

# Isolation Valve 101

## External

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# Presentation Content

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- › *Code, Specifications, and Recommended Practices*
- › *Isolation Valve Overview*
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  - › *Gate Valves – Wedge Gate, Knife Gate, Slab Gate, Expanding Gates*
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# When is Isolation Necessary?

- › When energized process fluid needs to be contained for the purpose of safety, maintenance or processing.
- › In Alberta we adhere to the Alberta OH&S for piping energy isolation

## Piping and Pigging

### Isolating piping

**215.4(1)** To isolate piping or a pipeline containing harmful substances under pressure, an employer may use

- (a) a system of blanking or blinding, or
- (b) a double block and bleed isolation system providing
  - (i) two blocking seals on either side of the isolation point, and
  - (ii) an operable bleed-off between the two seals.

**215.4(2)** An employer must ensure that piping that is blanked or blinded is clearly marked to indicate that a blank or blind is installed.

**215.4(3)** An employer must ensure that, if valves or similar blocking seals with a bleed-off valve between them are used to isolate piping, the bleed-off valve is secured in the "OPEN" position and the valves or similar blocking seals in the flow lines are functional and secured in the "CLOSED" position.

**215.4(4)** An employer must ensure that the device used to secure the valves or seals described in subsection (3) is

- (a) a positive mechanical means of keeping the valves or seals in the required position, and
- (b) strong enough and designed to withstand inadvertent opening without the use of excessive force, unusual measures or destructive techniques.

**215.4(5)** If it is not reasonably practicable to provide blanking, blinding or double block and bleed isolation, an employer must ensure that an alternate means of isolation that provides adequate protection to workers, certified as appropriate and safe by a professional engineer



# Relevant Ball Valve Codes

- › **Alberta OH&S**
- › **ISO 5208 – Pressure Testing of Valves – Industrial**
- › ISO 5209 – General purpose industrial valves
- › ISO 5752 – Metal valves for use in flanged piping system
- › ISO 7121 – Flanged steel ball valve
- › ISO 15848 – Industrial valve – Test and qualification
- › ISO 17292 – Metal ball valves for petrochemical industry
- › **NACE MR 0175 – Materials for use in H<sub>2</sub>S environment in oil and gas**
- › API 6A – Wellhead and Christmas Tree equipment specification
- › **API 6D – Specification for pipeline and piping valves**
- › API 598 – Valve inspection and testing
- › API 591 – User acceptance of refinery valves
- › API 608 – Metal Ball Valves – flanged, threaded and butt welded ends
- › API 17D – Subsea wellhead and Christmas tree equipment
- › API 6FA – Specifications for fire test for valves
- › API 622 - Type testing of process valve packing for fugitive emissions
- › API 624 - Fugitive Emission valve testing
- › ASME B16.34 – Valves, flanged, threaded and butt welded end
- › **ASME B16.10 – Face to face and end to end dimensions of valves**
- › ASME B16.5 Pipe, Flanges and Flanged Fittings
- › ASME B16.25 Butt welded ends
- › ASME B16.11 Forged fittings and socket welding and threaded



# Gate Valve Codes

- › **Alberta OH&S**
- › **ISO 5208 – Pressure Testing of Valves – Industrial**
- › ISO 5209 – General purpose industrial valves
- › ISO 5752 – Metal valves for use in flanged piping system
- › ISO 5996 – Cast Iron Gate Valves
- › ISO 6002 – Bolted Bonnet Steel Gate Valves
- › ISO 7259 – Key-operated cast iron gate valves for underground
- › ISO 15848 – Industrial valve – Test and qualification
- › **NACE MR 0175 – Materials for use in H<sub>2</sub>S environment in oil and gas**
- › **API 6A – Wellhead and Christmas Tree equipment specification**
- › **API 6D – Specification for pipeline and piping valves**
- › API 598 – Valve inspection and testing
- › **API 600 – Bolted bonnet steel gate valves for petroleum, petrochemical and allied industries**
- › **API 602 – Steel gate, globe and check valves for sizes DN 100 or smaller**
- › API 17D – Subsea wellhead and Christmas tree equipment
- › API 6FA – Specifications for fire test for valves
- › API 622 - Type testing of process valve packing for fugitive emissions
- › API 624 - Fugitive Emission valve testing
- › ASME B16.34 – Valves, flanged, threaded and butt welded end
- › **ASME B16.10 – Face to face and end to end dimensions of valves**
- › ASME B16.5 Pipe, Flanges and Flanged Fittings
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- › ASME B16.11 Forged fittings and socket welding and threaded



# Butterfly Valve Codes

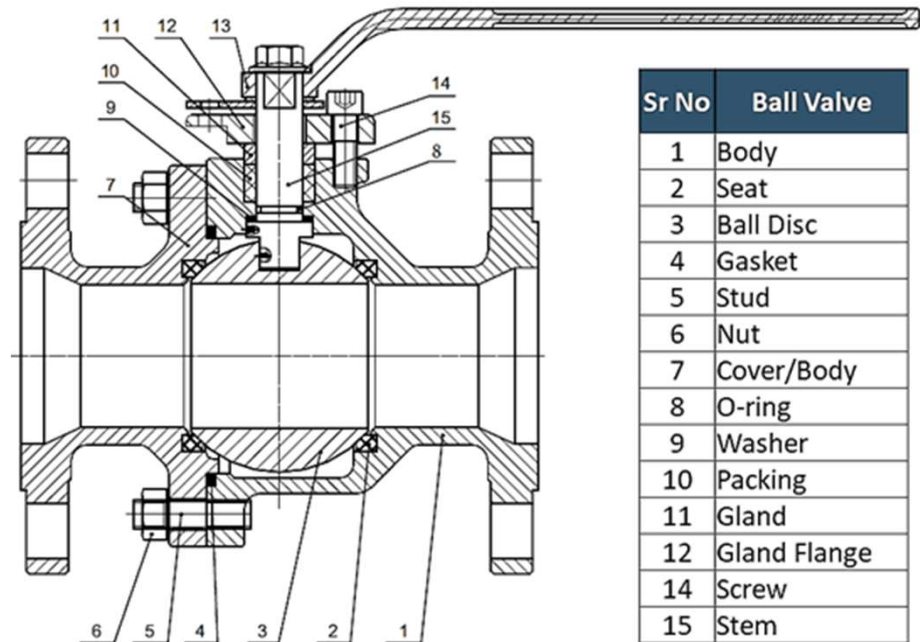
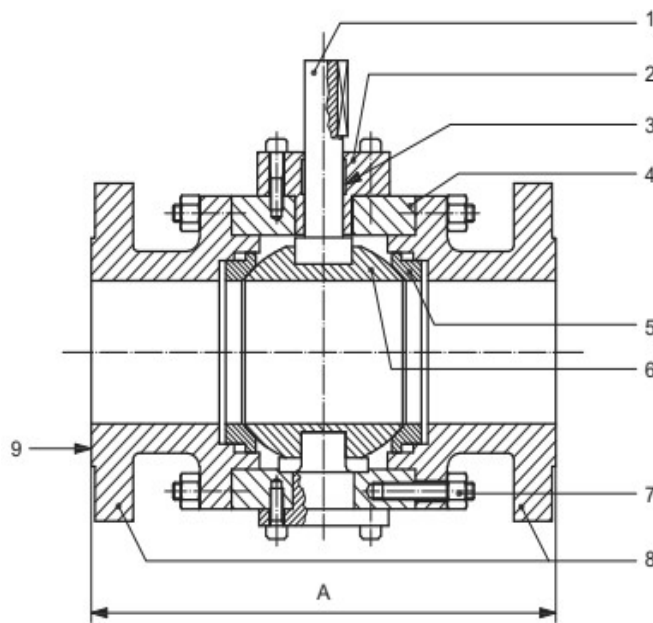
- › **Alberta OH&S**
- › **ISO 5208 – Pressure Testing of Valves – Industrial**
- › ISO 5209 – General purpose industrial valves
- › ISO 5752 – Metal valves for use in flanged piping system
- › ISO 15848 – Industrial valve – Test and qualification
- › **ISO 10631 - Metallic butterfly valves for general purpose**
- › **NACE MR 0175 – Materials for use in H2S environment in oil and gas**
- › API 6D – Specification for pipeline and piping valves
- › API 591 – User Acceptance of Refinery Valves
- › API 598 – Valve inspection and testing
- › API 6FA – Specifications for fire test for valves
- › API 622 - Type testing of process valve packing for fugitive emissions
- › API 624 - Fugitive Emission valve testing
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- › ASME B16.5 Pipe, Flanges and Flanged Fittings





# What is a Ball Valve?

- › Valve with ball that has a hole in it and when in open position is allows process fluid to flow through
- › Typically used for On/ Off and Isolation applications

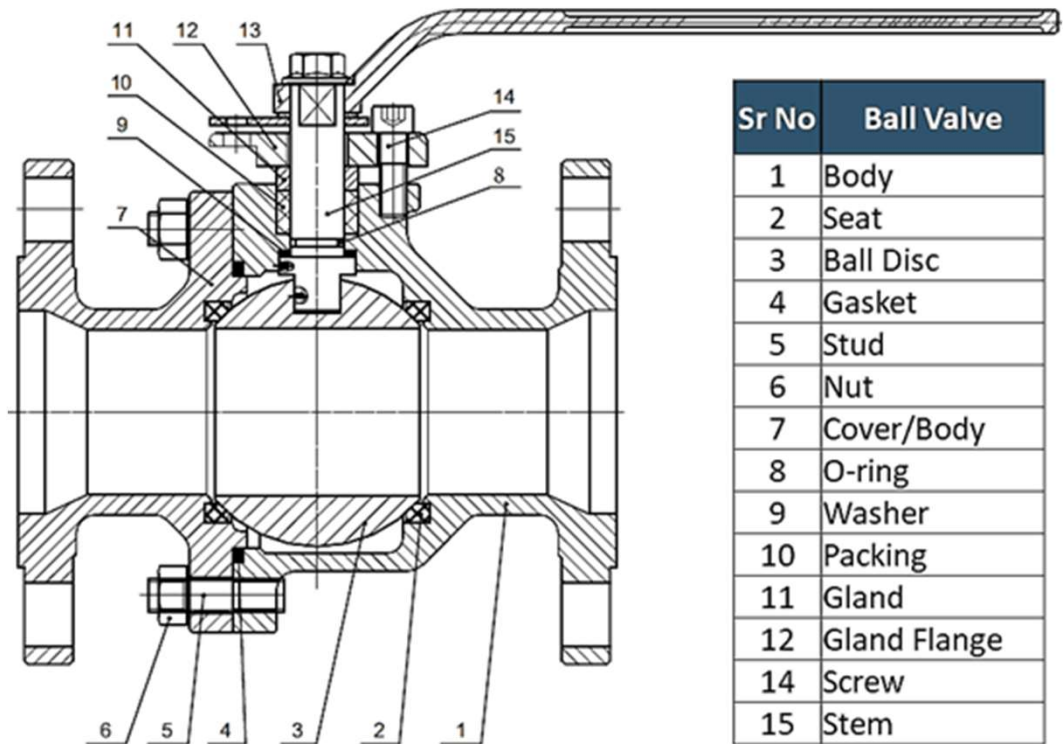


| Sr No | Ball Valve   |
|-------|--------------|
| 1     | Body         |
| 2     | Seat         |
| 3     | Ball Disc    |
| 4     | Gasket       |
| 5     | Stud         |
| 6     | Nut          |
| 7     | Cover/Body   |
| 8     | O-ring       |
| 9     | Washer       |
| 10    | Packing      |
| 11    | Gland        |
| 12    | Gland Flange |
| 14    | Screw        |
| 15    | Stem         |



# Floating Ball Valves

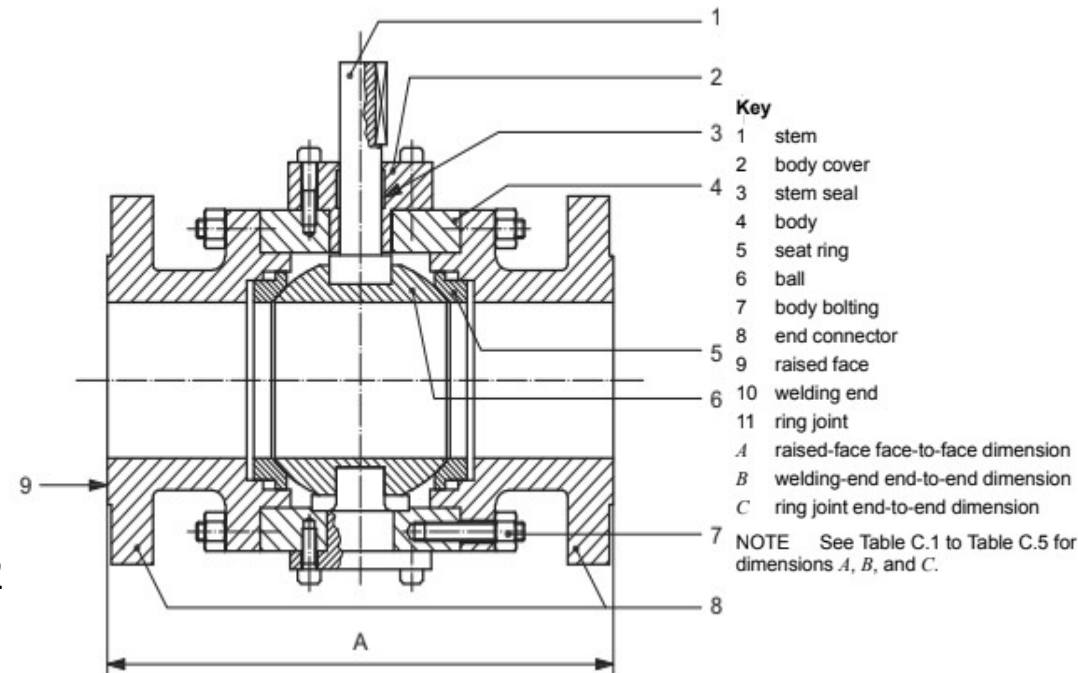
- › Quarter turn position seated valve
- › Ball sandwiched in between two seat's and supported by its stem. The bottom of the ball float's and uses process pressure to be pushed into the seat face while closed in order to create a seal.
- › Typical sizes 1/8" – 8" with typical pressure classes CL 150 – CL 600
- › API 6D – Floating Ball Valve is 1 Positive form of isolation
- › Economical valve for non critical application
- › Consumable valve typically not repairable





# Trunnion Mounted Ball Valves

- › Quarter turn position seated valve
- › Ball sandwiched in between two seat's and supported top and bottom so it does not move. Seat carriers push into the valve at all times to help create a seal.
- › Typical sizes 2" – 48" with typical pressure classes CL 150 – CL 2500
- › Best suited for critical application
- › Need servicing and are repairable
- › Comes in 3 configurations DBB, DIB -1, DIB - 2



# Single Piston Effect Seats (SPE)



- › API 6d also refers to this as UNI-Directional seat
- › Spring assisted for low pressure application
- › Uses process pressure to push on the single piston effect seat face to drive the seat carrier into the ball
- › Internal cavity pressure can overcome process pressure and cause the valve to relieve pressure
- › Can be referred to as Self Relieving Seats



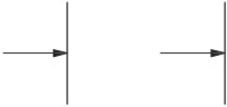
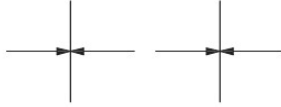

# Double Piston Effect Seats (DPE)



- › API 6d also refers to this as Bi-Directional seat
- › Spring assisted for low pressure application
- › Uses process pressure to push on one piston effect seat and cavity pressure to push on another piston effect seat driving carrier into the ball.
- › Internal cavity pressure cannot overcome process pressure
- › Can be referred to as Non- Relieving Seats



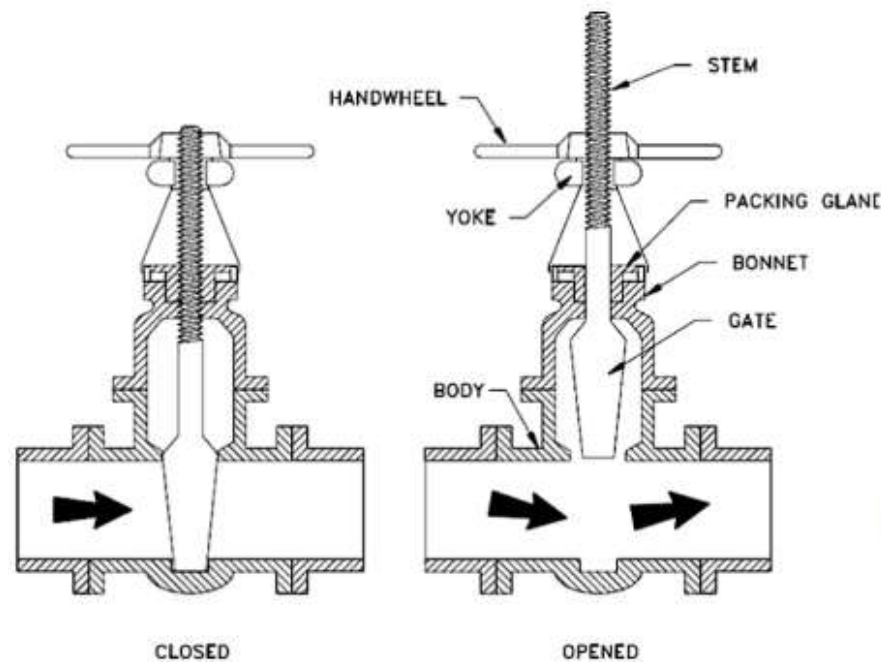
# Ball Valve Isolation Summary

|  |  |  |
|--|--|--|
| Floating Ball Valve  |  | 1 Positive Form of Isolation                   |
| Double Block and Bleed Valve<br>SPE x SPE  |    | 1 Positive Form of Isolation                   |
| Double Isolation and Bleed Valve 1<br>DPE x DPE<br>Liquid Relieve Kit necessary for liquid application |    | 2 Positive Forms of Isolation                  |
| Double Isolation and Bleed Valve 2<br>SPE x DPE  |  | 2 Positive Forms of Isolation in one direction |



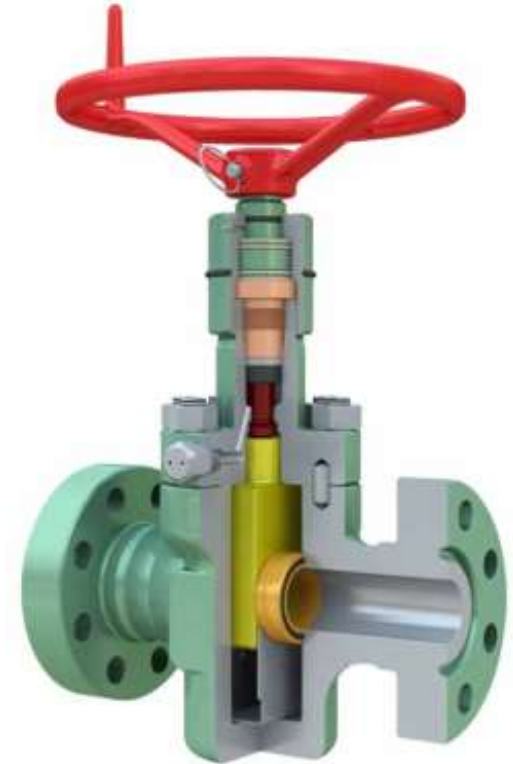
# What is a Gate Valve

- › Gate attached to a stem that move up and down to allow or restrict flow
- › Typically used for on/ off of Isolation applications



# API 6A Slab Gate valves

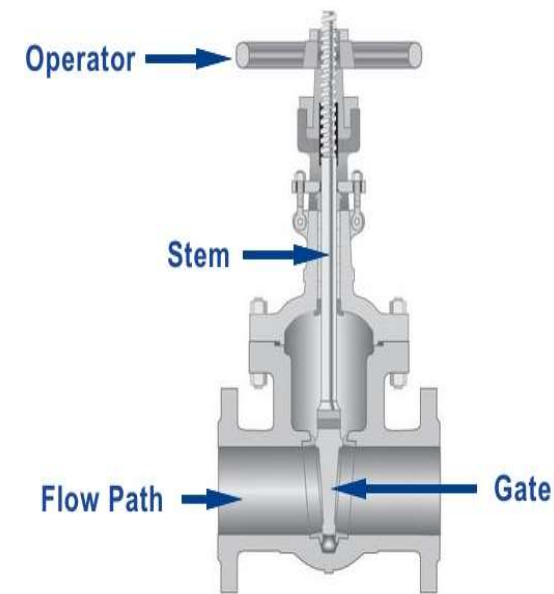
- › Rectangular slab moving vertically and in open position the slab has a hole through it matching in internal bore of the valve allowing flow.
- › As the slab moves vertically it is always in contact with the valve seats.
- › Used on wellsite application and frequently referred to as wing valves.
- › Typical sizes 1 3/4" – 11" with typical pressure classes 2,000 psi – 15,000 psi.
- › Alberta OH&S considers this 1 positive form of isolation





# Wedge Gate Valves

- › Wedge moves vertically to obstruct or clear the path for process fluid
- › Wedge creates a tight seal by driving in seat face at 5 degree angle. Can be metallic or soft seated.
- › Typical sizes 2" – 48" with typical pressure classes CL 150 – CL 2500
- › API 6D and Alberta OH&S considers these valves to be 1 positive form of isolation



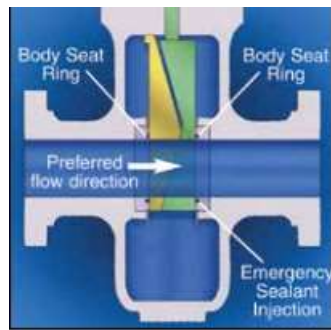
# Knife Gate Valves

- › Thin plate moves vertically to obstruct or clear the path for process fluid.
- › Typically uni-directional but can be in bi-directional set up
- › Typical sizes 2" – 20" with typical pressure classes CL 150 – CL 300
- › Great in low pressure applications with lots of entrained solids.

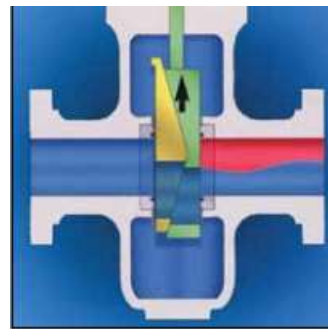


# Expanding Gate valves

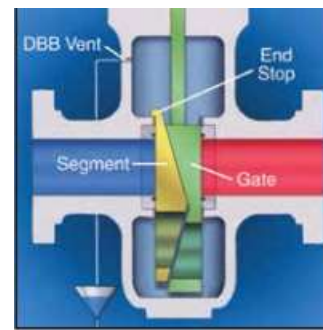
- › Two piece wedge system moves vertically and in closed position splits to provide two independent positive forms of isolation pressed against independent seat rings.
- › Considered a DIB providing two positive forms of isolation and can have a liquid relief kit.
- › Typical sizes 6" – 24" with typical pressure classes CL 150 – CL 300
- › Very expensive valve



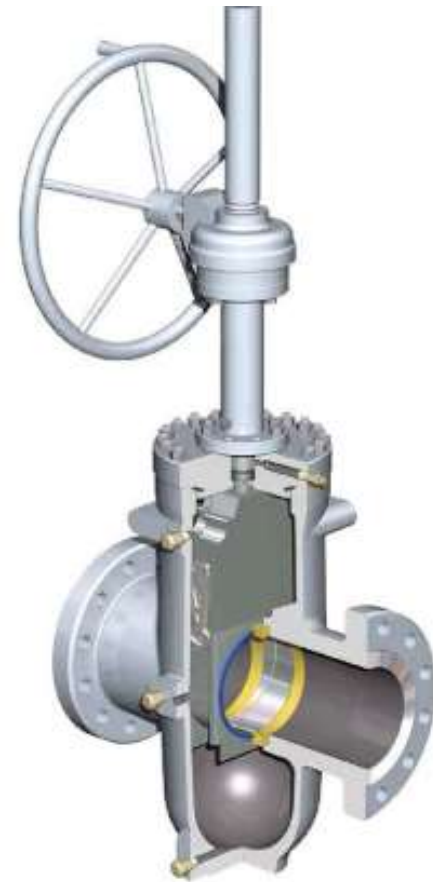
Fully Open



Mid-Travel

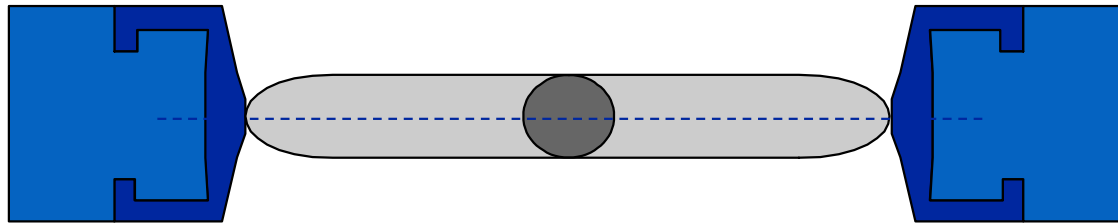


Sealed Closed



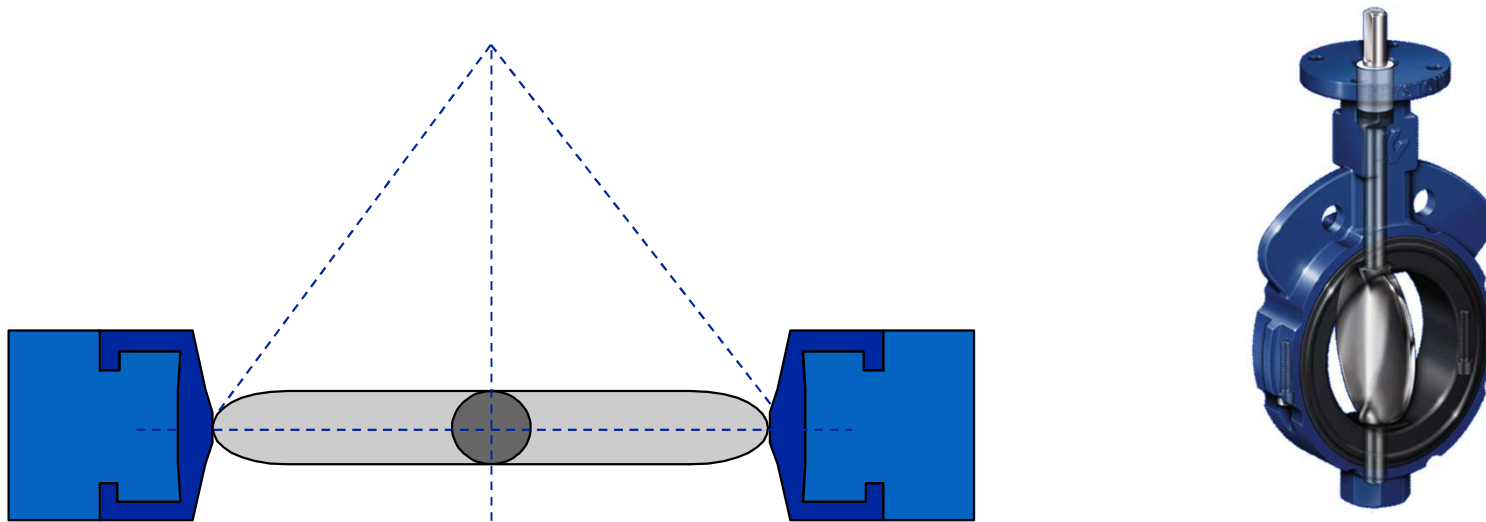
# What is a Butterfly Valve?

- › Disc that rotates on a shaft to allow or impede the flow of process fluid
- › Typically used for on/ off or Isolation applications.
- › Can be used for throttling applications in clean service



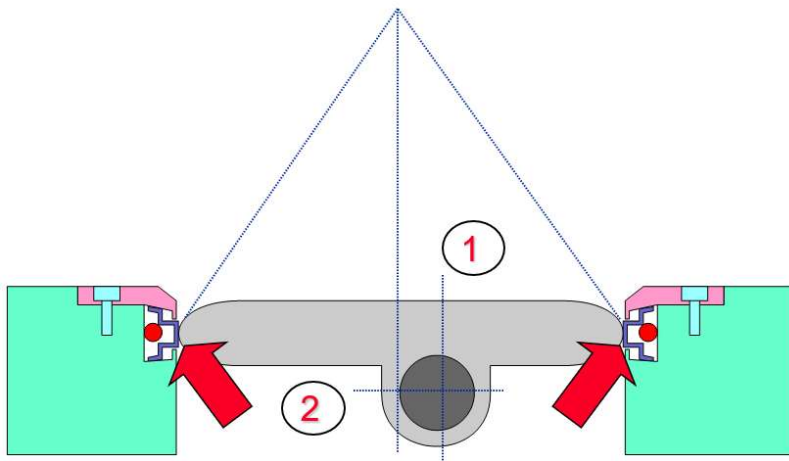
# Resilient Seat Butterfly Valve

- › Disc that rotates into an elastomeric or polymeric material to create a seal
- › Typical sizes 2" – 24" with typical pressure classes CL 150 – CL 300
- › Best suited for low pressure clean service applications
- › Economical valve



# High Performance Butterfly Valve

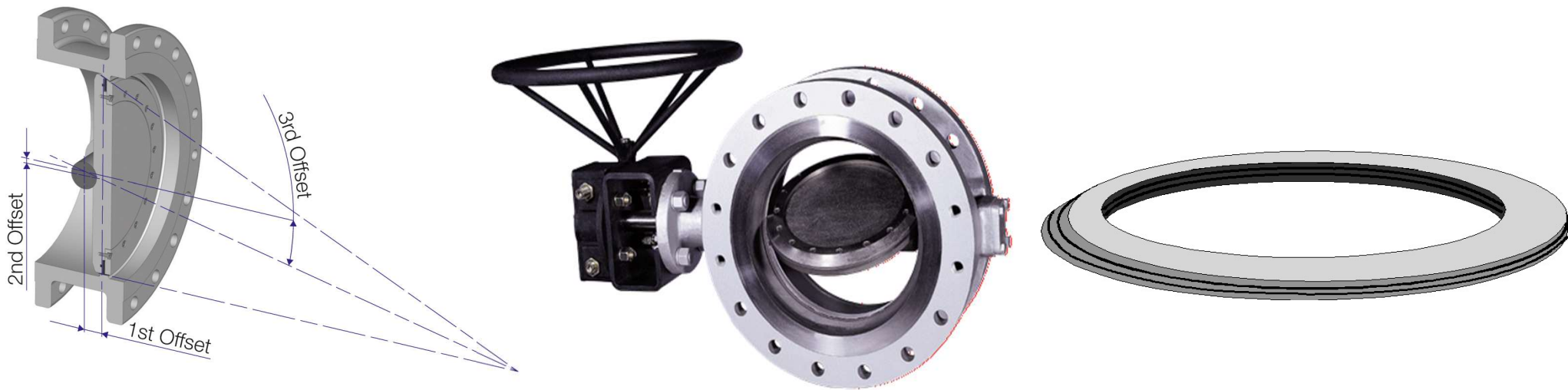
- › Also known as a double offset butterfly valve
- › Disc rotates off axis into an energized seal
- › Typical sizes 2" – 24" with typical pressure classes CL 150 – CL 600
- › Can be used for isolation but only considered 1 positive form of isolation
- › Expensive valve





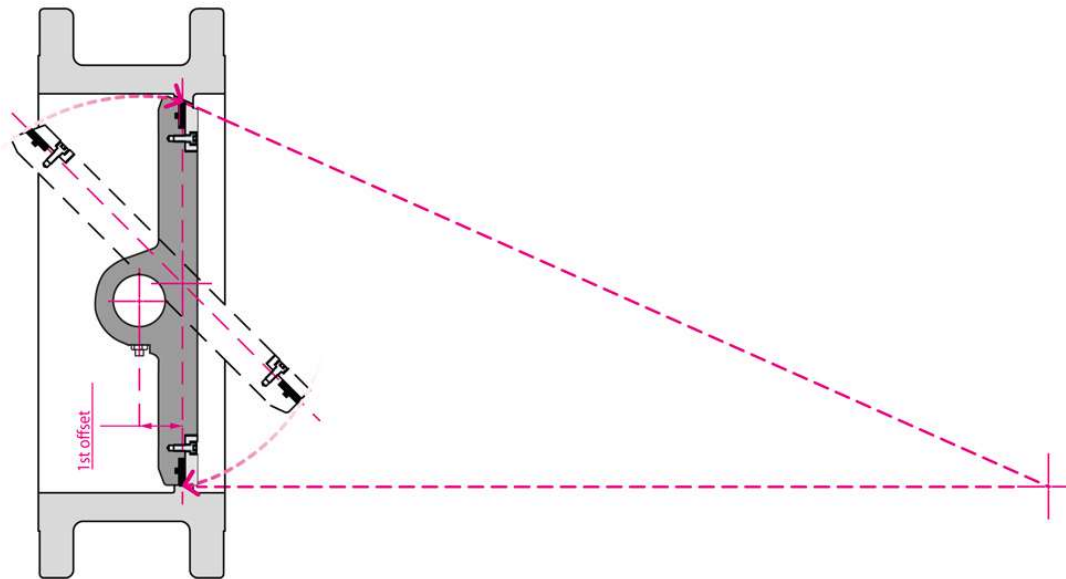
# Triple Offset Butterfly Valve

- › Conical edged disc that rotates off axis into resilient metal seal ring
- › Typical sizes 2" – 24" with typical pressure classes CL 150 – CL 600
- › Easy to operate and low maintenance valve
- › Expensive valve but typically long life expectancy



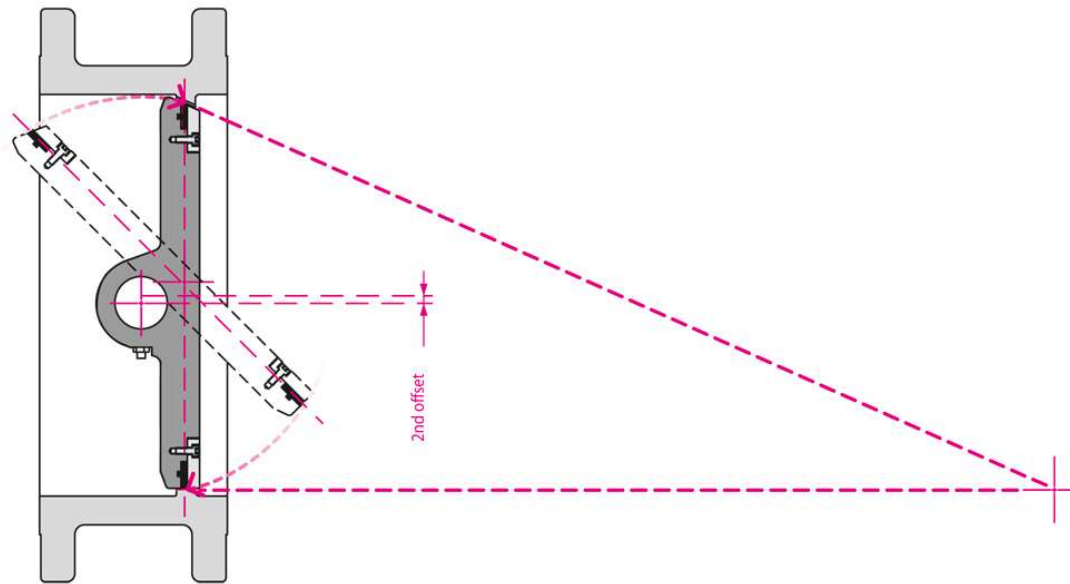
# Offset Review – First Offset

- › First Offset is given by placing the stem behind the disc sealing plane



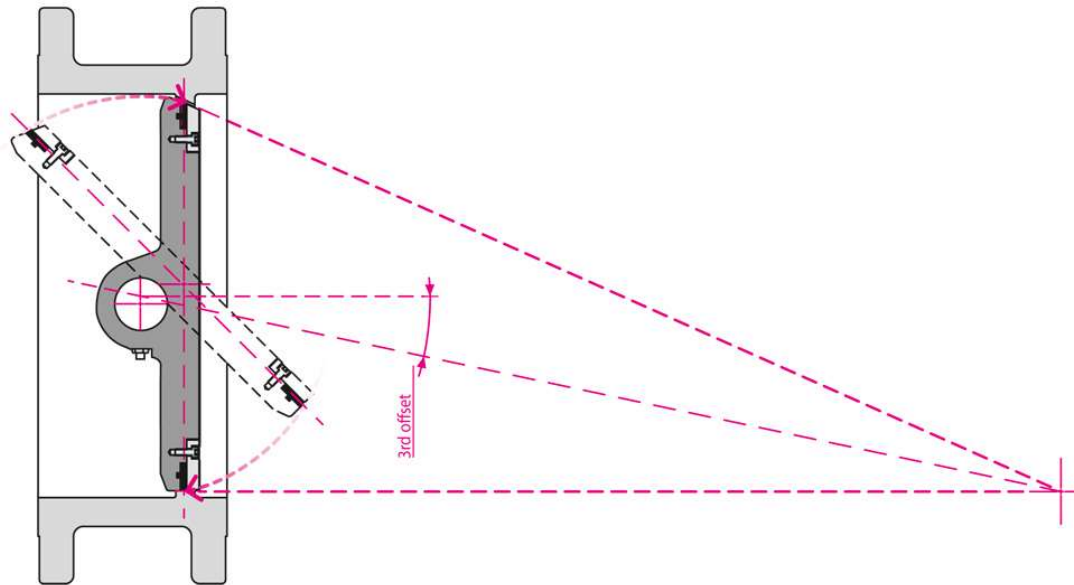
# Offset Review – Second Offset

- › Second Offset is given by placing the stem centerline away from the pipe centerline
- › This provided a “camming” action that drives the disc away from the seat during rotation.



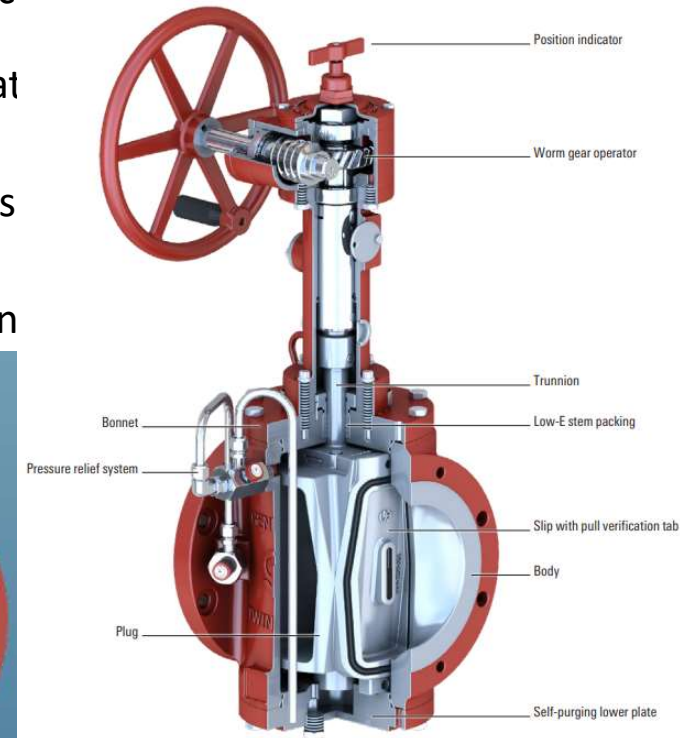
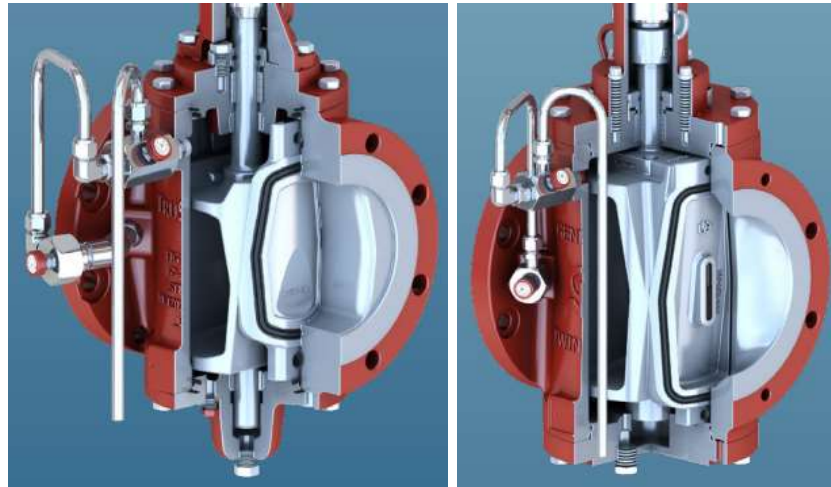
# Offset Review – Third Offset

- › Third off set has the disc and seat machined to match conical disc profile with an incline plane.
- › Contact angle between seat and seal decrease



# Twin Seal Plug Valve aka THE GENERAL

- › Plug rotates concentrically to allow or obstruct flow. Soft seats are retracted in open position and when rotating do not drag against the seat face. In closed position the slips rotate into position and are pushed into the seat faces of the valve.
- › This valve typically keeps the soft seated materials away from the process fluid to prevent damage
- › Valve recommended for high criticality and severe service. Its very expensive



# Jordan's Design Considerations

- › Is this in a critical application?
  - › Critical valve applications are those where malfunctions could cause safety issues or production loss.
- › Is there a potential for chemical incompatibility?
  - › Consider metallurgy, elastomeric materials, polymeric Materials
- › Are there Space Constraints?
  - › Could be limited overhead space of limited
- › Do you have entrained Solids?
  - › Sand, wax.....etc
- › What is your budget?
  - › Based on conversation there is an extremely wide range or pricing
- › How often will you operate this valve?
  - › Consider how easy it is to open and close that valve.





# Isolation Summary

|                              | # forms of isolation | Price          | Physical Size   |                  | Ease of Operation | Reliability with Solids | Necessary Maintenance |
|------------------------------|----------------------|----------------|-----------------|------------------|-------------------|-------------------------|-----------------------|
|                              |                      |                | Face to Face    | Height           |                   |                         |                       |
| Floating Ball                | 1                    | Low            | Moderate        | Short            | Easy              | Low to Moderate         | None                  |
| Double Block and Bleed       | 1                    | Moderate       | Moderate        | Short - Moderate | Easy - Moderate   | Low to Moderate         | Low - Moderate        |
| Double Isolation and Bleed 1 | 2                    | Moderate       | Moderate        | Short - Moderate | Easy - Moderate   | Low to Moderate         | Low - Moderate        |
| Double Isolation and Bleed 2 | 2                    | Moderate       | Moderate        | Short - Moderate | Easy - Moderate   | Low to Moderate         | Low - Moderate        |
| Wedge Gate                   | 1                    | Low - Moderate | Thin - Moderate | Tall             | Hard              | Moderate                | Low                   |
| Knife Gate                   | 1                    | Low            | Thin            | Tall             | Hard              | Excellent               | Low                   |
| Slab Gate                    | 1                    | Moderate       | Thin - Moderate | Tall             | Hard              | Excellent               | Low                   |
| Expanding Gate               | 2                    | High           | Thin - Moderate | Tall             | Hard              | Excellent               | Low - Moderate        |
| Resilient Seat Butterfly     | 1                    | Low            | Thin            | Short            | Easy              | Low                     | None                  |
| High Performance Butterfly   | 1                    | Low - Moderate | Thin            | Short - Moderate | Easy              | Moderate                | None - Low            |
| Triple Offset Butterfly      | 1                    | Moderate       | Thin            | Short - Moderate | Easy              | Moderate                | None - Low            |
| Twin Seal Plug Valve         | 2                    | High           | Moderate        | Tall             | Hard              | Excellent               | Moderate              |



# Tundra Ball Valve Portfolio

- › **Floating Ball Valve** – *Himark, Wocster, KF*
- › **Trunnion Mounted Ball Valve** – *Cameron, DHV, OMB, Pibivisse*
- › **V- Ball** - *Dynaflow*
- › **Segmented Ball Valve** - *Dynaflow*
- › **Eccentric Segmented Ball Valve** – *OMB, Dynaflow*
- › **Rising Stem Ball Valve** – *Orbit, DHV*
- › **Pigging / Sphere Valve** – *Argus*



# Tundra Gate Valve Portfolio

- › **API 6A Slab Gate Valves** – *Stream flo, Cameron*
- › **Wedge Gate** – DHV, Cameron, Ladish
- › **Expanding Gate Valves** – DHV, Cameron
- › **Knife Gate Valve** – *Delta Weir*



# Tundra Butterfly Valve Portfolio

- › Resilient Seat Butterfly Valves - Demco
- › High Performance Butterfly Valves – OMB, WKM, Score
- › Triple Offset Butterfly Valves – OMB, WKM, Score



# Questions ?

