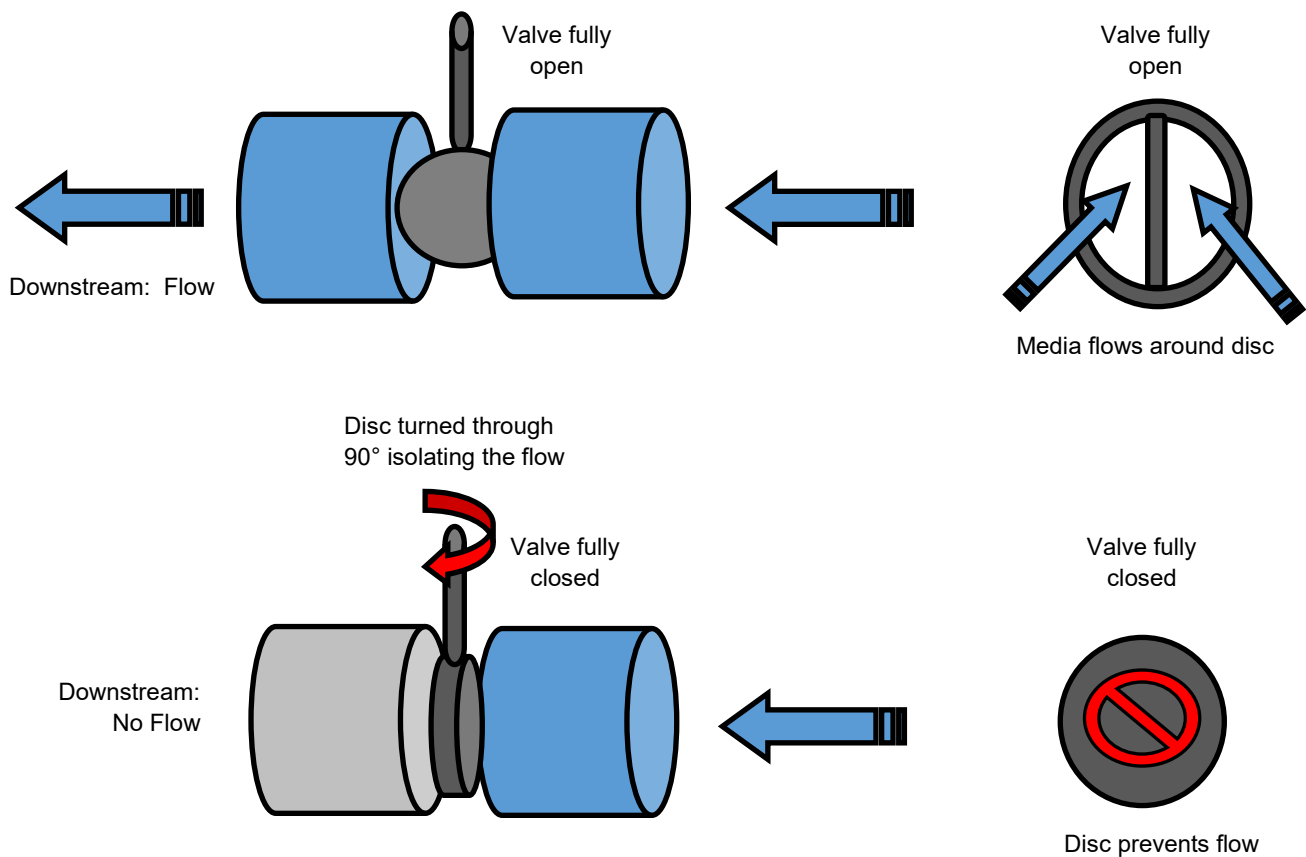


BASIC PRINCIPLE OF A BUTTERFLY VALVE

Typically a butterfly valve is a device designed to isolate the flow in pipes using a disc which, when aligned with the connecting pipe(s) allows flow, but when the disc is oriented perpendicular to the pipe, the flow is isolated. The disc is rotated by a sealed stem which connects it to the turning device, which can be a manually operated by a lever or gearbox, or an automatic device called an actuator.



Nowadays, butterfly valves are used in vast numbers because with correctly matched materials of construction to their intended application, they offer a reliable and effective means of controlling flow in pipes. With several different designs that achieve the same objective, butterfly valves vary enormously in price from very low cost throw-away types for simple, basic water isolation applications to very expensive, specialist butterfly valves for the most demanding and critical applications.

TYPES OF BUTTERFLY VALVES

The majority of butterfly valves are covered by 3 basic construction types, and 5 body types;

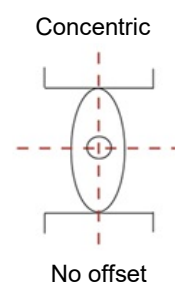
Construction: Concentric, double offset and triple offset.

Body types: Wafer pattern, fully lugged & tapped, flanged, groove joint & hygienic.

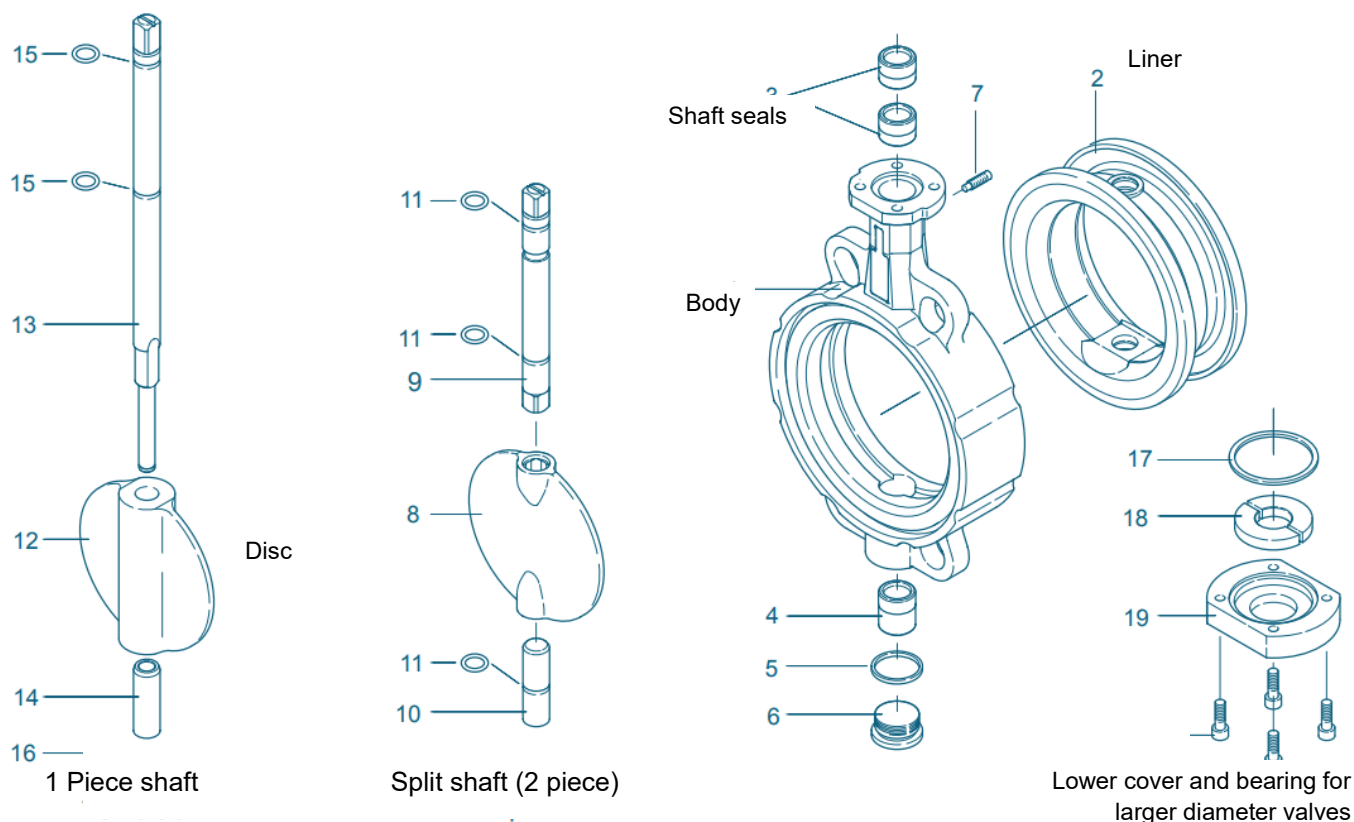
Concentric Construction

Concentric construction butterfly valve have the stem that drives the disc fixed along the same centre line as the disc, so that the disc and shaft rotate on the same axis. A significant advantage of concentric butterfly valves is that the flowing media is never in contact with the valve body or stem, it only wets the liner and disc.

In volume terms, this is the most common and popular construction as its production can be low cost, and in the huge volume of applications where simple isolation of water is required, for example, this simple and cost effective design performs well.



Below is an exploded view drawing showing typical construction of a concentric butterfly valve.



The seal is typically created by the compression by the disc of a resilient rubber liner whose internal diameter is slightly larger than the disc diameter. Another method of sealing may be the compression of an O ring inserted into a groove around the circumference of the disc, which seals directly to the bore of the butterfly valve.

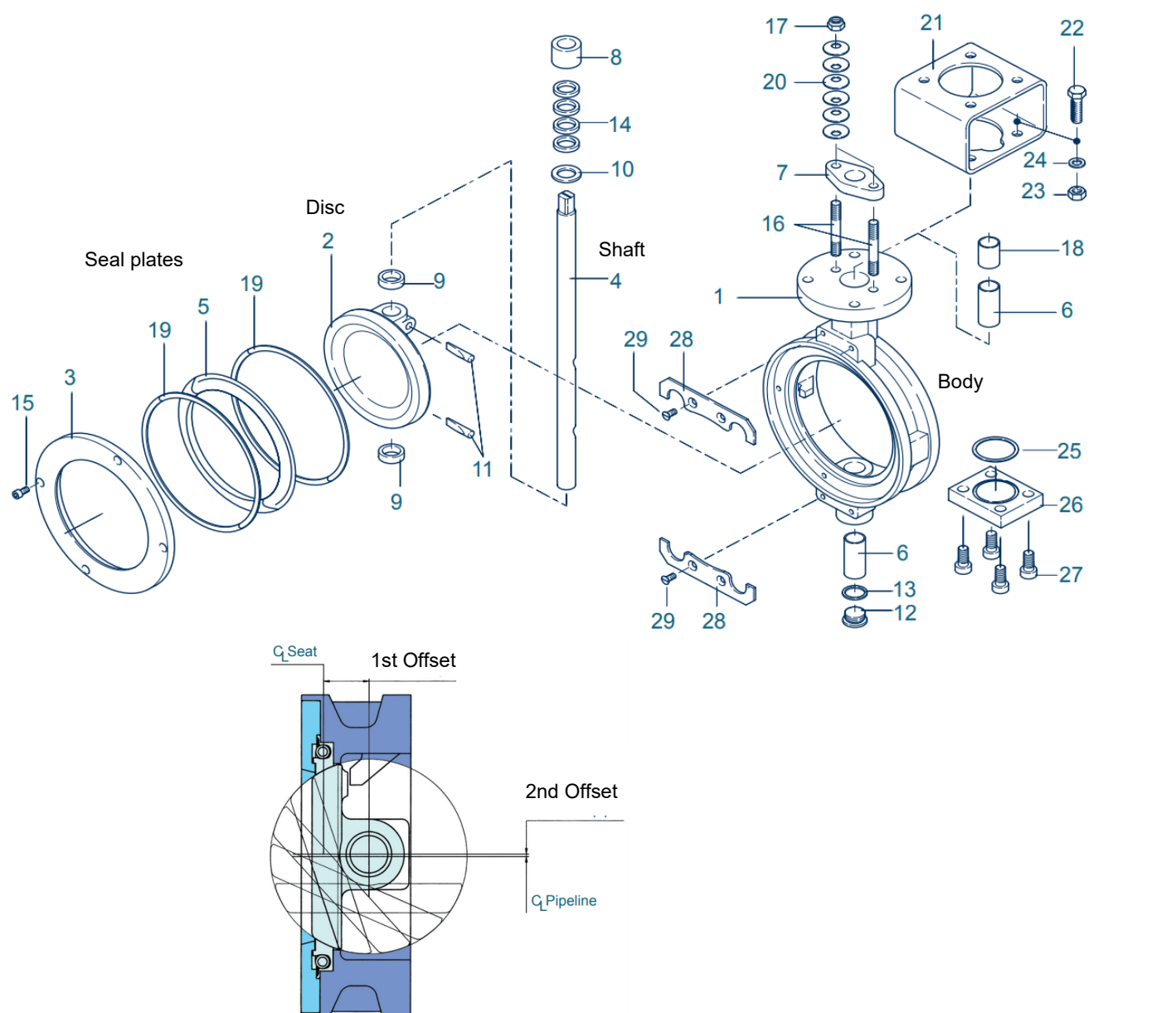
The liner can be bonded to the body to eliminate the risk of movement or distortion - particularly under vacuum conditions, or can be a push fit into the body enabling the liner to be replaced, or exchanged for a liner constructed from a different material.

Double Offset Construction

Eccentric construction butterfly valve have the axis of the shaft behind the centreline of the disc to seat seal, and the shaft is also eccentric, creating a cam effect. The result is that the disc creates a flat seal against the seat face, and the valve is unidirectional as the disc cannot rotate through the seat.

The flat face seal allows the double offset butterfly valve to operate at higher pressures and temperatures, and these valves are often called high-performance butterfly valves because of this. The ease of installing a metal to metal seal also allows the double offset valve to be used at much high temperatures than resilient seated concentric butterfly valves.

Below is a drawing showing typical exploded view of a double eccentric butterfly valve.



Triple Eccentric Construction

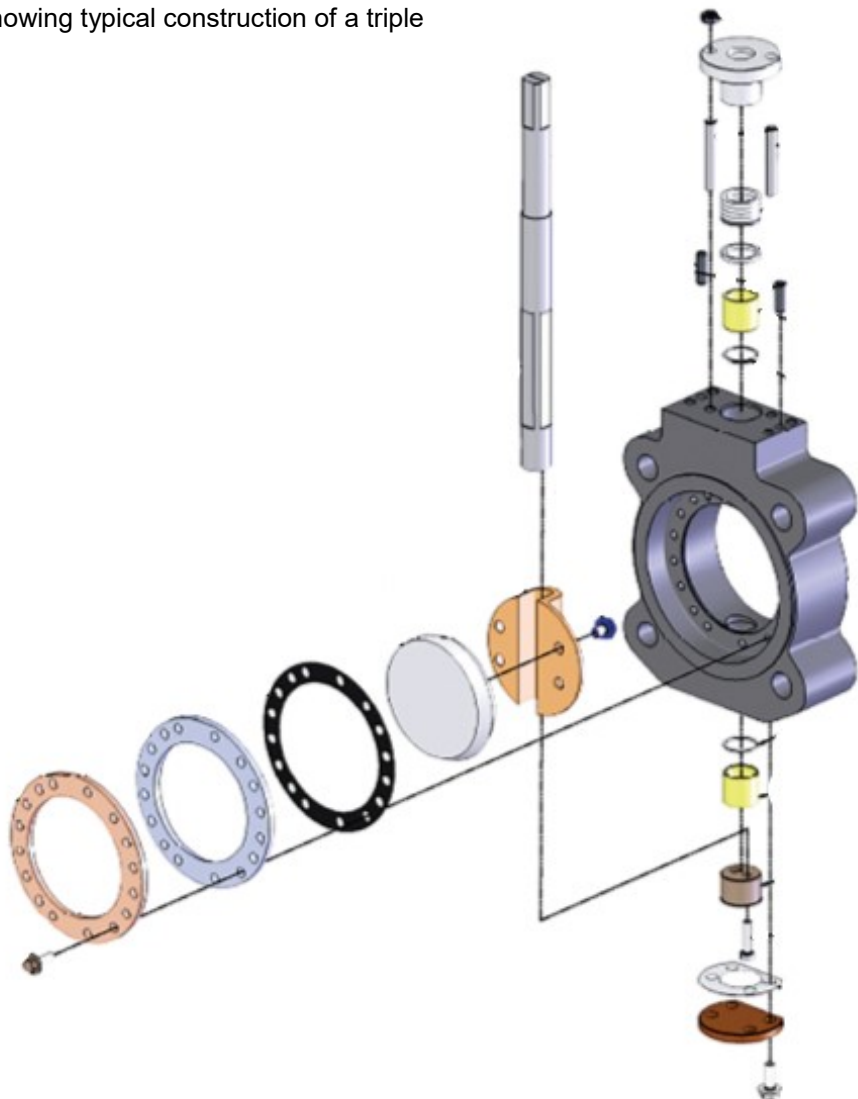
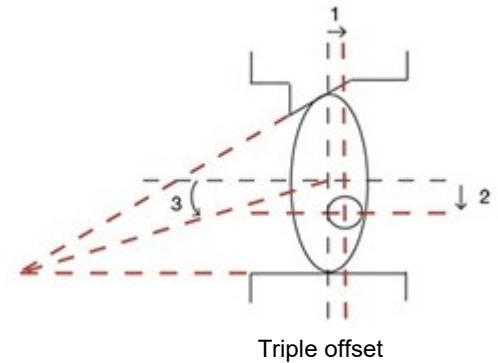
The triple offset valve was developed to change and improve the seat and resulting sealing performance of metal seated double offset butterfly valves, who's seats can be prone to leaking. The solution was to add a third offset, not of the position of the shaft, but the design of the seat and as a consequence the sealing, and a right angle seat arrangement rather than a conical seat was developed.

This new seat

The advantages of triple offset butterfly valves are;

- 1) Contact is only made at the final point of closure at 90 degrees
- 2) Fuller disc to seat yet frictionless contact
- 3) Lower comparative operating torques
- 4) Low fugitive emissions due to quarter turn operation
- 5) Cost effective compared to metal seated gate, globe and ball valves

Below is an exploded view drawing showing typical construction of a triple eccentric butterfly valve.



Butterfly valve body types

There are five main styles of butterfly valve body types, flanged, wafer, fully lugged, groove coupling, and hygienic.

Double flanged butterfly valves have a full flange at each side for ease of mounting in adjoining flanged pipework.

Wafer pattern where the butterfly valve sandwich mounts between flanges and securing bolts pass through both flanges to grip the valve between the flanges. The wafer body can have elongated lugs that assist with alignment, but these lugs are through-hole and are not threaded.

Fully lugged where the body has a full set of threaded lugs that perfectly match the mating flange, and the butterfly valve is secured by bolts from either side, screwed into the valve body.

Groove coupling bodies have an extended body in the form of a grooved pipe each side that mate with similarly grooved adjoining pipes, connected with a groove style coupling.

Hygienic butterfly valves have a variety of end connections that, apart from a butt welded version, allow fast disassembly and reassembly for wash-down purposes. These are typically a clamp style, or threaded union connection.



Double flanged body



Wafer pattern body



Fully lugged body



Grooved body



Hygienic or sanitary body

Butterfly valve - compatibility with flowing media

The compatibility of the wetted parts of a butterfly valve with the flowing media affects the service life of the valve. The actual wetted parts vary between the different butterfly valves and there are a wide variety of materials available to guarantee that the flowing media will not damage, corrode or otherwise adversely affect the butterfly valve's internals.

In resilient lined concentric butterfly valves, the only wetted parts are the disc and liner. Typical disc material options are cast iron, stainless steel and aluminium bronze, and various coating options such as PTFE then further enhance the disc's resistance to the effects of the flowing media. Seat or liner materials enable butterfly valves to be used on a vast range of media, with EPDM, NBR, Viton, Silicon and PTFE being the most common.

In high performance butterfly valves, the disc material tend to be stainless steel, with either glass filled PTFE or metal seat rings.

Butterfly valve - hand operators and actuators

Butterfly valves are either operated by hand making them manually operated, or by a valve actuator which makes them automatic.

Hand operators are either a hand lever, or a hand-wheel operated gearbox.

Actuators are either electric, pneumatic, or hydraulic.



Hand lever operator



Hand gear operator



Electric actuator



Pneumatic actuator



Hydraulic actuator