

# VALVES-Maintenance and Materials

- **VALVES:** *A valve is a device to control the flow of liquid.*

**Valve.**—*A valve is a closure device in which the closure member remains fixed axially with respect to the fluid way and is either rotated or moved longitudinally to control the flow of water*

# SELECTION OF VALVES



## The control function

- Isolation valve
- Regulation valve
- Non Return valve
- Relief valve
- Safety valve
- Special valve

## The fluid being transported

- Erosion caused by particles in suspension
- Viscosity of the fluid
- Corrosion caused by the fluid itself
- Temperature and pressure

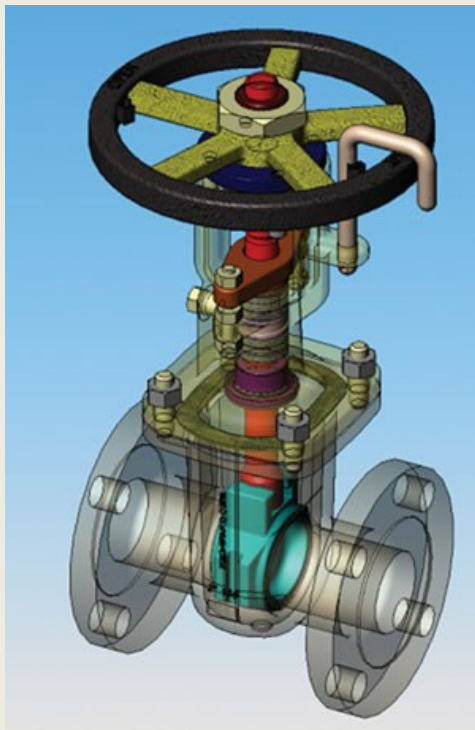
## The friction Loss:

# TYPES OF VALVES

- Cocks
- Plug Valves
- Screw down stop valves
- Wedge gate sluice valves
- Parallel slide valves
- Diaphragm valve
- Butterfly valve
- Swing check valves
- Lift check valves
- Spring type safety valve
- Pilot operated safety valve
- Ball float valves
- Pressure reducing valves

# Isolating valves

Gate valve



Plug valve

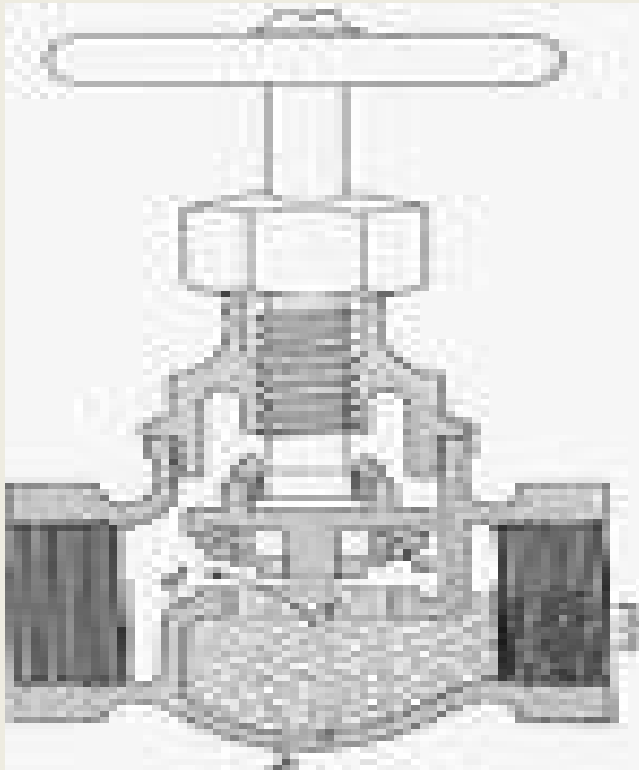


Ball

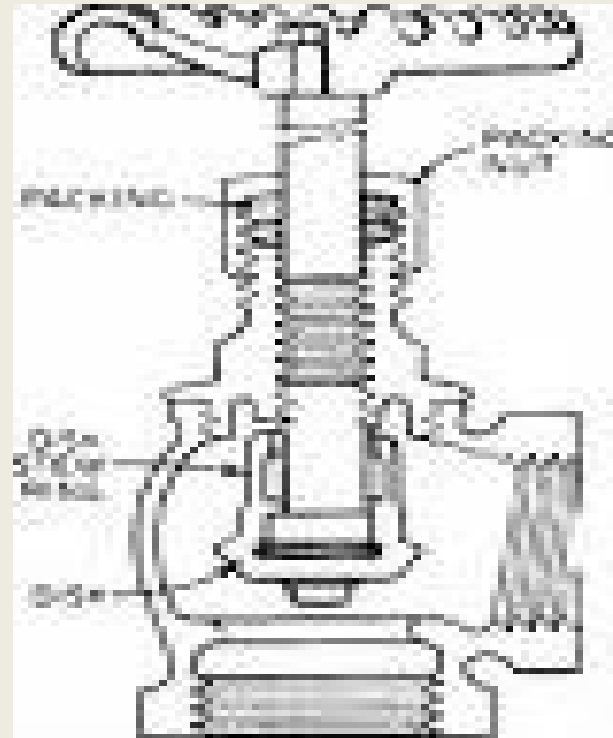


# Regulating valve

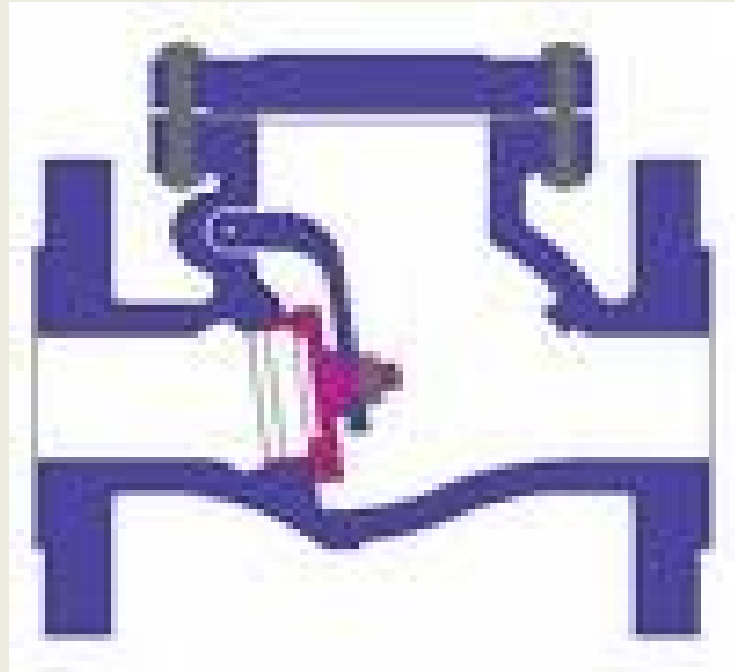
Globe valve



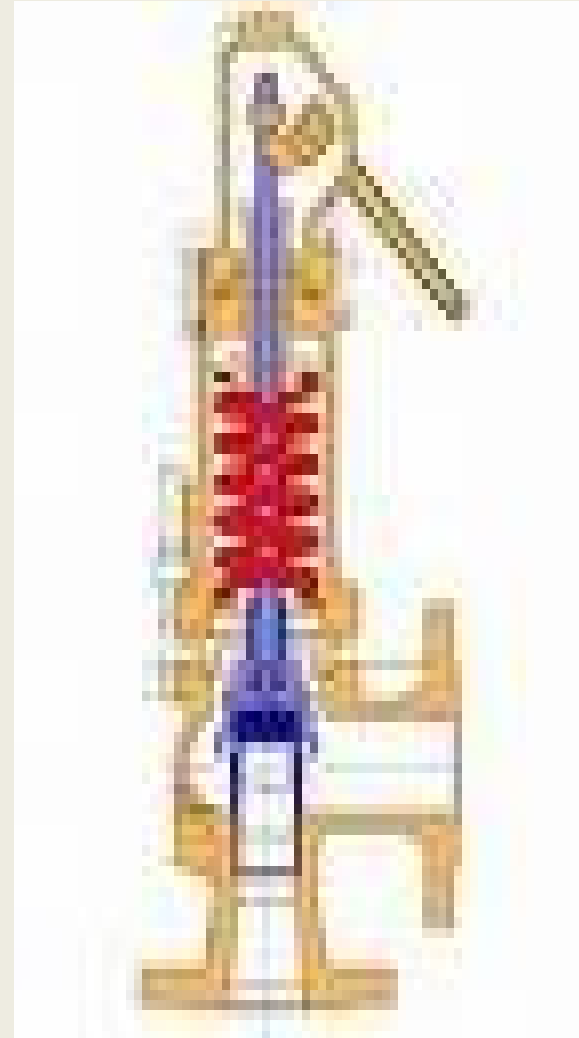
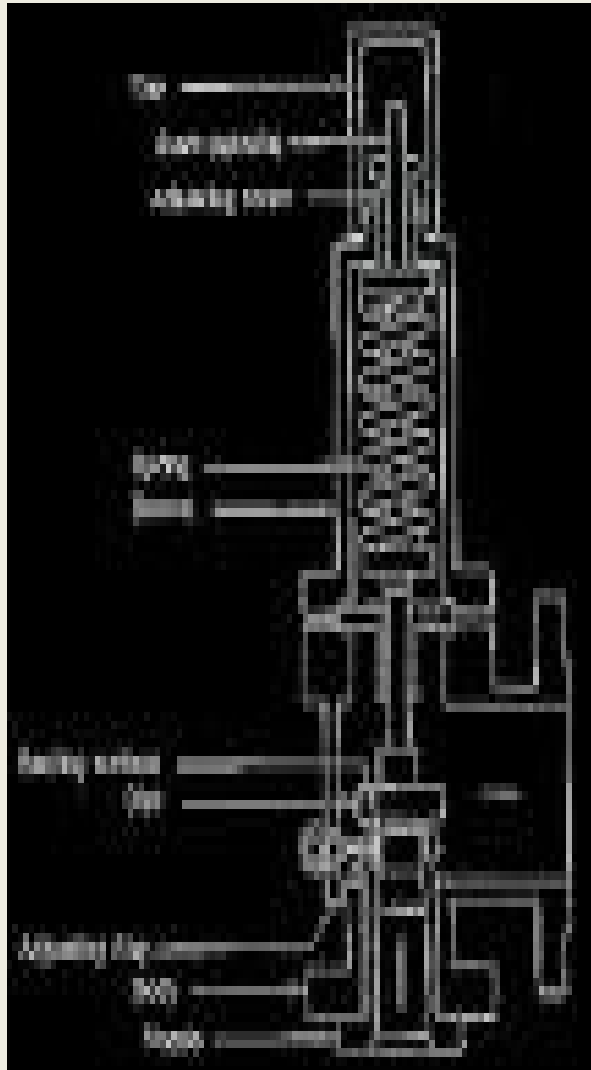
Angle valve



# Non return valve



# Safety valve



# Other special valves used in Hydro station

- Butter fly valve
- Spherical valve
- Annular sluice valve

and

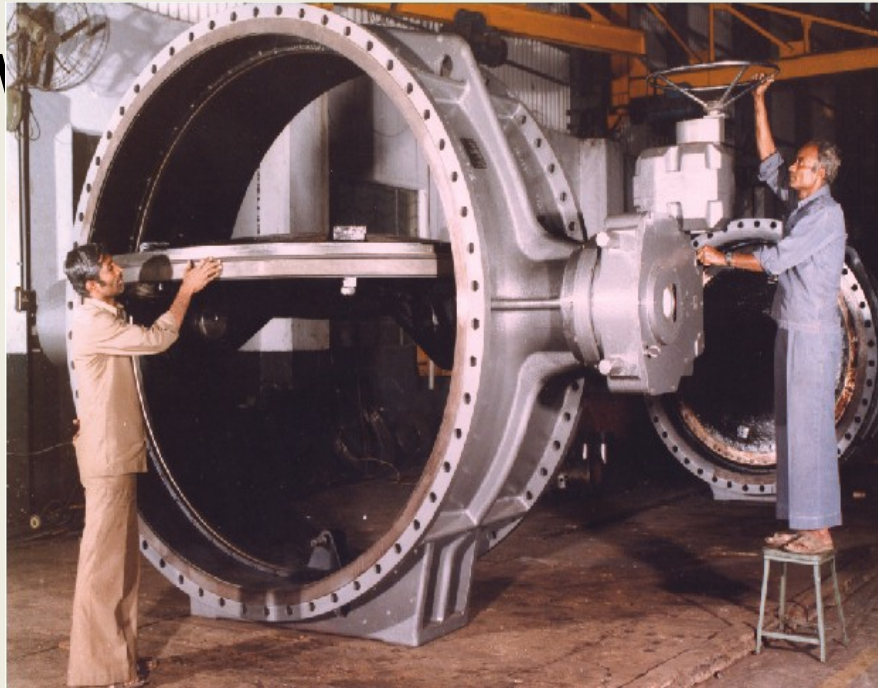
Directional control valve



# Butter fly valves

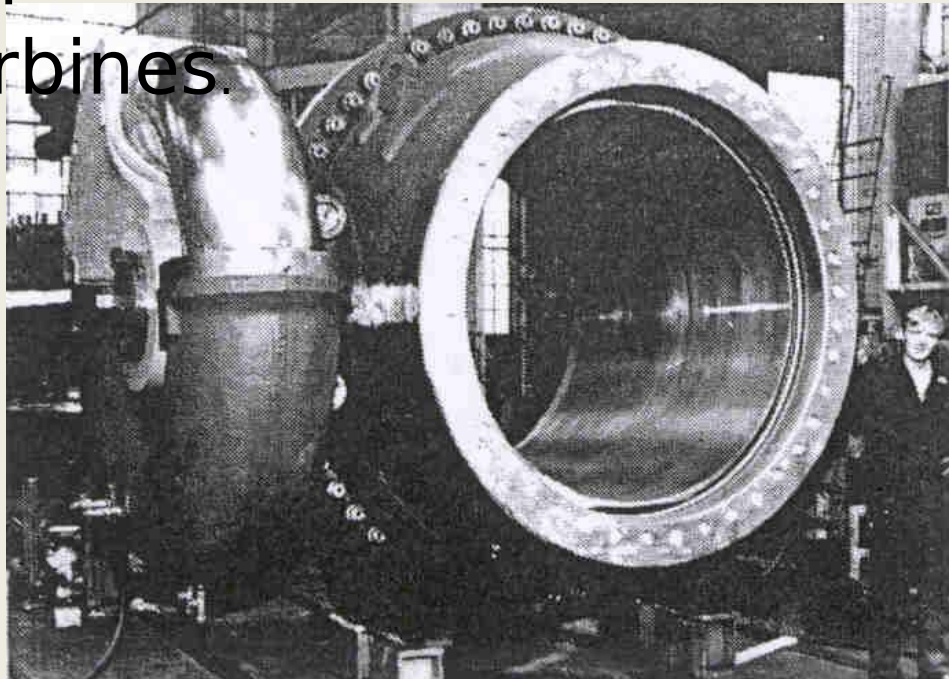
- ❖ Used in low pr lines-low Maintenance

low



# SPHERICAL VALVE

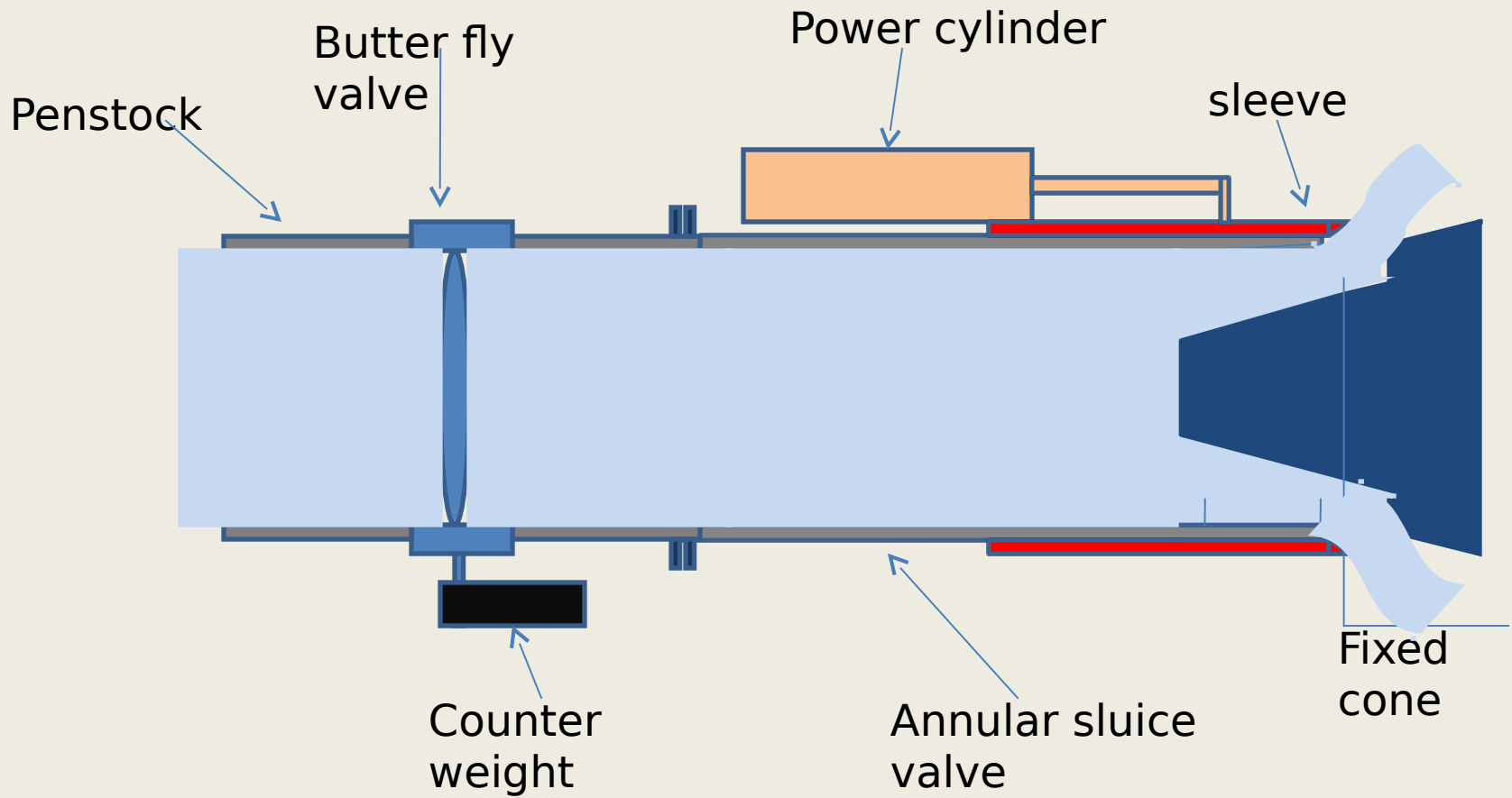
- Spherical valves are applied mostly as shut off valves in front of high head water turbines.



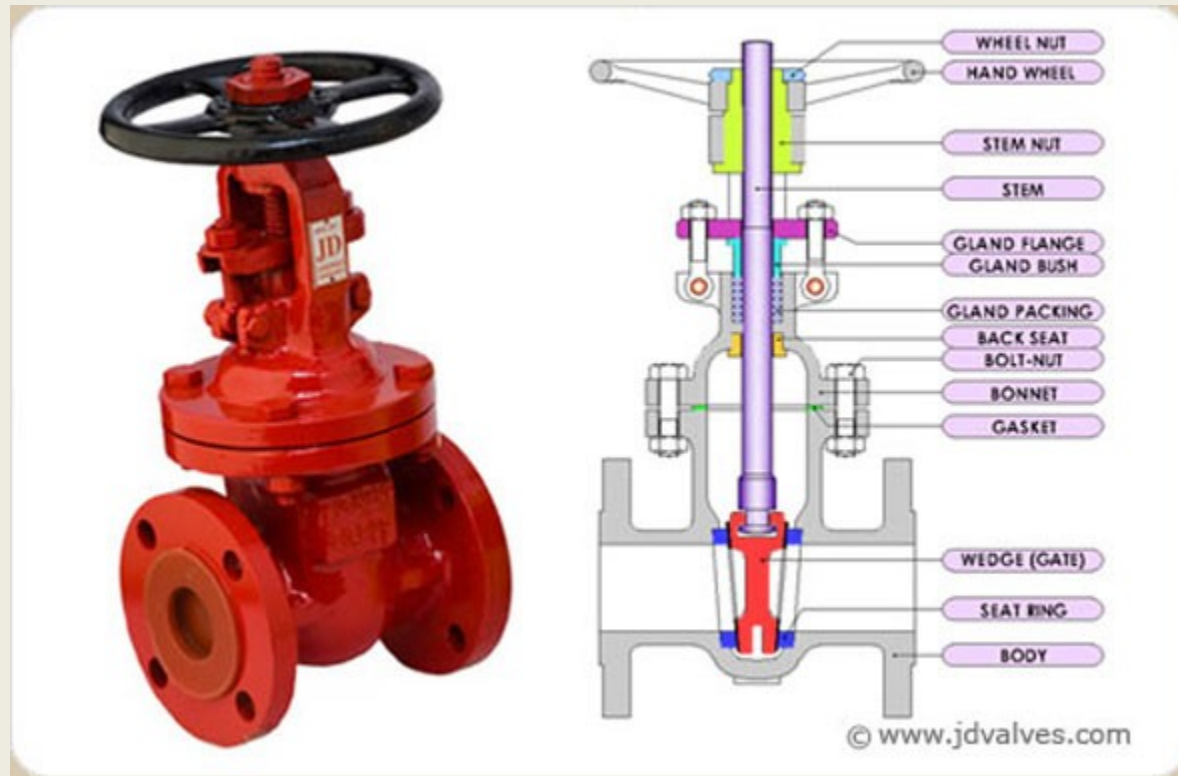
# ANNULAR SLUICE VALVE



# ASV



# Basic elements of valves



# Selection material for valves

<b>MATERIAL</b>	<b>TEMP</b>	<b>PRESSURE</b>
Cast Iron & Bronze	220 Deg	10 to 13 ksc
Carbon steel Forging	426	17 ksc
Alloy steel( Alloying Elements Mo,v,Ni,Cr)	Super Critical temp	Super Critical Pressure
Stainless Steel	For Chemicals	

# Valve seat and Disc Material

## VALVE BODY

Up to 425 deg C

Carbon steel material

Above 425 deg C

Low alloy steel with Cr.Mo.

## YOKE, BONNET AND COVER

Small sizes

Forged steel

Above 425 deg C

Alloy steel with Cr.Mo contents

## DISC/WEDGE

Up to 425 deg C

Carbon steel with seat hard facing to 13% Cr or Stellite

Above 425 deg C

Low alloy steel with Cr.Mo. And hard facing of stellite

# Valve seat and Disc Material

## STEM

Up to 425 deg C

13% Cr or Stellite

Above 425 deg C

Creep resisting steel

## Gland group

Gland packing

Knitted asbestos yarn with solid lubricants like Graphite's

Gland cover Bolt and Nut

Carbon steel Normally



# Maintenance of Gate valve

- Running maintenance or on load maintenance
- Leakage through
  - Flange joint- Tighten the bolts & Nuts.
  - Bonnet joint- Tighten the bolts & Nuts.
  - Gland - Open the valve fully for back seating
    - and tighten the gland bolts or change the glands.
- Difficulty in Opening and Closing
- Exercising the valve

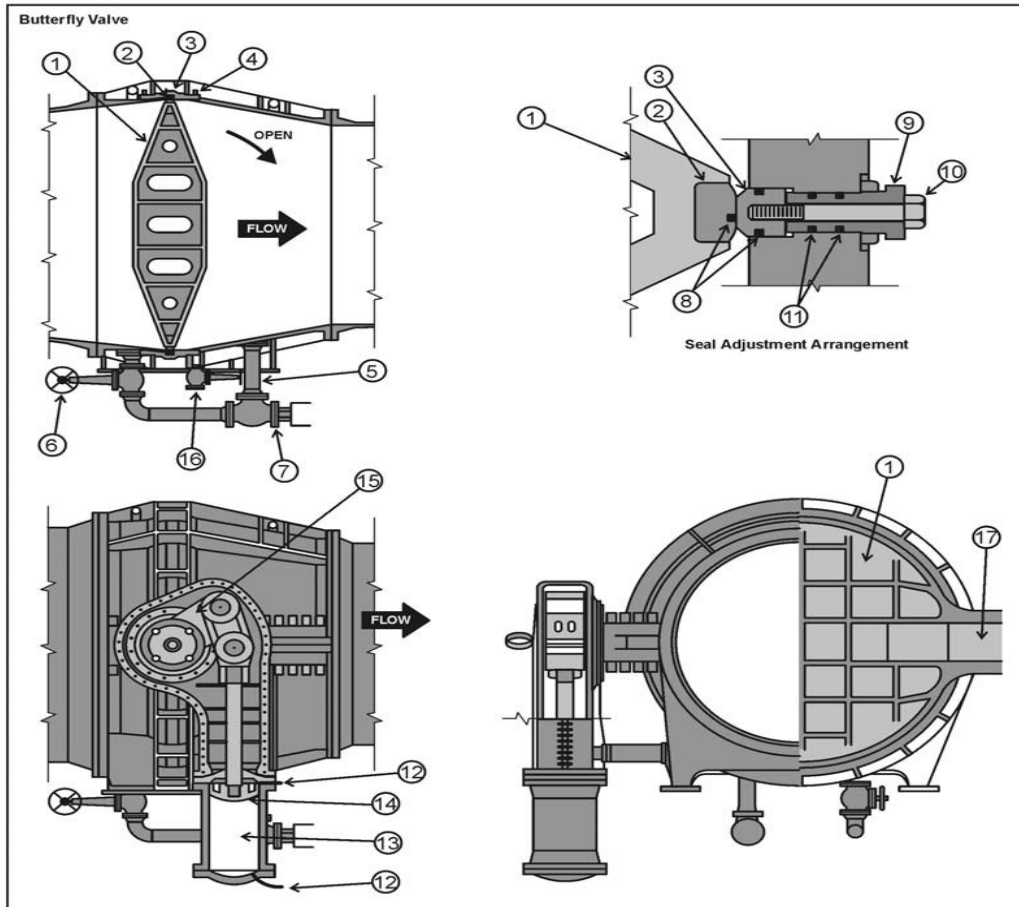
# GATE/GLOBE VALVE DEFECT

DEFECT	CAUSES	REMEDY
Seat Passing	<ol style="list-style-type: none"> <li>1. Damage to body and/Wedge.</li> <li>2. Incorrect Operation.</li> </ol>	Machining and Lapping
Leakage Through Body/Bonnet Joint	<ol style="list-style-type: none"> <li>1. Insufficient Bolt tightening .</li> <li>2. Damaged gasket.</li> <li>3. Damage to the Sealing surface of body and yoke Bonnet</li> </ol>	Tighten uniformly Replace the Gasket Machining
Operational Difficulty	<ol style="list-style-type: none"> <li>1. Insufficient lubrication.</li> <li>2. Over tightening of Gland packing.</li> <li>3. Incorrect Packing.</li> <li>4. Stem Bend.</li> </ol>	
Leakage through	<ol style="list-style-type: none"> <li>1. Insufficient Gland</li> </ol>	

# Reconditioning methods

1. Machining - will be necessary if the disc or seat badly damaged
2. Lapping - is an operation of bringing surfaces to high degree of smoothness- adopted for slight pitting or scars.
3. Check the run out of spindle should not exceed 0.25mm

# Butterfly Valve maintenance

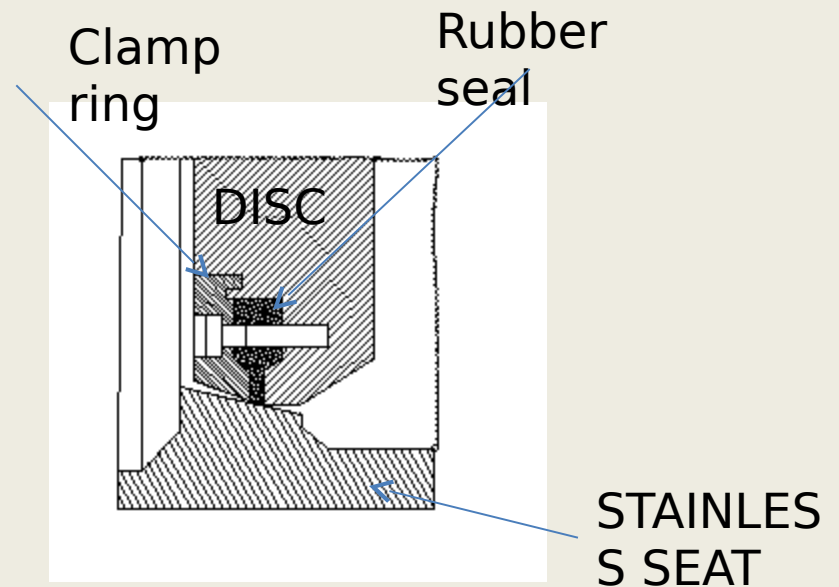
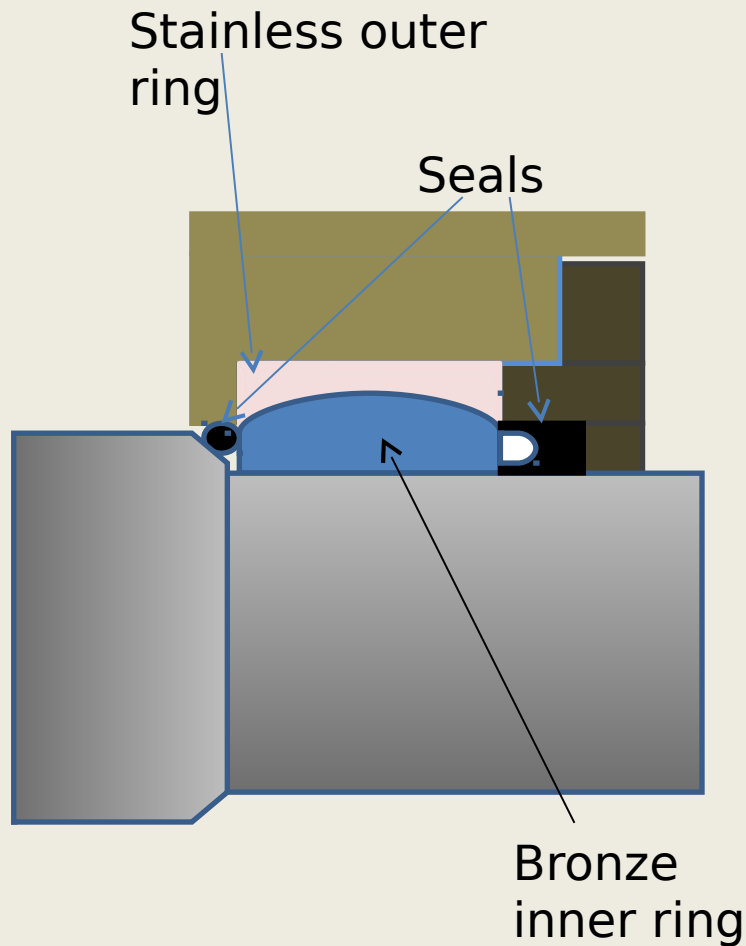


- |   |  |    |                      |
|---|--|----|----------------------|
| 1 | Leaf   | 9  | Adjusting Screw      |
| 2 | Seal   | 10 | Locking Bolt         |
| 3 | Adjustable Seal                                    | 11 | O-Rings              |
| 4 | Vent Valves  | 12 | Oil Pipe             |
| 5 | Bypass Line  | 13 | Cylinder             |
| 6 | Guard Valve  | 14 | Piston               |
| 7 | Service Valve with Manual or Power-Driven Operator | 15 | Crank (Valve Closed) |
| 8 | Rubber Inserts                                     | 16 | Drain                |
|   |  | 17 | Stem                 |

# DEFECTS IN BUTTERFLY VALVE

- BEARING FAILURE IN TRUNION
- TRUNION SEAL LEAK
- VALVE DISC SEAT EROSION

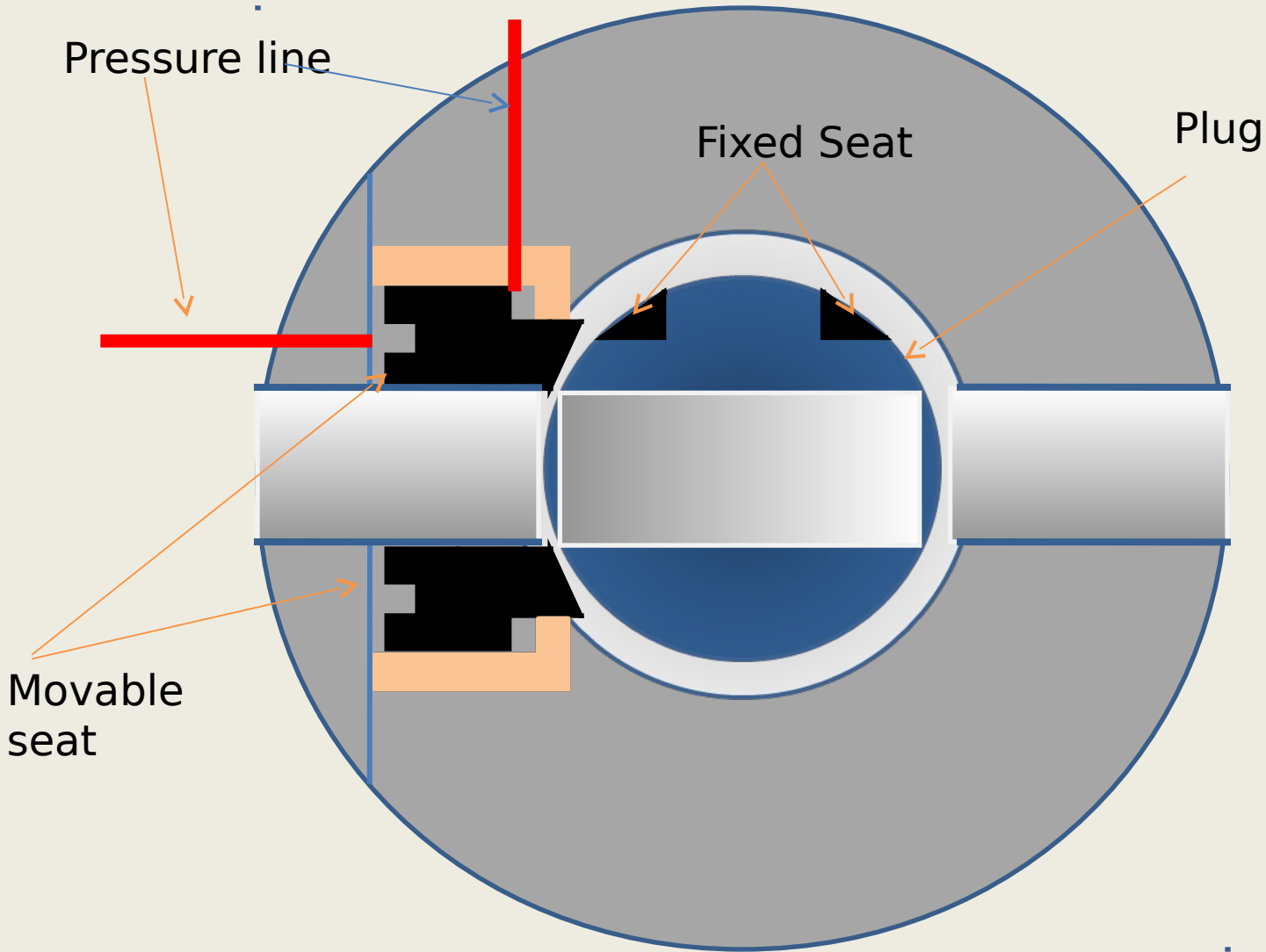
# BUTTER FLY VALVE TRUNION



# DEFECTS IN SPHERICAL VALVE

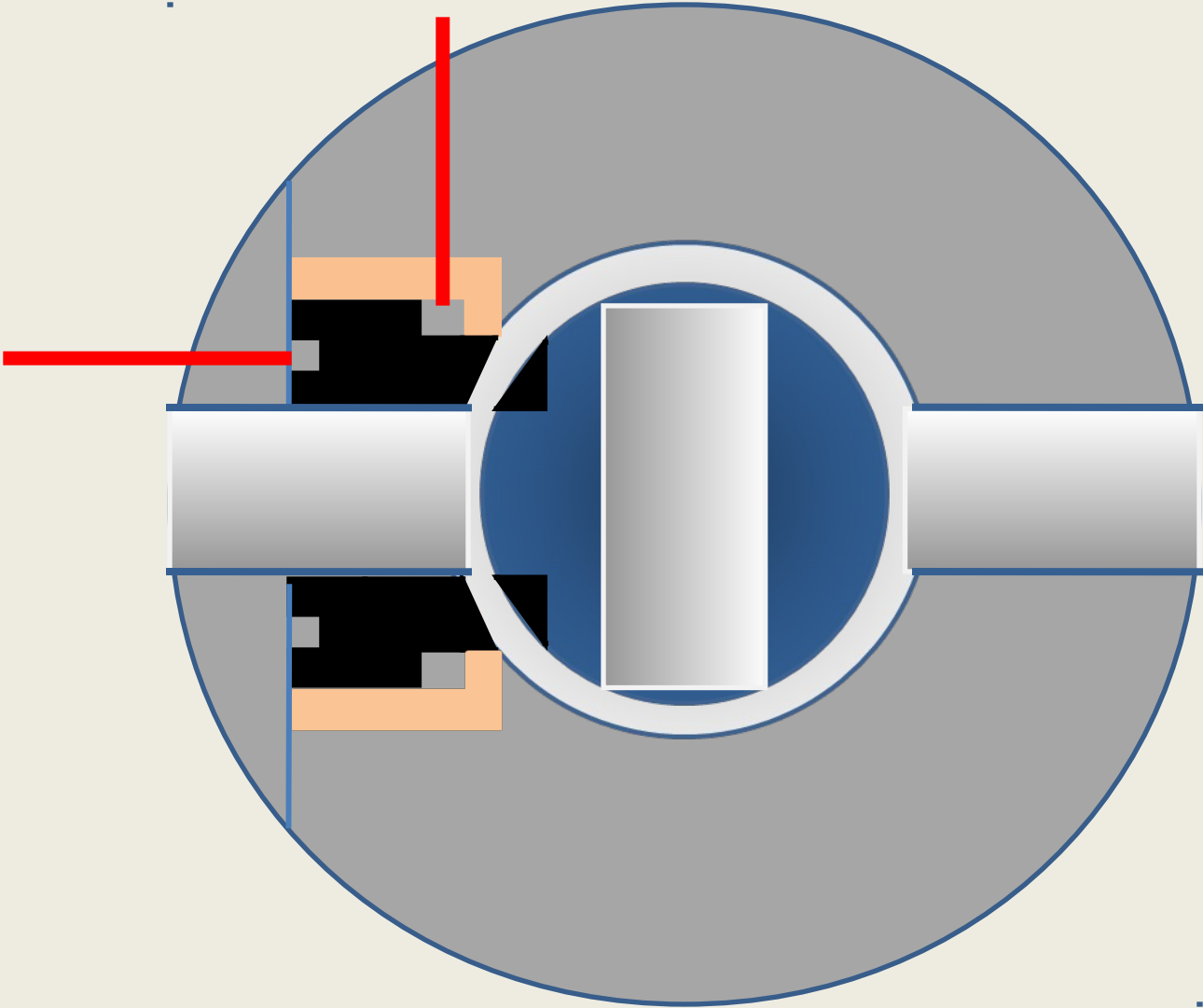
- EROSION OF MOVING AND FIXED SEAT IN SPHERICAL VALVE
- TRUNION SEAL FAILURE
- OPERATING CYLINDER LEAK
- HIGH PRESSURE WATER LINE PUNCTURE
- BYPASS VALVE LEAK

# Maintenance of spherical valve





# Maintenance of spherical valve





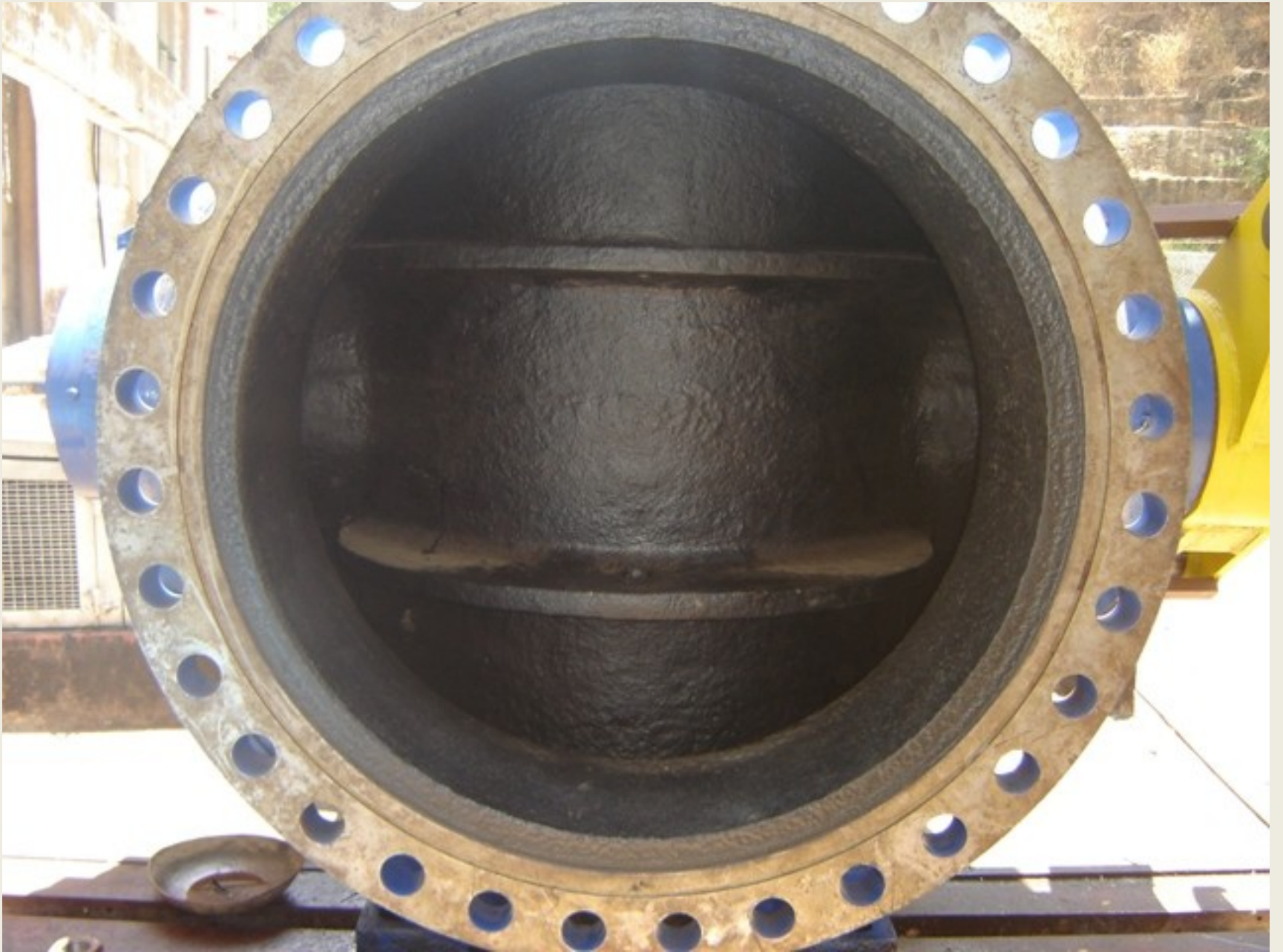










































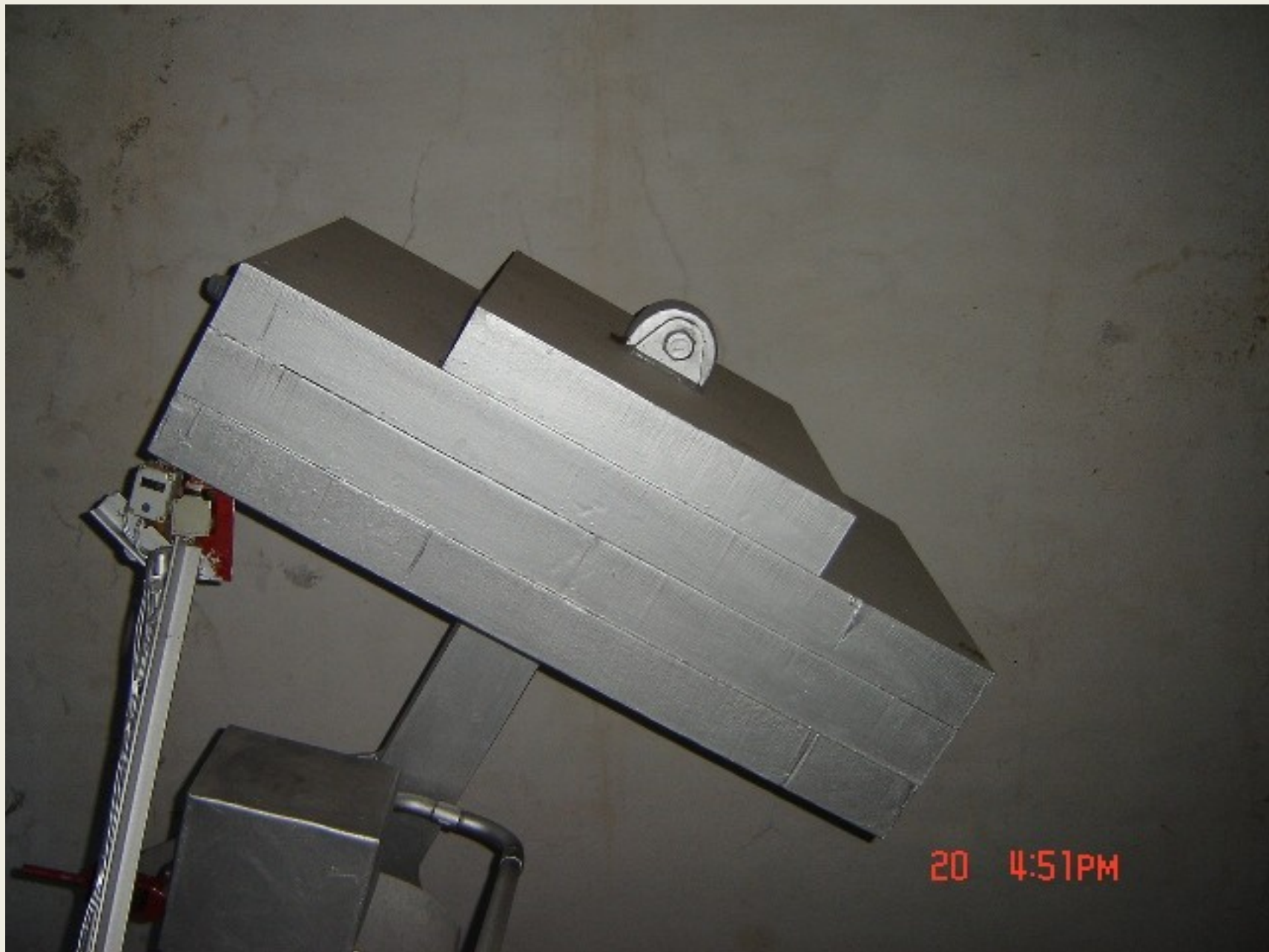
































































Valves are the devices which will  
controls

Flow

Pressure

Direction.**a**

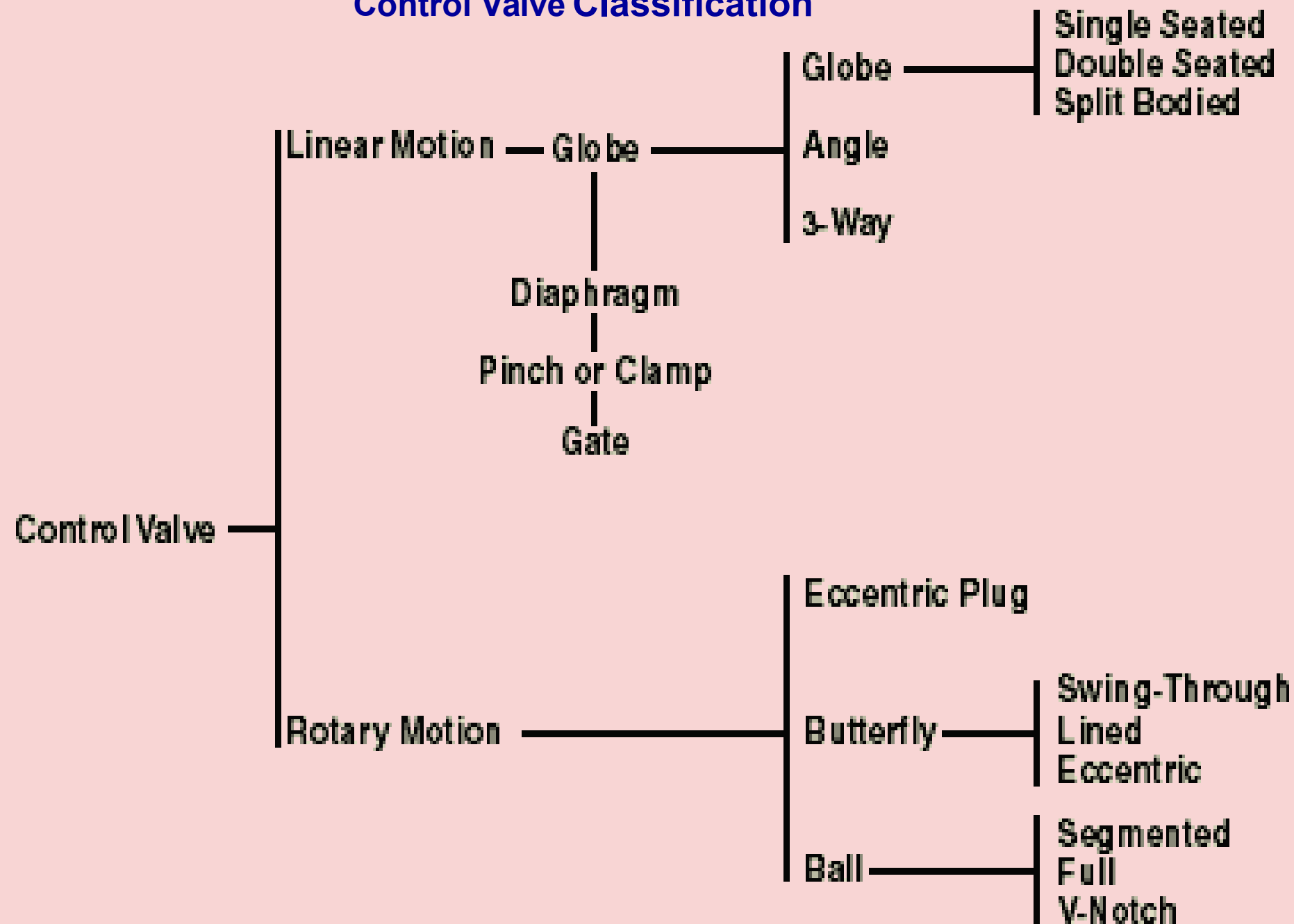
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**Control valve** - A power-operated device which changes the fluid flowrate in a process control system

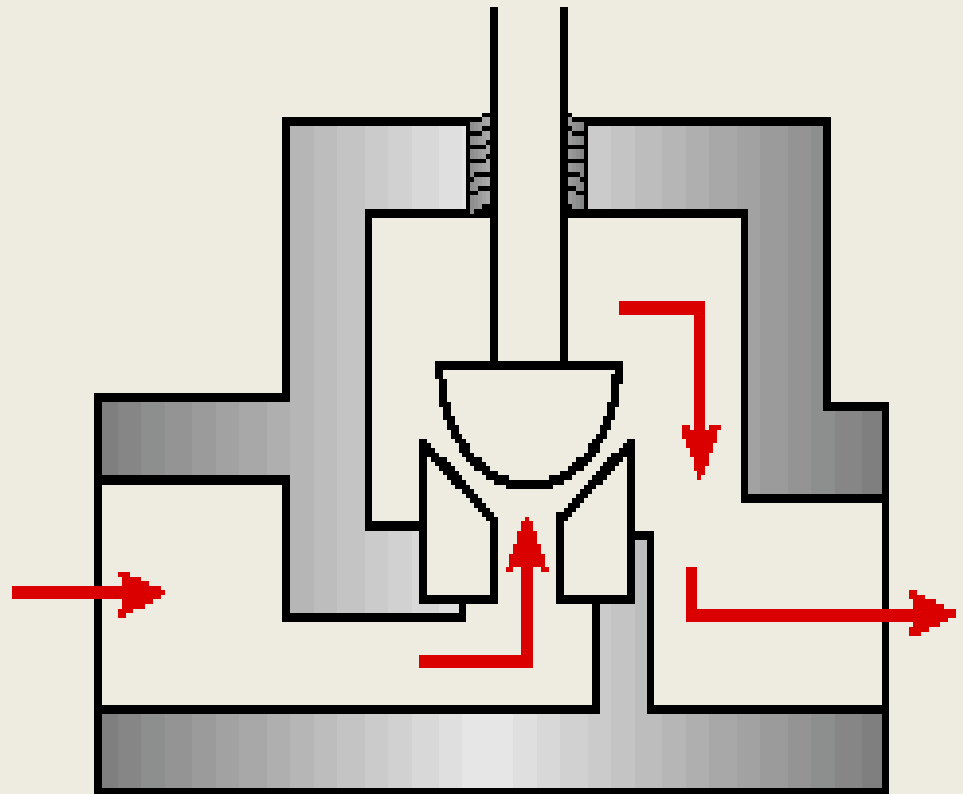


# Control Valve Classification



# LINEAR Valve Features

**TORTUOUS FLOW PATH**  
**LOW RECOVERY**  
**CAN THROTTLE SMALL FLOW RATES**  
**OFFERS VARIETY OF SPECIAL TRIM DESIGNS**  
**SUITED TO HIGH-PRESSURE APPLICATIONS**  
**USUALLY FLANGED OR THREADED**  
**SEPARABLE BONNET**



# Rotary Valve Features

**STREAMLINED FLOW  
PATH**

**HIGH RECOVERY**

**MORE CAPACITY**

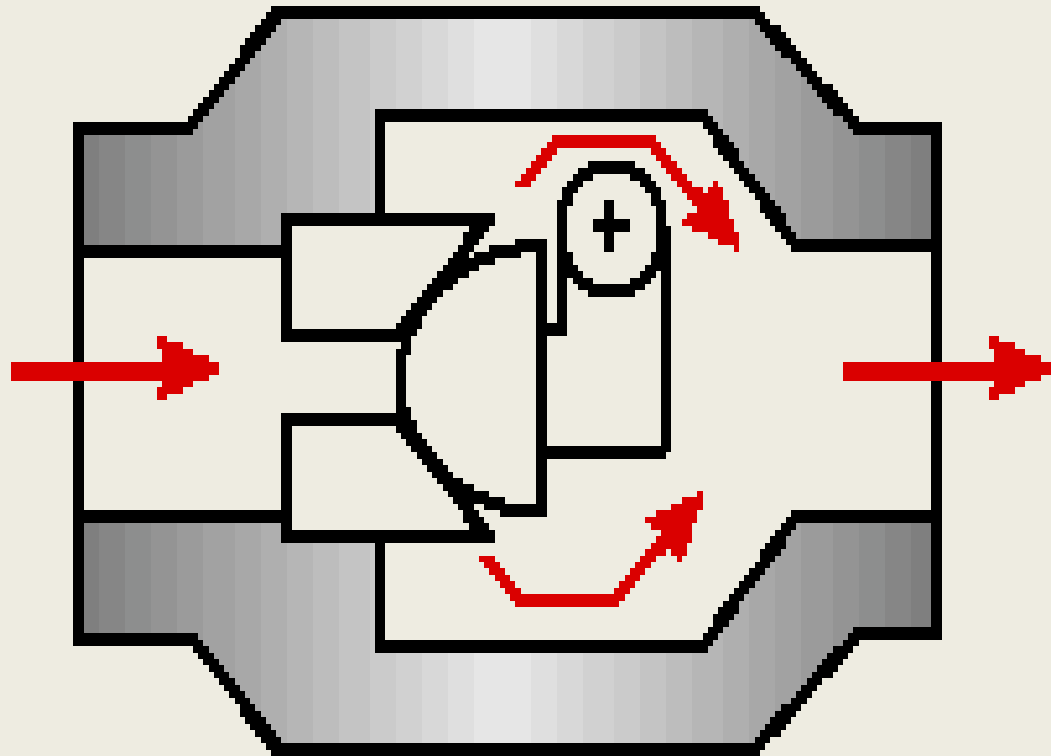
**LESS PACKING WEAR**

**CAN HANDLE SLURRY  
AND ABRASIVES**

**FLANGELESS**

**INTEGRAL BONNET**

**HIGH RANGEABILITY**





- **Linear movement valves -**

The obturator moves in a straight line. Included in this category are gate valves, globe valves, diaphragm valves and pinch valves. These valves are covered in greater depth within this tutorial.

Isolation Valves - Rotary Movement.

# **Rotary movement valves -**

The obturator rotates about an axis at right angles to the direction of flow. Ball valves and butterfly valves are the two most important rotary valves associated with steam applications and are covered in greater depth in Tutorial

# TYPES

## QUARTER TURN VALVES

BALL, PLUG, BUTTERFLY

## MULTI TURN VALVES

GLOBE, GATE

Self actuated

SWING CHECK, WAFERCECK, LIFT CHECK



# MULTI TURN VALVES

## **ADVANTAGES**

GRADUAL OPENING,  
REDUCES HAMMER EFFECT

## **DISADVANTAGES**

REQUIRES MORE TIME TO OPERATE

# QUARTER TURN

## **ADVANTAGES**

FASTER OPERATION

## **DISADVANTAGES**

DOWNSTREAM IS PRONE FOR HAMMER EFFECT

# Primary Selection parameters

Nature of media

Temperature

Pressure

Flow

**valve body material such as  
bronze, iron, steel,  
stainless steel and plastic.**

**The valve body may be  
produced with one material  
and the trim, may or may  
not be made of the same  
material.**

**Valve trim is exposed to flow media and may be made of a different material than the valve body. The trim is normally more corrosion resistant than the valve body, so that corrosion is less likely to occur at the valve seating area.**



**The valve is actually stated by the NPS of the valve end connection. You should know that NPS is the abbreviation for Nominal Pipe Size. It refers to the named size of the pipe. The NPS of the valve end connections must always match the NPS of the line in which it is to be installed.**

**Ductile iron valves can be used in applications that experience vibration and shock. Ductile iron absorbs shock and also has good corrosion resistance**

**No size limitations for iron valves, these valves have temperature limits. Cast iron has a temperature limit of approximately 450 F. and ductile iron has a limit of 650F.**

**Valves are also made of steel and stainless steel. Steel valves can be separated into two categories based on how the valve is made.**

**Forged steel and or cast steel.**

**Forged steel is formed from heated slugs, which are forged into the valve shape by huge forging hammers and presses. Cast steel is melted in a furnace and then poured into molds in a foundry.**

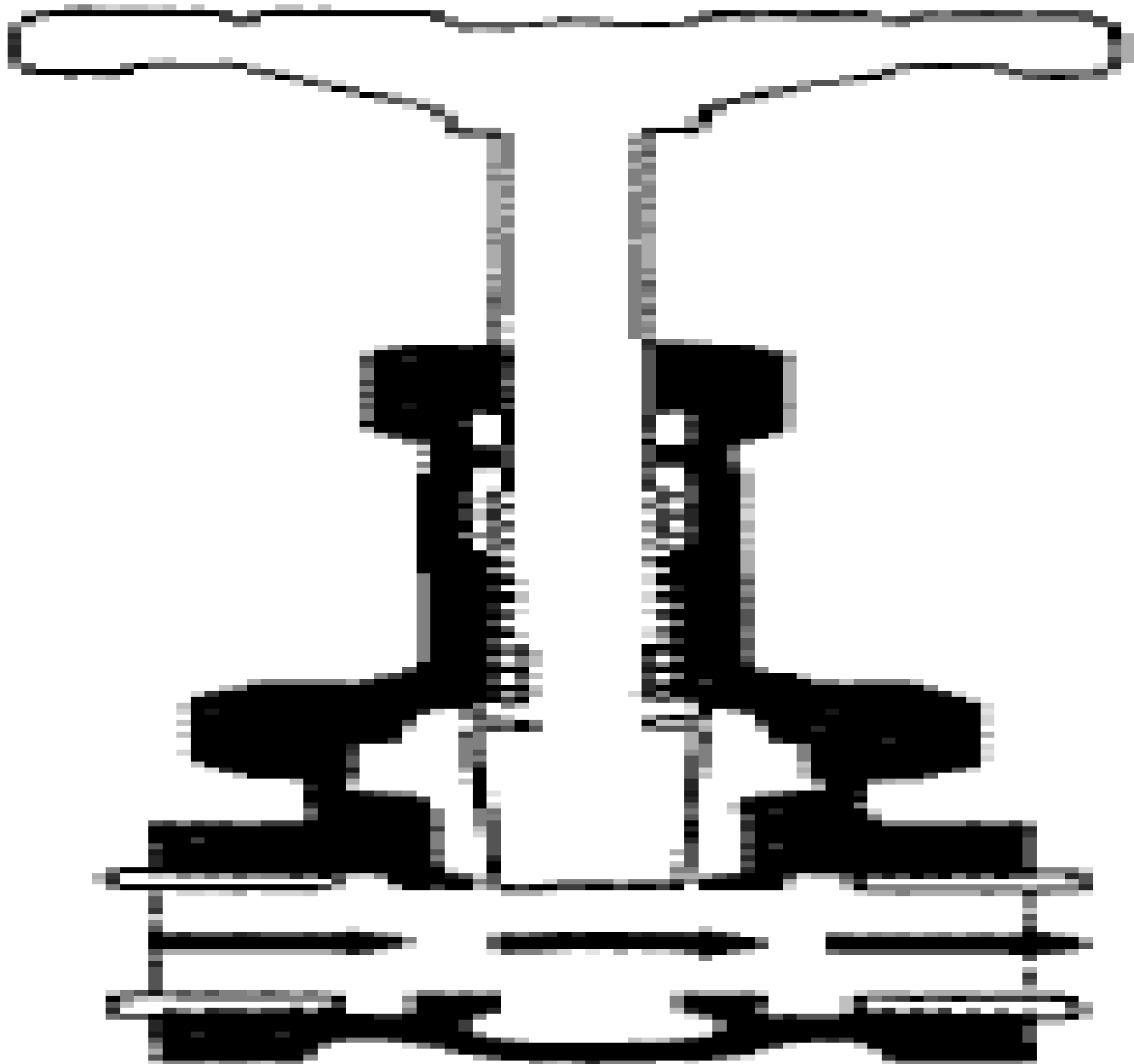


**Forged steel Valves are used when higher pressures and temperatures are involved and the line size is generally under 2-1/2". Other factors could also favor the selection of forged steel, such as system requirements for socket-weld piping and compatibility of media**

# GATE VALVE

The gate valve is a general service valve used primarily for on--off, The valve is closed by a flat face, vertical disc, or gate that slides down through the valve to block the flow.







# Material

Gun Metal

Cast Iron

Cast Steel

Stainless Steel

Alloy Steel

Connection End

Screwed

Flanged

Usage

Water

Chemicals

steam

Sizes

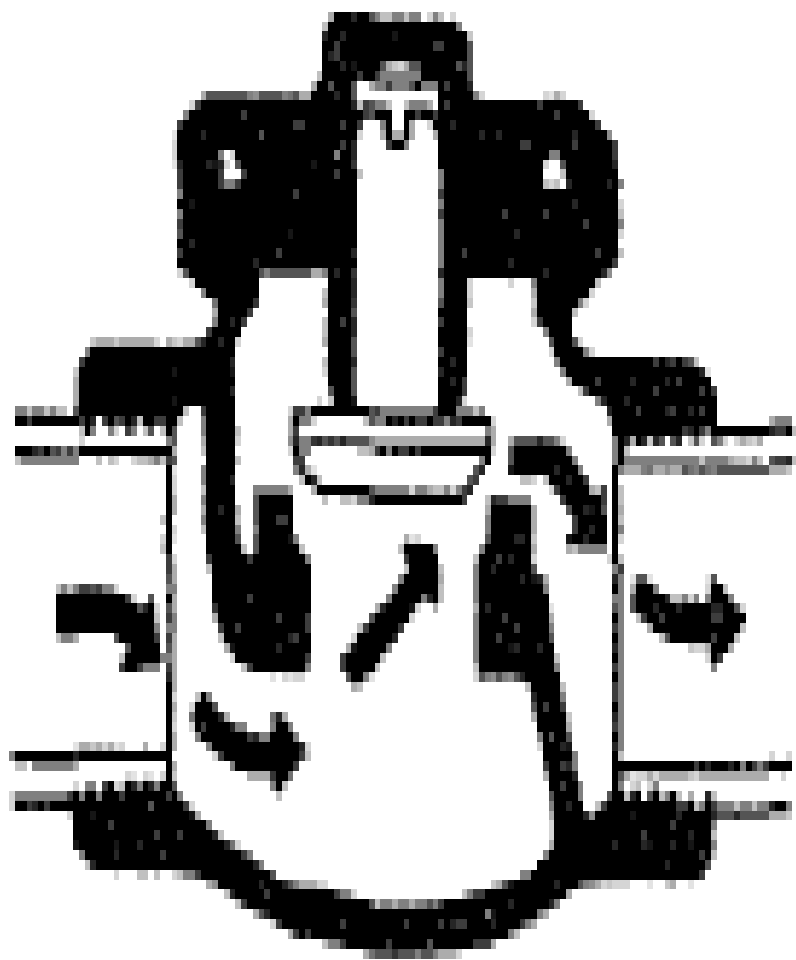
3/8" to 12"

## CHECK VALVE

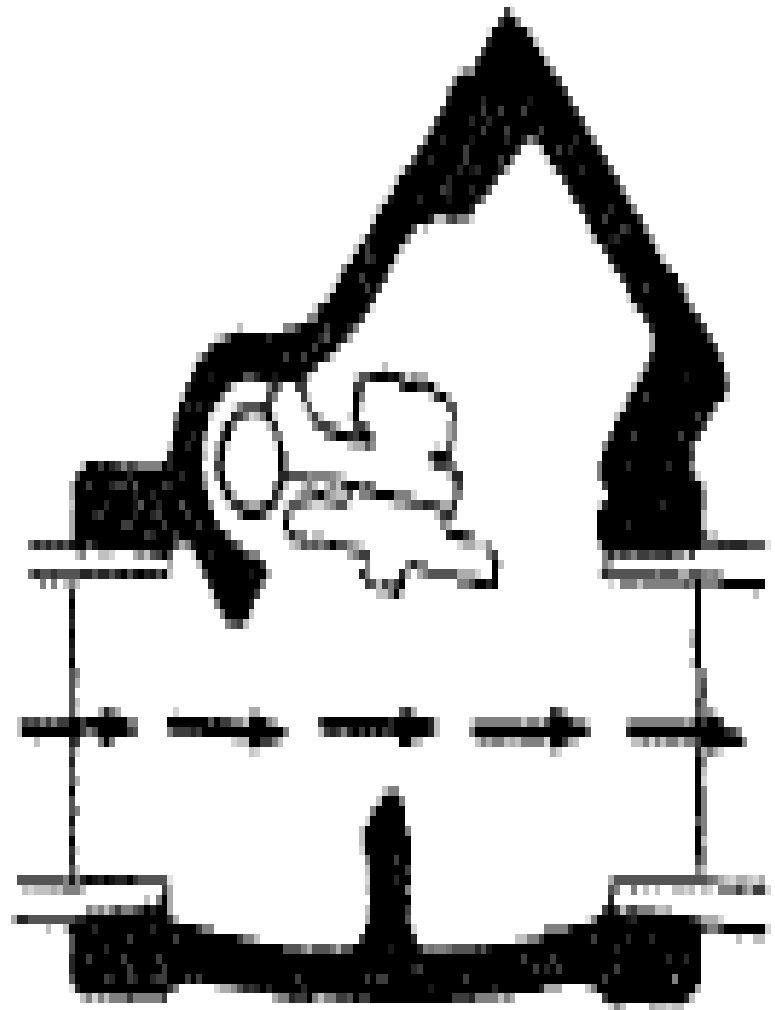
The check valve is designed to prevent backflow. Fluid flow in the desired direction opens the valve, while backflow forces the valve closed.







*HORIZONTAL  
LIFT CHECK*



*SWING CHECK*

# Material

Gun Metal

Cast Iron

Cast Steel

Stainless Steel

Alloy Steel

Connection End

Screwed

Flanged

Usage

Water

Chemicals

Sizes

3/8" to 12"

## BALL VALVE

The ball valve uses a rotating ball with a hole through it that allows straight-through flow in the open position and shuts off flow when the ball is rotated 90 degrees to block the flow passage.







# Material

Gun Metal

Cast Iron

Cast Steel

Stainless Steel

Alloy Steel

Polypropylene

# End Connection

Screwed

Flanged

Socket Weld

Usage

Water

Chemicals

Steam

Sizes

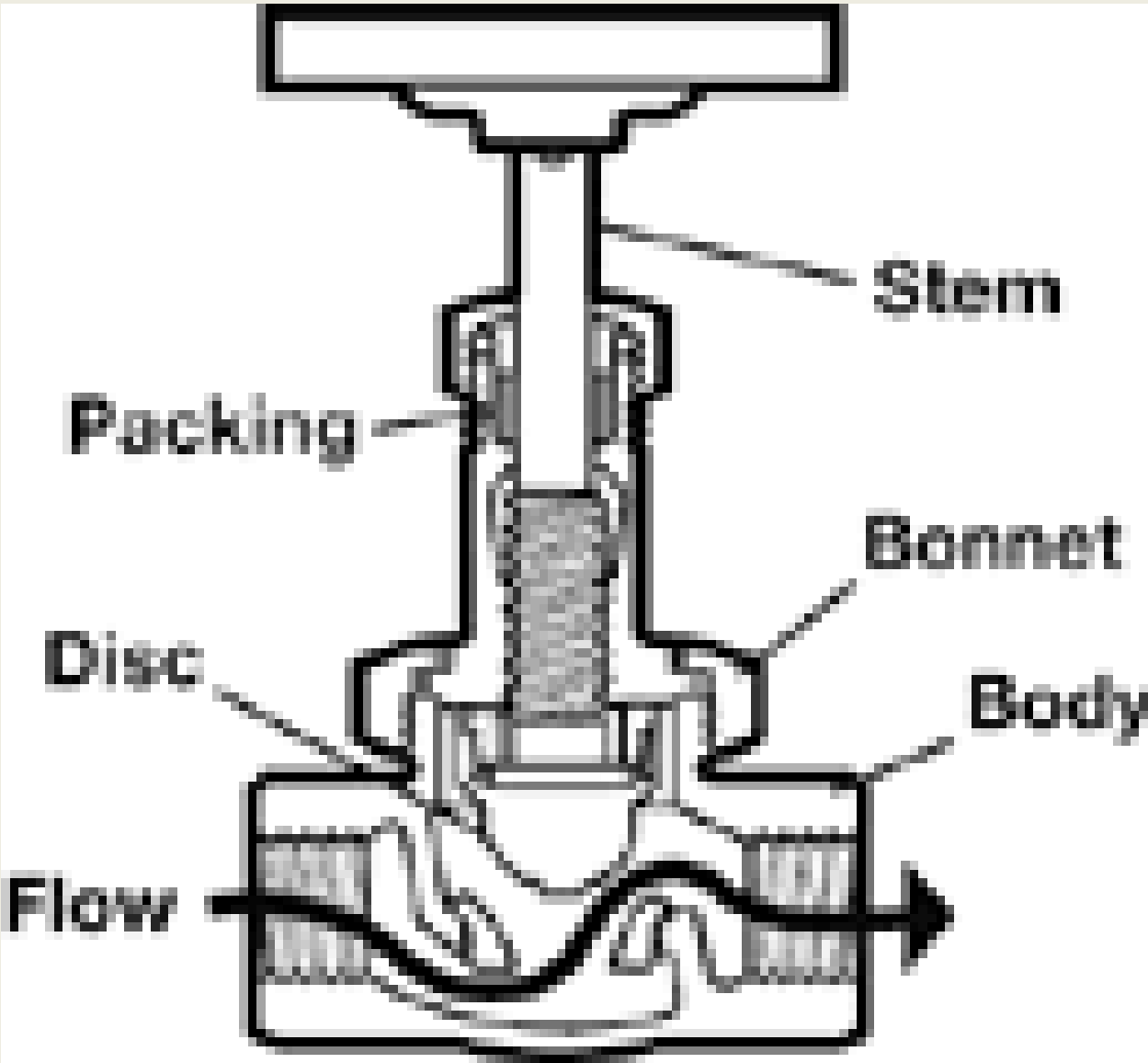
$\frac{1}{4}$ " to 6"



# GLOBE VALVE

The globe valve effects closure by a plug with a flat or convex bottom lowered onto a matching horizontal seat located in the center of the valve. Raising the plug opens the valve, allowing Service media flow.





Connection End

Screwed

Flanged

Usage

Water

Chemicals

Steam

Sizes

3/8" to 12"

# Material

Cast Iron

Cast Steel

Stainless Steel

Alloy steel





**C.R.I. VALVES**



# BUTTERFLY VALVES

The butterfly valve controls flow by using a circular disc with its pivot axis at right angles to the direction of flow in the pipe.

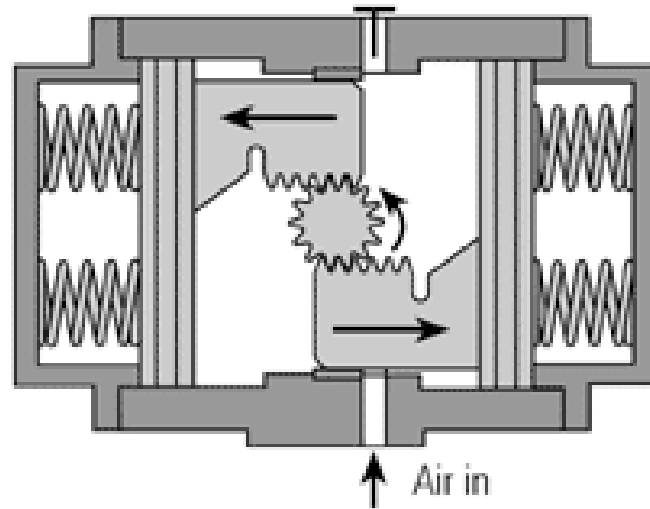
# Actuators

A manual actuator employs levers, gears to facilitate movement; automatic actuator has an external power source to provide the force to operate a valve Power actuators are a necessity on valves in pipelines located in remote areas

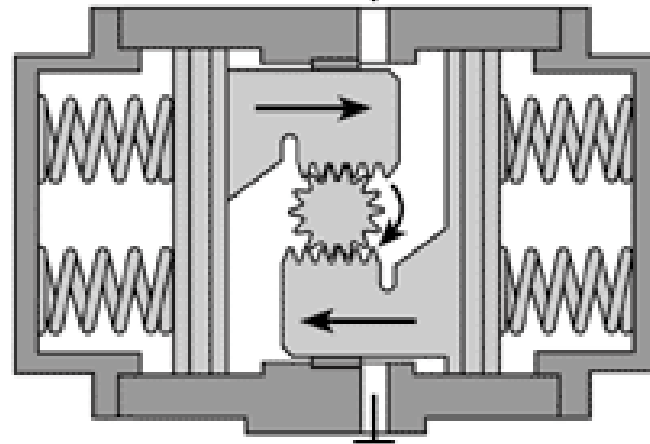
**a**

**Anticlockwise**

Air is supplied forcing the pistons away from each other (towards the ends), rotating the drive pinion anticlockwise.



Air out



**b**

**Clockwise**

Air failure (loss of pressure) allows compressed springs to force pistons towards each other (toward centre), rotating the drive pinion clockwise and exhausting the air.





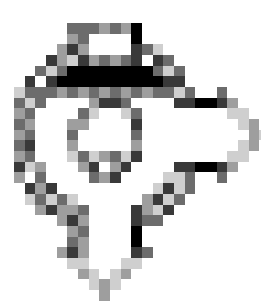
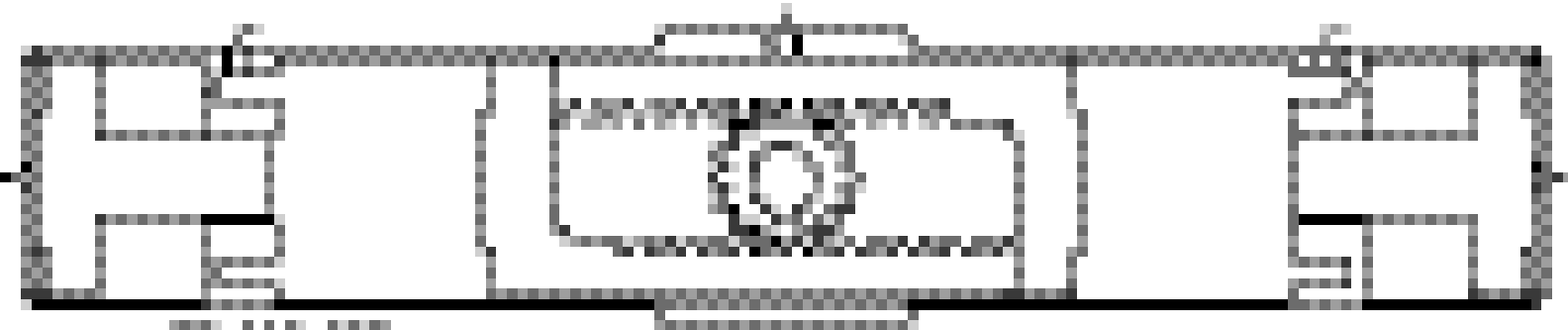
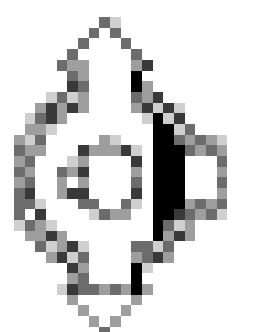
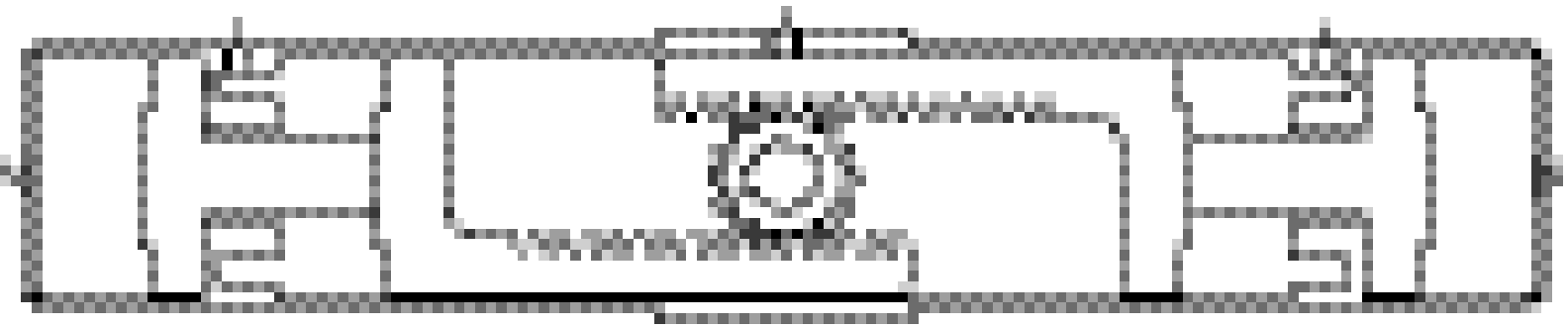
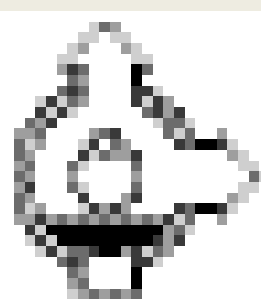
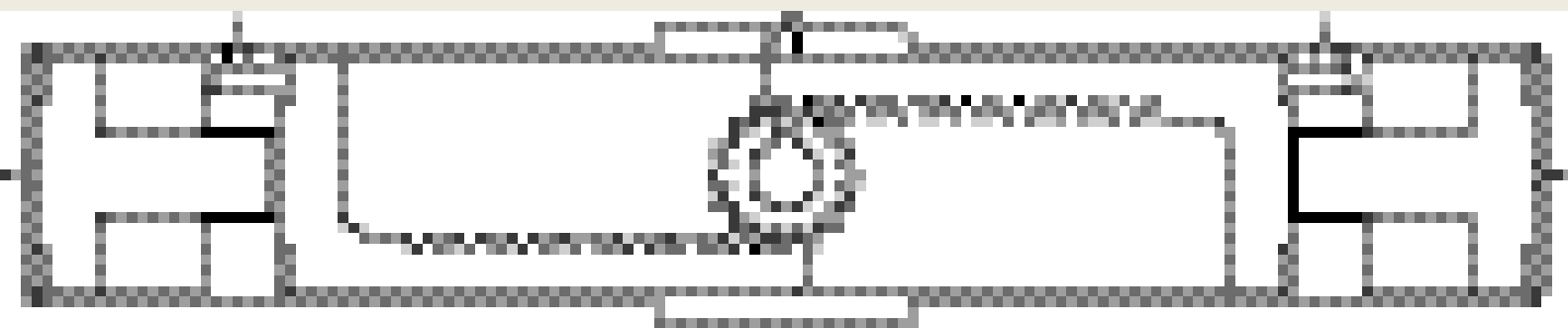


图 418-138



Connection End

Wafer

Flanged

Usage

Water

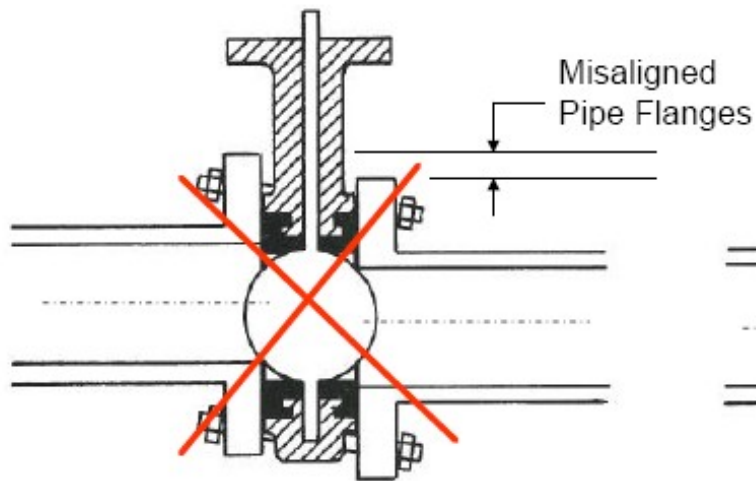
Chemicals

Sizes

1/2" to 12"

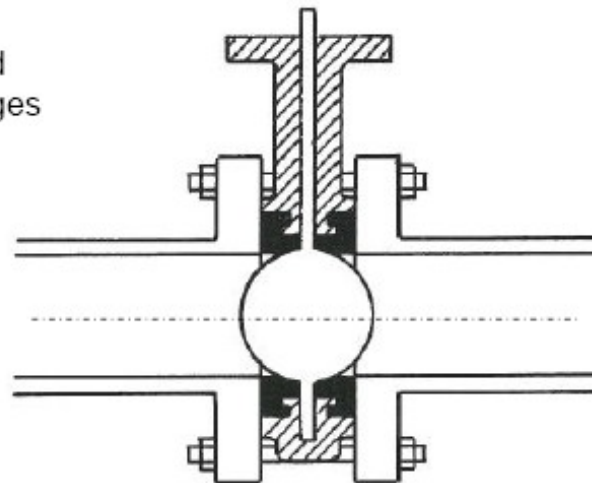
## Installation

### Pipe Flange Connections



#### **Incorrect installation!**

*Pipe flanges are misaligned.  
Butterfly disc edge will hit pipe flange  
Resulting in valve damage and leakage.*



#### **Correct Installation**

*Pipe flanges are aligned and centered.*

# ADVANTAGES

Functional design

Smaller space requirement

Excellent flow characteristics

High grade safety



# FEATURES

Replaceable /Bonded seat.

Square coupling between stem/disc.

Self lubricating bearings.

Machined disc to reduce the operating torque.

Easy disassembling

# RANGE

PRESSURE RATING PN10/PN16

SIZE RANGE : 40mm  
600mm

OPERATION : HAND  
LEVER  
: WORM  
GEAR

:

ACTUATOR

# M O C

BODY

CASTIRON

DISC

DUCTILE

IRON/S.S

SEAL

E.P.D.M/Nitrile

SHAFT

AISI 410



Valves are the devices which will  
controls

Flow

Pressure

Direction.**a**

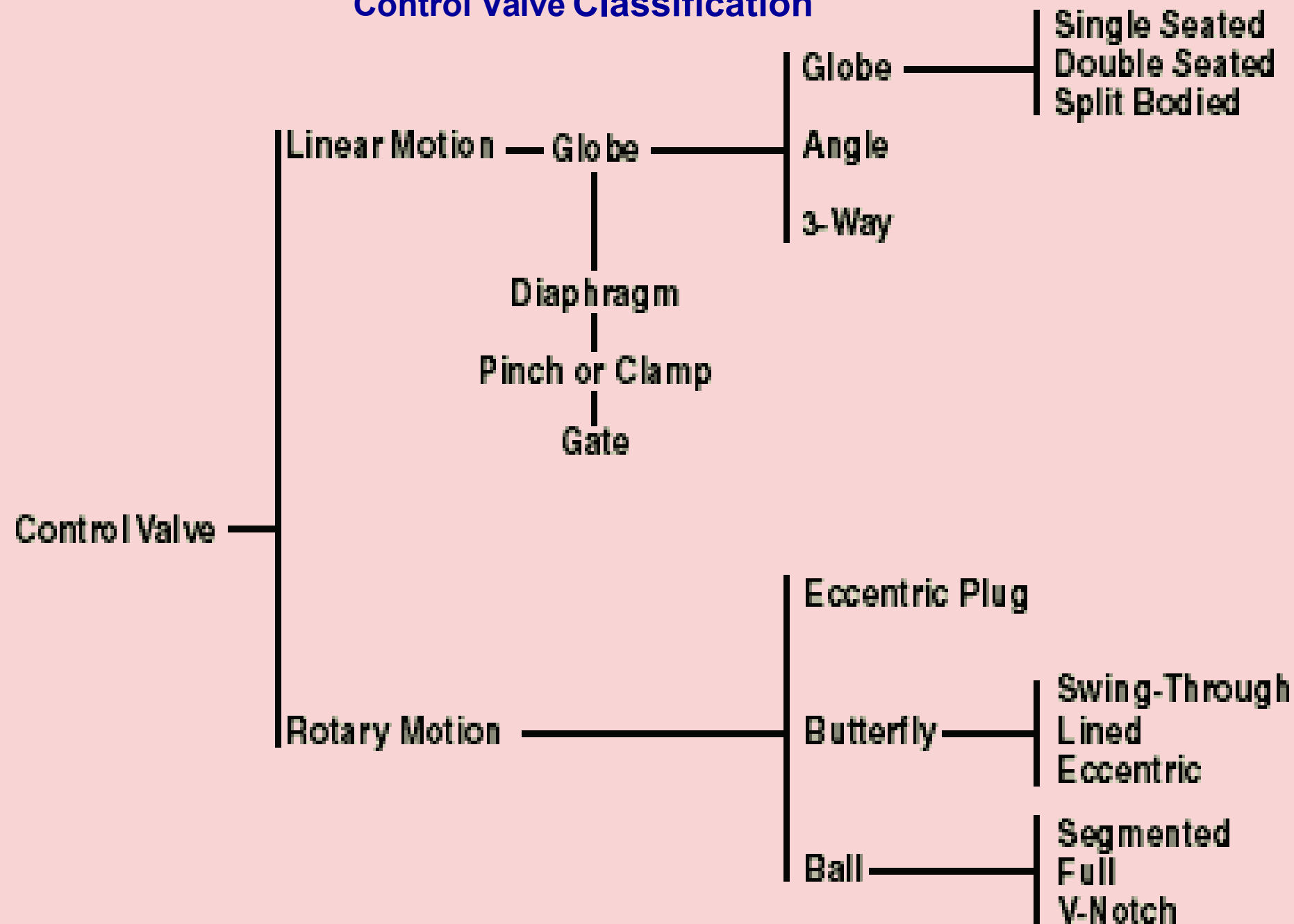


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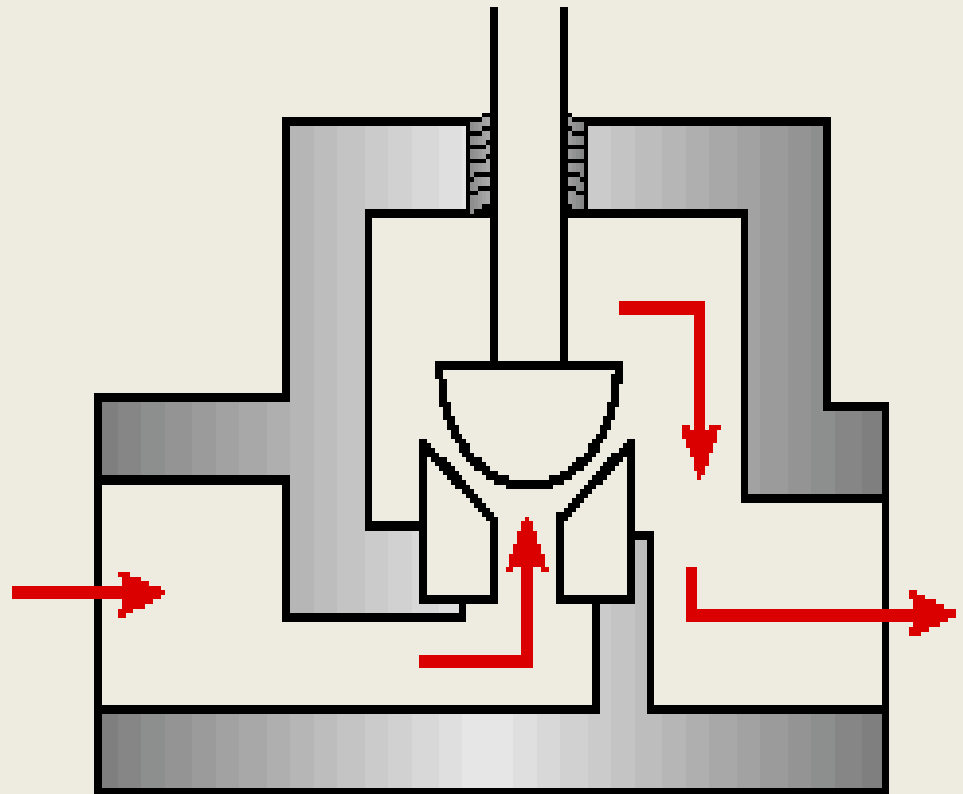
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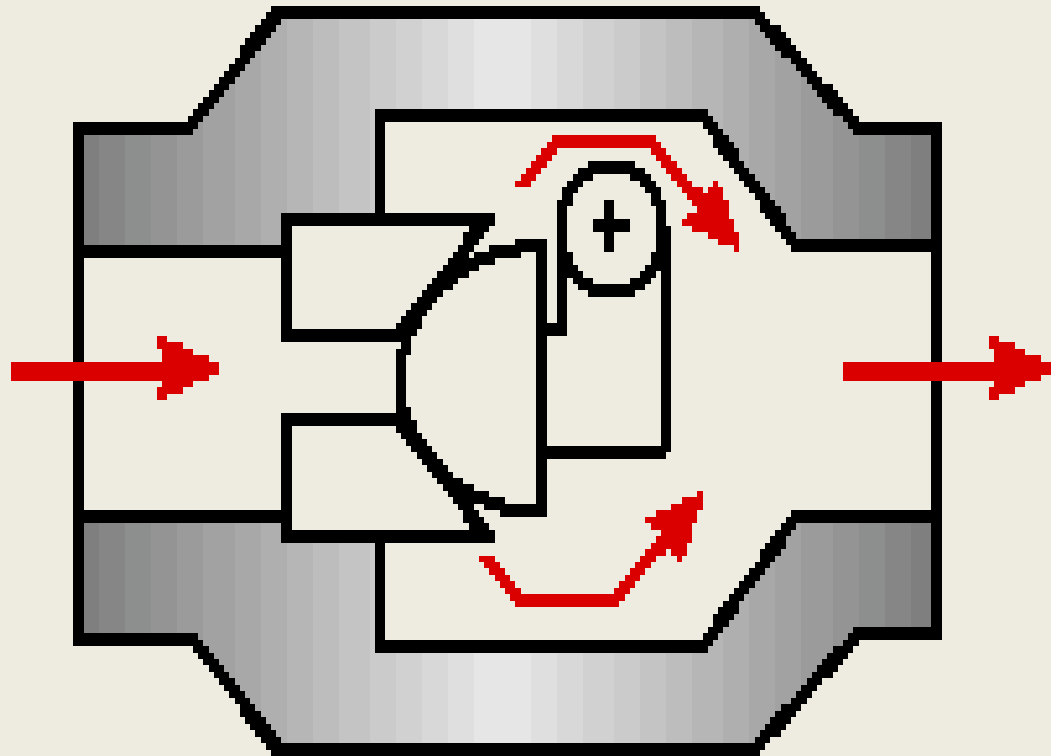
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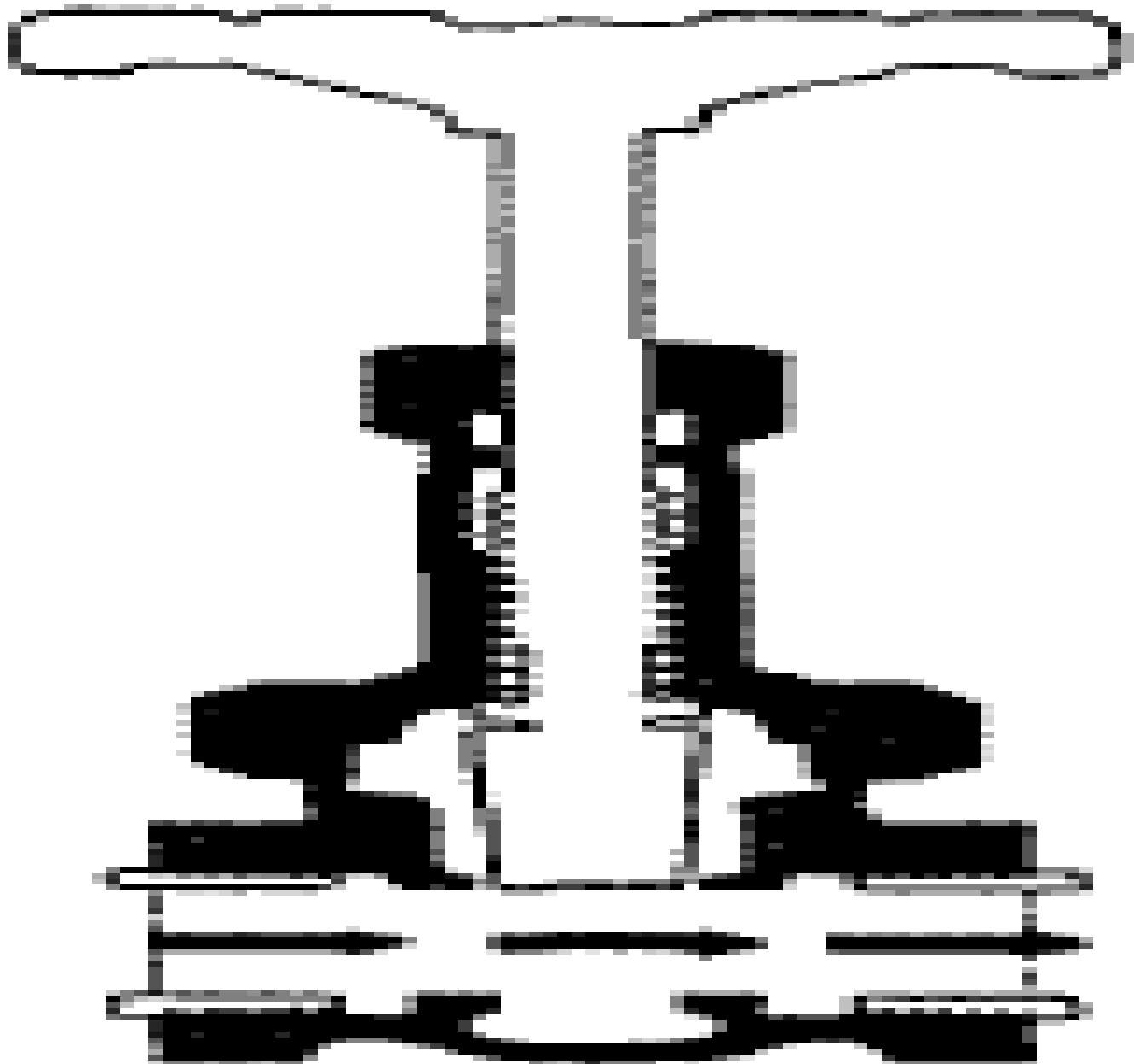
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Alloy Steel

Connection End

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Flanged

Usage

Water

Chemicals

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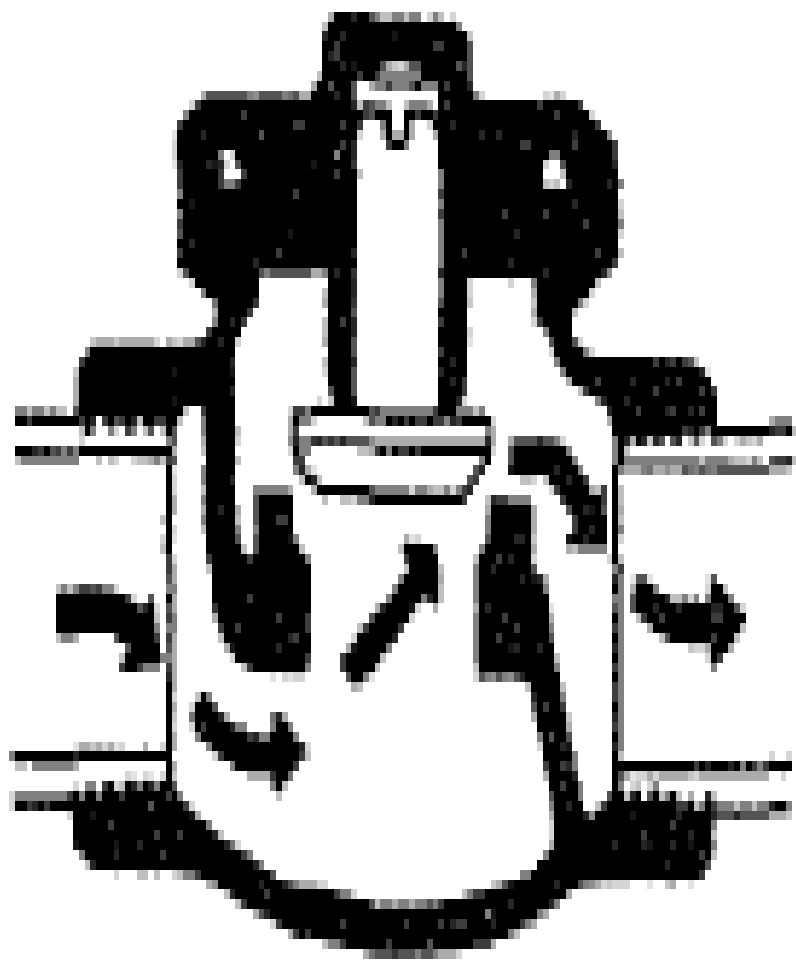
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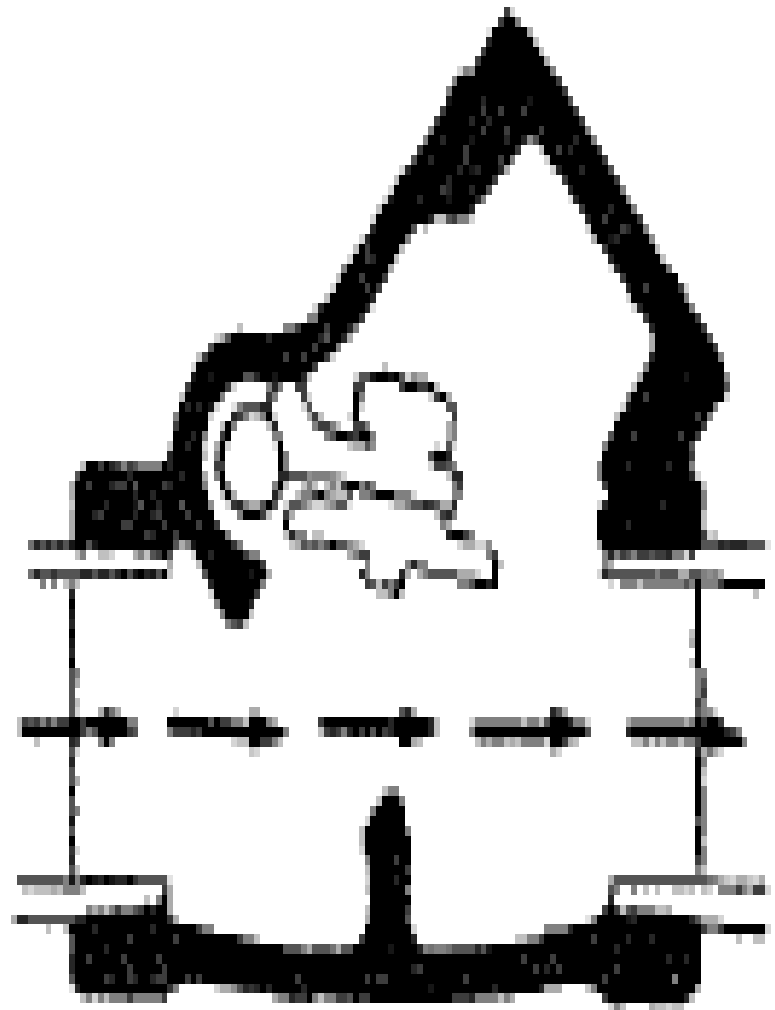
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*HORIZONTAL  
LIFT CHECK*



*SWING CHECK*



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Connection End

Screwed

Flanged

Usage

Water

Chemicals

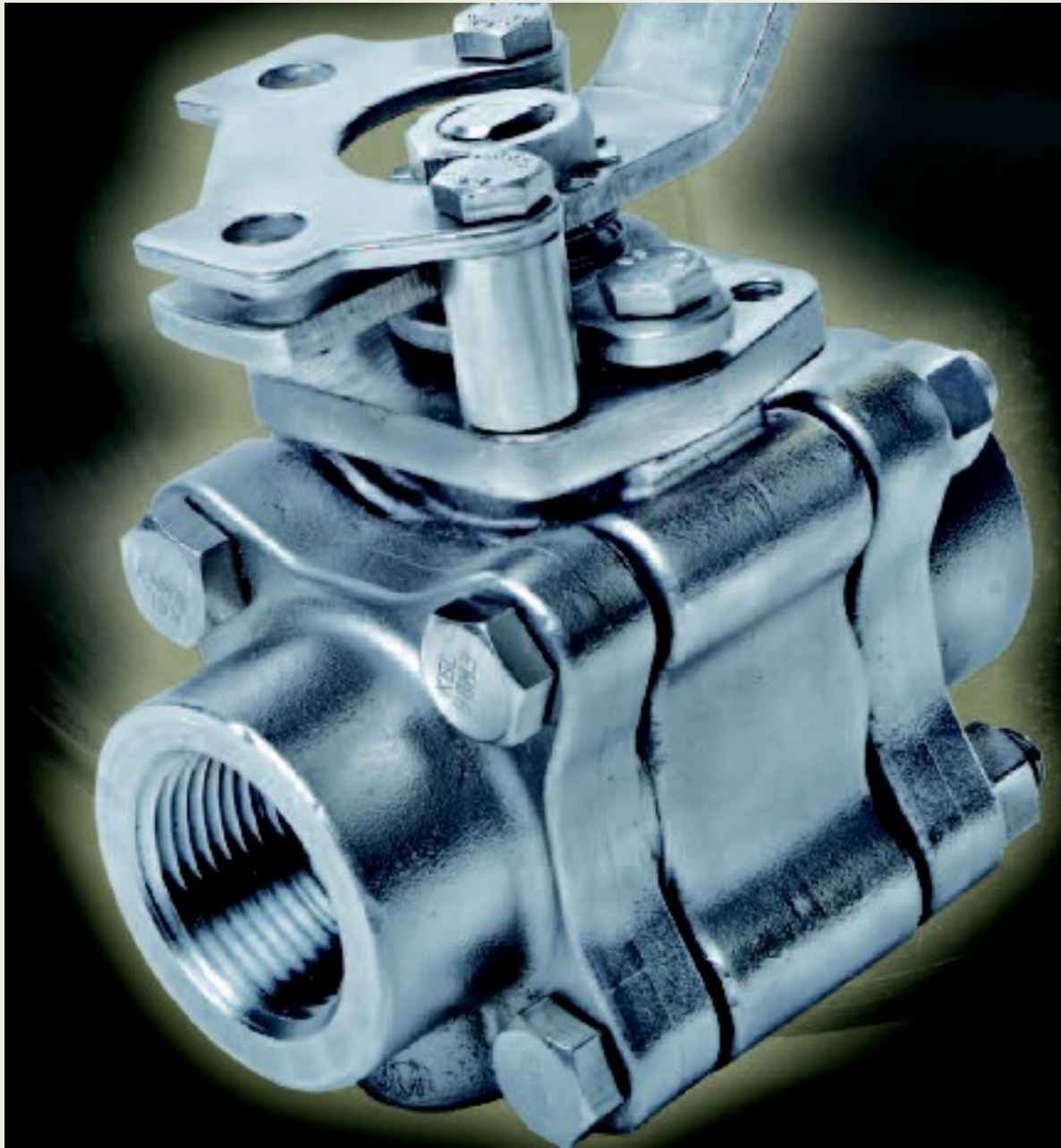
Sizes

3/8" to 12"

## BALL VALVE

The ball valve uses a rotating ball with a hole through it that allows straight-through flow in the open position and shuts off flow when the ball is rotated 90 degrees to block the flow passage.





# Material

Gun Metal

Cast Iron

Cast Steel

Stainless Steel

Alloy Steel

Polypropylene



# End Connection

Screwed

Flanged

Socket Weld

Usage

Water

Chemicals

Steam

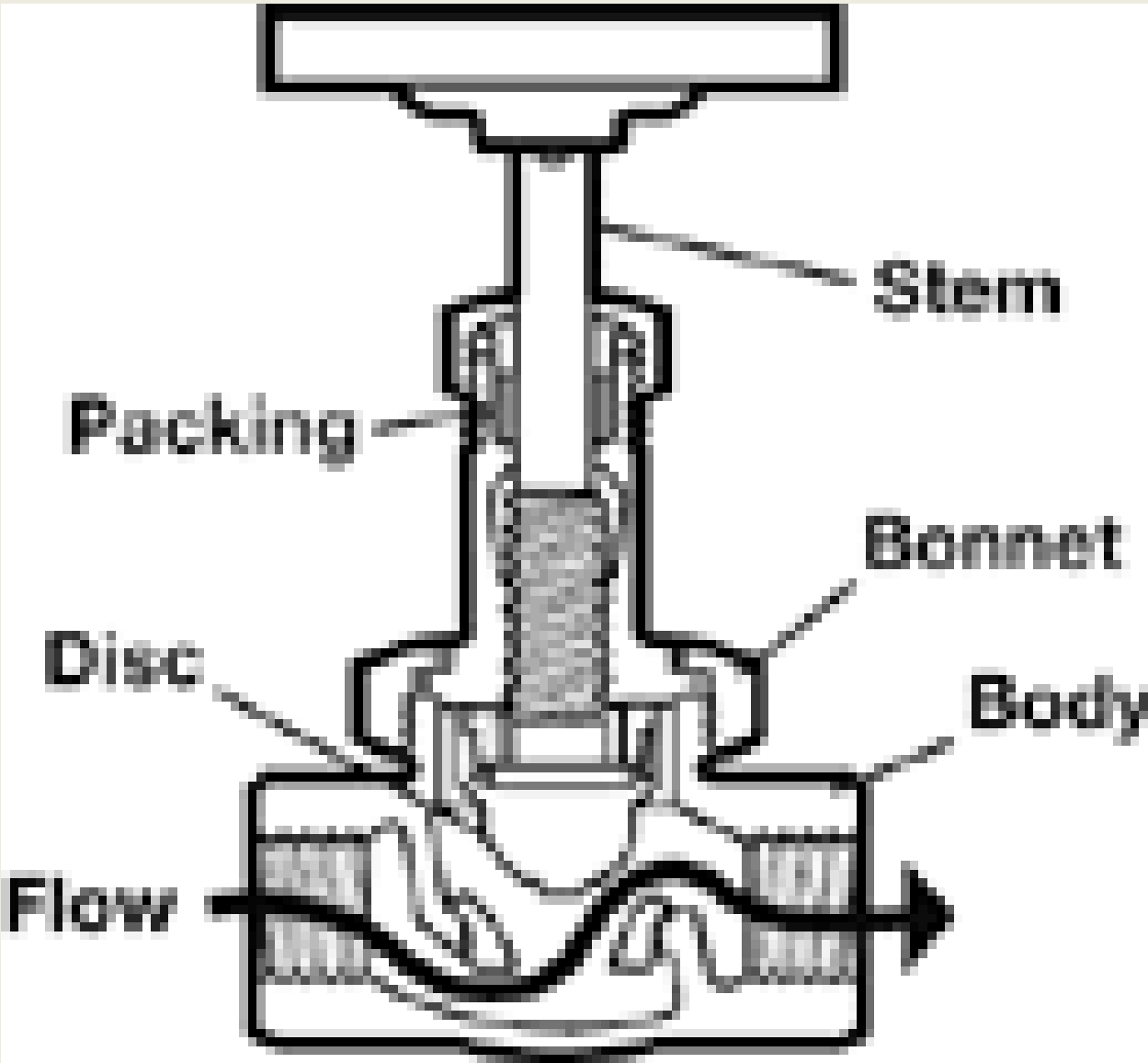
Sizes

$\frac{1}{4}$ " to 6"

# GLOBE VALVE

The globe valve effects closure by a plug with a flat or convex bottom lowered onto a matching horizontal seat located in the center of the valve. Raising the plug opens the valve, allowing Service media flow.





Connection End

Screwed

Flanged

Usage

Water

Chemicals

Steam

Sizes

3/8" to 12"

# Material

Cast Iron

Cast Steel

Stainless Steel

Alloy steel





**C.R.I. VALVES**



# BUTTERFLY VALVES

The butterfly valve controls flow by using a circular disc with its pivot axis at right angles to the direction of flow in the pipe.

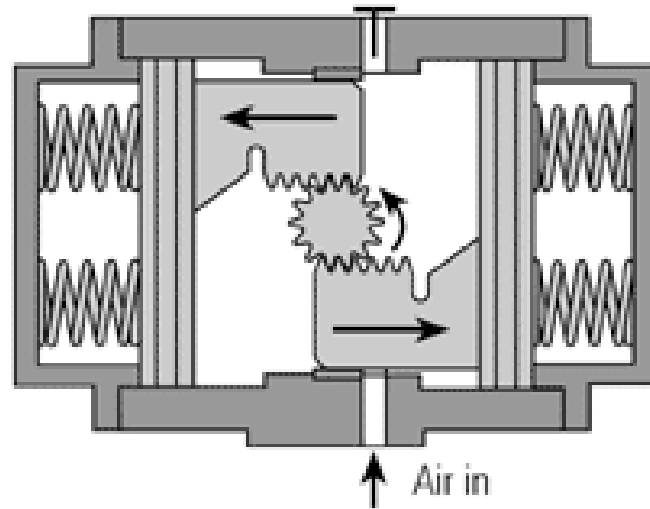
# Actuators

A manual actuator employs levers, gears to facilitate movement; automatic actuator has an external power source to provide the force to operate a valve Power actuators are a necessity on valves in pipelines located in remote areas

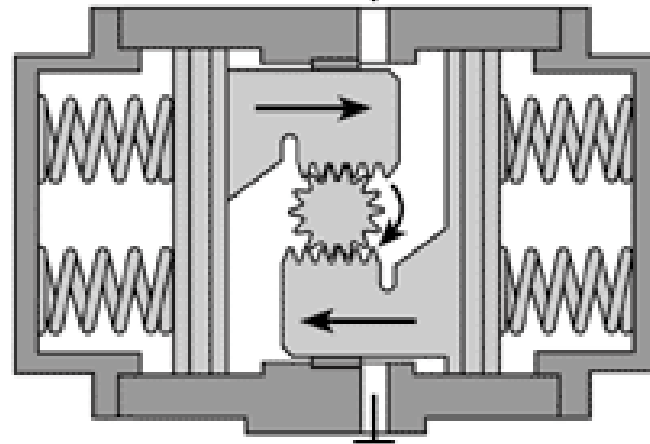
**a**

**Anticlockwise**

Air is supplied forcing the pistons away from each other (towards the ends), rotating the drive pinion anticlockwise.



Air out



**b**

**Clockwise**

Air failure (loss of pressure) allows compressed springs to force pistons towards each other (toward centre), rotating the drive pinion clockwise and exhausting the air.



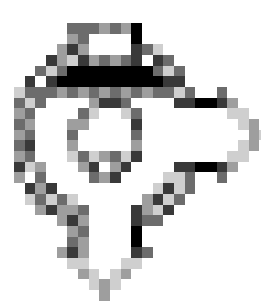
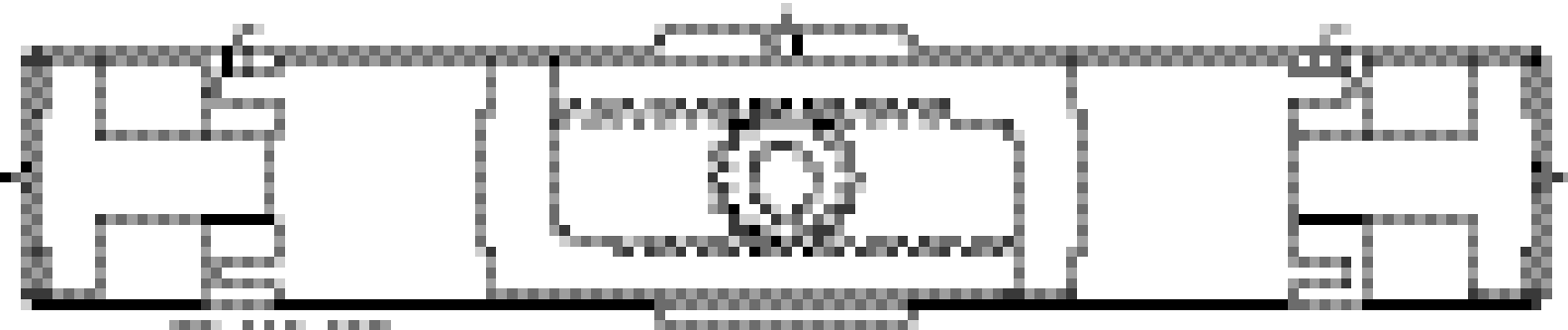
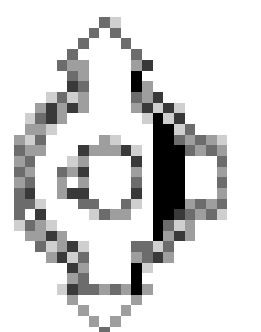
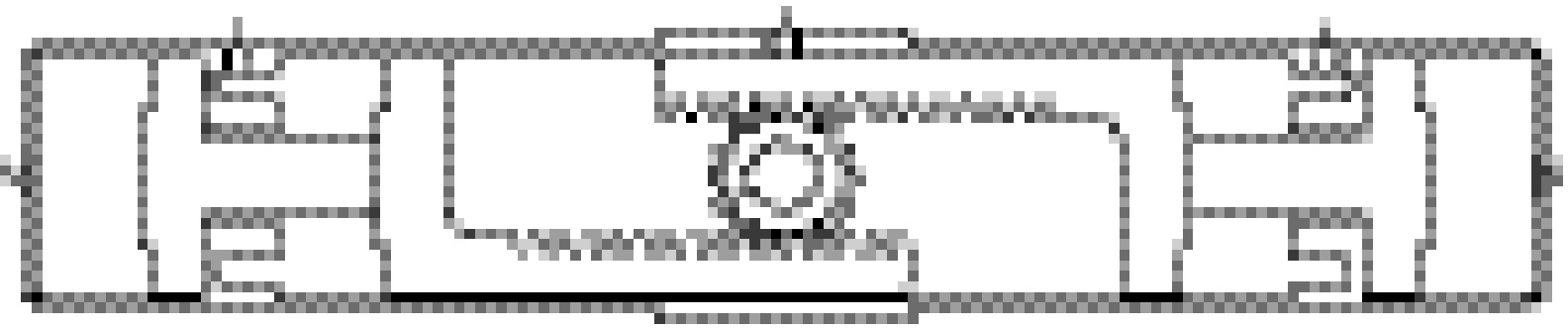
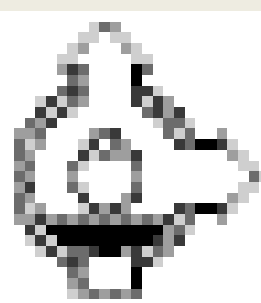
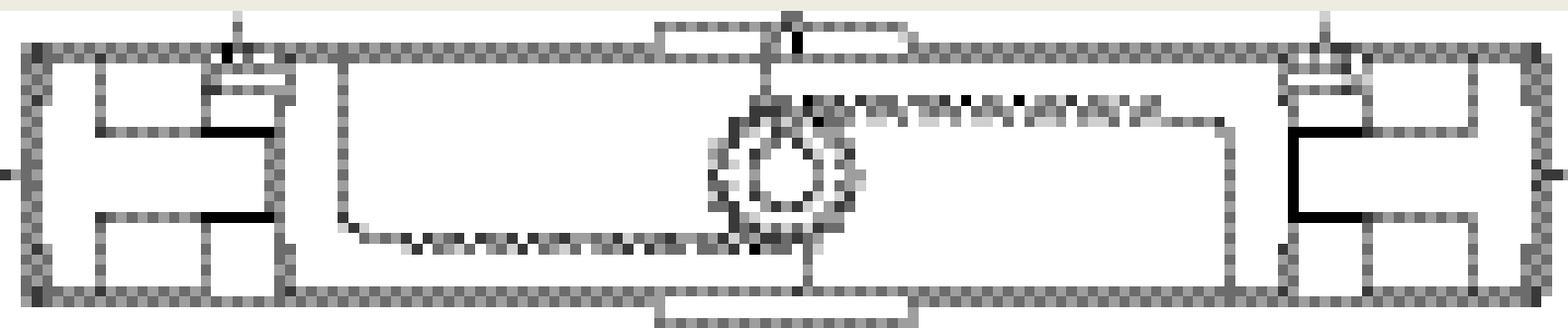


图 418-138





Connection End

Wafer

Flanged

Usage

Water

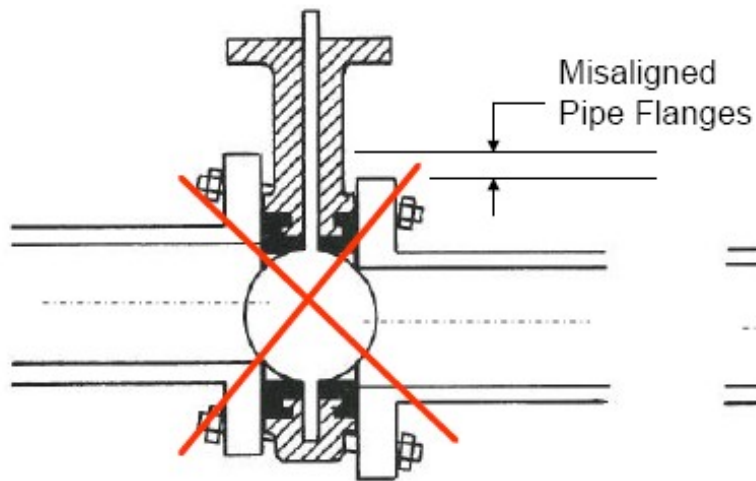
Chemicals

Sizes

$\frac{1}{2}$ " to 12"

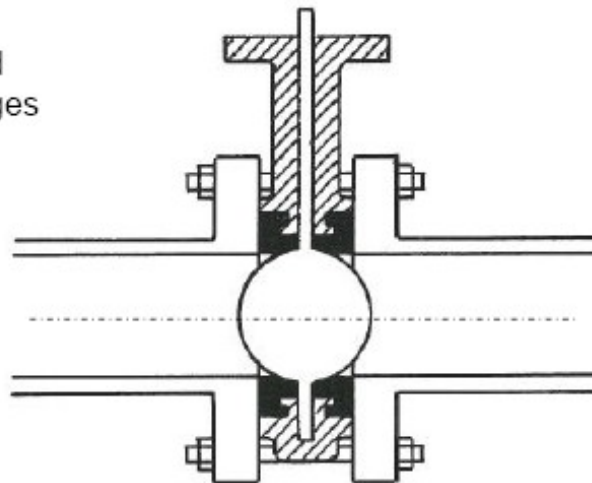
## Installation

### Pipe Flange Connections



#### **Incorrect installation!**

*Pipe flanges are misaligned.  
Butterfly disc edge will hit pipe flange  
Resulting in valve damage and leakage.*



#### **Correct Installation**

*Pipe flanges are aligned and centered.*

# ADVANTAGES

Functional design

Smaller space requirement

Excellent flow characteristics

High grade safety

# FEATURES

Replaceable /Bonded seat.

Square coupling between stem/disc.

Self lubricating bearings.

Machined disc to reduce the operating torque.

Easy disassembling

# RANGE

PRESSURE RATING PN10/PN16

SIZE RANGE : 40mm  
600mm

OPERATION : HAND  
LEVER  
: WORM  
GEAR

:

ACTUATOR

# M O C

BODY

CASTIRON

DISC

DUCTILE

IRON/S.S

SEAL

E.P.D.M/Nitrile

SHAFT

AISI 410



10 10:47AM



















20 11:44AM





































