SEALING OF BALL VALVES

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1. Introduction

The sealing of ball valves, in their trunnion guided ball design, can be selected according to different premises according to the application.

Sealing forms are:

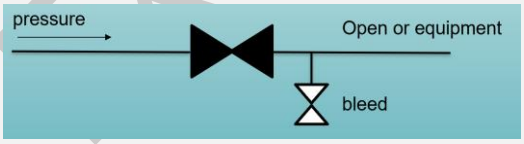
- Block & bleed (BB) unidirectional
- Double block & bleed in twin valve (DBB) bidirectional

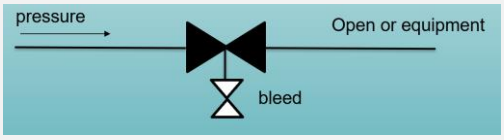
According to API 6D Specifications, following sealing forms are possible:

- Double block & bleed (DBB) in one valve
- Double isolation and bleed (DIB 1) both seats bidirectional
- Double isolation and bleed (DIB 2) one seat unidirectional and one seat bidirectional

2. Block & bleed (BB)

At unidirectional valves with block and bleed function the bleeding can be done or outside the valve or through a bleeding connection in the body of the valve

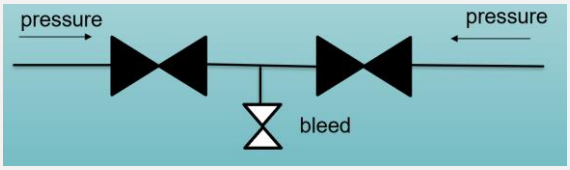




The sealing of the valve is only reached when the flow is always in the same direction.

3. Double block & bleed (DBB) with two valves system or twin valves

When a bidirectional sealing is required, the blocking can be obtained by using two valves



The bleeding connection is done between the two valves, which can be integrated in one body.

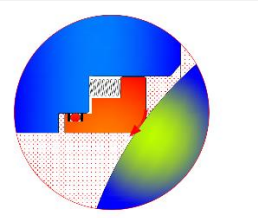
4. Definitions of double block & bleed and double isolation & bleed in one valve

According to API 6D specifications, a double block & bleed valve (DBB) is a "single valve with two seating surfaces that, in closed position, provides a seal against pressure from both ends of the valve, with a means of venting/bleeding the cavity between the seating surfaces". API also notes in this definition that this valve does not provide positive double isolation when only one side is under pressure.

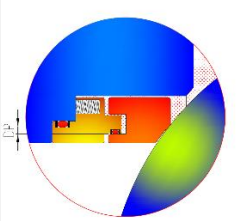
According to API 6D double isolation & bleed (DIB), is a "single valve with two seating surfaces, each of which, in the closed position, provides a seal against pressure from a single source, with a means of venting/bleeding the cavity between the seating surfaces. The feature can be provided in one direction or in both directions.

A difference between DIB and DBB is the ability to relieve pressure. At a DBB valve there are two unidirectional single piston effect (SPE) self-relieving seats. These seats do not rely on outside mechanism to relieve pressure. A DIB valve utilizes one or two bidirectional seats. The valve provides a double isolation from pressure at both ends of the valve, but there is usually one operational drawback, a DIB valve cannot relieve the body cavity pressure, meaning its seats are not self-relieving. When using DIB valves, an external relief system is necessary to relieve the pressure buildup.

The seat design can be "double piston effect" (DPE), or "single piston effect" (SPE) in which the DPE is not self-relieving and the SPE is self-relieving



Single piston effect (SPE)
(self-relieving)

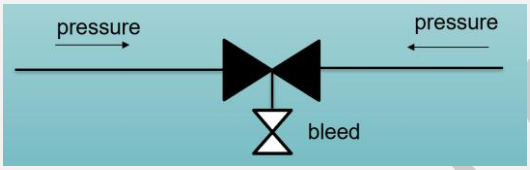


Double piston effect (DPE)

The DBB function according to OSHA (Occupational Safety and Health Administration of USA) can be achieved only with a two valves system.

5. Double block & bleed (DBB) in one valve

According to the API 6D specification, a DBB function can be obtained in one valve with bleeding connection at the valve body. The following test is required for this sealing design:
With the valve partially open, the cavity is completely filled with test fluid. The valve shall be closed, and the bleeding valve shall be opened to allow excess test fluid to overflow from the valve cavity. The test pressure shall be applied simultaneously from both valve ends. Seat tightness can be monitored via overflow through the valve cavity connection.



5.1 Double isolation and bleed (DIB 1) both seats bidirectional

With this valve design, both seats are “double piston effect” DPE, with the effect that pressure in the cavity cannot be released in any direction.

To test the seat leakage in direction to the cavity the pressure shall be applied successively to each valve end to test each seat separately. Leakage shall be monitored via the bleeding connection. Thereafter, each seat shall be tested as a downstream seat. Pressure is applied in the cavity, and the leakage is monitored at both ends of the valve.

5.2 Double isolation and bleed (DIB 2) one seat unidirectional and one seat bidirectional

With this seat design, the upstream seat has a “single piston effect” SPE design and the downstream seta has a “double piston effect” DPE design seat. When the cavity pressure exceeds the upstream pressure, the seat as self-relieving bleeds the overpressure upstream.
The cavity pressure cannot be relieved downstream.
To test the seat leakage in direction to the cavity the pressure shall be applied successively to each valve end to test each seat separately. Leakage shall be monitored via the bleeding connection.
To test the bidirectional seat from the cavity, pressure shall be applied simultaneously to the valve cavity and upstream end. The leakage is monitored at the downstream end.
The installation of DIB-2 valves is critical, and it must be ensured that the SPE seat should be on the upstream/pressurized side.

6. Applications

Which sealing design should be selected depend on the specific application.

Example 1: maintenance of a process section. To prevent that the entire process must be closed, the specific section should be isolated and depressurized. Upstream of the section is a trunnion mounted ball valve, in a “double block & bleed” design. The problem appears in form of leakages through the valve, and this can be dangerous. To be sure that the section is really isolated, and there is no danger of leakages, several solutions can be adopted:

- To use a valve system with two valves with a bleeding port between them
- To use a twin valve (two valves in one body) with a bleeding port between them
- To use a valve with double isolation and bleed.

Example 2: application in a measuring station. Here it is absolutely necessary that the valves seal the system completely, any leakage can modify the measured values in a non-acceptable way. The same solutions than in the above-mentioned example may be used.