

# BDK Launches the Triple Offset Butterfly Valve

## in Technical Collaboration with Weir Valves, UK.

### Introduction

After years of research and development, the new generation Butterfly valve - a precision engineered product is designed capable of being used effectively in a wide



range of applications that were previously only considered suitable for gate, globe or ball valves - and at a fraction of their cost

This article outlines the development of the Butterfly valve and the state of the art Triple Offset metal sealed design

### Development of Butterfly valves

In the 1950's and 60's the typical maximum operating pressure of butterfly valves would be about 10 bar with only uni-directional sealing at temperatures close to ambient and the usual design would be single or double offset

using elastomeric seals or body liners. Over the years this design was refined and improved and termed as 'High Performance' butterfly valves.

In some applications this design of valve was found to suffer from problems concerning wearing / erosion of the soft sealing material at high flow rates and where sand was flowing with the fluid; seat failure due to high and low temperatures and seat damage when used on throttling duty for part of it's life. In addition there was a requirement for these valves to be operable after a fire, usually when used in firewater main systems.

About 25 years ago some valve manufacturers started to investigate a

more robust valve design where both the seat and seal were metallic and two basic types were developed which can be classified as follows:

- ◆ Seat and seal contact area was energized by mechanical deformation of either the seat or seal component. This design would be called Double Offset.
- ◆ Seat and seal contact force produced by the operating mechanism (gearbox, actuator) without significant deformation of the components. This design would be **Triple Offset**.

The Triple Offset design has the following significant advantages over the deformable, double-offset design:

- ◆ For the Triple Offset valve, torque (not position) is the important criterion for tight shut off. It does not require accurate location of the actuator closed limit stop (except that this stop should never be in contact).
- ◆ The broad seal contact width of Triple Offset valve is less susceptible to leakage resulting from minor damage to the sealing



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surfaces than the deformable type which usually only have line contact.

- ◆ Some deformable designs have cavities around the seat or seal that can fill with solids present in the pipeline fluid and impair the sealing performance - the Triple Offset is free of such cavities.

Triple offset valves were first used in offshore process lines in 1990 with pressure ratings up to 600# Class and have demonstrated a proven sealing capability over an extended time span and are now being increasingly used in place of ball valves.

### Sealing method and construction of the Triple Offset valve

The Triple Offset valve uses the well-established sealing geometry where the shaft is offset in the Body, whilst

Low initial cost	◆ Minimal maintenance
◆ Low fugitive emissions due to rotary stem	◆ Low torque therefore low cost of automation
◆ Low weight / small space	◆ Long term reliable sealing
◆ Replaceable seat and seal ring	◆ Cavity Free

the Disc is a segment taken from a cone where the apex is offset from the valve centre-line.

Bi-directional zero leakage is achieved by a principle whereby the torque generated by the actuating mechanism is allowed to flex the metal seal within

its elastic limit, compressing the seal into the exact profile of the mating seat. This seal resiliency results in zero leakage. This resiliency of the seal ring and its ability to flex creates the ideal

design for hot, cold or thermal cycling applications where the Body is able to

expand or contract without the risk of valve jamming. The Triple Offset valve's camming action on closing elements ensures that the metal seat and seal are never in contact with

each other whilst the valve is stroking. Contact is made between the seat and seal only as a final shut off position is reached. This motion extends the life of the valve seal by designing out the continual rubbing of the seat and seal



that is inherent in conventional rotary valve designs.

The advantages of The Triple Offset butterfly can be summarized as follows

**Gate valve replacement:** gate valves for isolation are being replaced by ball valves and butterfly valves and butterfly

valves are now available with the same face to face dimension as gate valves so they can be retrofitted into existing pipelines without changes to the pipe work.

**Cryogenic applications:** Triple Offset Butterfly valves have been successfully adapted for cryogenic service down to -196 C complete with cryogenic extensions and butt-weld top-entry body style

**Steam jacketed:** for applications where the pipeline product must be kept heated to prevent it from solidifying.

**Bellows sealing of gland:** although butterfly valves with conventional packed glands meet the usual requirements for gland emissions (i.e EPA Method 21), glands fitted with bellows are now available with virtually zero leakage.

**Weld end/Top entry:** for valves welded into the pipeline a top entry feature is available from some suppliers which allows access for seat/seal replacement without removing the valve from the pipeline.

**Block and Bleed:** process applications requiring double isolation can benefit

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from the double block & bleed facility which is now available in some Triple Offset Butterfly valves.

**Control:** globe valves have traditionally been used as they have a high recovery which tends to minimize flashing and cavitation when compared to rotary valves but for less critical control applications butterfly valves have proven to be successful and in particular the metal sealed design.

**Conclusion:** It can be seen that

Sizes in mm(inch)	Pressure Rating
80 (3") to 600 (24")	CLASS 150
80 (3") to 600 (24")	CLASS 300

the metal sealed Butterfly valve can perform many of the functions previously carried out by gate and ball

Description	Triple Offset Butterfly Valves
<b>Design Std.</b>	API 609.
<b>Face to Face</b>	API 609 CAT-B.
<b>Testing Std.</b>	API 598, FCI 70-2
<b>Body Materials</b>	WCB, CF8, CF8M, AL20, DUPLEX SS & Other Exotic Alloy etc.
<b>Body Seat (INTEGRAL)</b>	SS316, STELLITE 6 & ALLOY-21 OVERLAY.
<b>Disc</b>	CF8, CF8M, AL20, DUPLEX SS & Other Exotic Alloy etc.
<b>Disc Seat</b>	316 / S31803 / INCONEL LAMINATED+GRAPHITE SEAT
<b>Stem</b>	17-4PH / S31803
<b>Gland Packing</b>	Pre-Moulded Grafoil Rings, Braided Graphite Rings.
<b>Option</b>	Solid Metal Disc Seat with Stellite Overlay
<b>Ends</b>	Wafer & Lugged.

valves at a much lower cost and with a considerable weight saving and this is demonstrated by the increasing use of metal sealed Butterfly valves in the applications previously specified for gate and ball valves.

As with any valve selection, the correct

choice is dependent on many factors however, the metal - sealed and in particular the Triple Offset design is the best choice when high reliability sealing is required, especially at high / low temperatures and high pressures.