座的密封面相吻合达到可靠的密封性能,当使用一定周期时阀座密封面磨损后,可以调整驱动机构,使蝶板的关闭位置,驱前若干角度,这样可以恢复到新的密封状态。

The distinctive feature of variable eccentric butterfly valve is that the shaft where disc is mounted with is a three-segment eccentric shaft. The two ends of the three-segment shaft are concentric, while the centerline of the middle segment is deviated from the axial lines of the two ends by a center-to-center distance. Disc is just mounted on the middle segment. This eccentric structure forms up a double eccentric shape when disc is completely opened, and a single eccentric shape when disc is turned to be closed. Under the force of eccentric shaft, when tending to be closed, disc will move somewhat toward the conical sealing surface of the seat, and then engaged to perform dependable sealing. When seat sealing face is abraded after a period of service, adjust the driving mechanism to make the close position of disc forward for some degrees, in this way to set up a new sealing state.



双偏心密封蝶阀密封副结构
Double Eccentric Butterfly Valve Seal Pair Structure

蝶阀结构特征

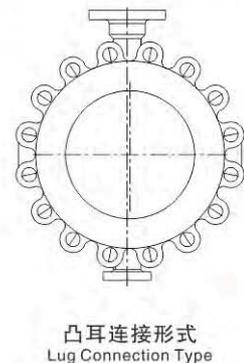
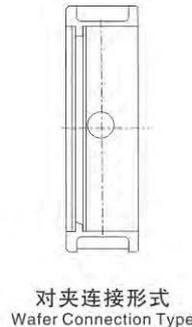
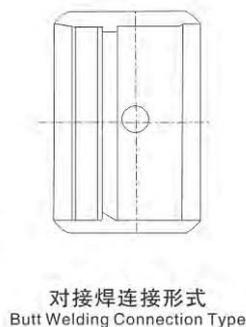
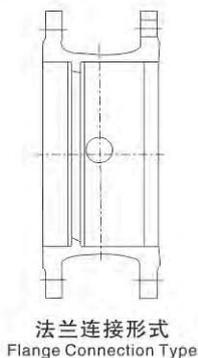
Butterfly Valve Structure Characteristic

蝶阀是用来打开和关闭管道内介质流通或调节管道内介质流量。它们主要结构及特点如下：
The butterfly valve is used to open and close the medium circulation or regulate the medium flow in the pipeline.

主要结构特点 The Main Structure Features

- 1、结构简单、体积小、重量轻、安装尺寸小。根据阀体连接形式可分对夹式(包括凸耳对夹式)、法兰连接和对焊连接三种基本连接形式。
- 2、密封结构形式有多层硬密封、整板式硬密封和弹性硬密封三种，可用于各种不同工况，且密封性能好，使用寿命长。
 - 1)多层次硬密封和整板硬密封蝶阀(分别见下图和左图)，全部采用了三偏心、锥面密封结构形式，密封副具有越关越紧的功能，并能有效清除阀座上的结垢，大锥角设计能承受600℃的高温。本系列蝶阀压力等级达到Class600。
 - 2)弹性硬密封结构(见上图)采用J型金属密封圈结构，适用于双偏心结构的蝶阀，压力等级<Class300，具有优良的密封性，寿命长、易加工制造。
 - 3)、本系列蝶阀所有的密封部件均采用了防火设计，即使着火后还能保证各个位置的密封性能。
 - 4)、蝶阀在完全开启的情况下流阻较小，部分开启的情况下能进行灵敏的流量控制。
 - 5)、驱动力矩小，操作简便、迅速。

- 1.Simple structure, small volume, light weight and small size for installation. According to the connection type, there are three kinds of basic connection: wafer type (including lug wafer type), flange type and butt welding type.
2. The sealing structure has three kinds including multi-layer metal sealed, wholly metal Metal Sealed and the elastic Metal Sealed, used for a variety of different conditions, with good sealing performance and long service life.
 - 1) multi-layer hard seal and the whole board (see below are hard sealing butterfly valve, and left) all the three eccentric, cone sealing structure, sealing with more tightening function, and can effectively remove fouling on the seat, the design of high temperature can withstand 600 degrees wide angle. The pressure level of this series of butterfly valves reaches Class600.
 - 2) Flexible metal seal structure (see above picture) adopts J type metal seal structure, which is suitable for double eccentric butterfly valve, pressure rating <Class 300 and characterized by excellent sealing, long service life, easy processing and manufacturing.
 - 3)All the sealing parts of this series butterfly valve are used with fire protection design, ensuring the sealing performance of each position even after the fire.
 - 4) Small flow resistance as the butterfly valve in the fully open condition, sensitive control of the flow as valve in partially open condition .
 - 5) The torque force is small, operating easily and fast.



1)软密封结构(见下图)Soft Sealing Structure (See Bellow Picture)

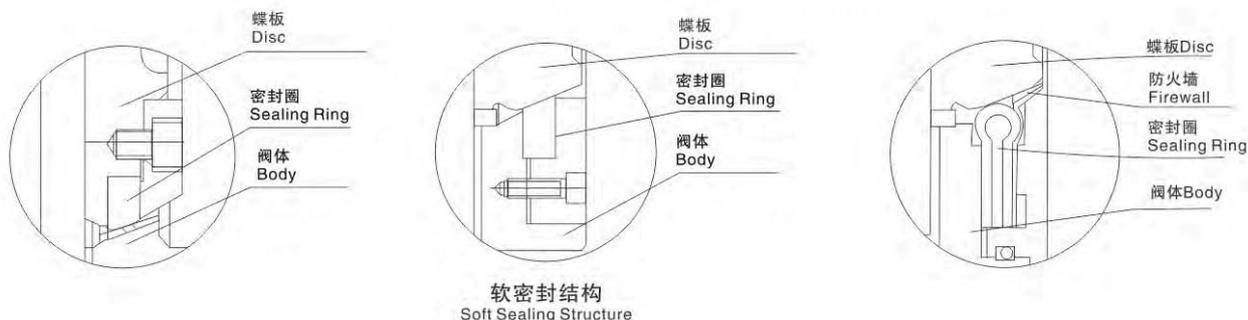
适用单偏心和双偏心结构的蝶阀，压力等级≤Class 600。(中线密封结构适用压力等级≤Class 150)密封圈(材料为PTFE)放置在阀体上具有以下特点：

- A)不需要使用附加的密封圈或金属支撑圈即可可靠密封。
- B)可保持双向的无泄漏的密封。
- C)维修量少，寿命长。

It is applicable for single and double eccentric butterfly valve, the pressure rating≤Class 600. (Centerline sealing structure applied to pressure ≤ Class 150), seal material (PTFE) placed on the body has the following characteristics:

- A) Don't require additional sealing ring or metal support ring, with reliably sealed.
- B) Maintaining bi-directional sealing with zero leakage.
- C) Less repair, long service life.

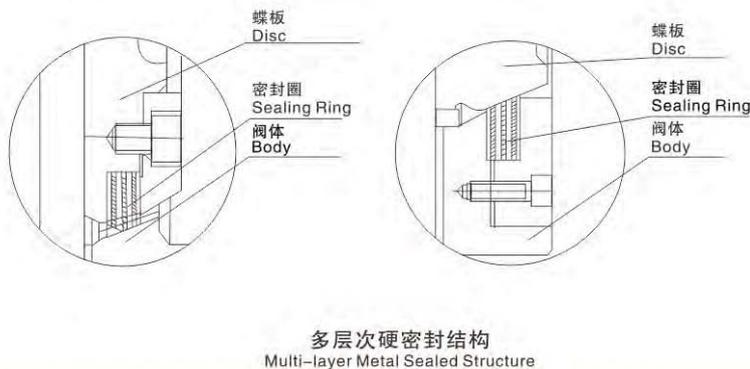
蝶阀结构特征 Butterfly Valve Structure Characteristic



2)多层次硬密封结构(见下图) The Multi-Layer Metal Sealed Structure (See Bellow Picture)

多层次硬密封结构，适用于单偏心、双偏心和三偏心结构的蝶阀，压力等级 \leq Class 600，其中三偏心蝶阀可保持双向无泄漏。多层次密封圈可采用不锈钢和非金属材料复合而成，其中非金属材料根据使用工矿选用柔性石墨、PTFE或非石棉材料等。

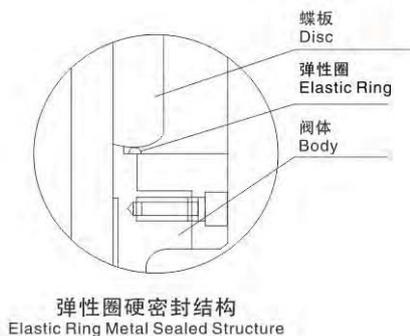
Multi-layer metal sealed structure, is suitable for single eccentric butterfly valves, double eccentric butterfly valves and triple eccentric butterfly valves, with pressure rating \leq Class 600. Besides, triple eccentric butterfly valves can be bi-directional zero leakage. The multilayer sealing ring can be made of stainless steel and non-metal material, which non-metal material can be flexible graphite, PTFE or non asbestos materials etc.



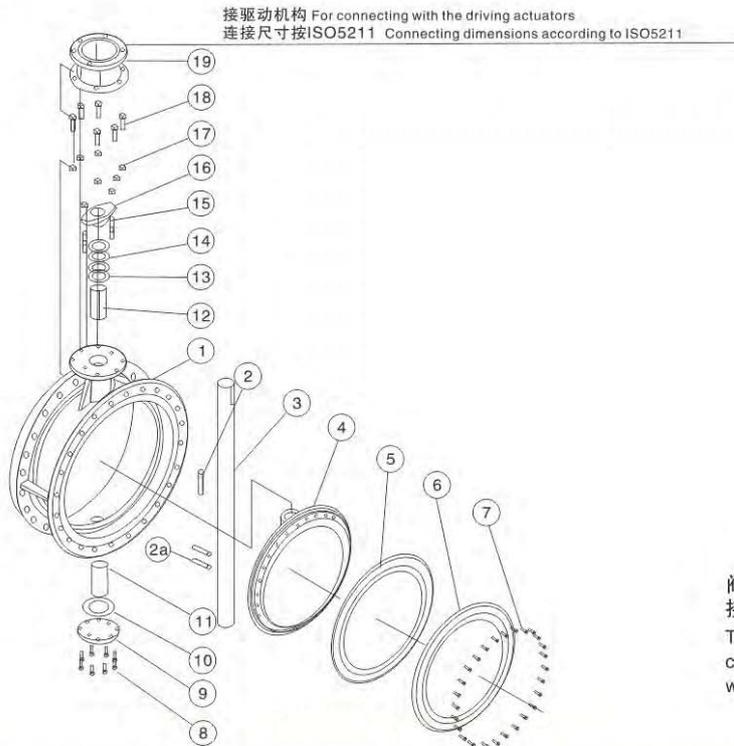
3)弹性圈硬密封结构(见下图) Elastic Ring Metal Sealed Structure

采用J型金属密封圈结构，适用于单偏心双偏心结构的蝶阀，压力等级 $<$ Class300。此结构本身具有防火结构，可适用温度变化较大的场合，具有优良的密封性，寿命长、易加工制造。

Using J type metal sealed structure, is suitable for single eccentric butterfly valve and double eccentric butterfly valve, the pressure class rating $<$ Class300. This structure has fireproof structure, can be suitable for large temperature changes, with excellent sealing performance, long service life, easy for processing and manufacturing.



蝶阀主要零件材质 Material of Butterfly Valve Main Parts



阀体连接形式有双法兰连接，对夹连接，凸耳对夹连接和对焊连接四种

The form of valve connection is double flange connection, clamp connection, lug to clamp connection and butt welding connection four kinds

主要零件材质 Material for Main Parts

序号NO.	零件名称 Part name	可选材料 Optional materials
1	阀体 Body	WCB,CF8,CF3,CF3M,CF8M,2205,2507,WC6,LCB, C95800等
2	键 Key	35#,304,316等
2a	销轴 Pin Shaft	F6a,F304,F304L,F316,F316L,F51,F53,Monel K400/500, 17-4PH等
3	阀杆 Stem	F6a,F304,F304L,F316,F316L,F51,F53,Monel K400/500, 17-4PH等
4	蝶板 Disc	WCB,CF8,CF3,CF3M,CF8M,2205,2507,WC6,LCB, C95800等
5	密封圈 Seal ring	SS304+Graphite,SS304+STL,SS316+Graphite,SS316L+Graphite, SS316L+STL,S31803+Graphite ,S31803+STL PTFE,RPTFE,PPL,EPDM,NBR等
6	压板圈 Clamping ring	A105,F304,F304L,F316,F316L,F51,F53,C95800等
7	螺钉 Screw	B7,B8,B7M等
8	螺栓 Bolt	B7,B8,B7M等
9	底盖 Bottom cover	Q235,F304,F304L,F316,F316L,F51,F53,C95800等
10	垫片 Shim	SS304+Graphite,SS304+Graphite,SS316+Graphite,PTFE等
11/12	轴套 Bushing	SF-1,SF-1B,SS304,SS316,SS304+PTFE,SS316+PTFE等
13	填料垫 Packing pad	F304,F316,F304L,F316L等
14	填料 Filler	Graphite,PTFE,PPL等
15	螺栓 Bolt	B7,B8,B7M等
16	填料压盖 Packing gland	WCB,CF8,CF3,CF3M,CF8M,2205,2507,WC6,LCB, C95800等
17	螺母 Nut	B7,B8,B7M等
18	螺栓 Bolt	2H,8,2HM等
19	支架 Bracket	WCB,CF8,CF8M,Q235等

提示：1、壳体材料压力温度等级表见84-85页
2、壳体材料化学成分及力学性能见86页
3、密封材料及使用服务范围见83页

Tip: 1. Shell material pressure and temperature level table 84-85.
2. The chemical composition and mechanical properties of shell material are shown in page 86.
3. The sealing material and service range are shown in page 83.