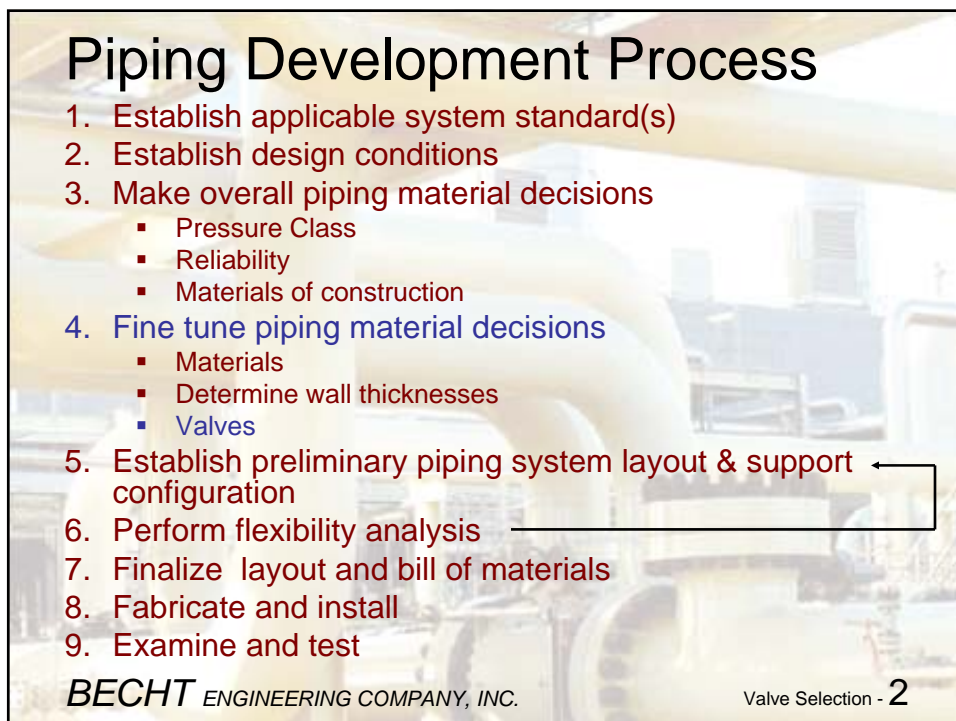


ASME B31.3 Process Piping

Charles Becht IV, PhD, PE
Don Frikken, PE
Instructors

BECHT ENGINEERING COMPANY, INC. Valve Selection - 1



Piping Development Process

1. Establish applicable system standard(s)
2. Establish design conditions
3. Make overall piping material decisions
 - Pressure Class
 - Reliability
 - Materials of construction
4. Fine tune piping material decisions
 - Materials
 - Determine wall thicknesses
 - Valves
5. Establish preliminary piping system layout & support configuration
6. Perform flexibility analysis
7. Finalize layout and bill of materials
8. Fabricate and install
9. Examine and test

BECHT ENGINEERING COMPANY, INC. Valve Selection - 2

5. Valve Selection

- Code Requirements
- Selection by Valve Type
 - Gate
 - Globe
 - Check
 - Butterfly
 - Ball
 - Plug

BECHT ENGINEERING COMPANY, INC.

Valve Selection - 3

The Material in This Section is
Addressed by B31.3 in:

Chapter IV - Standards for Piping
Components

BECHT ENGINEERING COMPANY, INC.

Valve Selection - 4

Code Requirements

Listed Valves

- Can be used within their pressure-temperature ratings and any additional limitations described in the Code
- Except that bolted bonnets secured by fewer than 4 bolts or a U-bolt may only be used in Category D Fluid Service.

[307]

BECHT ENGINEERING COMPANY, INC.

Valve Selection - 5

Code Requirements

Unlisted Valves can be used within Code limitations if they:

- have dimensions that “conform to those of comparable listed components insofar as practicable”
- “provide strength and performance equivalent to standard components”, and
- satisfy one of the following:
 - pressure-temperature ratings established by the method described in Annex F of ASME B16.34, or
 - are qualified for pressure design as required by para. 304.7.2.

BECHT ENGINEERING COMPANY, INC.

Valve Selection - 6

Selection by Valve Type

- Gate
- Globe
- Check
- Butterfly
- Ball
- Plug

BECHT ENGINEERING COMPANY, INC. Valve Selection - 7

Gate Valve

From
API 603

The diagram shows a cross-section of a gate valve. At the top, there is a handwheel with a nut. Below it is the stem, which passes through a gland containing stem packing. A plug is located below the packing. The stem is attached to a gate, which sits on a separate or integral seat. The valve body is bolted to a bonnet, which has its own gasket and bolts. The valve port is shown at the bottom. The distance between the two flanges is labeled 'Face to face'.

Figure 1—Typical Bolted Bonnet Gate Valve Nomenclature

BECHT ENGINEERING COMPANY, INC. Valve Selection - 8

Gate Valve Bonnets

Bolted

Welded

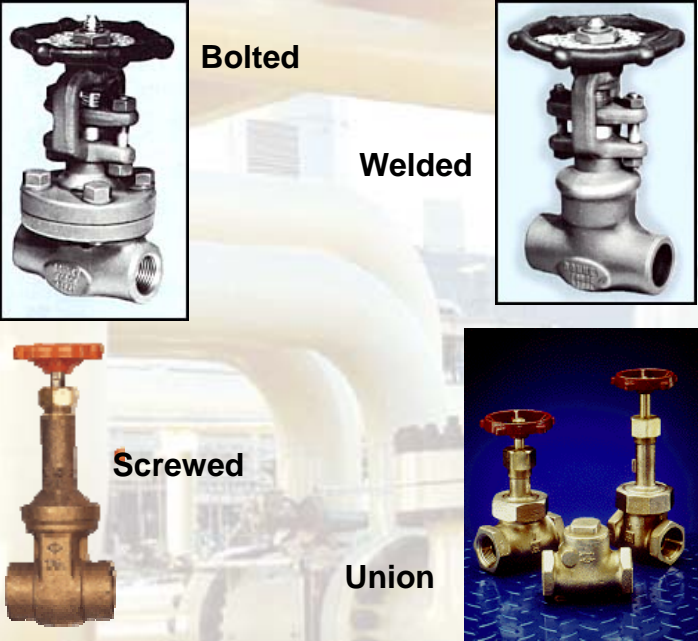
From Bonney Stockham Milwaukee

Screwed

Union

BECHT ENGINEERING COMPANY, INC.

Valve Selection - 9

The image displays four different styles of gate valve bonnets. The 'Bolted' style is a large, industrial valve with a handwheel and a flange. The 'Welded' style is a smaller, more compact valve with a handwheel. The 'Screwed' style is a smaller valve with a red handwheel and threaded connections. The 'Union' style consists of two smaller valves joined together, also with red handwheels.

Gate Valve Bonnets

Yoke Arm

Bonnet Retaining Stud

Thrust Ring

Spacer Ring

Seal Ring

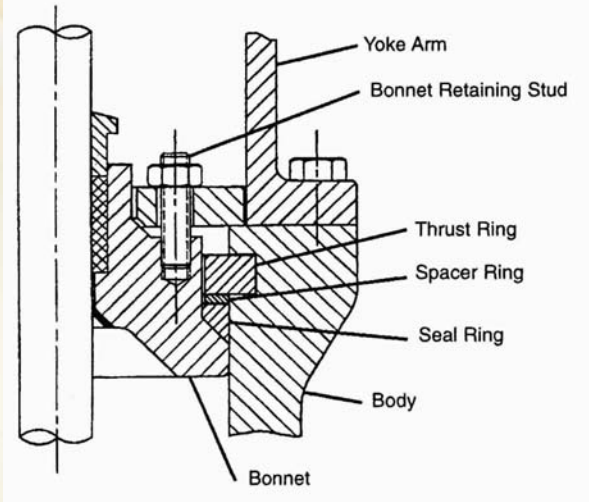
Body

Bonnet

Pressure Seal Body to Bonnet Joint

BECHT ENGINEERING COMPANY, INC.

Valve Selection - 10

A technical cross-section diagram of a gate valve body and bonnet joint. The diagram shows the internal components: a yoke arm at the top, followed by a bonnet retaining stud, a thrust ring, a spacer ring, a seal ring, and the main body. The bonnet is shown on the right, and the body is on the left. The seal ring is positioned between the body and the bonnet to create a pressure seal.

Gate Valve Stems

From Stockham

Outside Screw and Yoke (OS&Y)

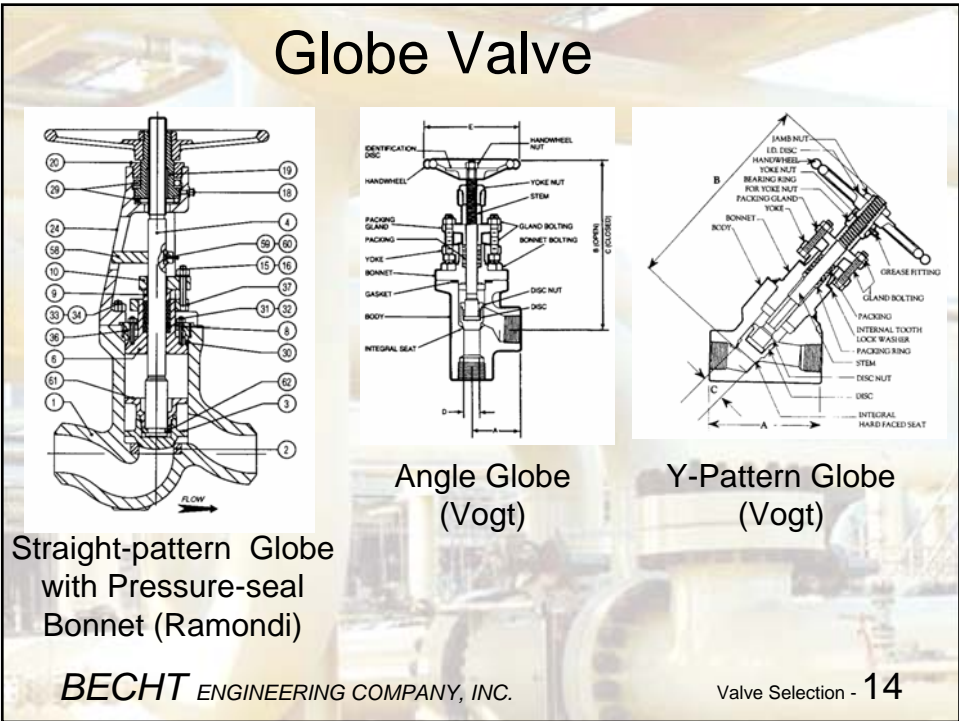
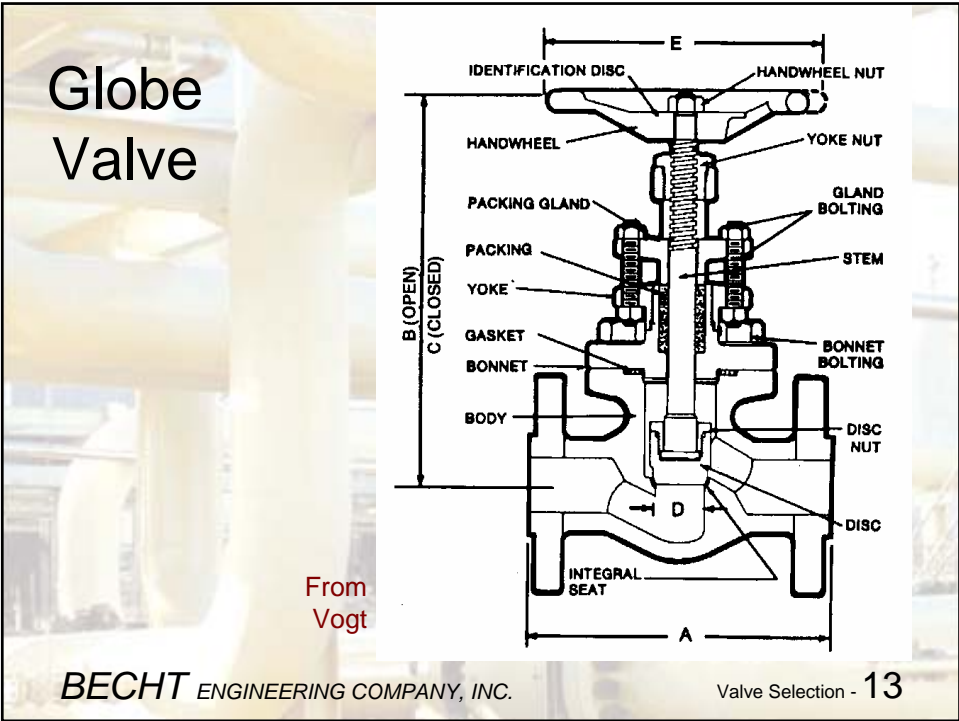
Inside Screw Non-rising Stem

BECHT ENGINEERING COMPANY, INC. Valve Selection - 11

Gate Valve Attributes

- On-off applications (Not considered suitable for throttling)
- Works as well with flow from either direction
- Suitable for use in wide range of conditions
- Can be made fire resistant and blow-out resistant
- Available in any size
- Blocked-in volume when the valve is closed
- Almost always leaks through the seat

BECHT ENGINEERING COMPANY, INC. Valve Selection - 12



Needle Instrument Valve

MSS-SP-105

From Vogt

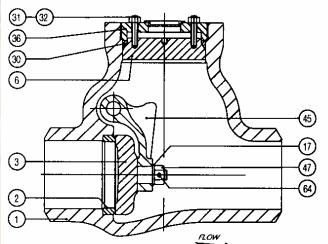
BECHT ENGINEERING COMPANY, INC. Valve Selection - 15

Globe Valve Attributes

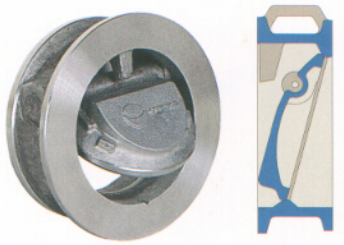
- Suitable for on-off applications and throttling
- Works best with flow from one direction
- Suitable for use in wide range of conditions
- Can be made fire resistant and blow-out resistant
- Available in sizes up to about NPS 14
- No blocked-in volume when the valve is closed
- Almost always leaks through the seat, but less than a gate valve

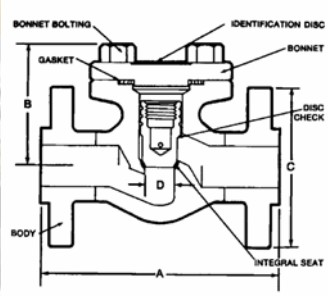
BECHT ENGINEERING COMPANY, INC. Valve Selection - 16

Check Valve




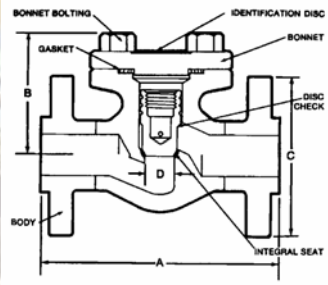
Swing
(Ramondi)






Tilting Disk
(ORBINOX)





Lift
(Vogt)

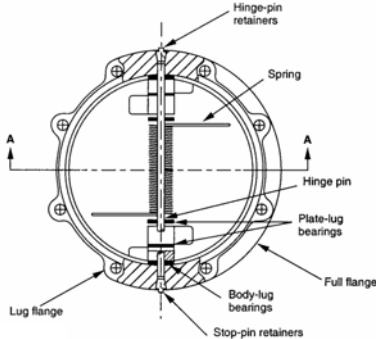
Centerline Guided Disk
(Durabla)



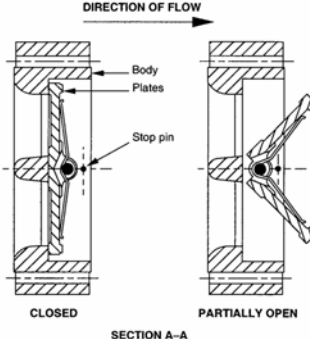
BECHT ENGINEERING COMPANY, INC.

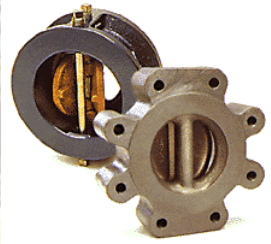
Valve Selection - 17

Dual-Plate Wafer Check Valves



DIRECTION OF FLOW





Lug Body Wafer (API 594)

Wafer & Lug Bodies (Mueller)

BECHT ENGINEERING COMPANY, INC.

Valve Selection - 18

Check Valve Attributes

- Works only with flow from one direction
- Suitable for use in wide range of conditions
- Can be made fire resistant and blow-out resistant
- Available in any size
- No blocked-in volume when the valve is closed
- Almost always leaks through the seat, but much more than a gate valve

BECHT ENGINEERING COMPANY, INC. Valve Selection - 19

Check Valve Attributes

- Check valves check about 95% of the time
- Check valves can close suddenly when the flow is reversed, causing severe water hammer

| Valve Type | Slam Characteristics |
|--------------|---|
| Swing | Severe (improved with weight or spring) |
| Lift | Severe (improved with spring return) |
| Wafer | Good |
| Tilting Disk | Excellent |
| C/L Disk | Excellent |

BECHT ENGINEERING COMPANY, INC. Valve Selection - 20

Butterfly Valve – Low Pressure

From
API 609

Category A

Minimum installed face-to-face dimension W

Lap-joint flange

Welding-neck flange

Chord of disc

Pipe inside diameter d

Maximum disc diameter D

Threaded flange

Nominal radial clearance

Slip-on flange

BECHT ENGINEERING COMPANY, INC.
Valve Selection - 21

Butterfly Valve – Low Pressure

**Wafer Body, PTFE Lined
(Durco)**

**Lug Body
(Contromatics)**

BECHT ENGINEERING COMPANY, INC.
Valve Selection - 22

Butterfly Valve – Low Pressure

- Suitable for on-off applications and throttling
- Works as well with flow from either direction
- Suitable for use up to ~200°F (95°C), 150 psig (10 bar)
- Cannot be made fire resistant or blow-out resistant
- Generally available NPS 3 and larger
- No blocked-in volume when the valve is closed
- Usually does not leak through the seat
- Can be PTFE Lined

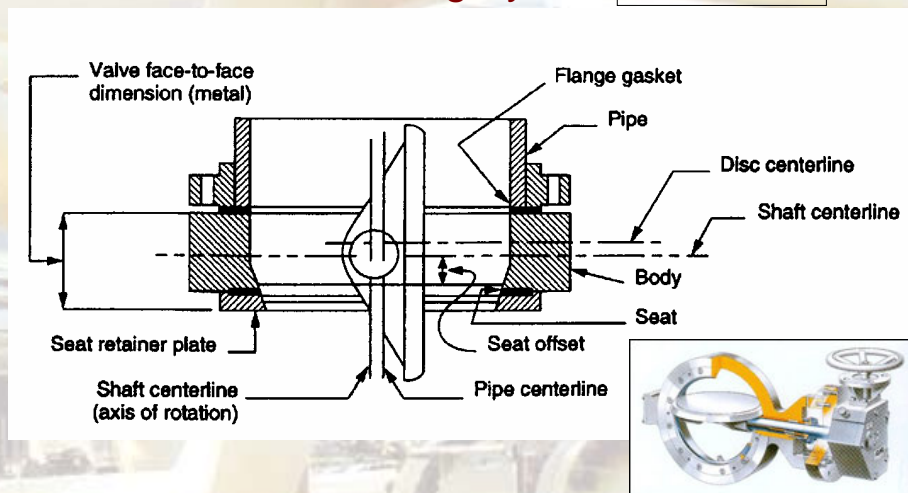
BECHT ENGINEERING COMPANY, INC.

Valve Selection - 23

Butterfly Valve – High Pressure

From API 609 - Category B

Double offset

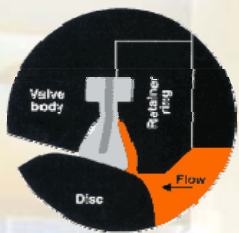


BECHT ENGINEERING COMPANY, INC.

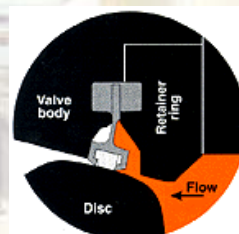
Valve Selection - 24

Butterfly Valve – High Pressure

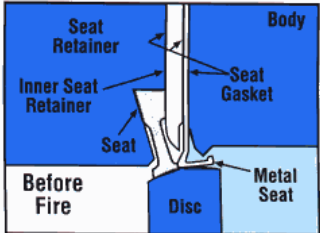
Valve Seats Double offset



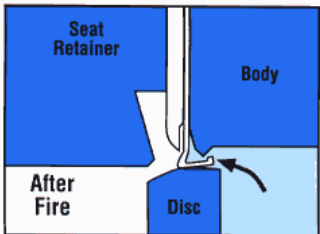
PTFE Seat
(Xomox)



Fire Resistant Seat
(Contromatics)



Before Fire



After Fire

BECHT ENGINEERING COMPANY, INC. Valve Selection - 25

Butterfly Valve – High Pressure

- Suitable for on-off applications and throttling
- Generally works as well with flow from either direction
- Suitable for use in wide range of conditions, but PTFE seats limited to ~400°F (200°C)
- Can be made fire resistant and blow-out resistant
- Generally available NPS 3 and larger
- No blocked-in volume when the valve is closed
- Usually does not leak through the seat

BECHT ENGINEERING COMPANY, INC. Valve Selection - 26

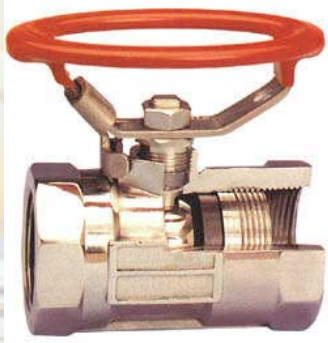
Ball Valve
From API 608
Floating Ball, End Entry

BECHT ENGINEERING COMPANY, INC. Valve Selection - 27

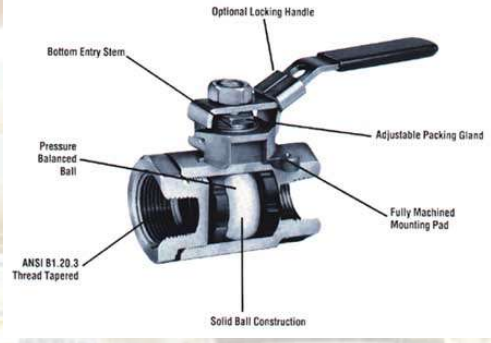
Ball Valve
From API 608
Trunnion Mounted, Two Piece

BECHT ENGINEERING COMPANY, INC. Valve Selection - 28

Ball Valve



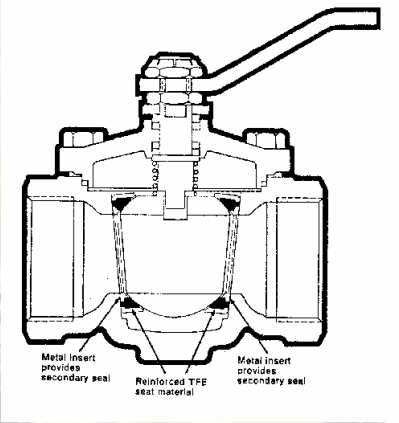
**End Entry
Oval Handle
(Contromatics)**



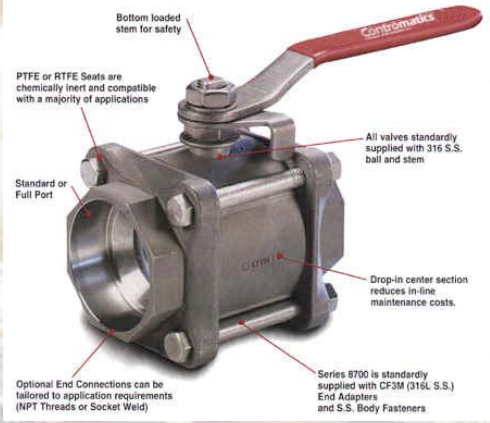
**Two Piece
Lever Handle
(Contromatics)**

BECHT ENGINEERING COMPANY, INC. Valve Selection - 29

Ball Valve

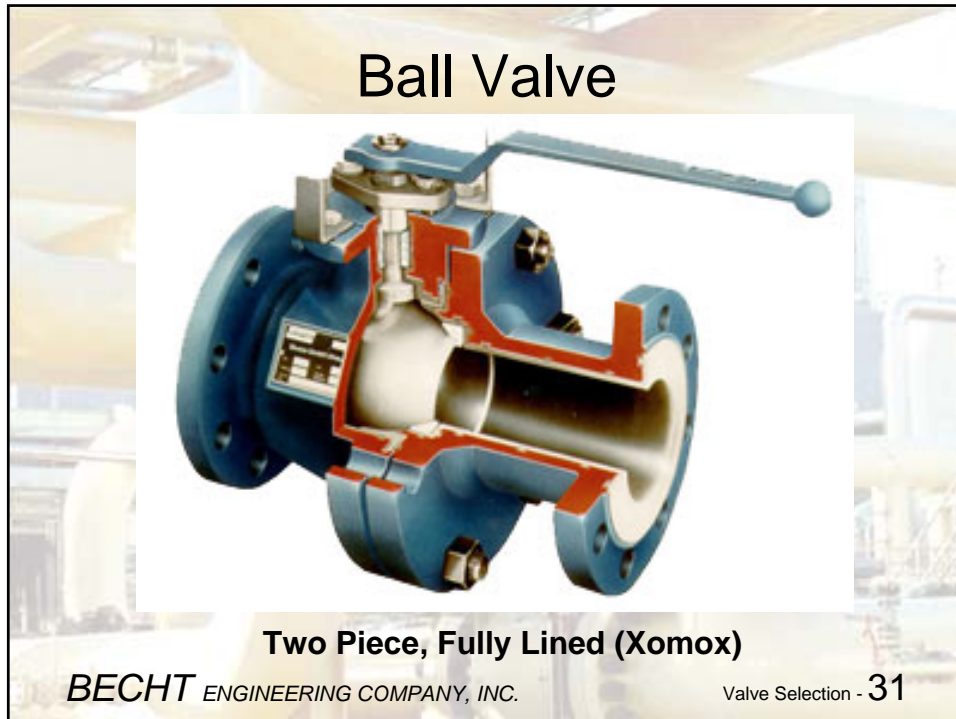


Top Entry



**Three Piece (Swing-out)
(Contromatics)**

BECHT ENGINEERING COMPANY, INC. Valve Selection - 30



Ball Valve Attributes

- On-off applications (not considered suitable for throttling)
- Works as well with flow from either direction
- Suitable for use in wide range of conditions, but PTFE seats limited to ~400 °F (200°C)
- Can be made fire resistant and blow-out resistant
- Available in any size
- Blocked-in volume when the valve is closed
- Usually does not leak through the seat

BECHT ENGINEERING COMPANY, INC. Valve Selection - 32

Plug Valve

From API 599

Lubricated

Sleeve Lined

BECHT ENGINEERING COMPANY, INC.

Valve Selection - 33

Plug Valve Fully Lined

(Durco)

API 599

BECHT ENGINEERING COMPANY, INC.

Valve Selection - 34

Plug Valve Attributes

- On-off applications and non-severe throttling
- Works as well with flow from either direction
- Suitable for use in wide range of conditions, but PTFE seats limited to ~400 °F (200°C)
- Can be made fire resistant (only lubricated type) and blow-out resistant
- Generally available up to ~NPS 12
- Blocked-in volume when the valve is closed
- Usually does not leak through the seat

Valve Selection Workshop

What valve attributes and block, throttle and check valve types would you select for the following services:

- Steam condensate
- Dry chlorine liquid
- Sulfuric acid
- Gasoline
- 650 psig (45 bar) Steam
- Heat transfer oil
- Styrene monomer
- Lime/water slurry