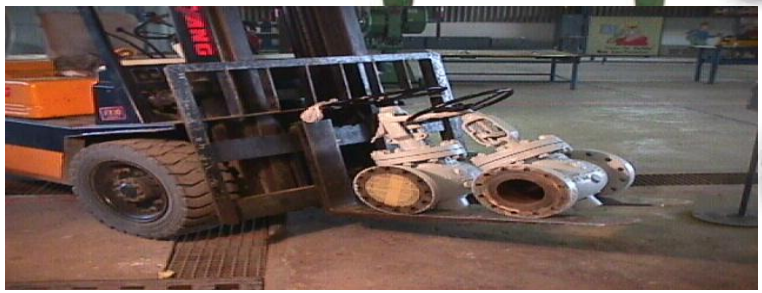
VALVES



MUDASSAR AZAM

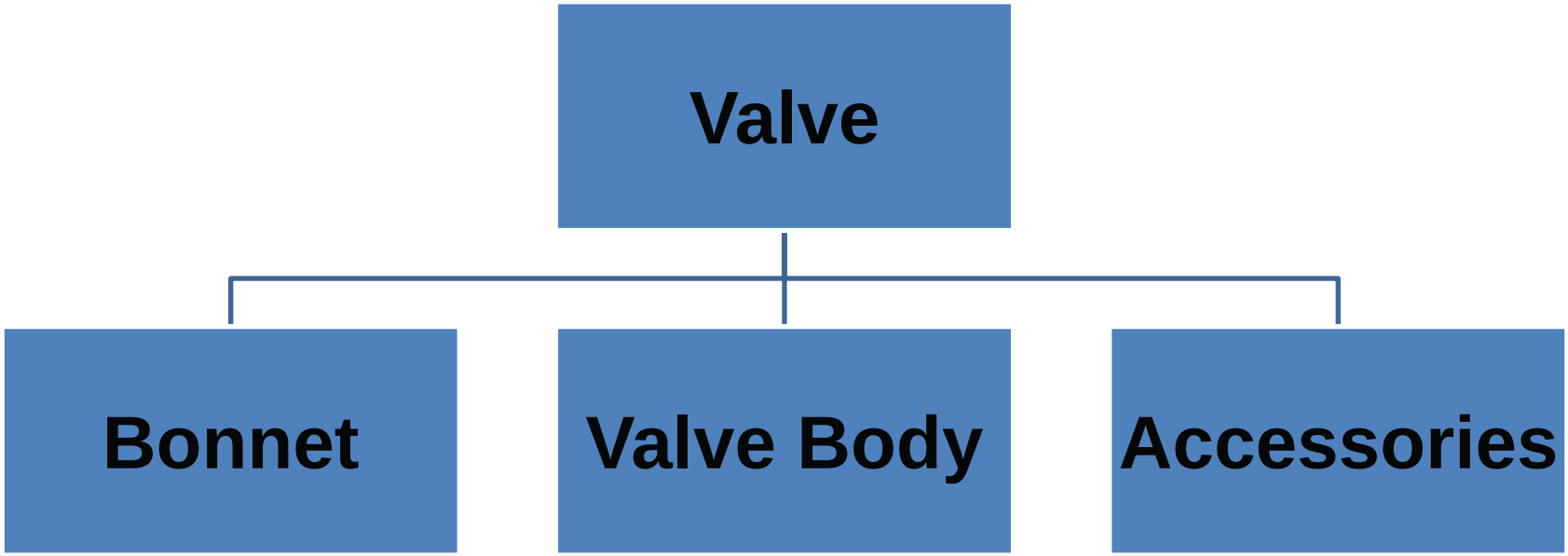
Contents

- Introduction
- Terminologies
- Types of Control Valves
- Valves Components
- Valves selection

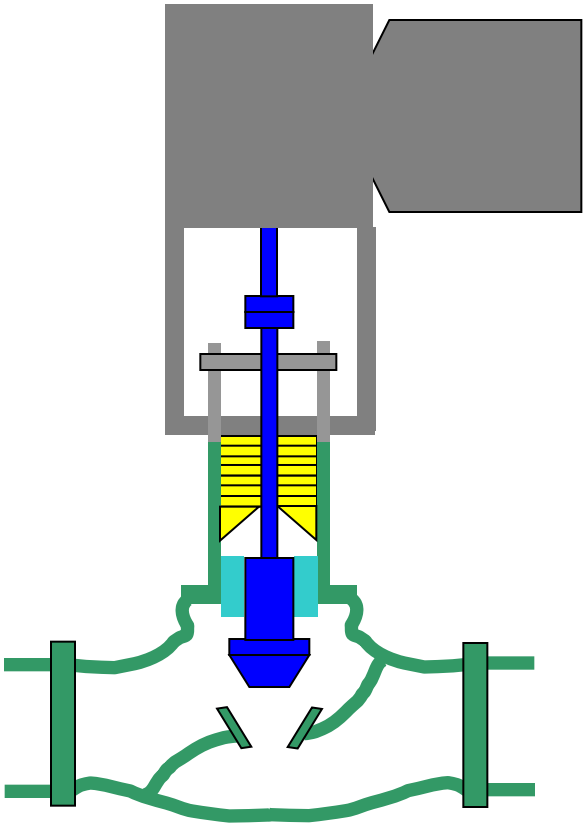
Valve

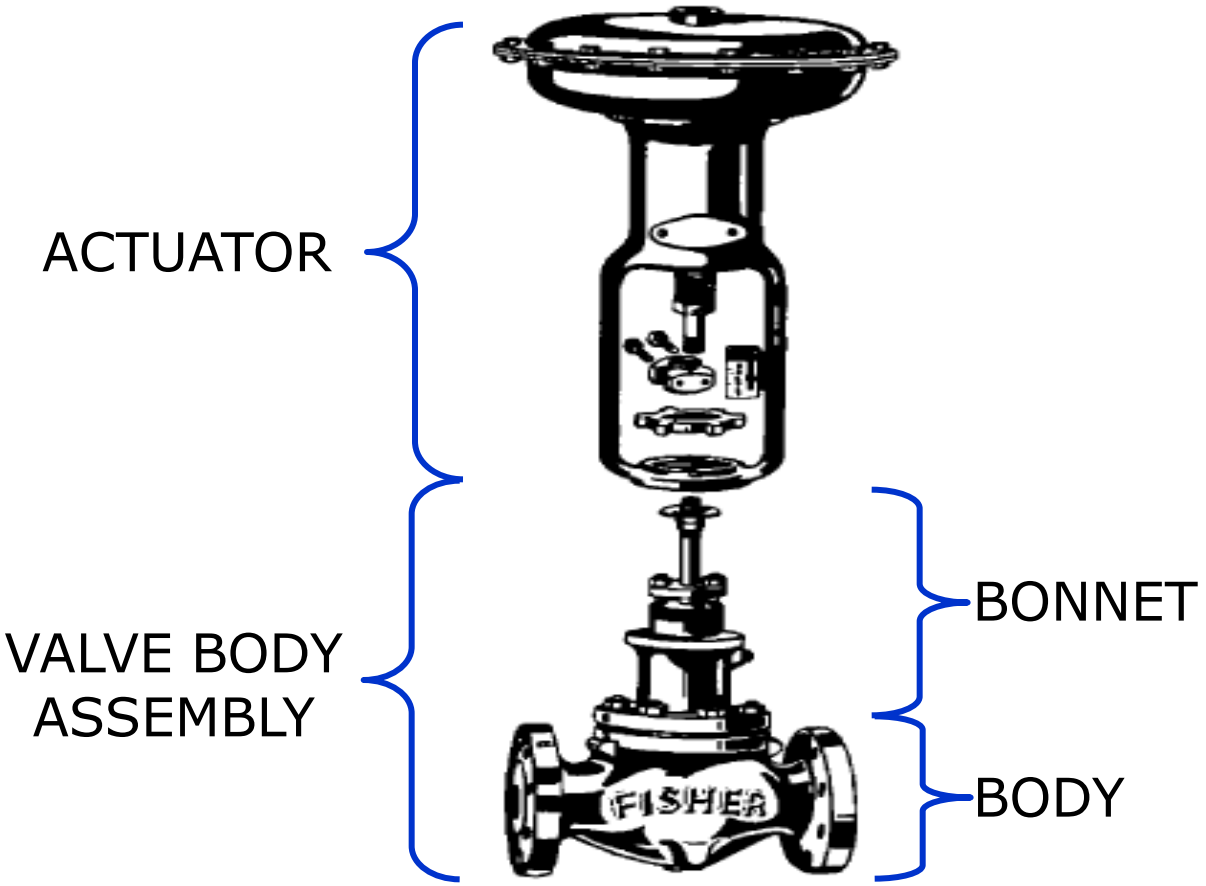
- Valve plays a very important part in industries.
- It controls and distributes pressure, flow, level, temperature etc.
- valve may be considered the MUSCLE of automatic control.

Major Section of valve



Control Valve





Classification of Valve

Type

- VS Gate Valve
- VD Globe Valve
- VR Plug Valve
- VB Ball Valve
- VDR Check Valve

Category

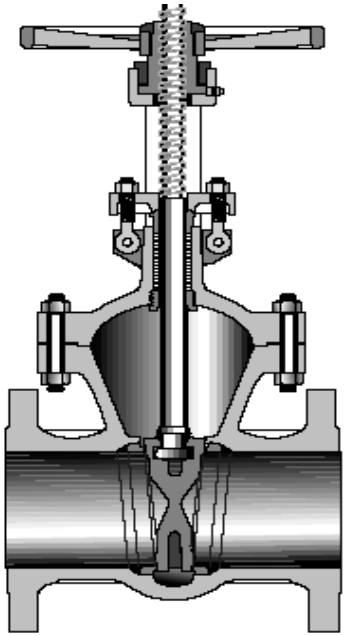
- VS BW or Flanged
- VS SW or Threaded
- VD BW or Flanged
- VD SW or threaded
- VR or VB BW or Flanged
- VR or VB SW or threaded
- VDR BW or Flanged
- VDR BW or Threaded

STANDARD ABBREVIATIONS

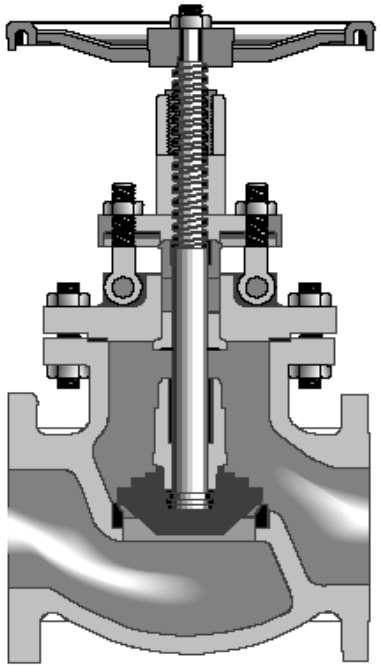
- IPS: IRON PIPE SIZE
- ISNRS: INSIDE SCREW NON-RISING STEM
- ISRS: INSIDE SCREW RISING STEM
- NRS: NON-RISING STEM
- RS: RISING STEM
- SIB: SCREWED BONNET
- SW: SOLID WEDGE

Types of Valves

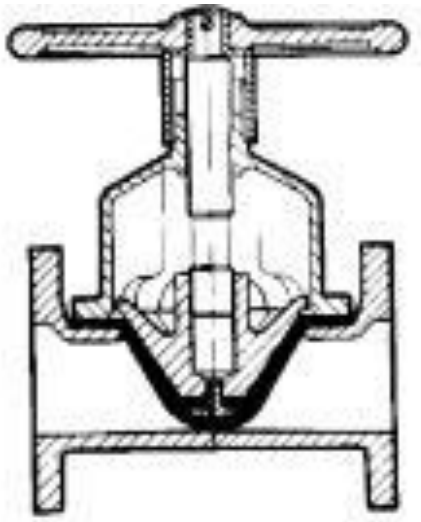
BASIC TYPES OF VALVES



GATE VALVE



GLOBE VALVE

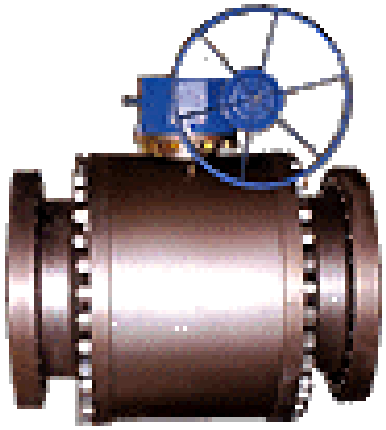


DIAPHRAGM VALVE

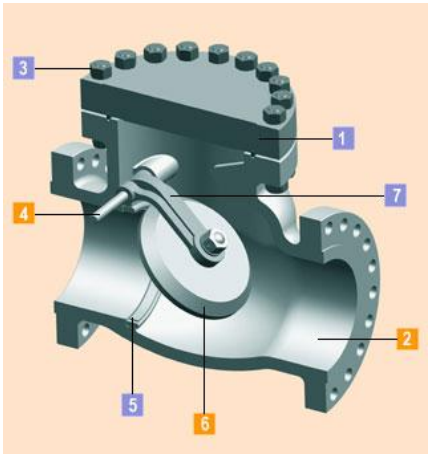
BASIC TYPES OF VALVES (Cond.)

PISTON VALVES

BUTTERFLY VALVE

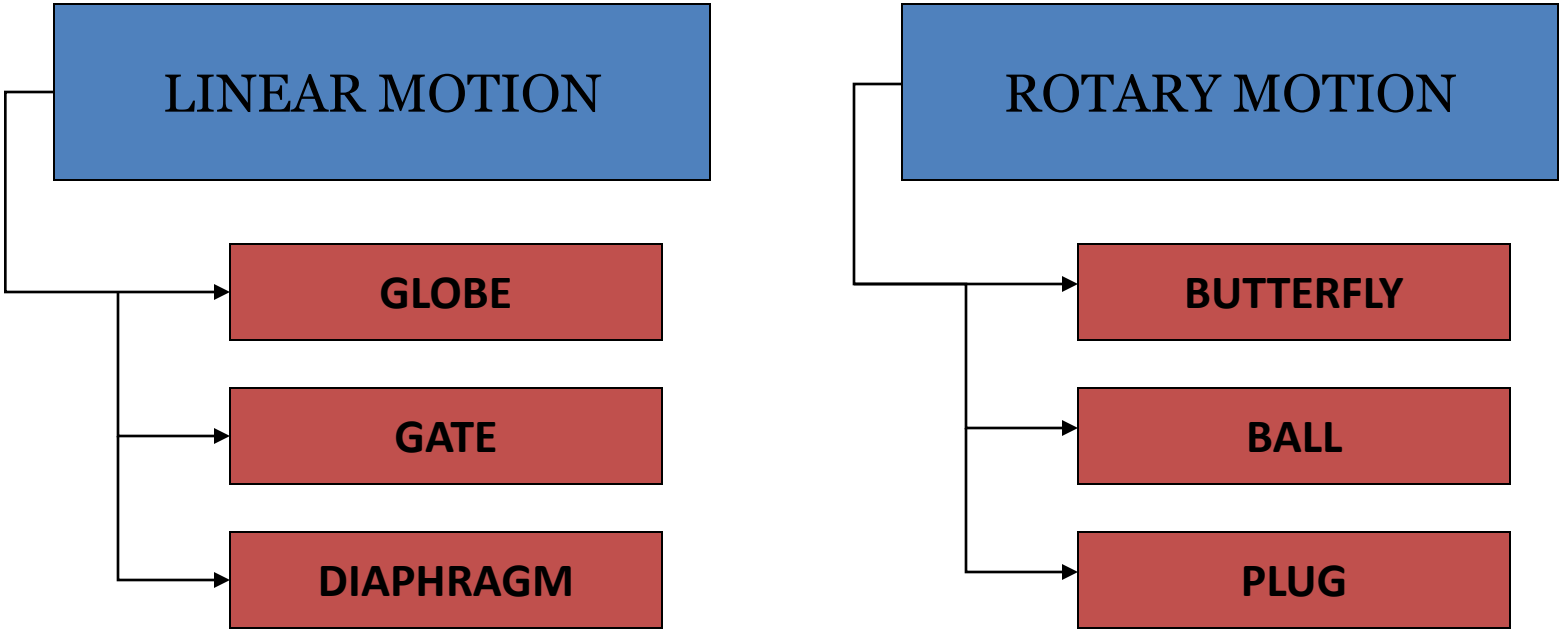


BALL VALVE



CHECK VALVE

Valve Types


LINEAR MOTION
GLOBE
GATE
DIAPHRAGM
ROTARY MOTION
BUTTERFLY
BALL
PLUG

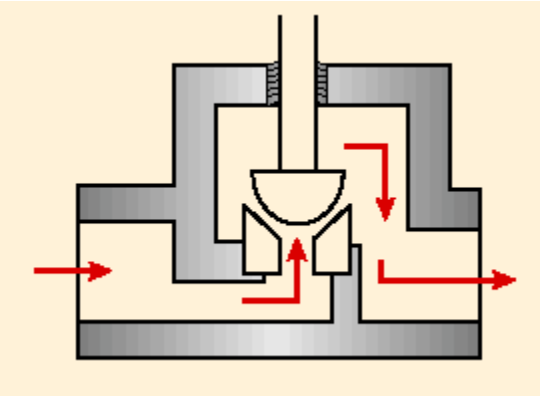
Rotary Types

- Advantages
  - Low weight
  - Simple design
  - High relative C_V
  - More reliable
  - Friction-free packing
  - Low initial cost.

Rotary Types of Control Valves

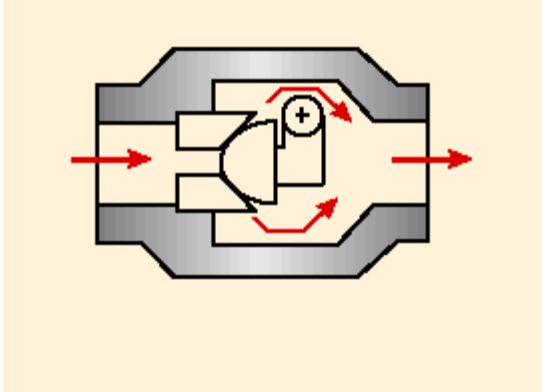
- Disadvantage
  - Generally not suitable below 1 to 2 inches.
  - Operating shaft must be designed to support a fairly heavy side-thrust.
  - Leakage problem.

Linear and Rotary Motion



LINEAR

Tortuous Flow Path
Low Recovery
Can Throttle Small Flow Rates
Suited to HP Applications
Usually Flanged or Threaded
Bonnet Separable



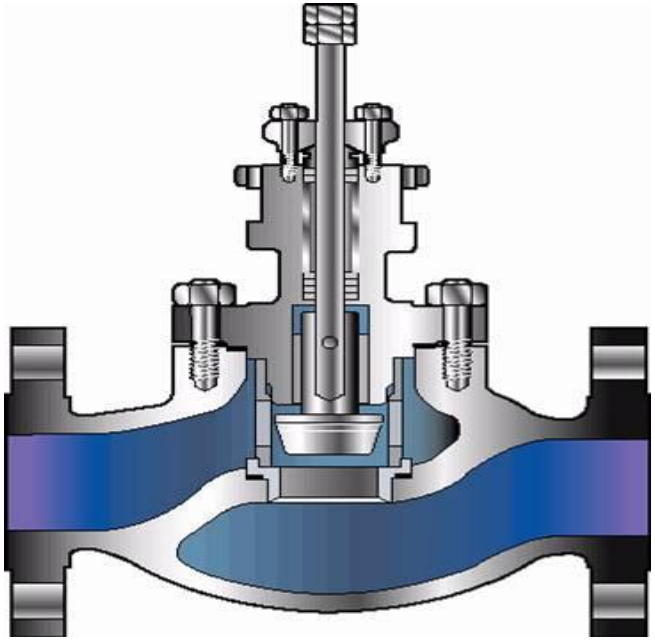
ROTARY

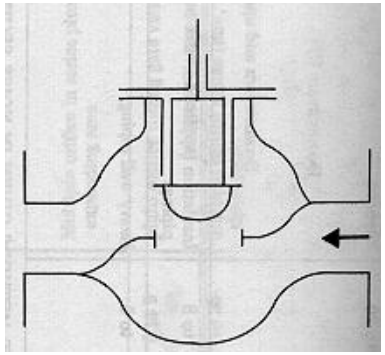
Streamlined Flow Path
High Recovery
More Capacity
Can Handle Slurry / Abrasives
Flangeless
Integral Bonnet

Globe Valve

General Characteristics

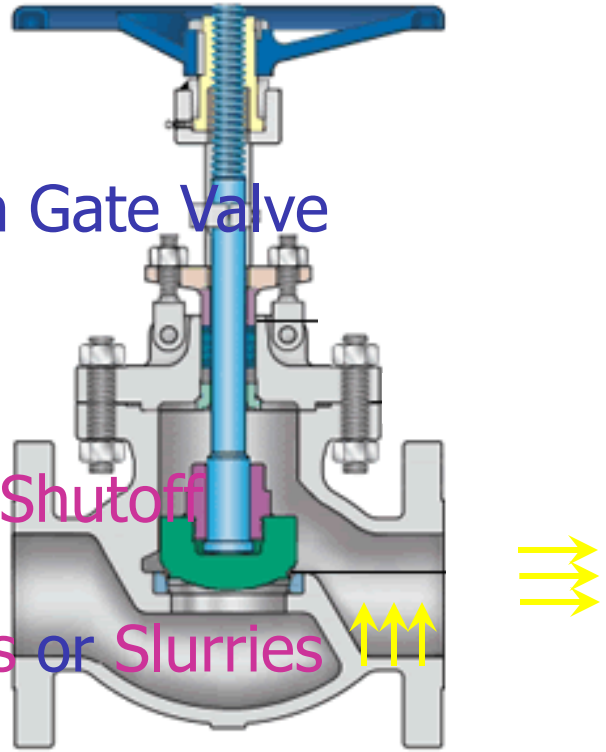
- Causing Turbulence & high △P
- Plug prone to wear/erosion
- Recommended for throttling
- Used for unidirectional flow
- Valve's bore < pipe opening
- Can be
  - Single seated
  - Double seated





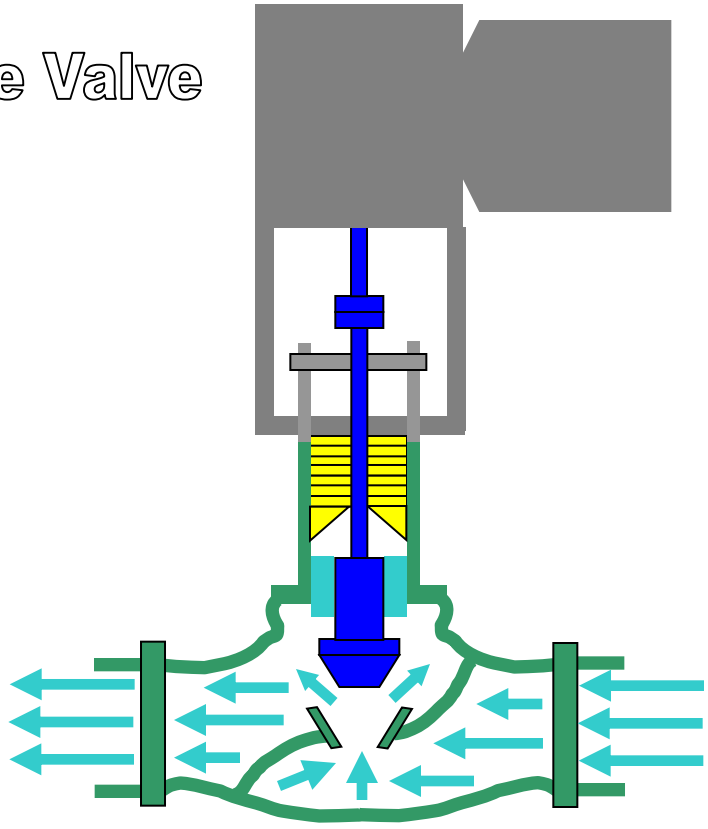
GLOBE VALVE

- **SALIENT FEATURES**
  - Flow Control Element is Disc
  - Resistance to Flow is Greater than Gate Valve
  - Globe Valves are Unidirectional
  - Recommended for Throttling and Shutoff
  - Not Recommended for Dirty Fluids or Slurries
  - Available in ISRS and OS&Y Designs.



Basic Principle

Globe Valve



OPEN

CLOSE

Outlet Pressure

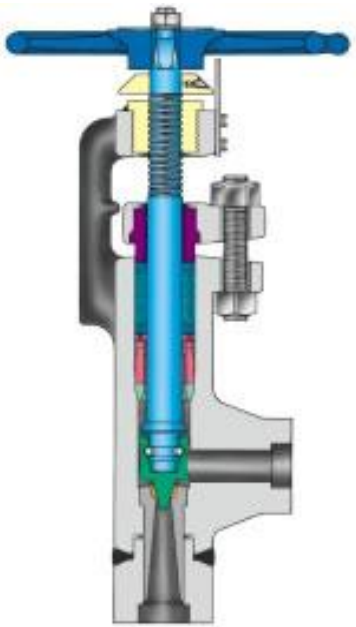
CONTROLLED

MINIMUM

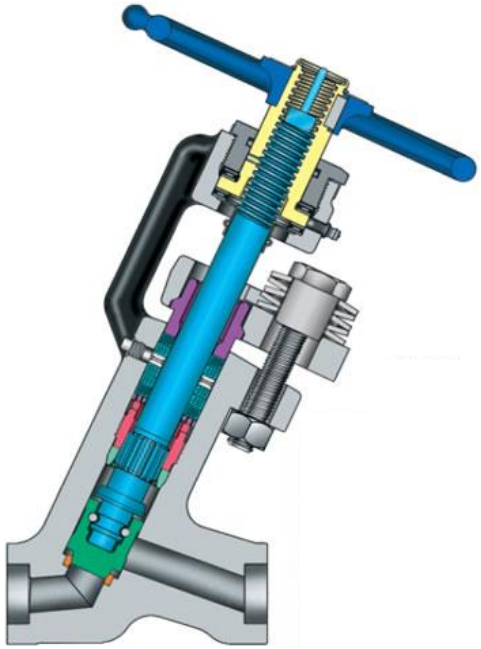
Inlet Pressure

MAXIMUM

GLOBE VALVE - CLASSIFICATION



Angle



Y-Pattern

Needle

Y Style

- ¾ -14”
- Used more frequently in On – Off Service
- Corrosive service

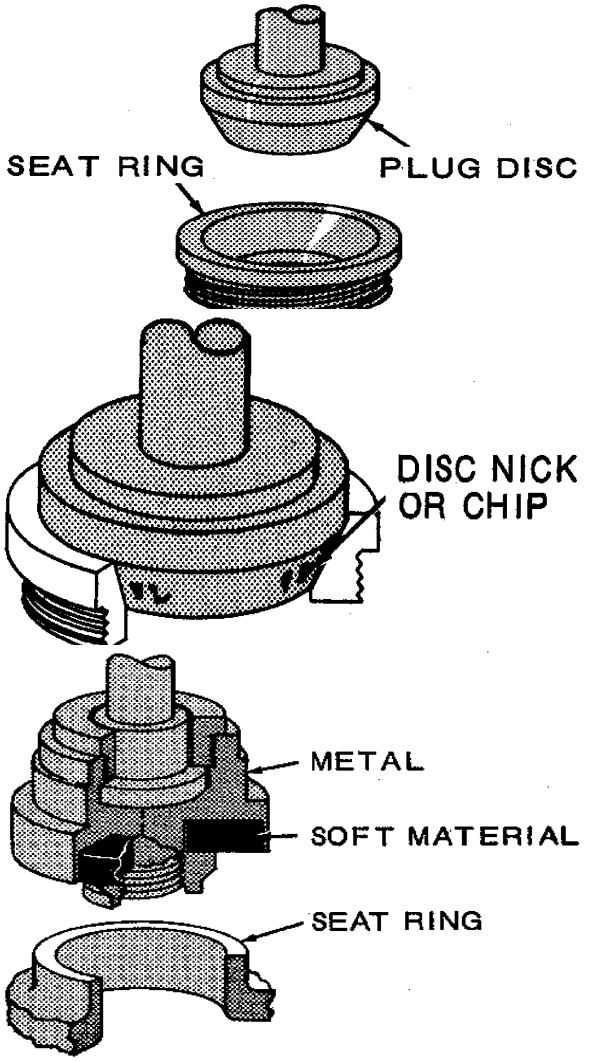
CLASSIFICATION (GLOBE VALVE)

BASED ON BODY STYLE

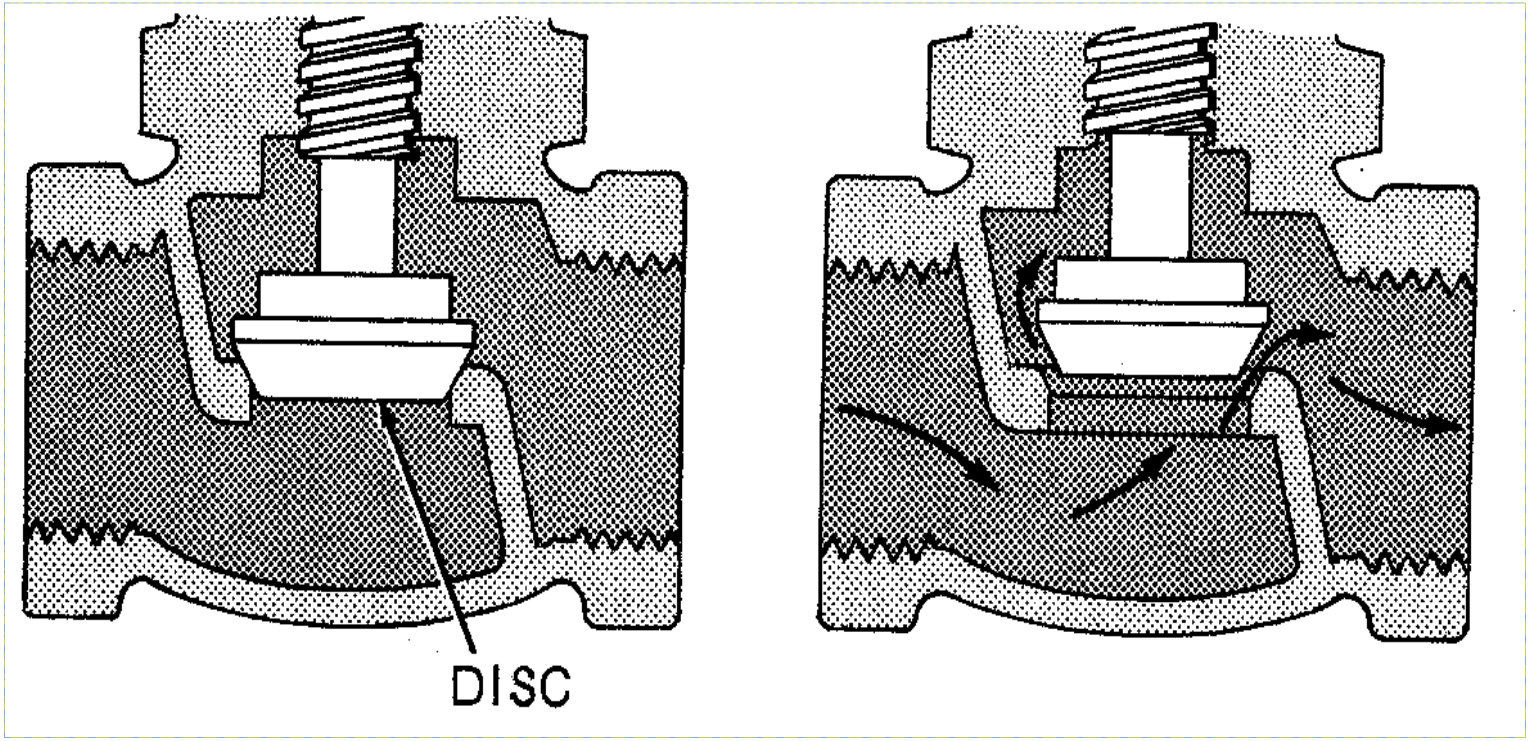
- Angle valve
- Oblique valve
- Needle valve

BASED ON DISC DESIGN

- Plug
- Composition disc
- Conventional disc



Single Seated Globe Valve



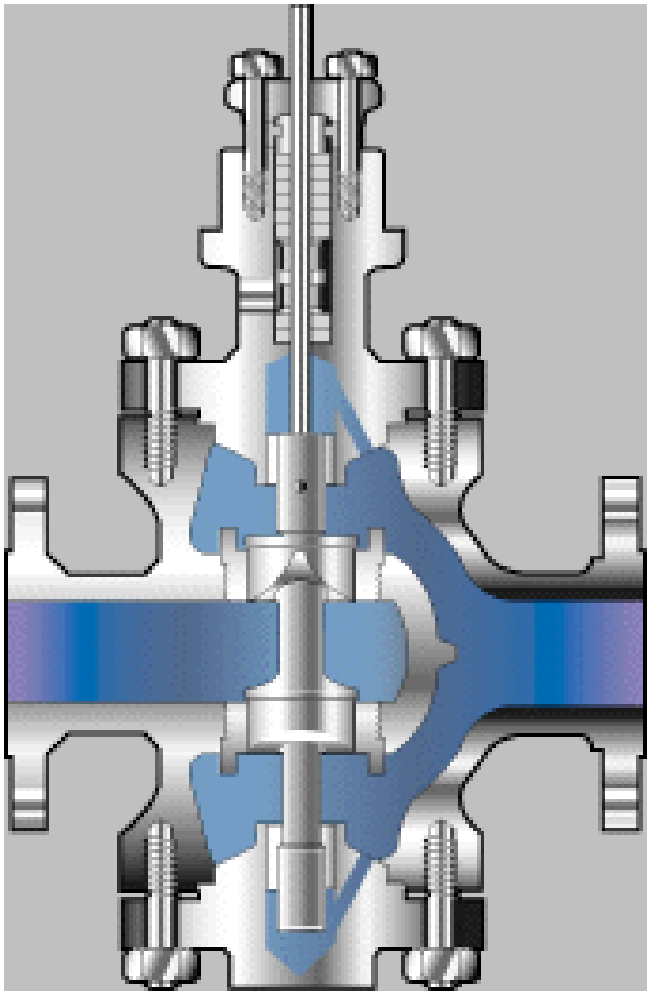
CLOSE

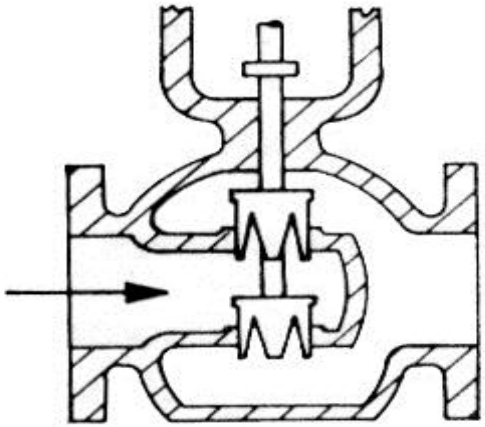
OPEN

Single Seated Valves

- Single-seated valves usually have a top guided construction.
  - Single-seated valves, are usually employed when tight shut-off is required.
  - Tight shut-off in this case usually means that the maximum expected leakage is less than 0.01% of the maximum valve C_V
- It also allows a somewhat higher flow capacity than top and bottom guided valves for a given orifice size.

Double Seated Globe Valve





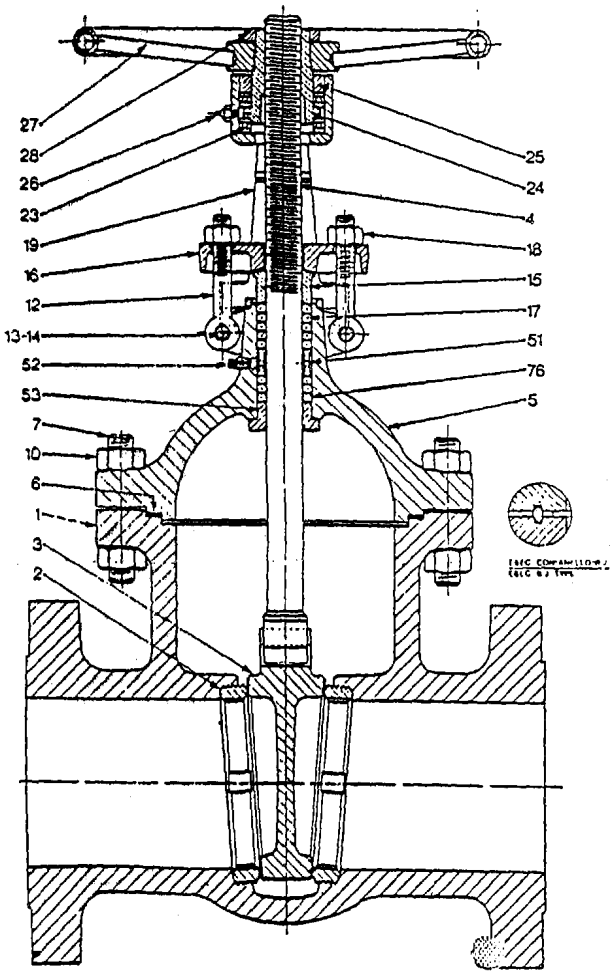
Double-seated value

- A double-seated value, is generally top and bottom guided.
- Leakage figure approaches 0.5% of the rated C_V.
- It is nearly impossible to close the two ports simultaneously
- Advantage of double-seated construction lies in the reduction of required actuator forces.

Gate Valve

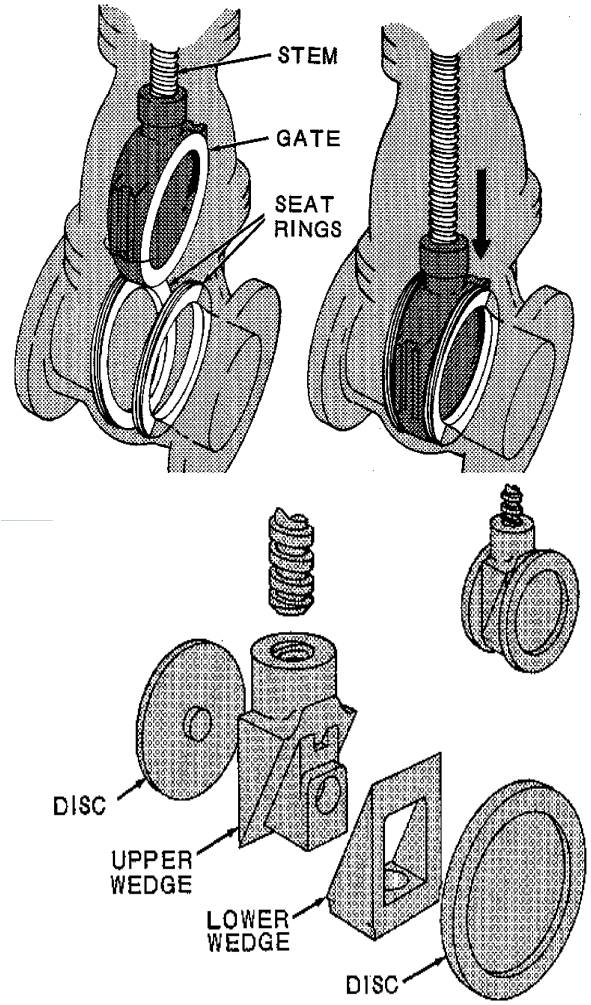
General Characteristics

- Straight flow
- Directionless valve
- Minimum pressure drop
- Valve's bore ≅ pipe opening
- Not recommended for throttling
- Occupy less space as compare to Globe
- Low cost
- Frequent opening/closing not recommended
- A metallic gate/disc is used to stop the flow



CLASSIFICATION (GATE VALVE)

- BASED ON STEM
  - Rising Stem Gate Valve
  - None Rising Stem Gate Valve
- BASED ON GATE DESIGN
  - Solid Wedge
  - Solid Split Gate
  - Parallel Discs And Wedges Gate

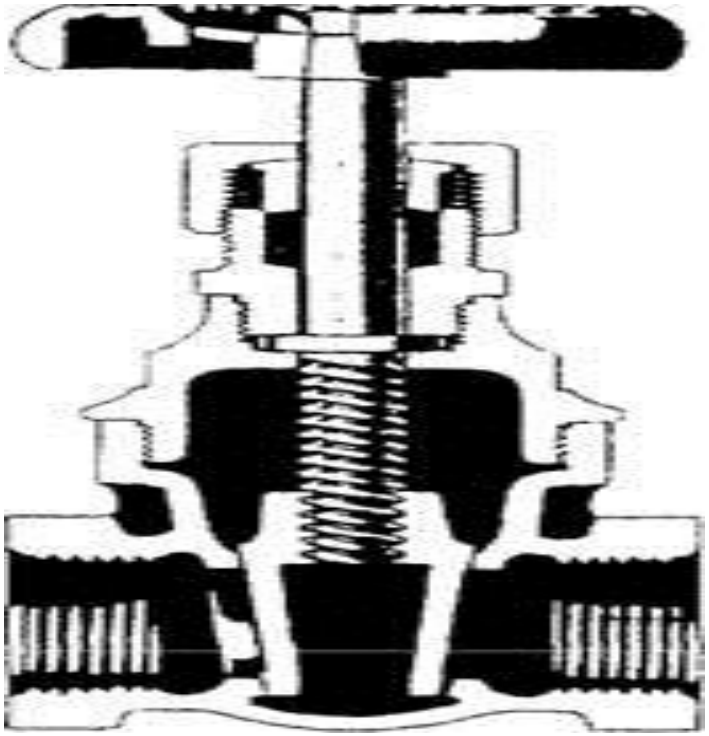


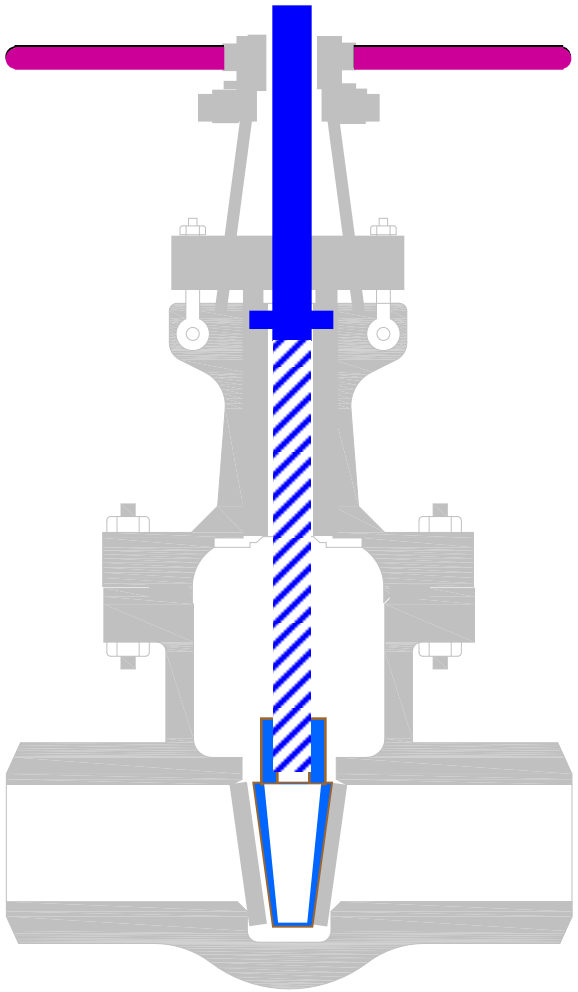
NON RISING STEM (NRS) DESIGN

Internal Threads on Stem

Gate Rises When Valve is Opened

Stem Does not Vertically Move.

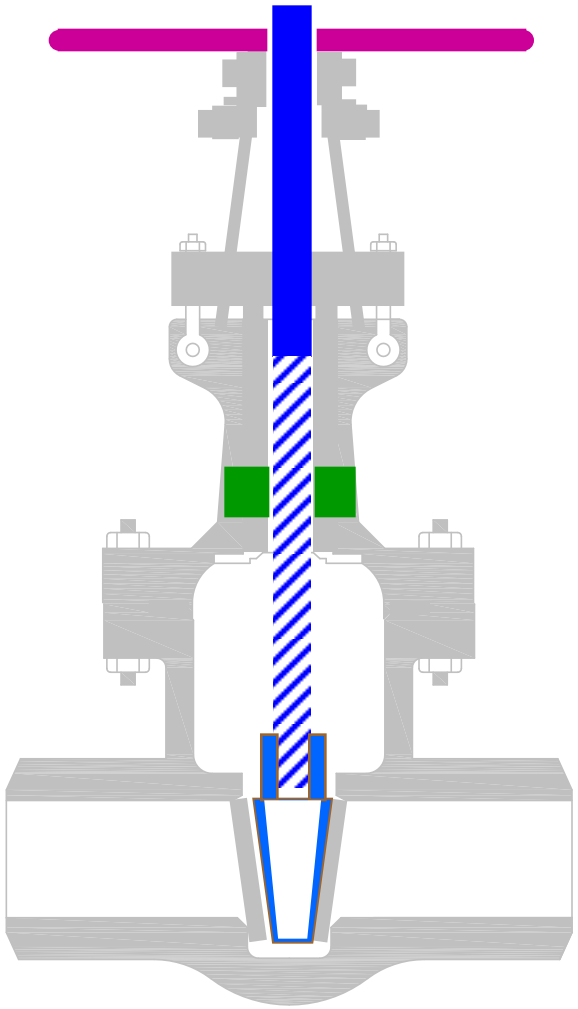




INSIDE SCREW RISING STEM (ISRS) DESIGN

Internal Threads on Stem

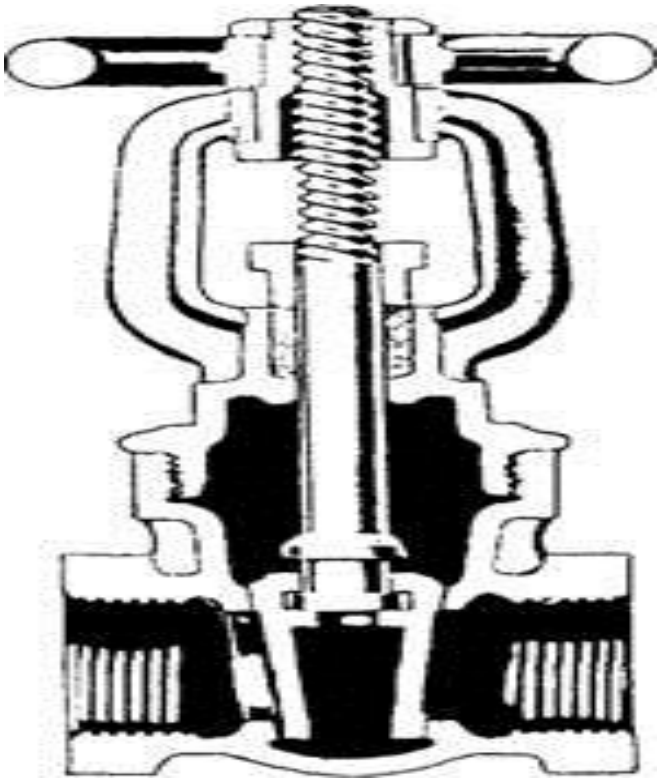
Stem, Gate and Hand Wheel Rise When Valve is Opened

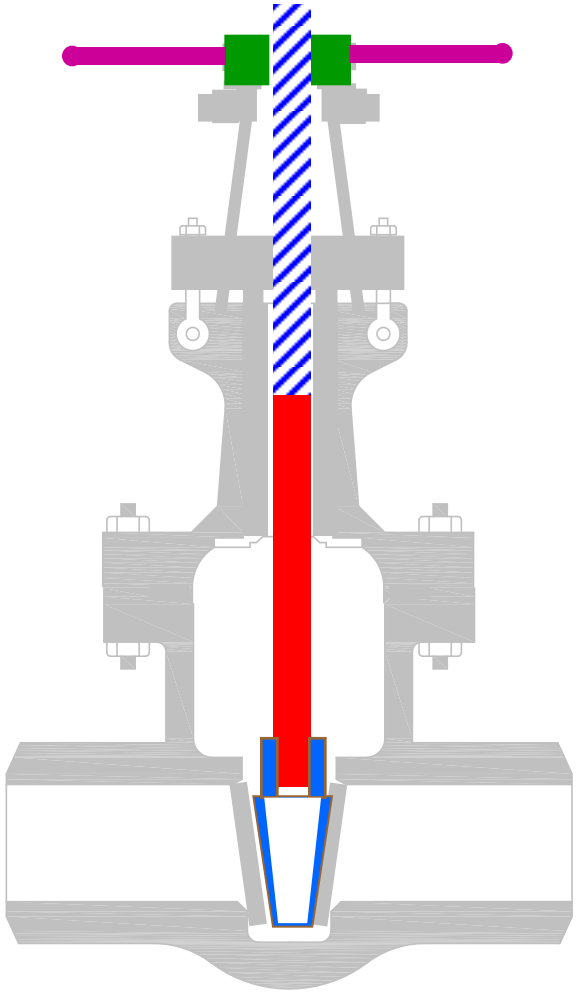


OUTSIDE SCREW & YOKE (OS&Y) DESIGN

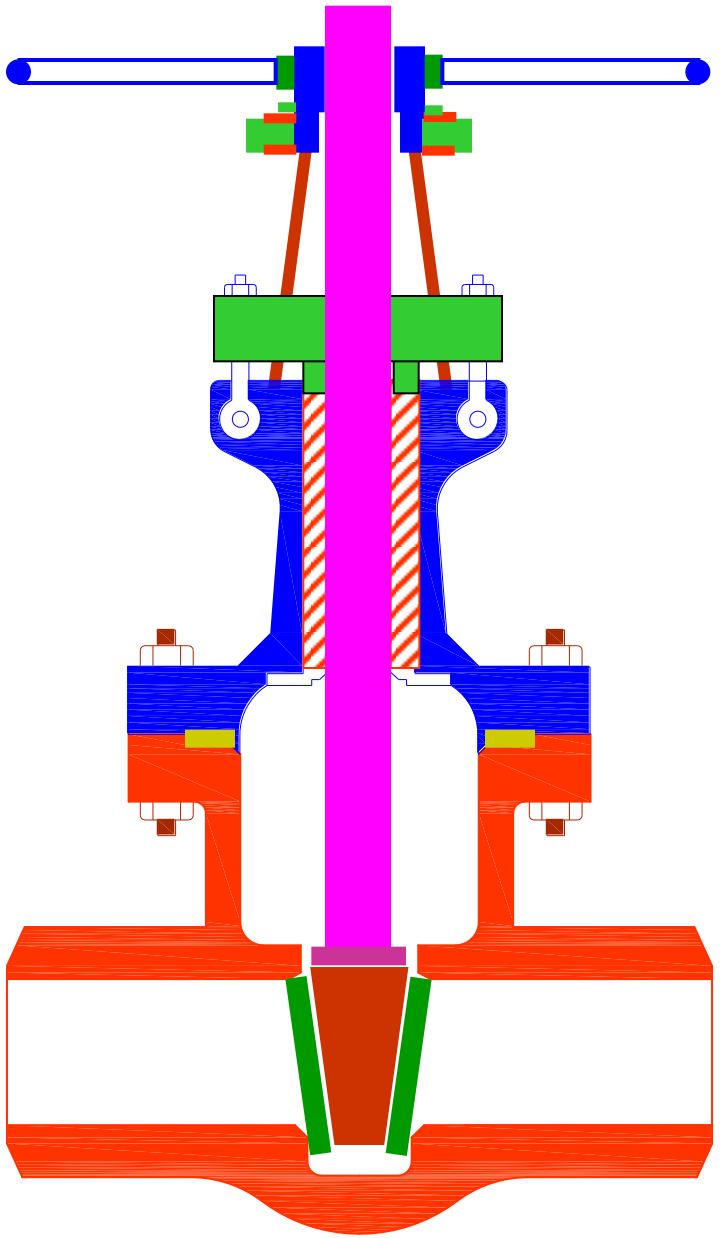
External Threads on Stem

Stem &Gate Rises When Valve is Opened



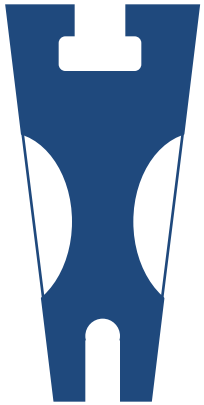


VALVE BACK SEAT



GATE VALVE - CLASSIFICATION

Solid



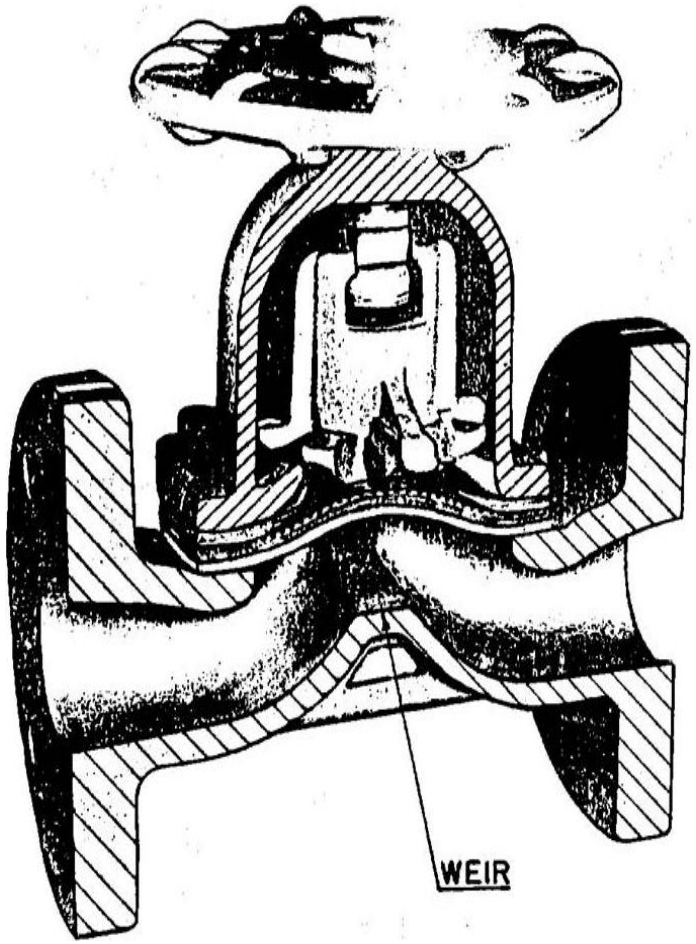
Flex

Split

Diaphragm Valve

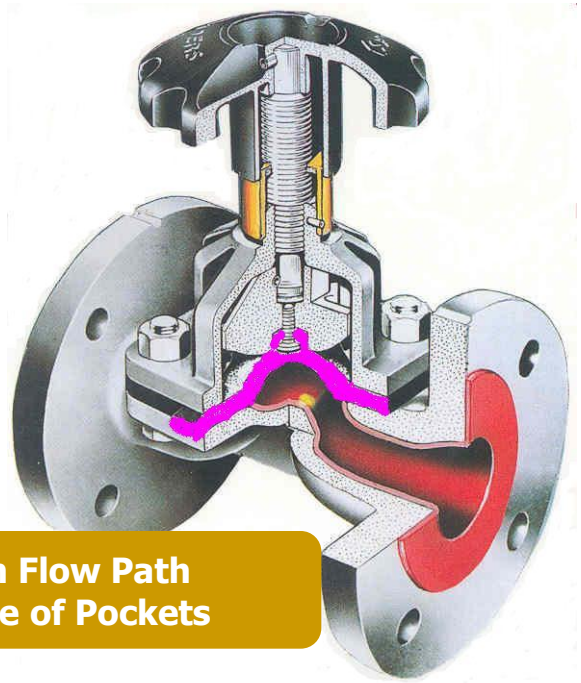
General Characteristics

- No stuffing box packing
- Not recommended for HP
- Used where tight closure is important
- Long life and friendly maintenance valve
- Normally used for scale forming or corrosive fluid
- A flexible disc or diaphragm used as closing element
- Diaphragm Valves are Symmetrical



DIAPHRAGM VALVE

- **SALIENT FEATURES**
  - Flow Control Element is Diaphragm
  - Low Strength Even at Ambient Temperature
  - Very Little Resistance to Fluid Flow.
  - Suitable for:
    - Slurries
    - Viscous Fluids
    - Gases
    - Vapors
    - Corrosive Fluids
    - Clean Fluids



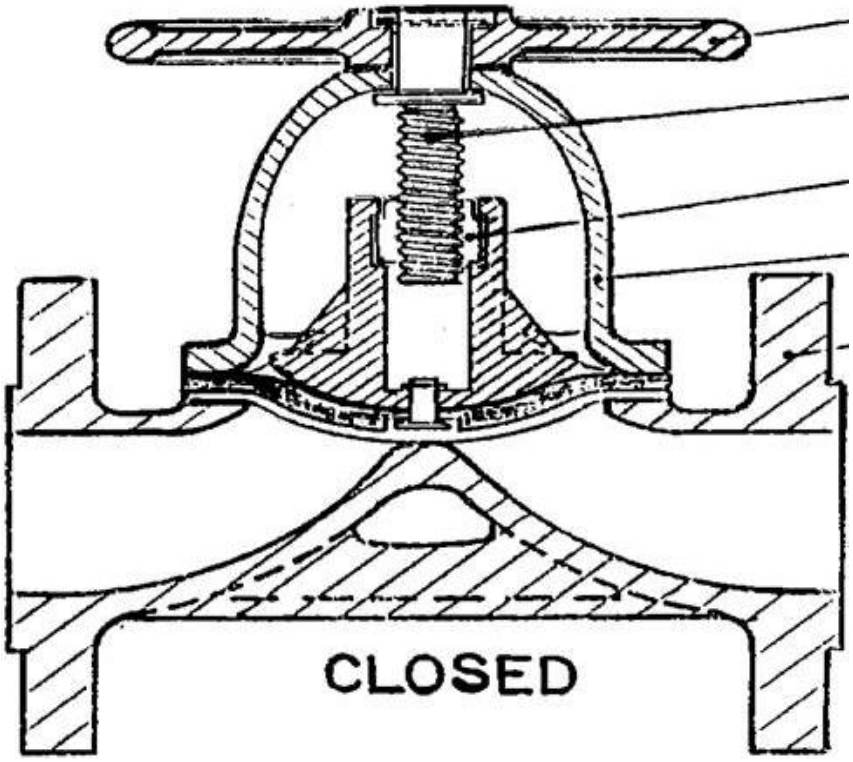
- Smooth Flow Path
- Absence of Pockets

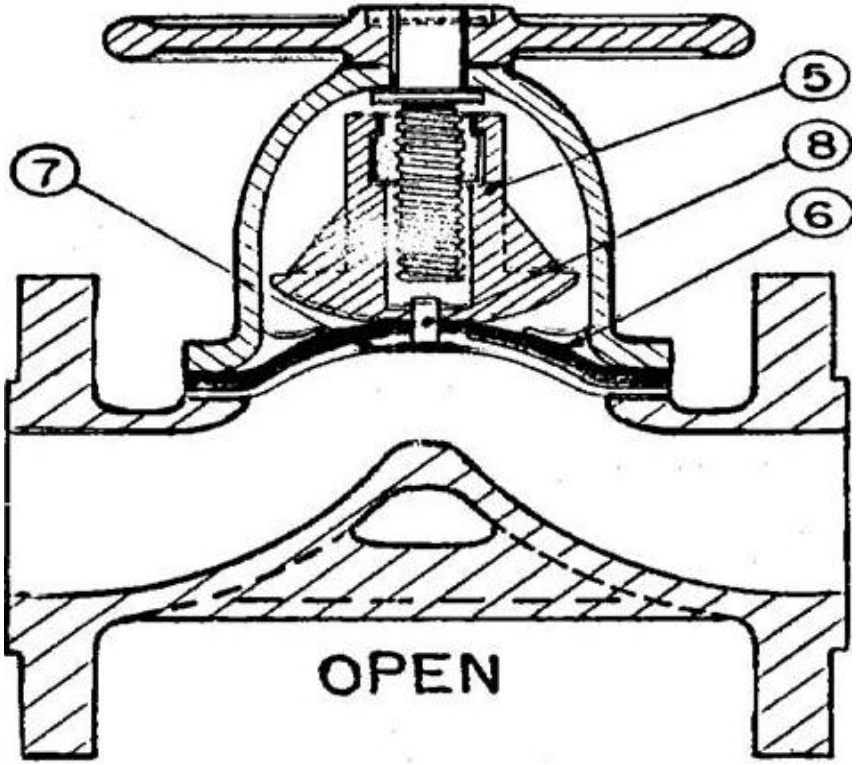
Soft Sealing point

Minimum Exposed Components

Lining and Elimination of Dirt

Diaphragm Valve





BUTTERFLY VALVES

- **SALIENT FEATURES**

  - Flow Control Element is Circular Disc

  - Primarily it is a Throttling Valve; Can be Used as Stop Valve

  - Suitable for:

    - Gases
    - Vapors
    - Slurries (Only Lined Valve)

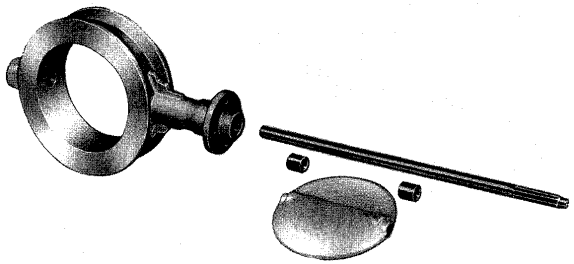
  - Leak Tight Sealing is Difficult to Achieve in Metal Seated Valves

  - Temperature Limitations in Lined and Soft Seated Valves

Butterfly Valve

General Characteristics

- Reliable & long service life
- Lines cannot be cleaned by pig
- Suitable for low pressure service, 10-20 bar
- Leakage 0.5% of rated C_V.
- Easy to operate, both manually & by remote control.
- Circular shaped disc used for quick opening/closing
- The typical application range is in sizes from 2 inches to 36 inches or larger.



BUTTERFLY VALVES

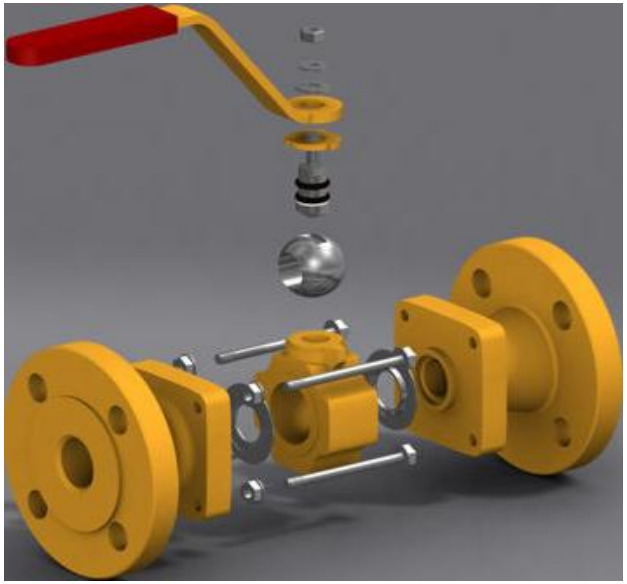
General Characteristics (cond.)

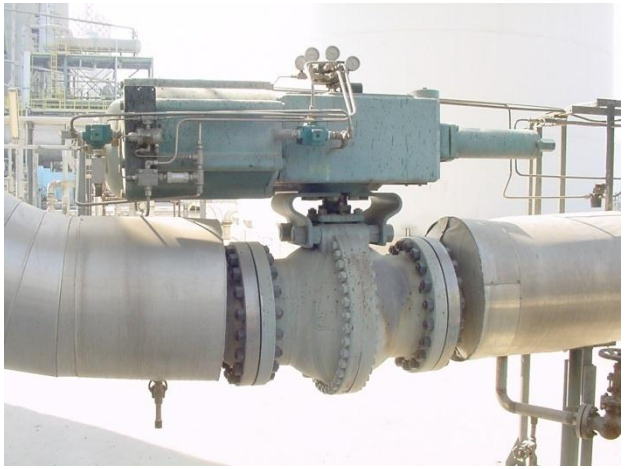
- Not suitable for crystallizing/caking medium
- The disc always remains in the center of the port.

Ball Valve

General Characteristics

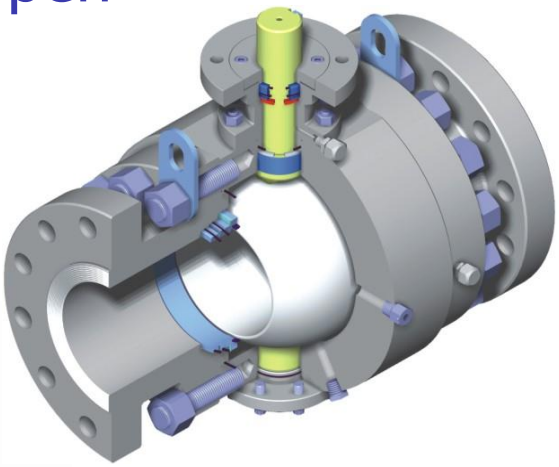
- Low △P
- Easy operation
- Quick opening
- Two-way flow possible
- Low maintenance costs
- Ball is used for opening & closing





BALL VALVE

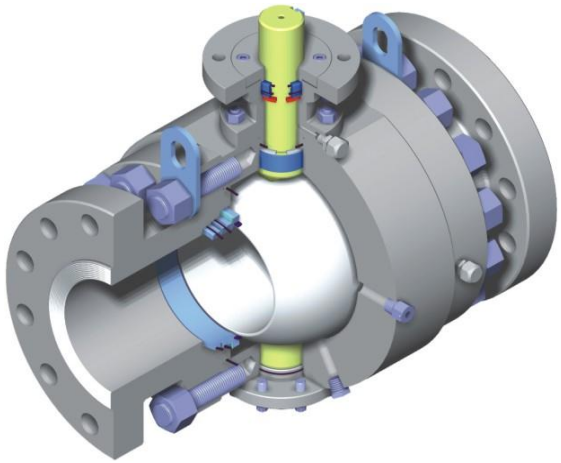
- **SALIENT FEATURES**
  - Flow Control Element is Ball
  - Very Little Resistance to Flow When Open
  - Suitable for:
    - Slurries
    - Viscous Fluids
    - Gases
    - Vapors
    - Corrosive Fluids
    - Clean Fluids



BALL VALVE

- **SALIENT FEATURES (cond)**

  - Available in Full Port and Reduced Port Design
  - Temperature Limitations When Seat Ring is Non-Metallic
  - Leak Free Seating is Difficult With Metallic Sealing
  - Can be Use for Throttling (Fluid Should be Non-Abrasive)
  - Quick Opening (Quarter Turn Operation)
  - Available in Three Way Design

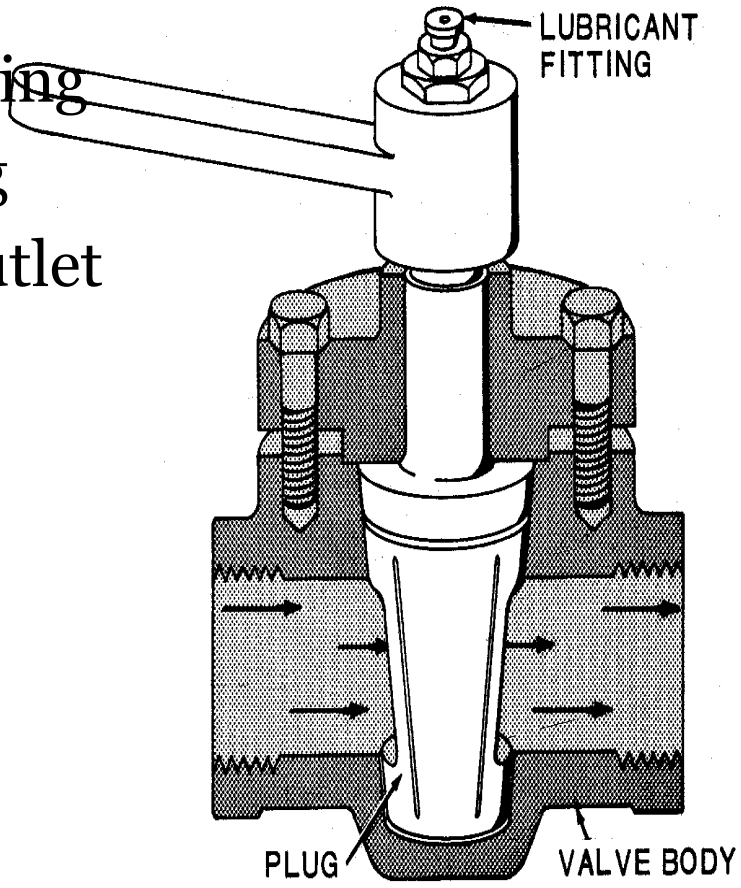


THREE-WAY BALL VALVE

Plug Valve

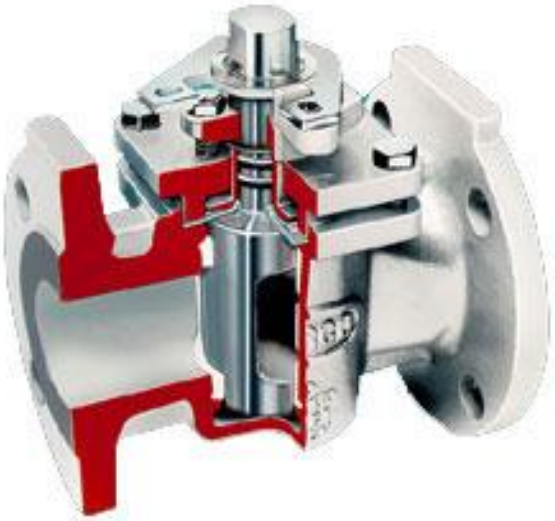
General Characteristics

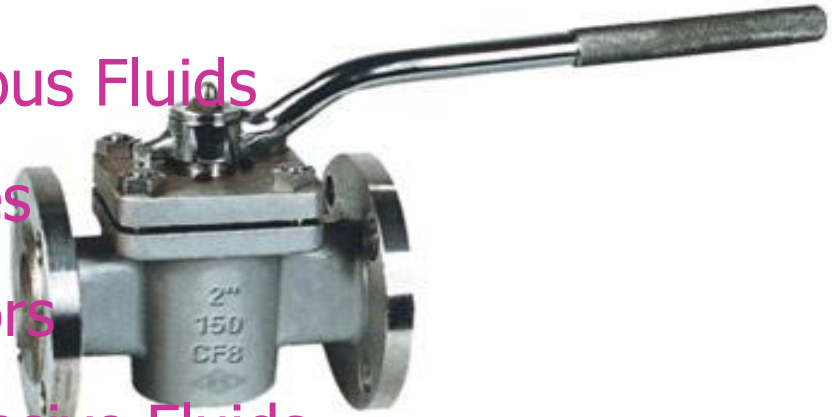
- Used for quick opening and closing
- Not recommended for throttling
- Used for more than one inlet/outlet lines
- Provides straight through flow
- Used for low pressure services
- Turn plug at 900 for opening/closing
- No gland packing used
- Tapered plug is used to avoid sticking



PLUG VALVE

- **SALIENT FEATURES**
  - Flow Control Element is Plug
  - Very Little Resistance to Flow When O
  - Suitable for:
    - Slurries
    - Viscous Fluids
    - Gases
    - Vapors
    - Corrosive Fluids
    - Clean Fluids

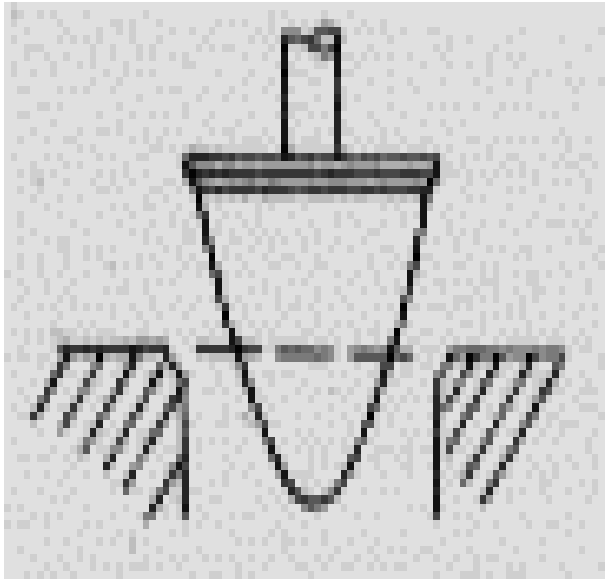




Plug

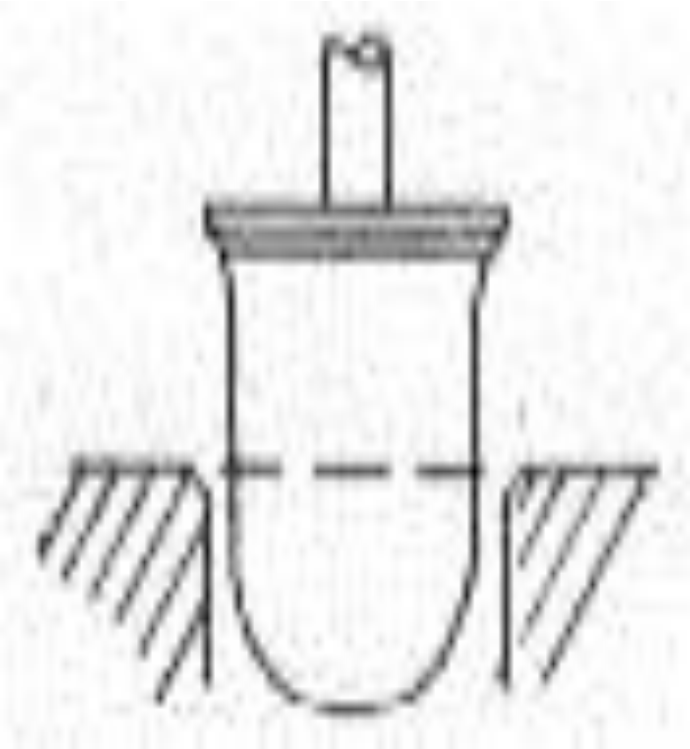
- Plug types depends upon flow characteristic:
  - Quick Opening
  - Linear
  - Parabolic or Equal Percentage

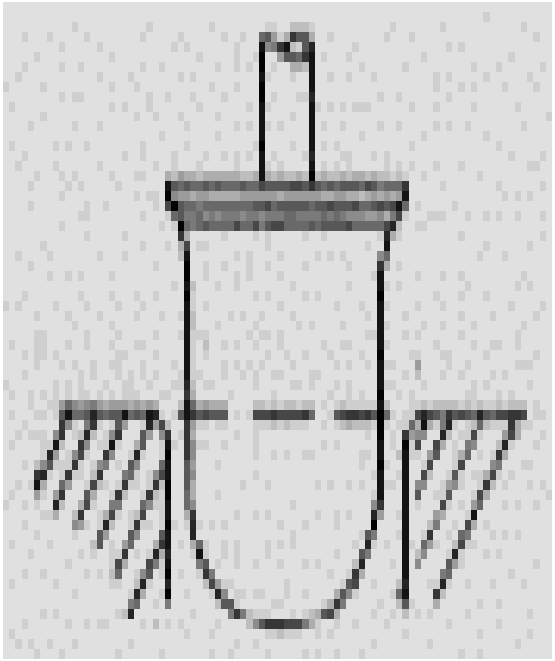
Plug → Linear



(Conical)

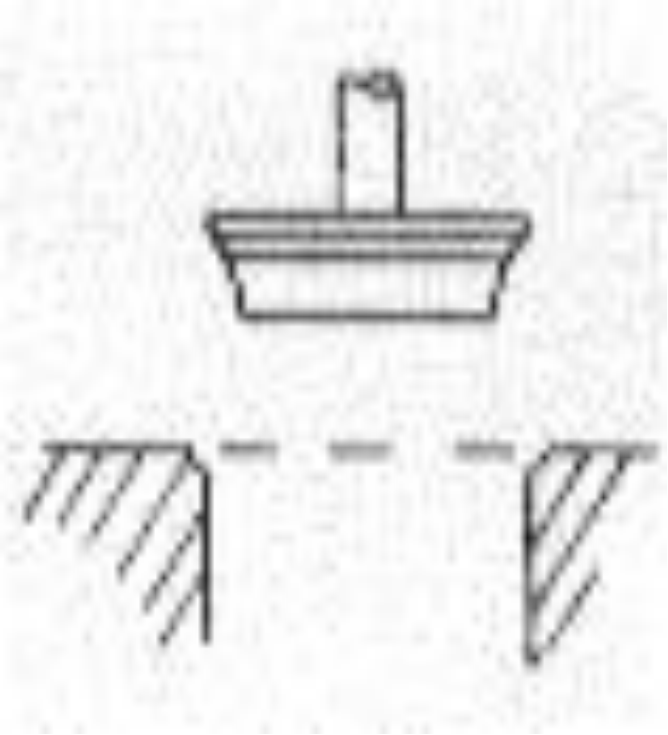
Plug → Equal Percentage

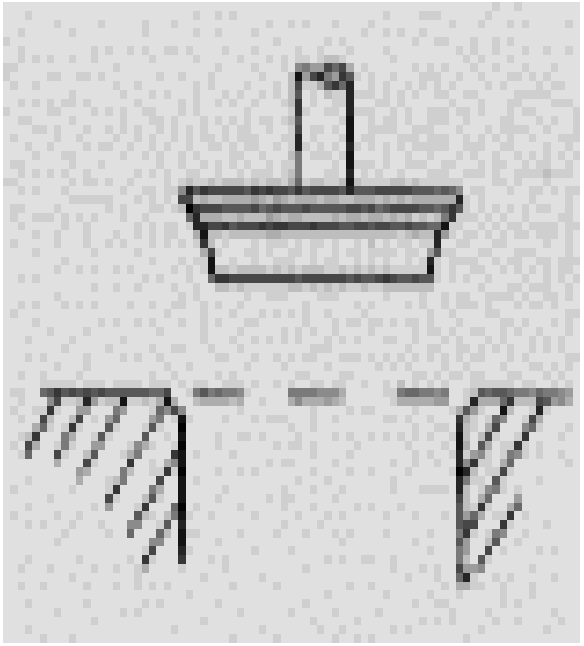




(Tapered)

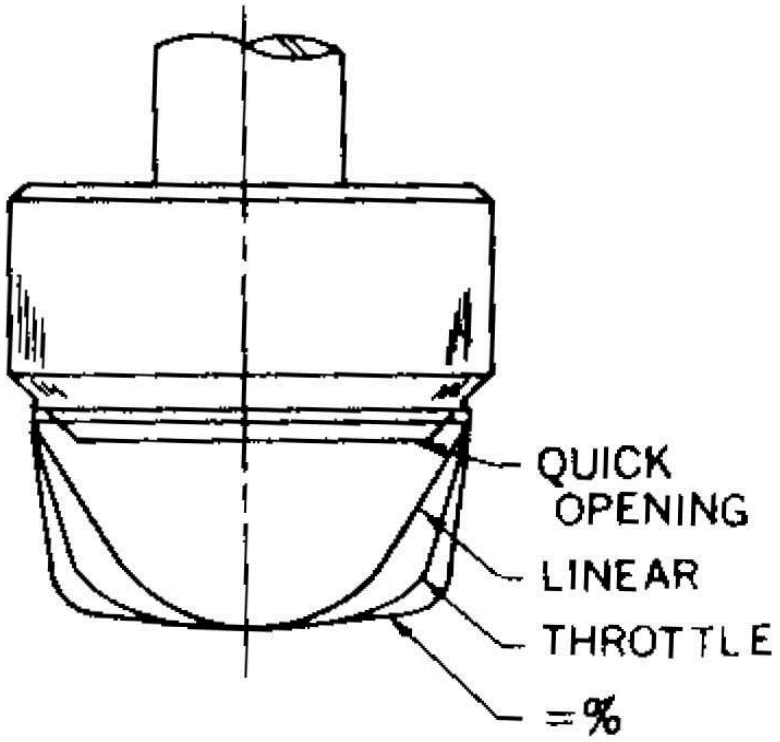
Plug → Quick Opening





(Flat)

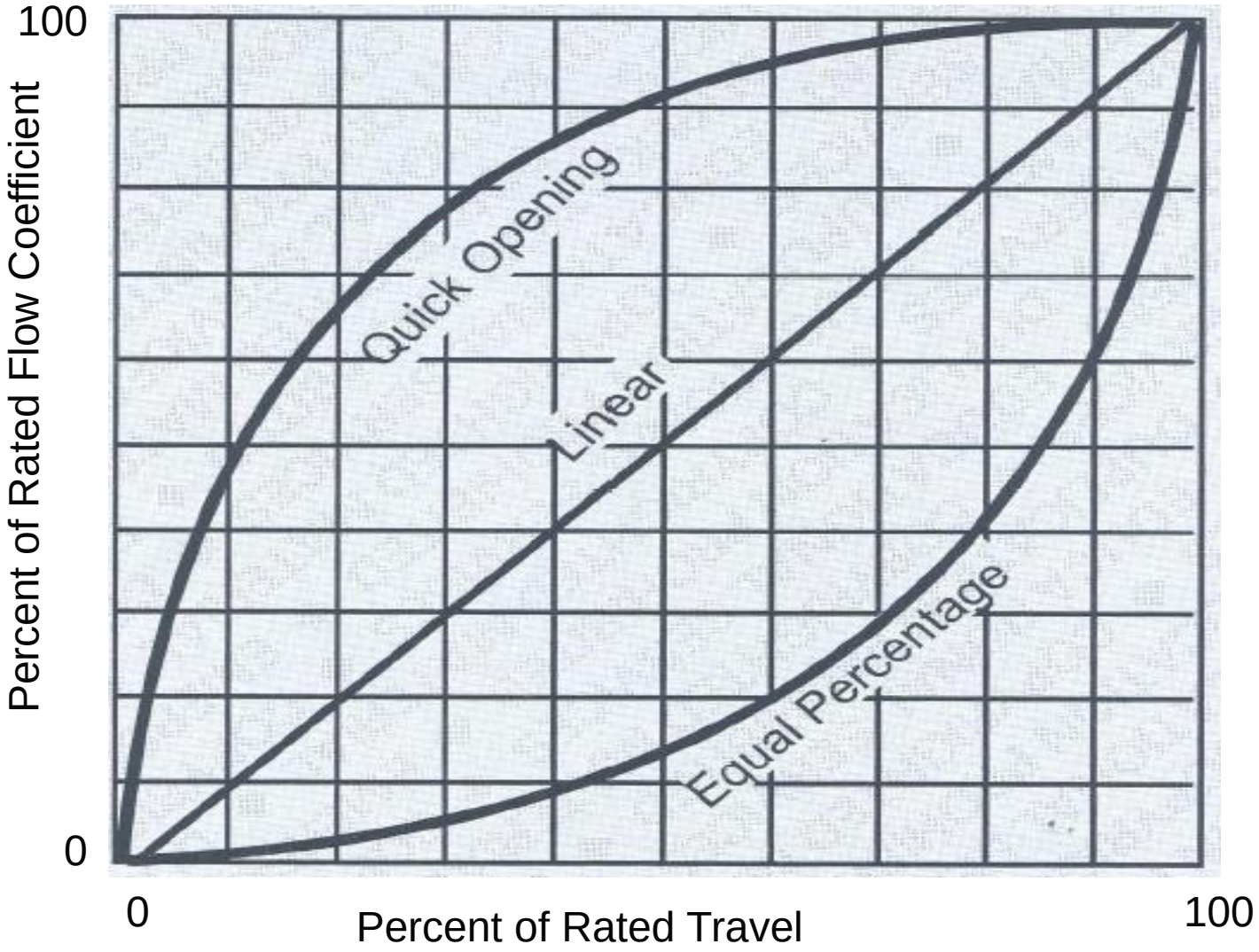
Different Shapes of Plugs



Characteristics of Different Plugs

Valve Opening	30 %	70 %	100 %
	C_v		
Quick Opening	62	90	100
Linear	30	70	100
Equal %	8	33	100
V-Port	6	30	100

Valve Characteristic



C_V

The number of U.S. gallons of water at 60° F which will pass per minute through a given flow restriction with a pressure drop of 1 PSI

Solving for C_V

Rearranging the Equation - Until now, the discussion has centered on calculating a flow rate through a restriction. In valve sizing, of coarse, the objective is to calculate a C_V from a required flow rate. To accomplish this, the basic equation can he rearranged to solve for C_V as shown below.

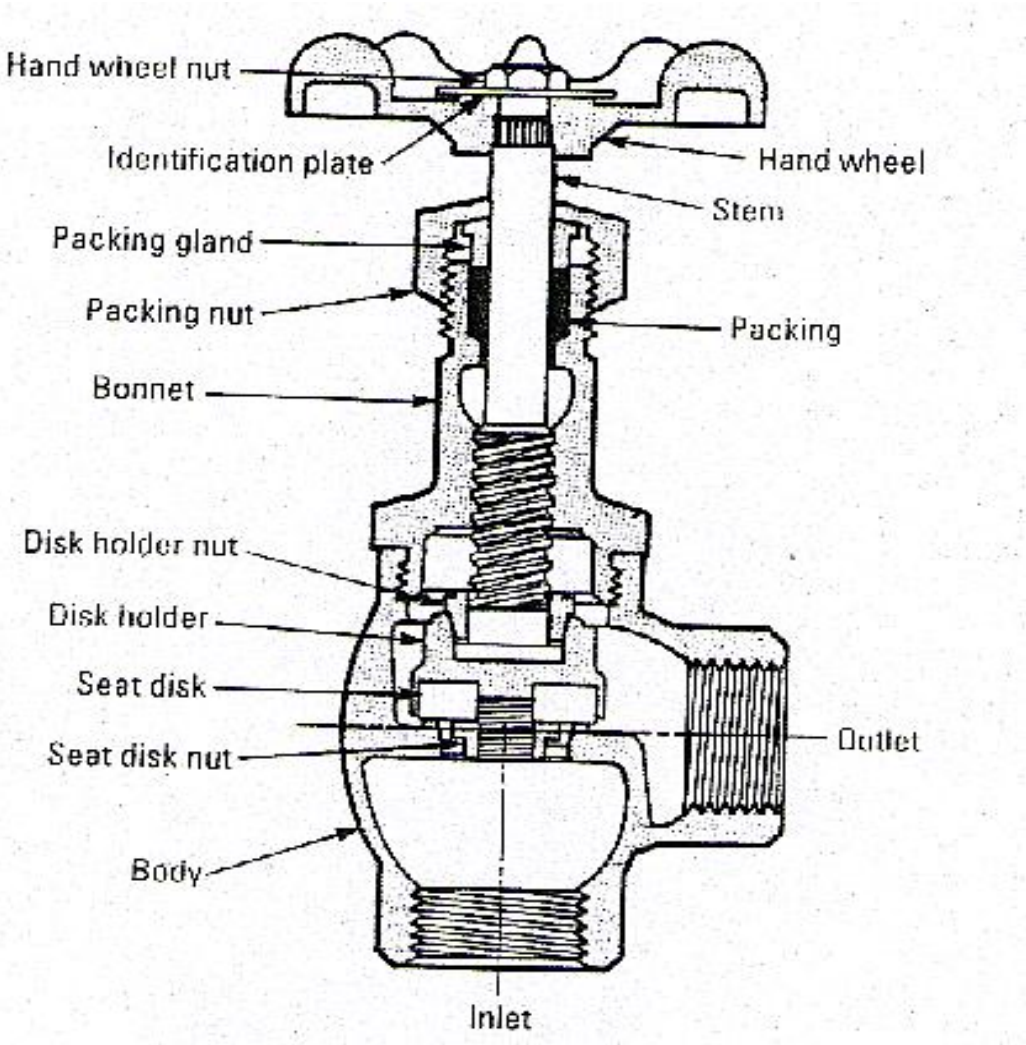
where:
Q =Flow Rate, gpm
C_V =Valve Flow Coefficient
$\Delta P = P_2 - P_1$
G= Fluid Specific Gravity

Arranging the Equation to Solve for C_v

Angle Valves

- These Valves are single-seated.
- Used for high pressure drop service.
- Minimum Space required.

ANGLE VALVE


Hand wheel nut
Identification plate
Hand wheel
Stem
Packing gland
Packing nut
Packing
Bonnet
Disk holder nut
Disk holder
Seat disk
Seat disk nut
Outlet
Body
Inlet

Cage Valves

- So-called "top entry" or cage valves have the advantage of easy trim removal.
- Typical top entry valve with unbalanced, single-seated trim.
- The inner valve parts, often referred to as "quick change trim," can easily be removed after removing the bonnet, because of the absence of internal threads.

Cage

General Characteristics

- A bit less hard material
- According to the requirement of process
- Guides the Plug
- Reduces the noise (10 to 15 db)

Types of Cages

Quick Opening

Linear

Equal Percentage

Quick Opening Cage

Cage Guided Valves
Quick Opening cages provide maximum Cv at minimal
travel.

Visual Features
•Square-edge window bottoms

Applications
- Relief
- On-Off
- Dump
- Hi-gain linear at low lifts

Quick Opening Cage

Linear Cage

Linear cages produce a percentage of maximum control valve C_v that is directly proportional to valve stem position; e.g., 60% travel = 60% maximum rated C_v.

Visual Features

- Pear-shaped windows

Applications

- Constant pressure drop applications

Linear Cage

Equal Percentage Cage

Equal Percentage

- Equal increments of change in stem position produce an equal percentage change from the existing Cv,

Visual Features

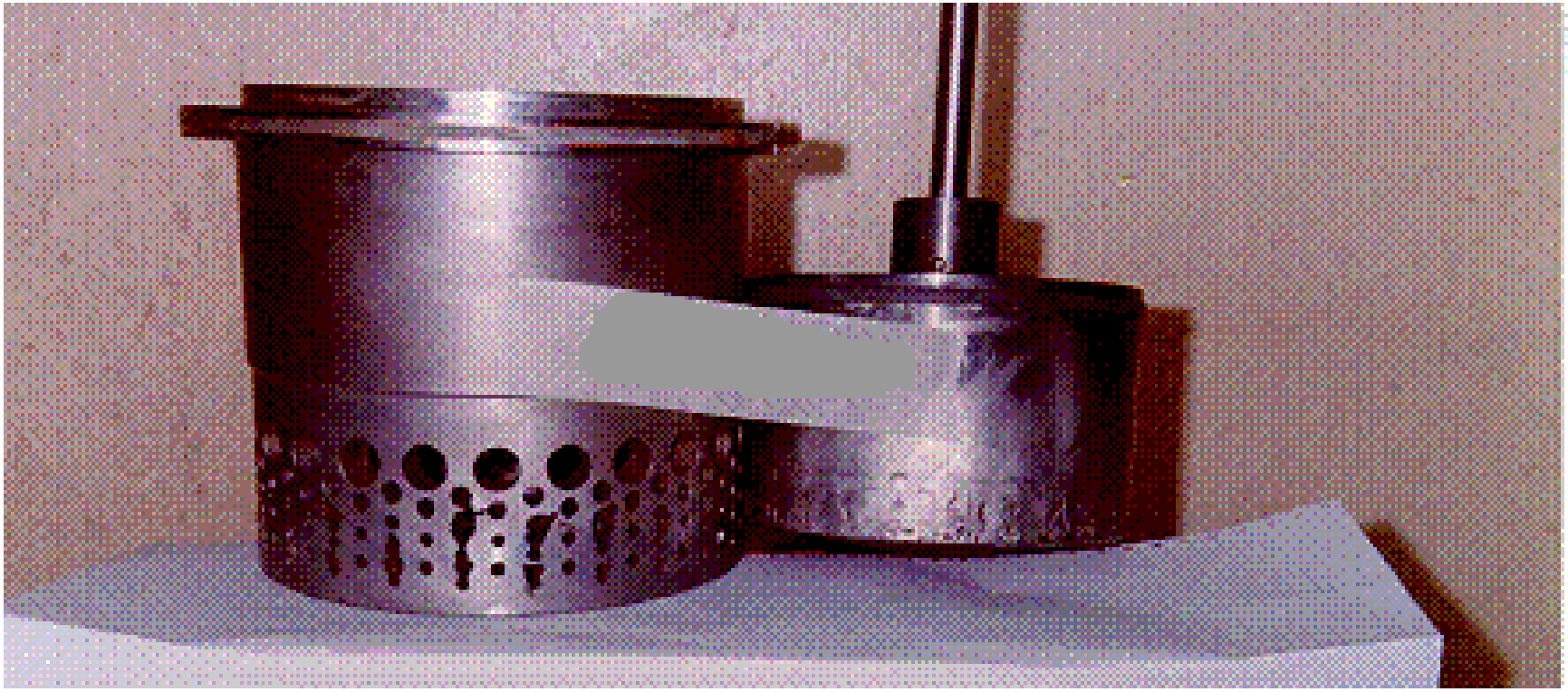
- Alternately offset pear-shaped windows

Applications

- Many pressure and flow where ΔP decreases as flow rate increases

Equal Percentage Cage

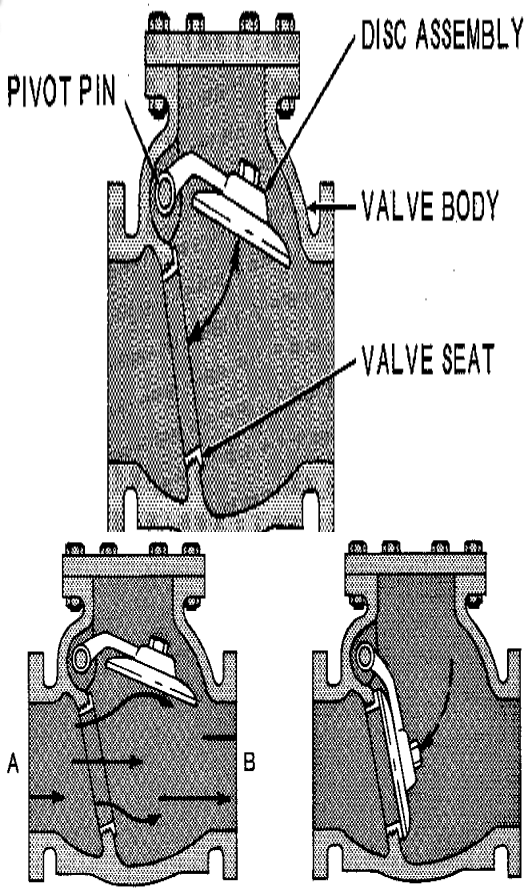
Plug and Cage



CHECK VALVES

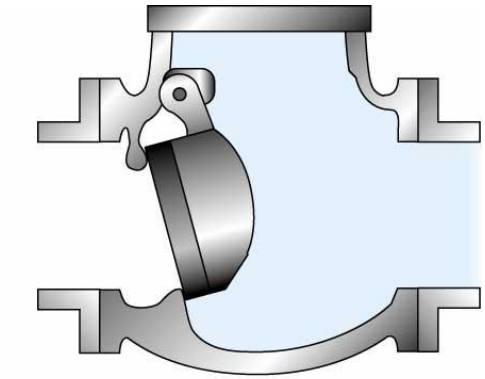
GENERAL CHARACTERISTICS

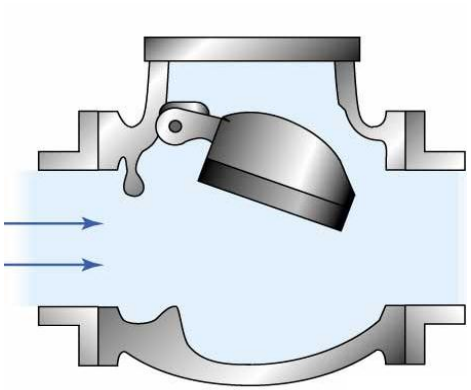
- Low △P
- Quick opening
- Low maintenance costs
- To control the direction of flow
- Used for both high/low pressure
- Most reliable and long service life
- Used for both horizontal & vertical flow



CHECK VALVE

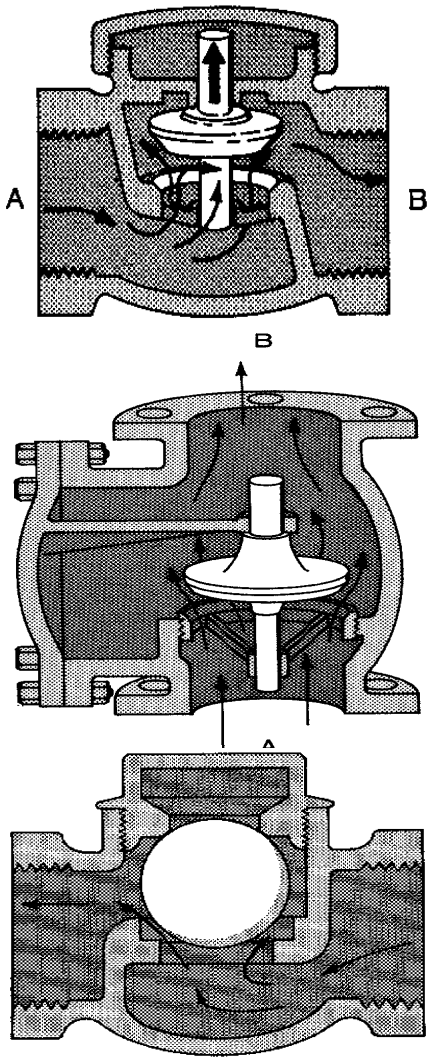
- Used for Unidirectional Flow



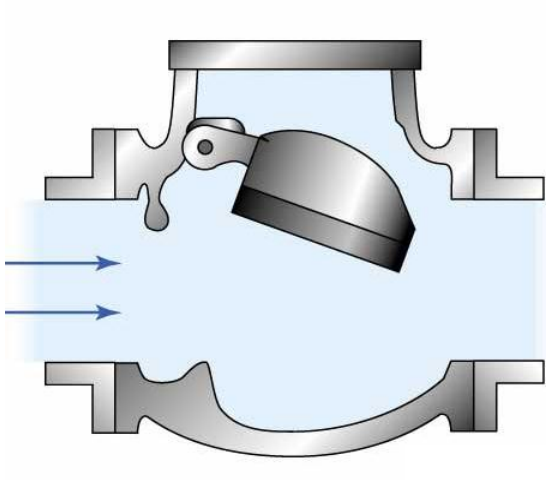


CHECK VALVES

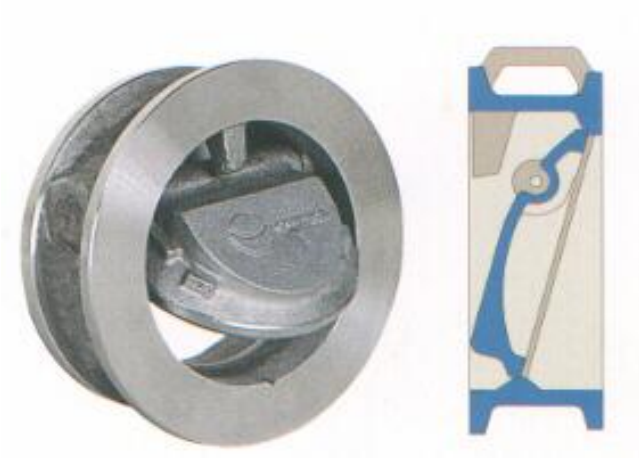
- CLASSIFICATION
  - **FOOT VALVE**
  - **BALL CHECK VALVE**
  - **SWING CHECK VALVE**
  - **TILTING DISC CHECK VALVE**
  - **VERTICAL LIFT CHECK VALVE**
  - **HORIZONTAL LIFT CHECK VALVE**



CHECK VALVE - TYPES

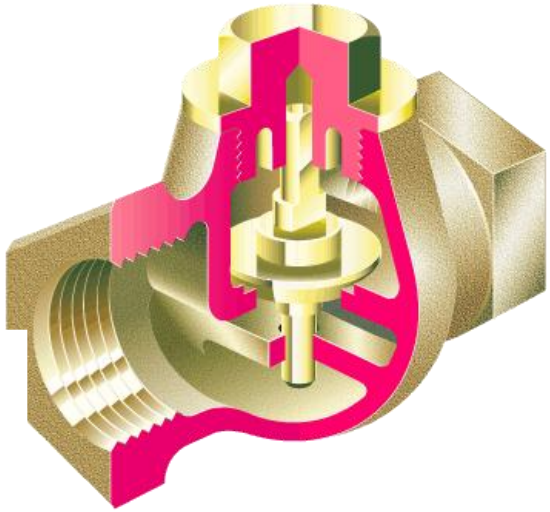


Swing Check Valve



Tilting Disk

CHECK VALVE - TYPES



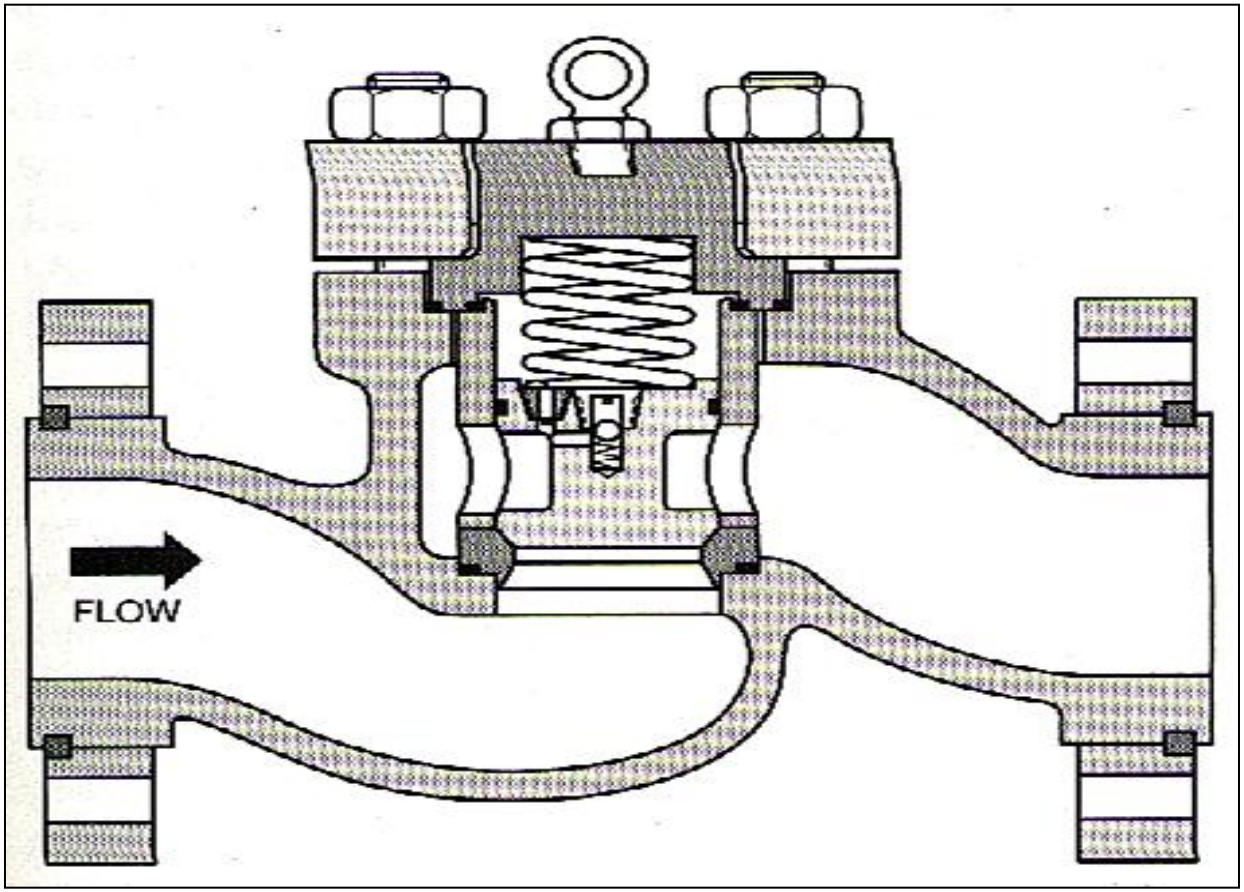
Lift Check Valve

Ball Check Valve

CHECK VALVE - TYPES

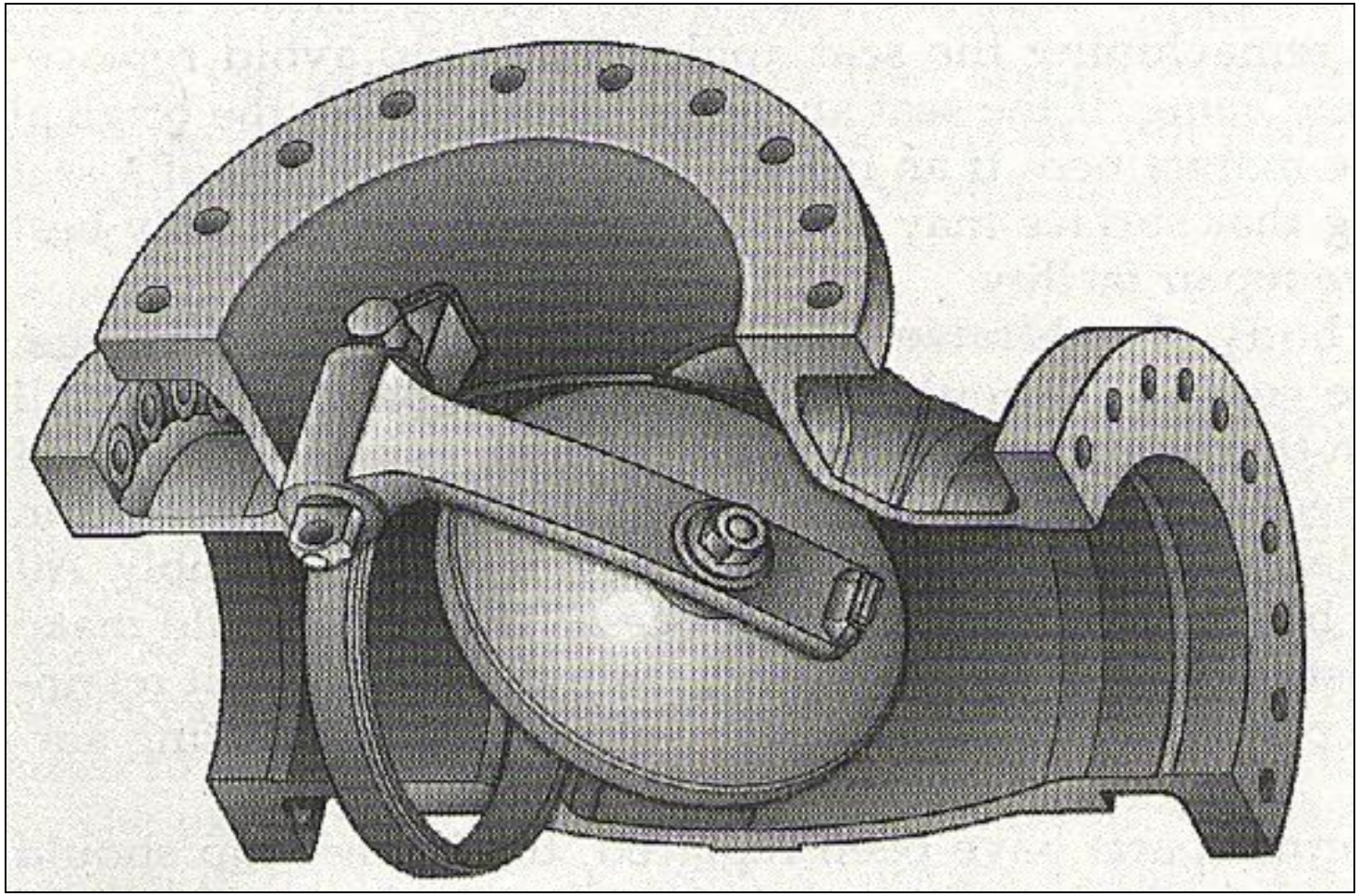
Wafer Check Valve

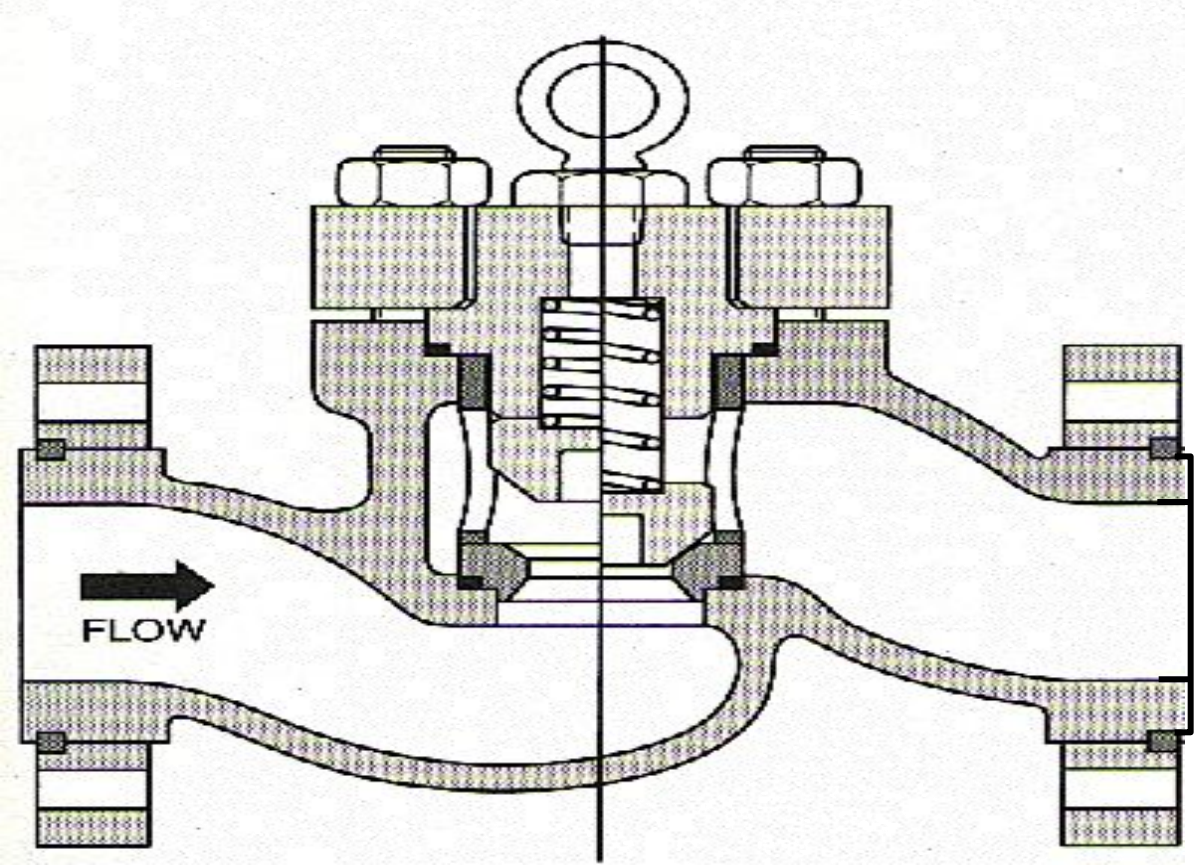
LIFT CHECK VALVES



Non-slam piston-type check valve.

SWING CHECK VALVES

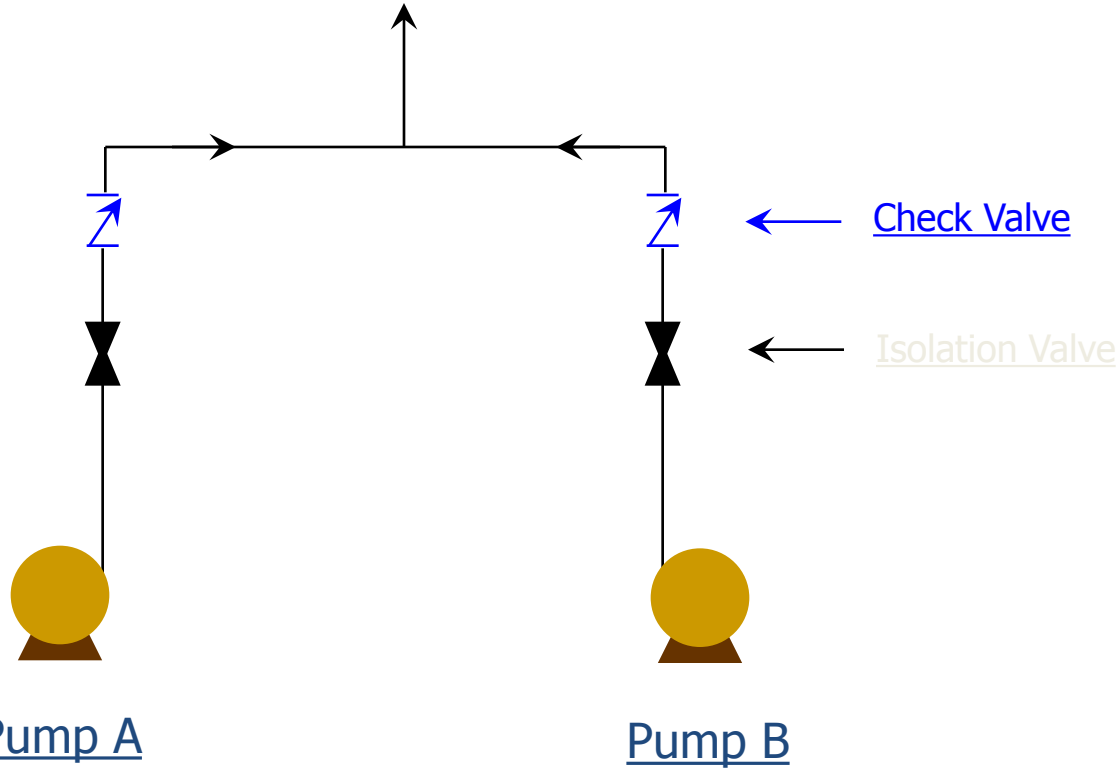




Plug-type check valve.

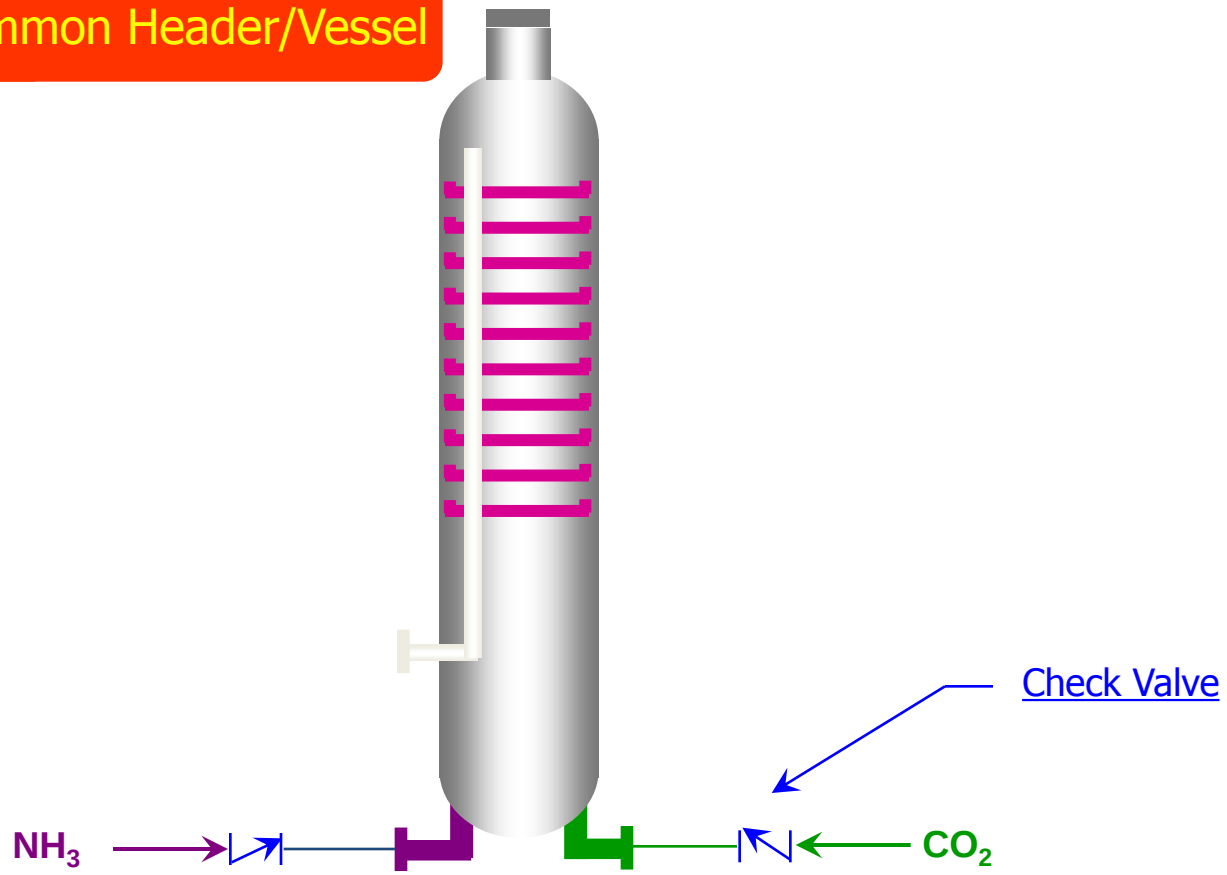
CHECK VALVE - APPLICATIONS

At Pump Discharges



CHECK VALVE - APPLICATIONS

At Pipes Joining Common Header/Vessel



PINCH VALVES

- **PINCH VALVE**
  - THE WORKING ELEMENT OF A PINCH VALVE IS AN ELASTOMER TUBE OR SLEEVE WHICH CAN BE SQUEEZED AT ITS MID SECTION BY SOME MECHANICAL SYSTEM UNTILL TUBE WALLS ARE PINCHED TOGETHER PRODUCING FULL CLOSURE OF FLOW PATH
  - OTHER THAN MECHANICAL MECHANISM, HYDRAULIC OR AIR PRESSURE INJECTED DIRECTLY INTO THE BODY OF THE VALVE TO OPERATE IT

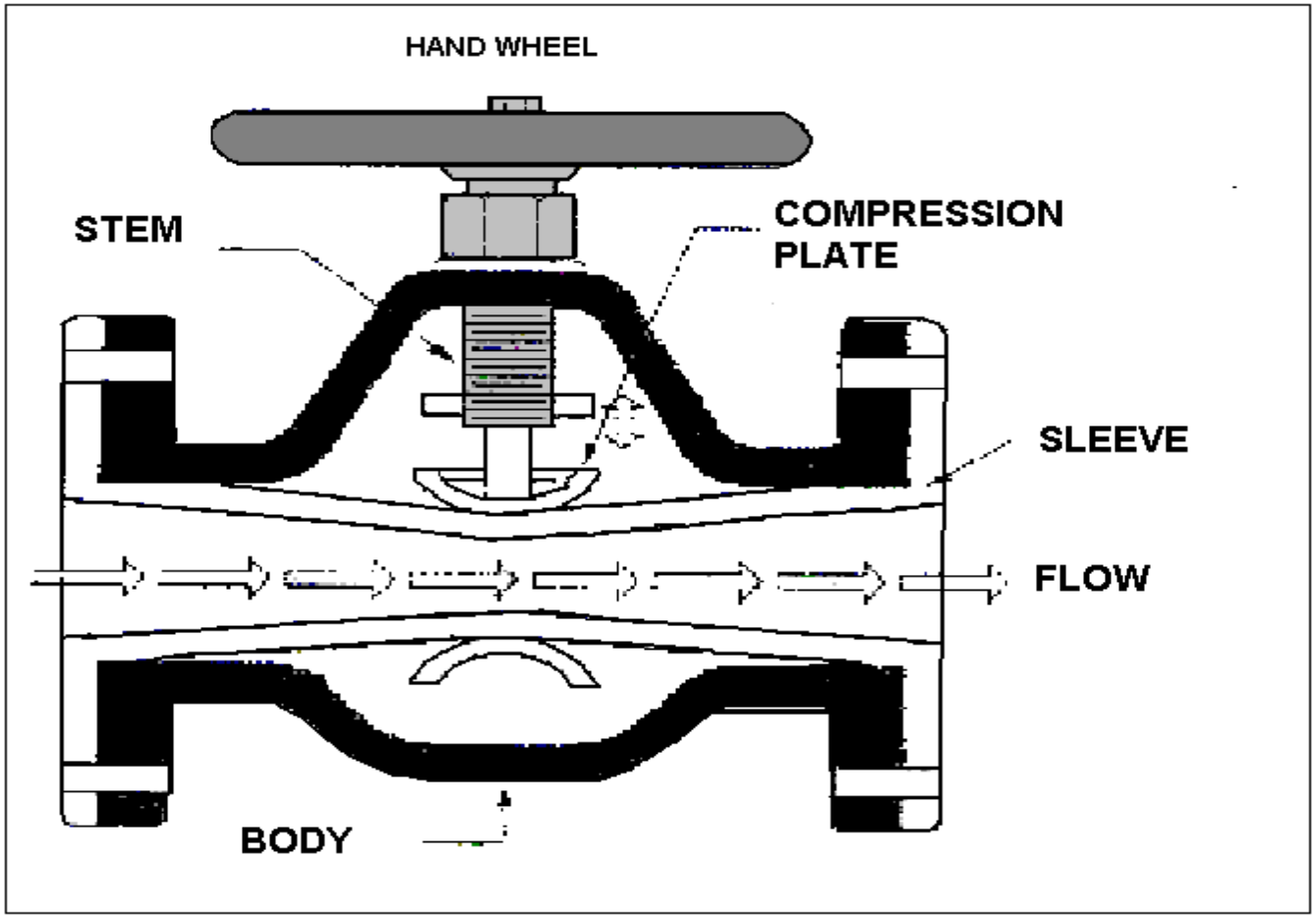
Continued…

- WITH REGULATED FLUID PRESSURE, VALVE MAY BE USED FOR THROTTLING AS WELL AS SHUT-OFF SERVICE
- PARTICULAR ADVANTAGE OF FLUID OPERATED PINCH VALVE IS ITS TIGHT CLOSURE OVER ENTRAPPED SOLIDS
- THESE ARE PARTICULARLY SUITABLE FOR HANDLING COROSIVE MEDIA, SOLIDS IN SUSPENSION & SLURRIES
- THESE HAVE UNRESTRICTED BORE AT FULL OPENING
- CAN HANDLE ALL TYPES OF FLUIDS

Continued…

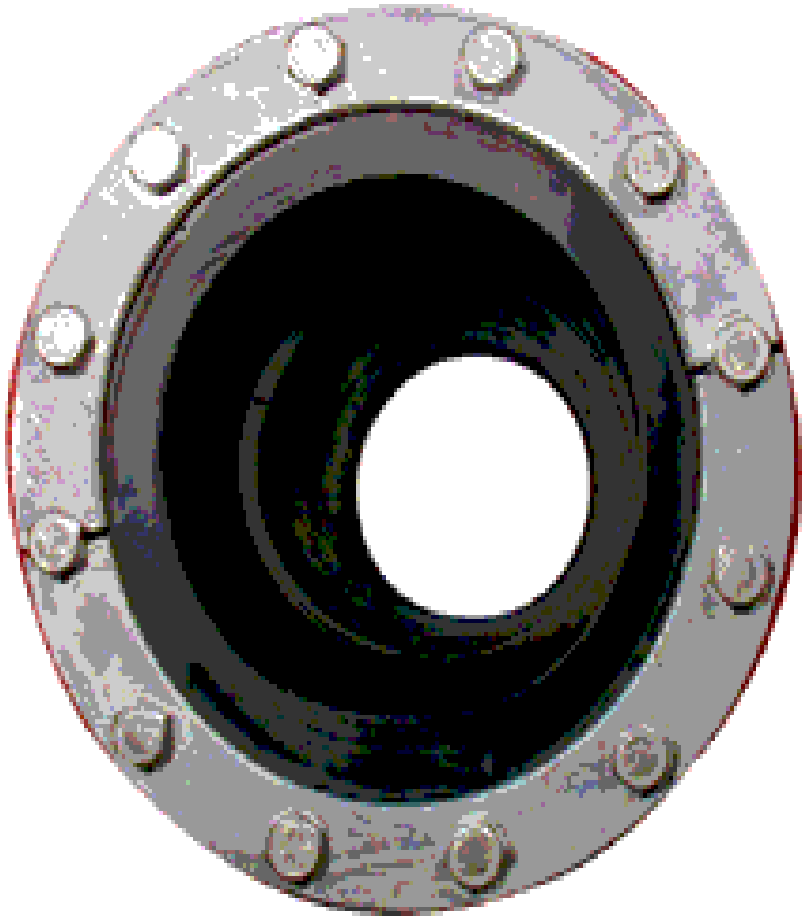
- VALVES WITH MECHANICAL MECHANISM ARE OPERATED BY HANDWHEEL, SCREW MECHANISM IN SMALL SIZES AND WITH POWERED MECHANISM IN LARGE SIZES
- ALSO OPERATED BY PNEUMATIC AND HYDRAULIC ACTUATORS
- VARIOUS LOW HARDNESS, HIGH TENSILE ELASTOMER COMPOUNDS ARE USED FOR TUBES. CHOICE DEPENDS ON CHEMICAL/ ABRSION RESISTANCE AND SERVICE TEMPERATURE
- SIZES COMMONLY AVAILABLE ARE UPTO 12”

PINCH VALVES



PINCH VALVE

PINCH VALVE



PICH VALVE (OPEN POSITION)

PICH VALVE (CLOSED POSITION)

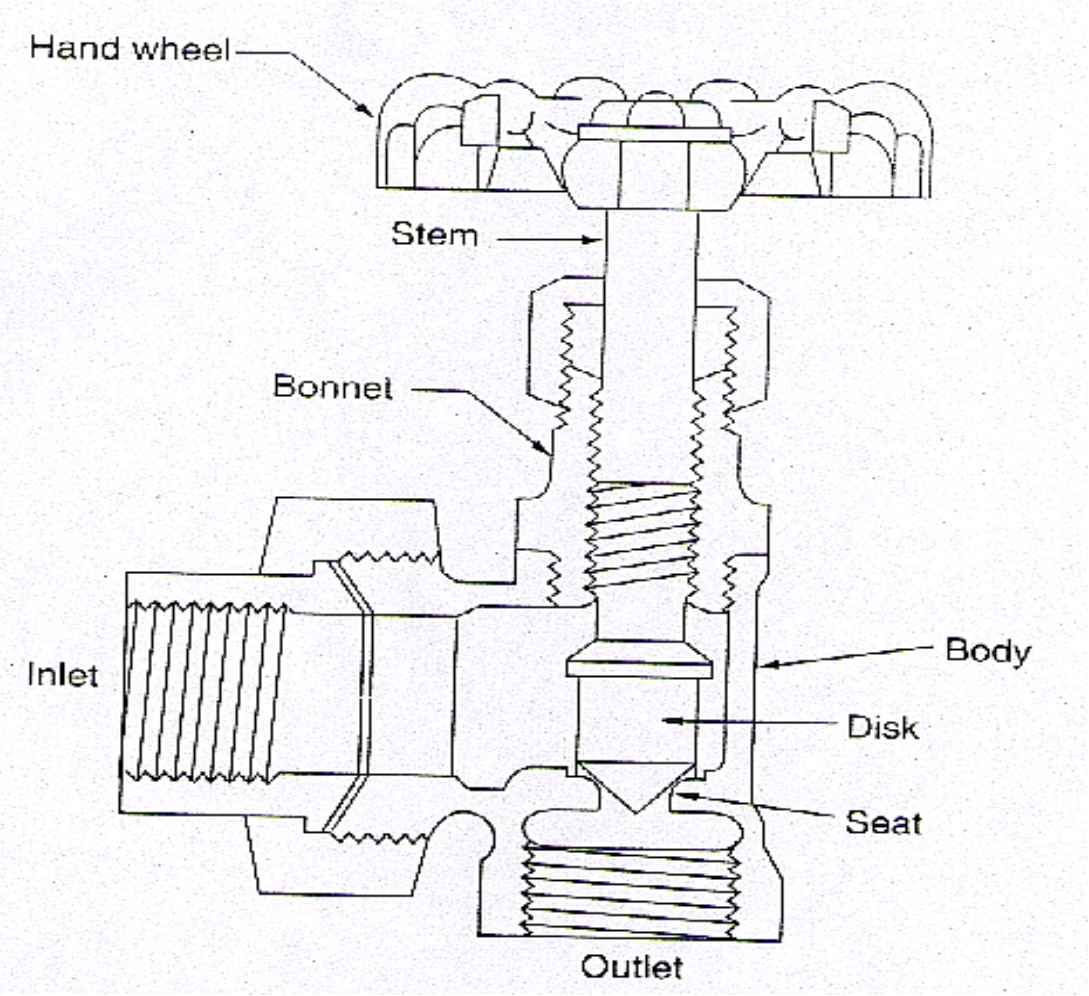
NEEDLE VALVE

- SMALL SIZE OF GLOBE VALVE WITH FINELY TAPERED PLUG HAVING OR NOT AXIAL MOVEMENT RELATIVE TO THE AXIS OF THE CONCENTRIC ORIFICE AND CONTROLLS EFFECTIVE OPENING OF ORIFICE
- HAS THREE BASIC TYPES
  - SCREWDOWN VALVE
  - OBLIQUE VALVE
  - ANGLE VALVE

Continued…

- IN SCREWDOWN VALVE, NEEDLE ACTS PERPENDICULAR TO THE AXIS OF FLOW
- IN OBLIQUE VALVE, NEEDLE ACTS AT 45° ANGLE AND OFFERS COMPARATIVLEY MORE DIRECT FLOW PATH. FLOW PATH IS LESS TORTUROUS WITH REDUCED PRESSURE DROP THAN A GLOBE VALVE. HAS GOOD THROTTLING X-TICS.
- IN ANGLE VALVES, NEEDLE ACTS ON FLUID AGAINST FLOW PATH AND CONTROLLED OUTLET FLOW IS AT RIGHT ANGLE TO THE MAIN FLOW
- NEEDLE IS GENERALLY THREADED AND ITSELF ACTS AS A SEAL TO ELIMINATE LEAKAGE PAST THE NEEDLE

NEEDLE VALVE



NEEDLE VALVE

NEEDLE VALVE

SOLENOID VALVE

- OPERATED BY BUILT-IN ACTUATOR IN THE FORM OF AN ELECTRIC COIL(SOLENOID) AND A PLUNGER
- OPENS AND CLOSES BY AN ELECTRICAL SIGNAL AND RETURNS BACK TO ORIGINAL POSITION BY THE SPRING ACTION WHEN THE SIGNALIS REMOVED
- PRODUCED TO OPERATE IN ONLY TWO MODES
  - FULL OPNE
  - FULL CLOSE

Continued…

- SOLENOID MAY BE OPERATED BY A.C OR D.C
- **A.C** IS SUPPLIED FROM MAIN VOLTAGE THROUGH A TRANSFORMER, IF NECESSARY
- **D.C** IS PROVIDED BY BATTERY, D.C GENERATOR OR THROUGH A RECTIFIER
- **A.C** OPERATED SOV IS QUICKER IN RESPONSE TIME AND CAN HANDLE HIGHER PRESSURES INITIALLY. PREFFERED WHERE FAST RESPONSE IS REQUIRED AND RELAY TYPE ELECTRIC CONTROLS ARE USED. RESPONSE TIME IS 8-15 MILLISECONDS.

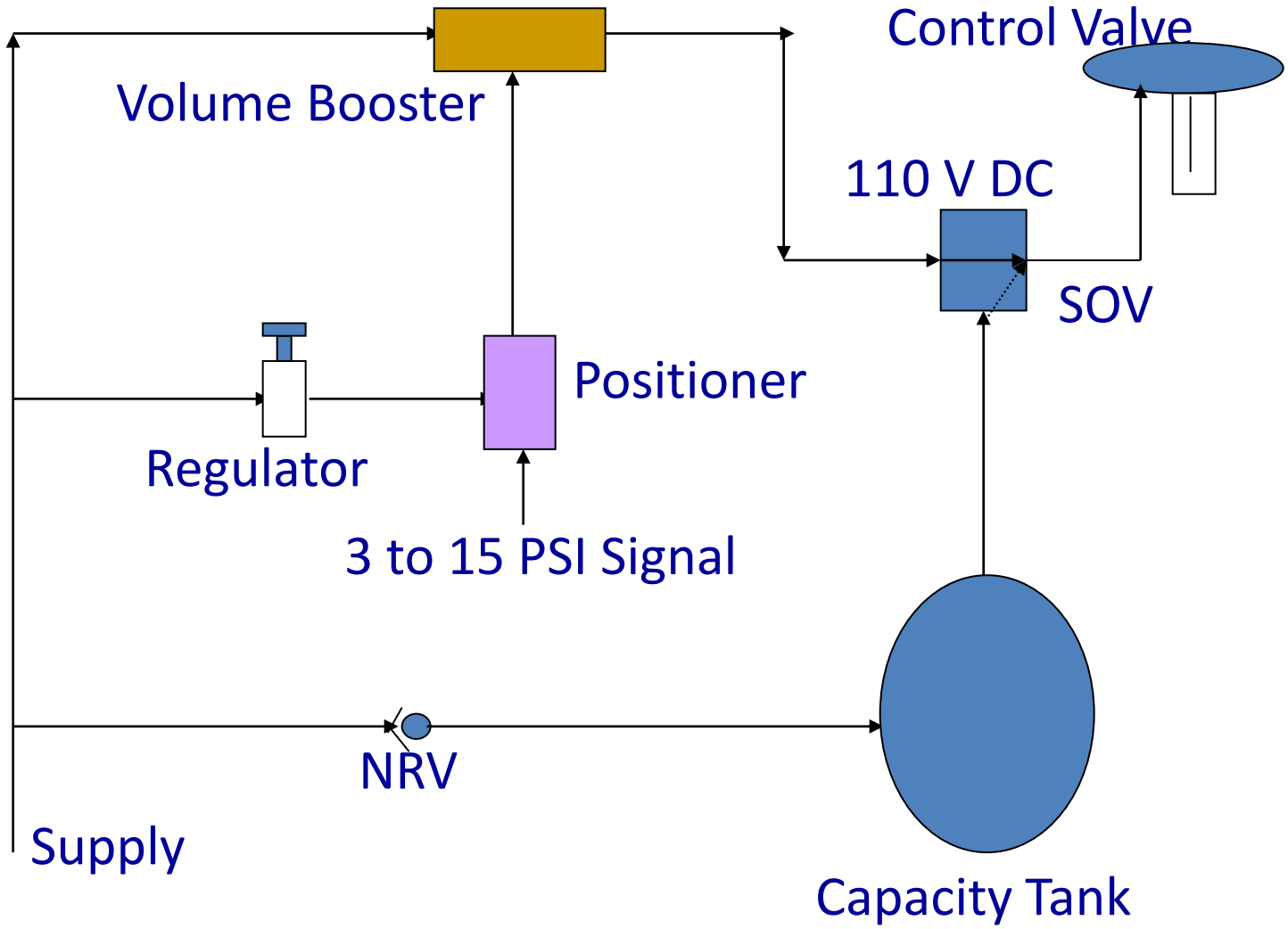
Continued…

- **D.C** OPERATED SOV IS SLOW IN RESPONSE AND CAN HANDLE LOW PRESSURES. NOT SUBJECT TO PEAK INITIAL CURRENT THAT PREVENTS FROM OVERHEATING AND COIL DAMAGE. RESPONSE TIME IS 30-40 MILLISEC.
- **A.C** OPERATED SOV HAS HIGHER POWER LOSSES THAN D.C OPERATED
- **SOVs** ARE PRODUCED IN 02 CATEGORIES
  - 2-WAY VALVE
  - 3-WAY VALVE

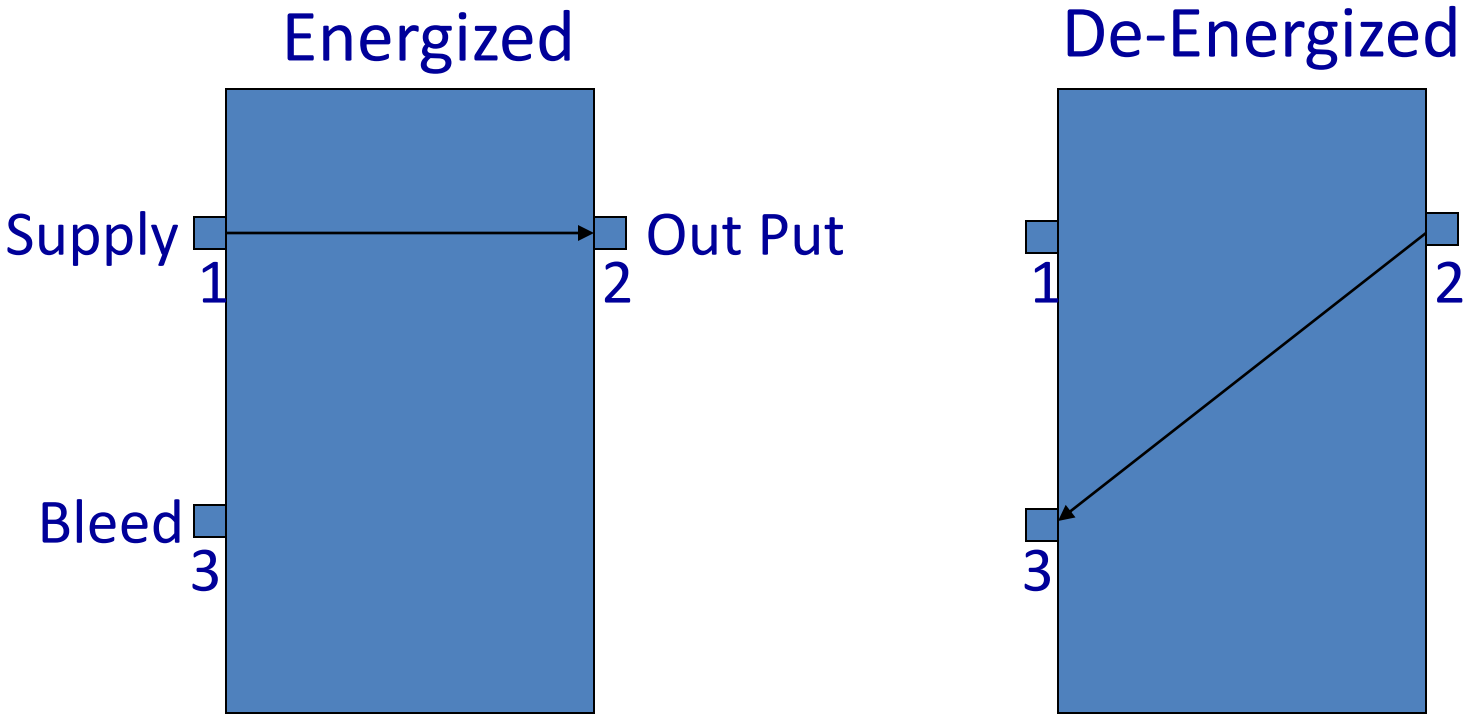
Continued…

- 02-WAY IS AVAILABLE IN NORMALLY OPEN AND NORMALLY CLOSED POSITION
- IN 02-WAY NORMALLY OPEN, SPRING HOLDS THE VALVE OPEN ASSISTED BY FLUID PRESSURE. SOLENOID FORCE OVERCOMES BOTH THESE FORCES AND CLOSES THE VALVE
- IN 02-WAY NORMALLY CLOSED, BOTH SPRING FORCE AND FLUID PRESSURE ACT TO CLOSE THE VALVE. SOLENOID FORCE OPENS THE VALVE AIDED UP BY THE GRAVITY FORCE AS THESE VALVES ARE GENERALLY MOUNTED IN VERTICLE POSITION

Control Valve Loop



SOV



Precautions

- In case of Electric device such as
  - SOV
  - Must have Explosion proof class.
  - When working at terminal or in J.B.
  - It is in open condition, one must be more careful, because Explosion proof system is violated.

SCREWDOWN VALVE

- GENERAL TERM USED TO REFER ALL TYPES OF VALVES SEALING BY DISC OR PLUG IN WHICH SEALING ELEMENT IS LIFTED FROM AND LOWERED ONTO THE VALVE SEAT BY ROTATION OF THREADED STEM, THE AXIS OF WHICH IS PERPENDICULAR TO VALVE SEAT
- INCLUDE GATE, GLOBE, OBLIQUE,LIFT TYPE PLUG AND ANGLE VALVES ETC

Continued…

- CATEGORIZED AS
  - INSIDE SCREW VALVE (ISV)
  - OUTSIDE SCREW VALVE (OSV)
- INSIDE SCREW HAVE THREADED PORTION OF STEM FULLY ENCLOSED WITHIN THE BONNET
- OUTSIDE SCREW HAVE THE THREADED PORTION OF STEM EXTERIOR TO THE BONNET AND INSIDE YOKE
- THESE CAN ALSO BE CATEGORIZED AS
  - RISING STEM VALVES (RSV)
  - NON-RISING STEM VALVES (NRSV)

Continued…

- In **RSV**, stem moves in or out of the bonnet as the stem is rotated by handwheel, lever or actuator
- In **NRSV**, there is no displacement of stem along its axis when rotated
- **ISV** have the threaded length of stem protected from dirt. Stem is fully exposed to fluid being handled. Stem is difficult to be lubricated

Continued…

- **OSV** HAVE THE THREADED LENGTH FULLY EXPOSED TO SURROUNDINGS. DIRT CAN DEPOSIT ON STEM BESIDES ALSO VULNERABLE TO CORROSION. THREADED PORTION CAN EASILY BE LUBRICATED. THREADED PORTION IS NOT EXPOSED TO FLUID BEING HANDLED. THIS TYPE IS MORE SUITABLE FOR HANDLING CORROSIVE FLUIDS AND SLURRIES.
- **RSV** PROVIDE A VISUAL INDICATION OF POSITION OF THE VALVE DISC OR GATE, HANCE INDICATE DEGREE OF OPENING. ADEQUATE SPACE IS REQD TO ALLOW RISING STEM MOVEMENT

Continued…

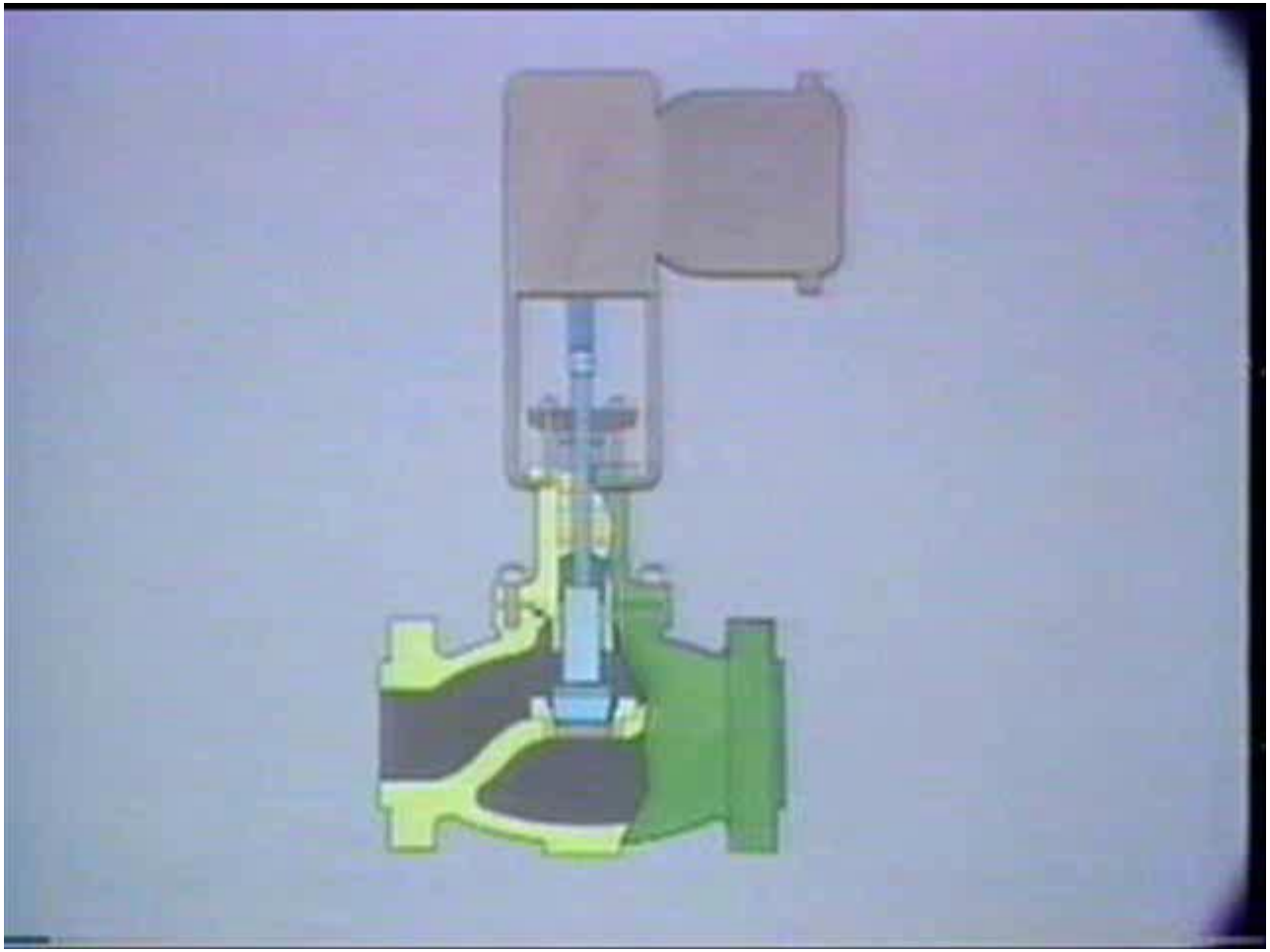
- **NRSV** CAN BE INSTALLED IN POSITIONS WHEREHEAD ROOM IS LIMITED.

VALVE TYPES FOR SPECIFIC SERVICES

SERVICE	MAIN	SECONDARY
Gases	**Butterfly valves, Check valves, Diaphragm valves, Lubricated plug valves, Screw down stop valves**	**Pressure control valves, Pressure relief valves, Pressure reducing valves, Safety valves, Relief valves**
Liquids, clear upto sludge and sewage	**Butterfly valves, screw down stop valves, Gate valves, Lubricated plug valves, Diaphragm valves, Pinch valves**	
Slurries and liquids heavily contaminated with solids	**Butterfly valves, Pinch valves, Gate valves, Screw down stop valves, Lubricated plug valves**	
Steam	**Butterfly valves, Gate valves, Screw down stop valves, Turbine valves**	**Check valves, Pressure control valves, Pre-superheated valves, Safety and relief valves**

Valve Components

Valve Parts



Complete Control Valve

- Actuator
- Diaphragm
- Spring
- Yoke
- Indicator
- Coupling Assembly

Complete Control Valve (cond)

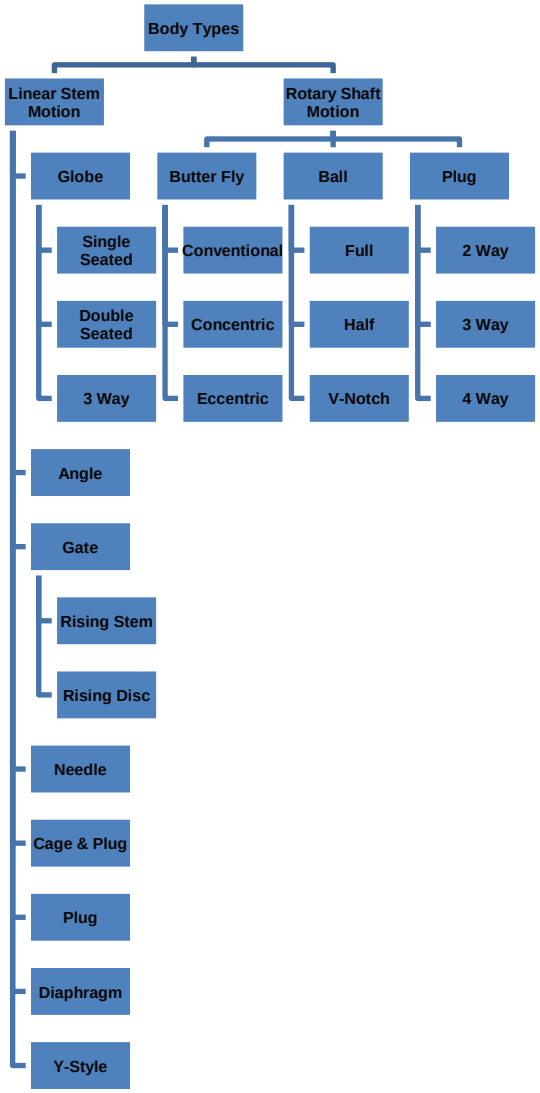
- Stem
- Bush
- Check Nut of yoke
- Packing Box
- Bonnet
- Body

Complete Control Valve (cond)

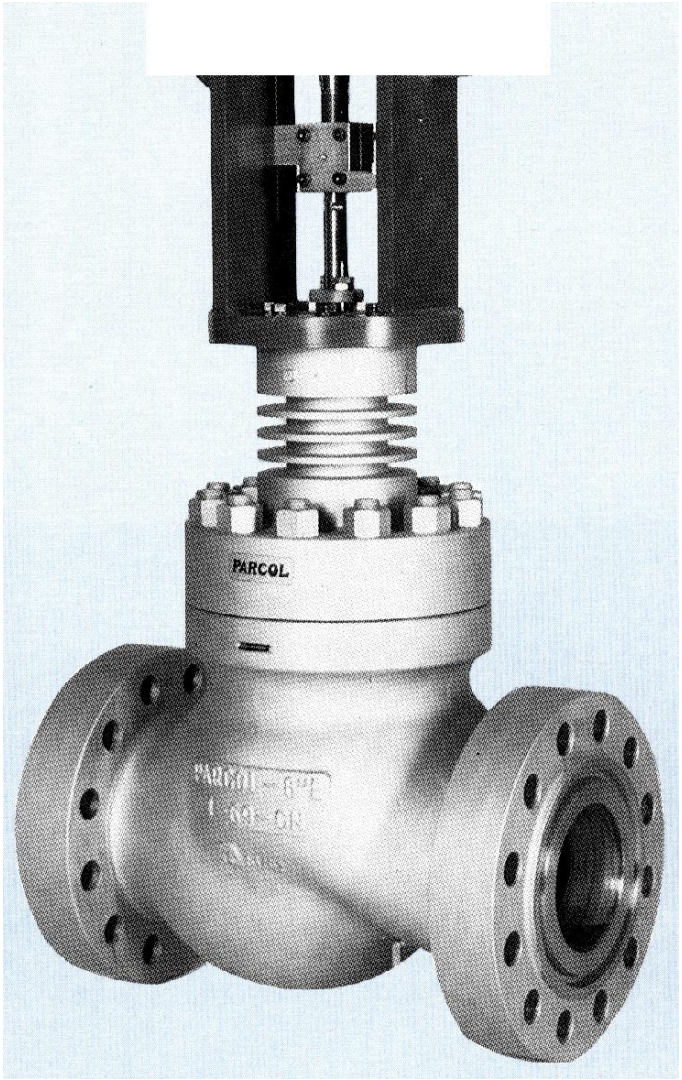
- Plug
- Seat Ring
- Cage
- Gaskets
- Bottom Guide

Valve Body

Valves Body Family

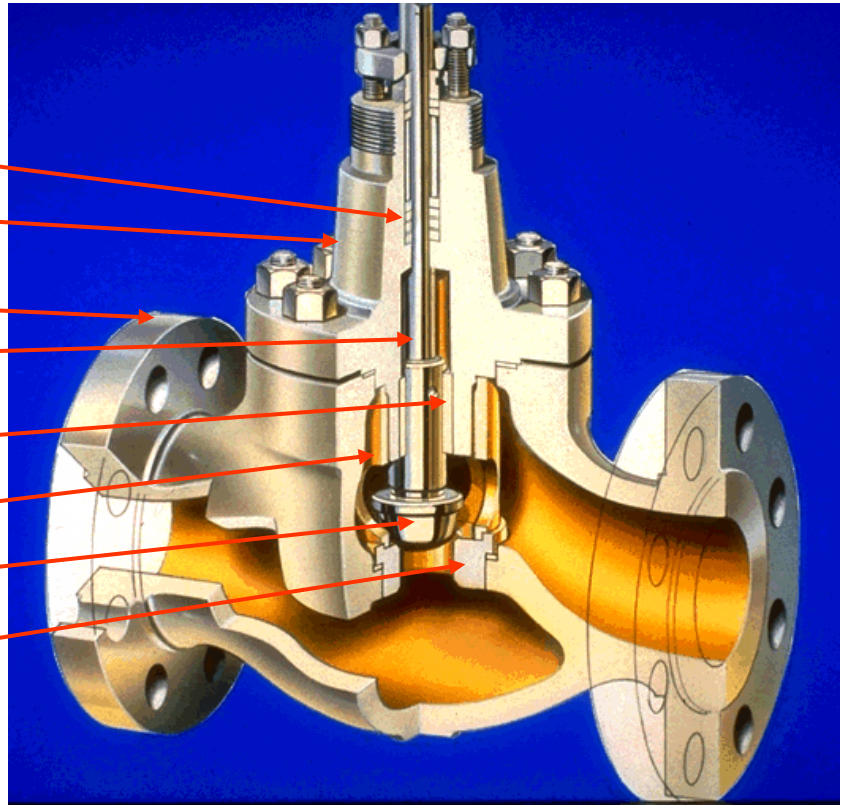


Valve Body

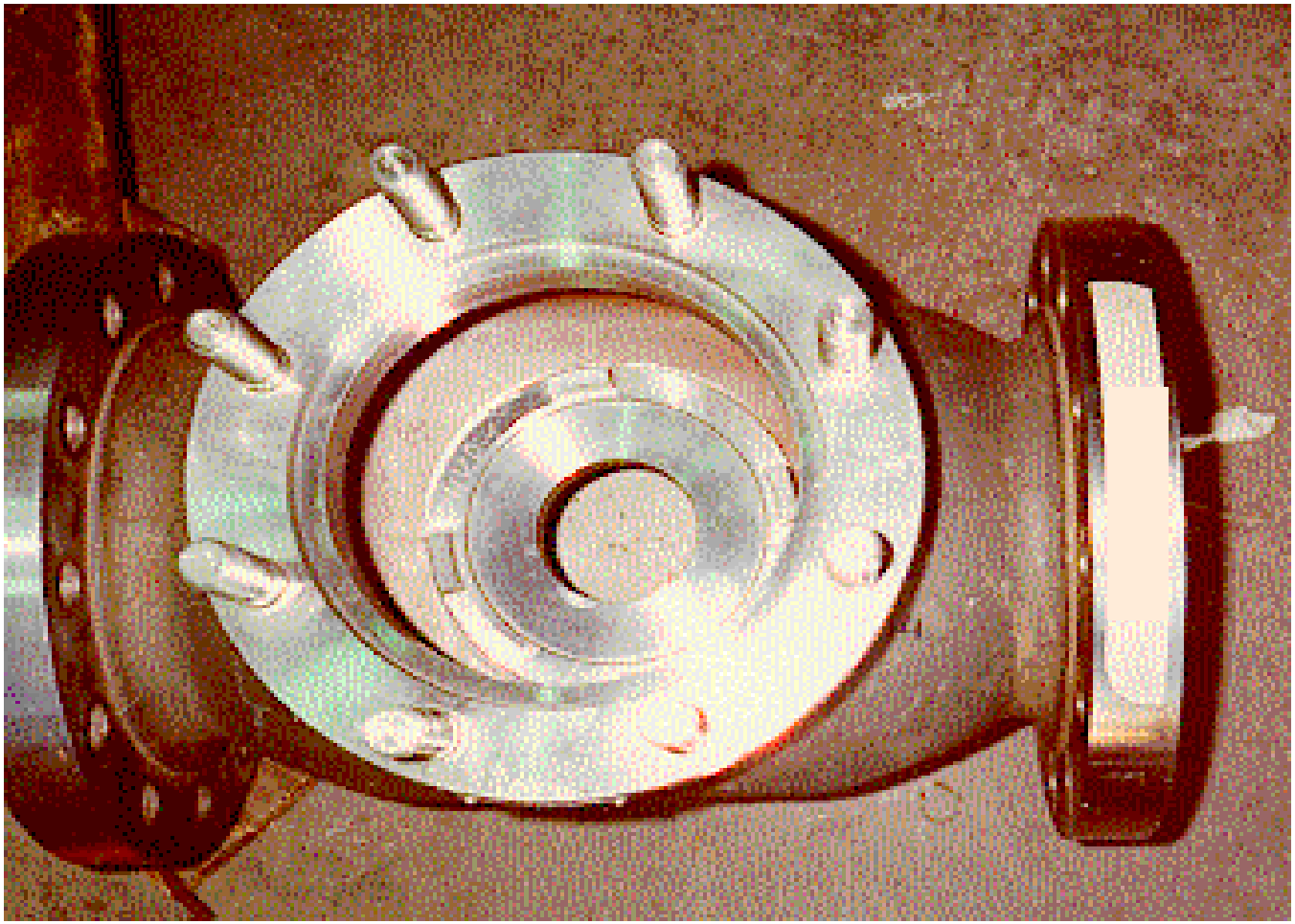


Valve Body Components

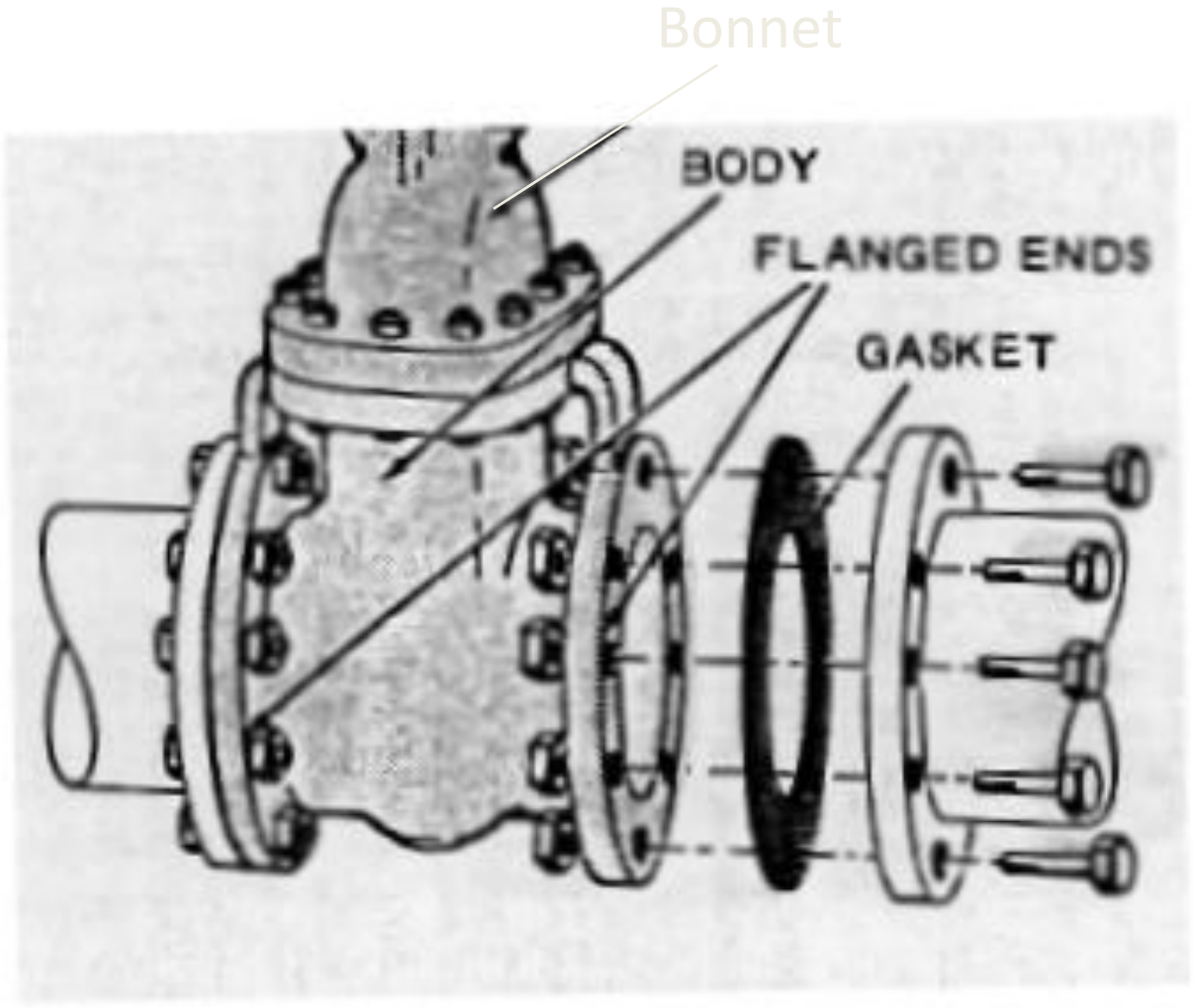
Packing
Bonnet
Body
Stem
Guide Bushing
Retainer or Cage
Plug
Seat Ring



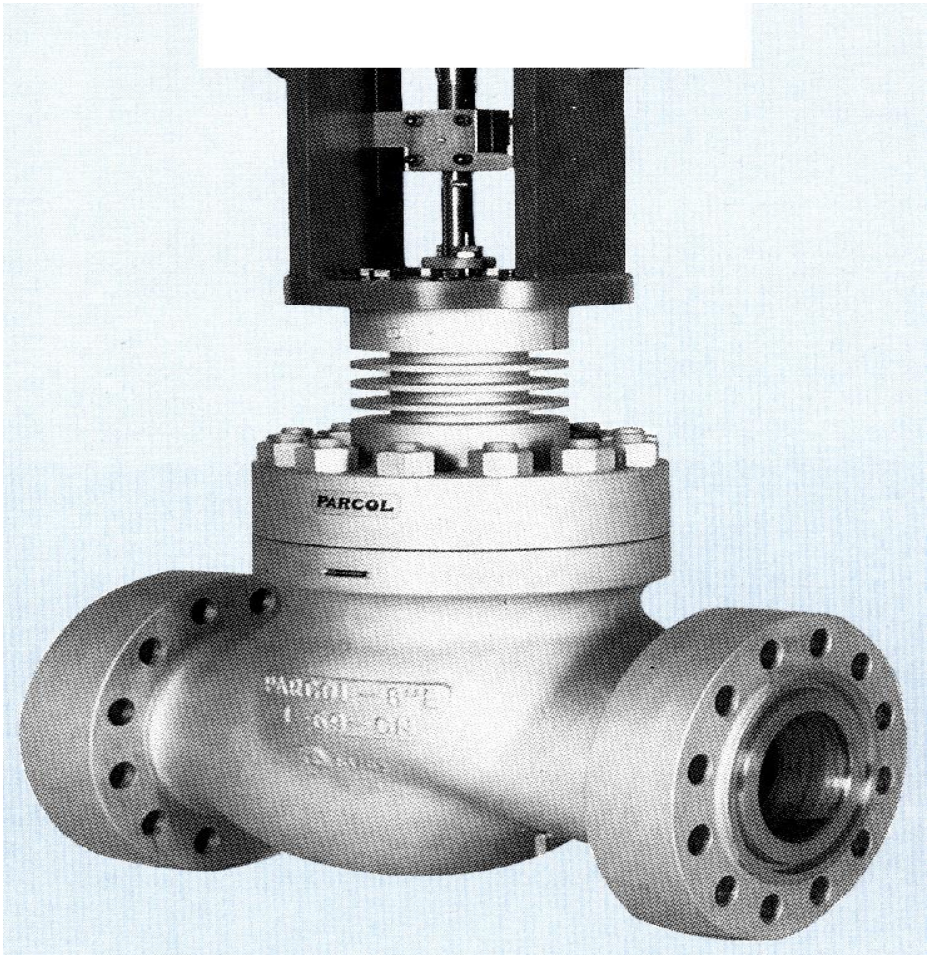
Valve Body



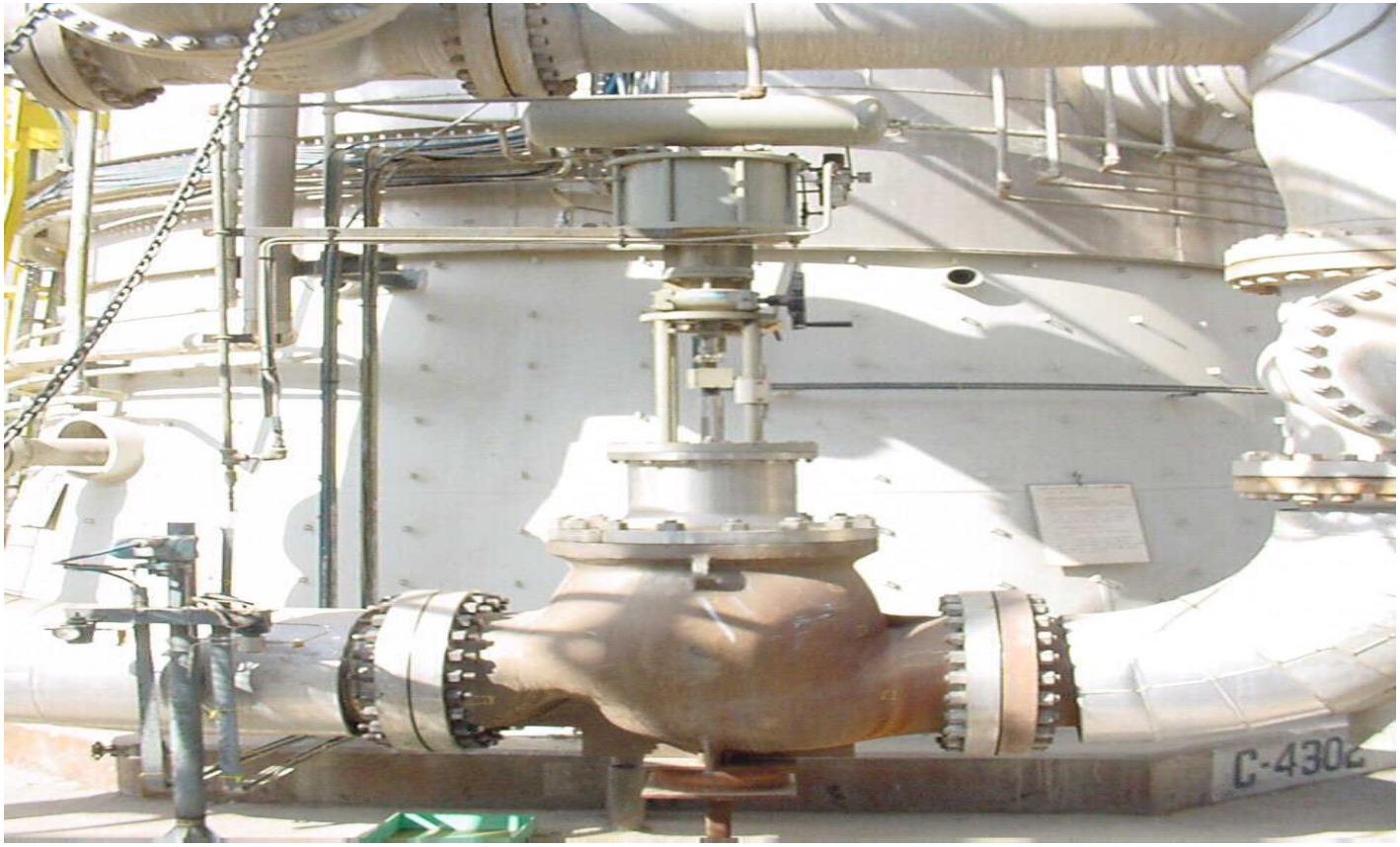
Valve Body



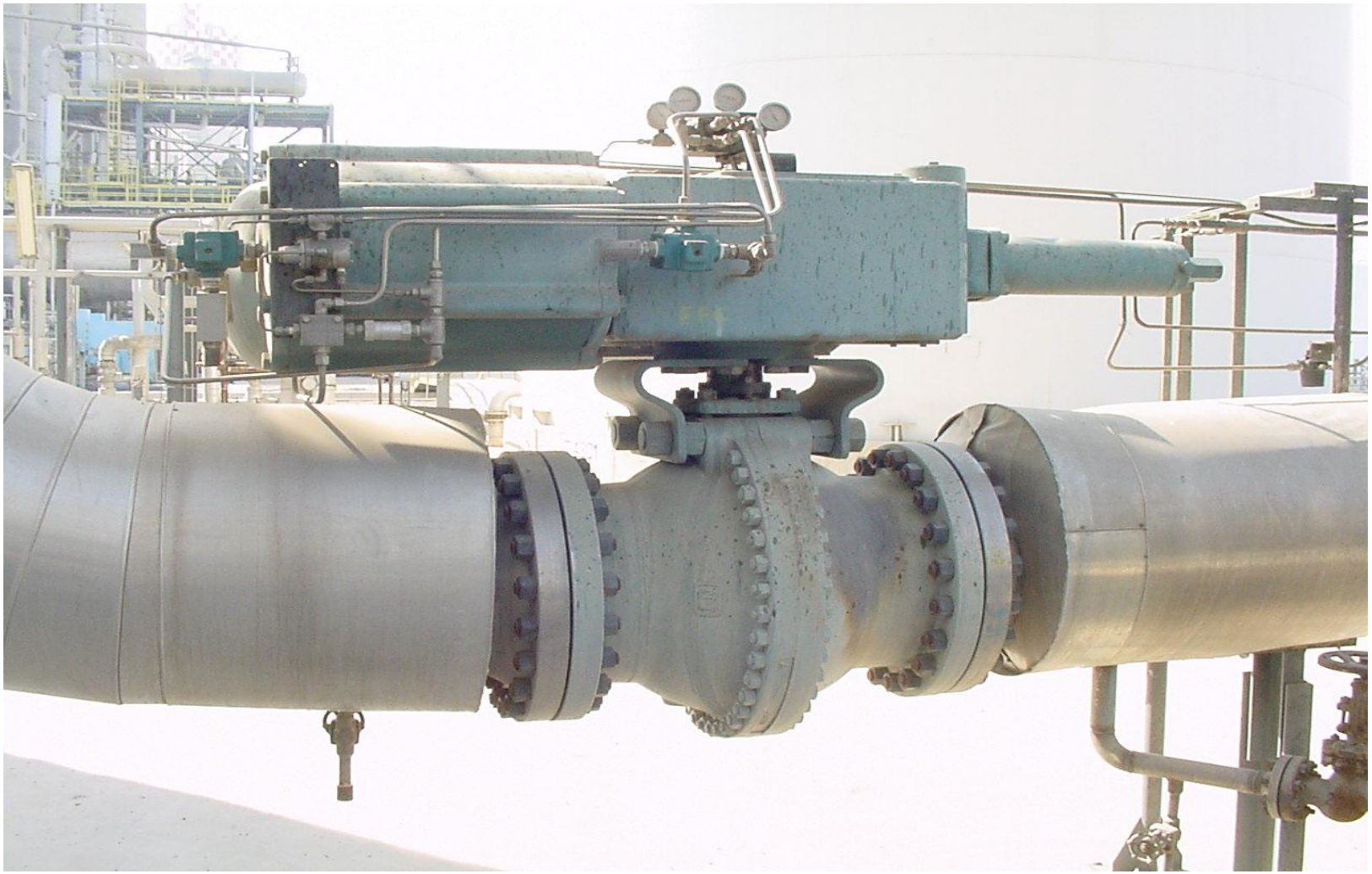
Valve Body



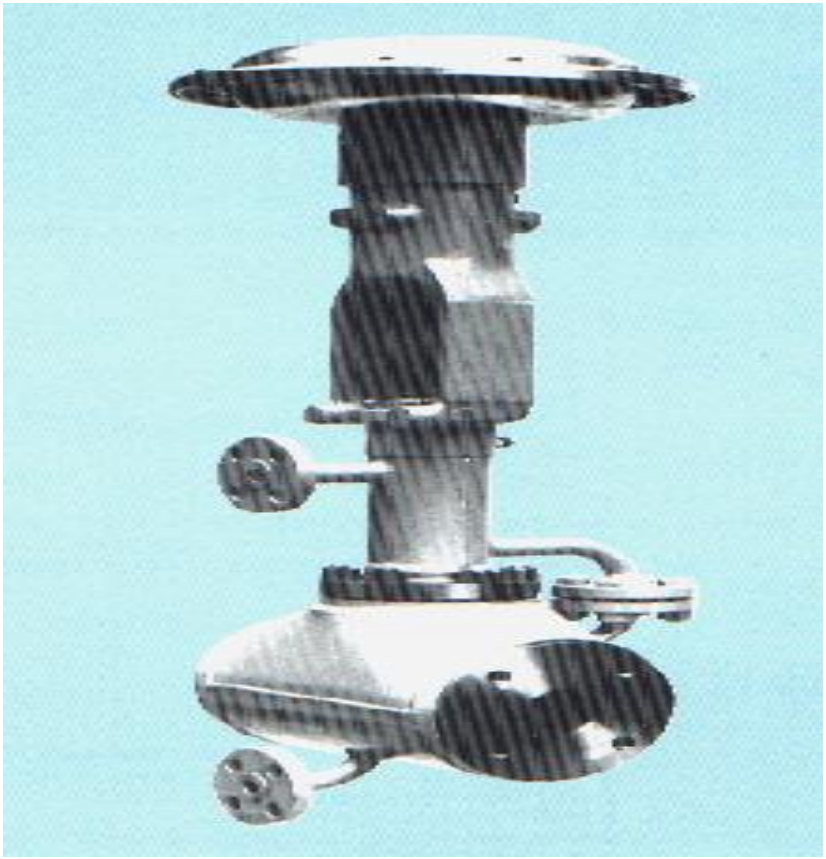
Valve Body



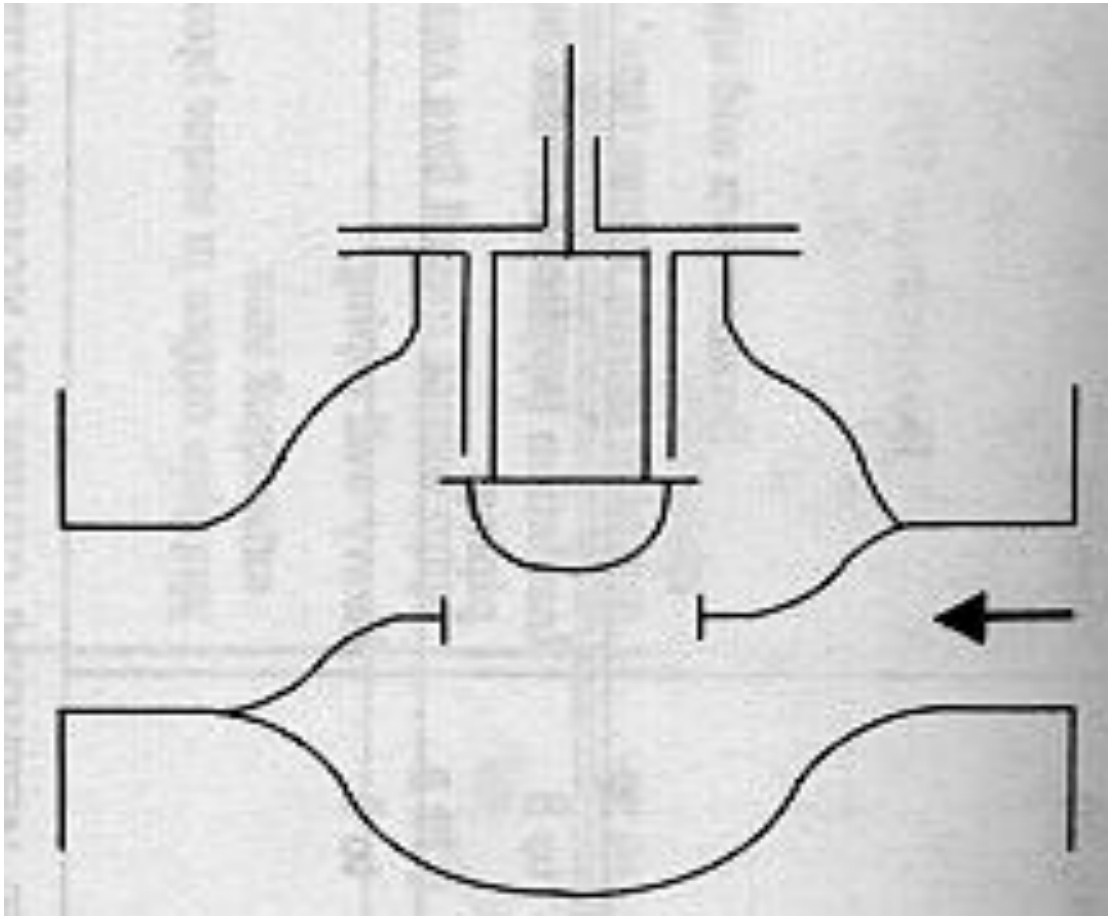
Ball Valve



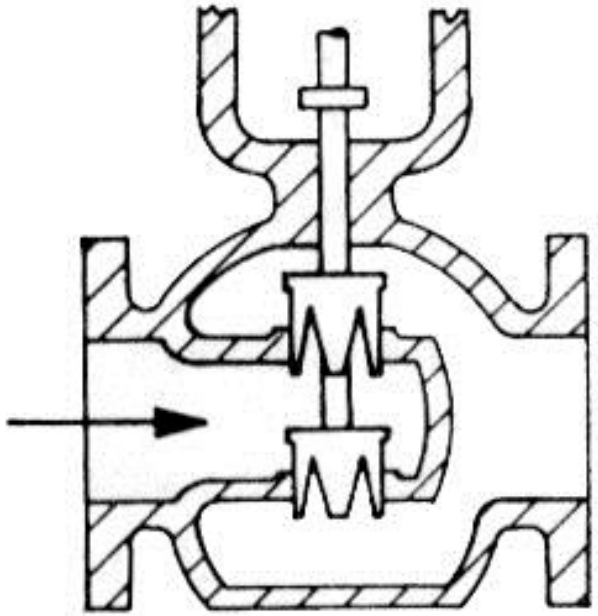
Jacketed Valve



Single Seated-Top Guided

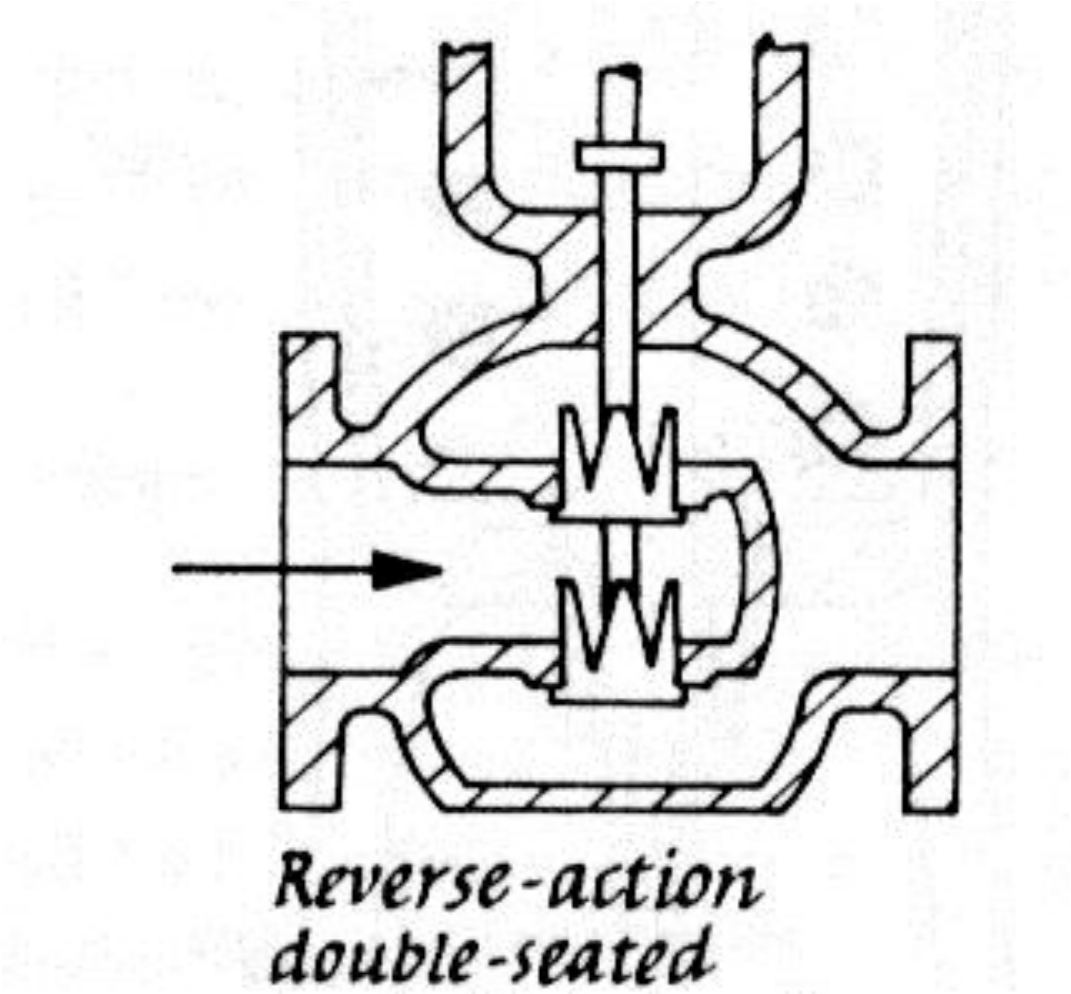


Direct Action Double Seated



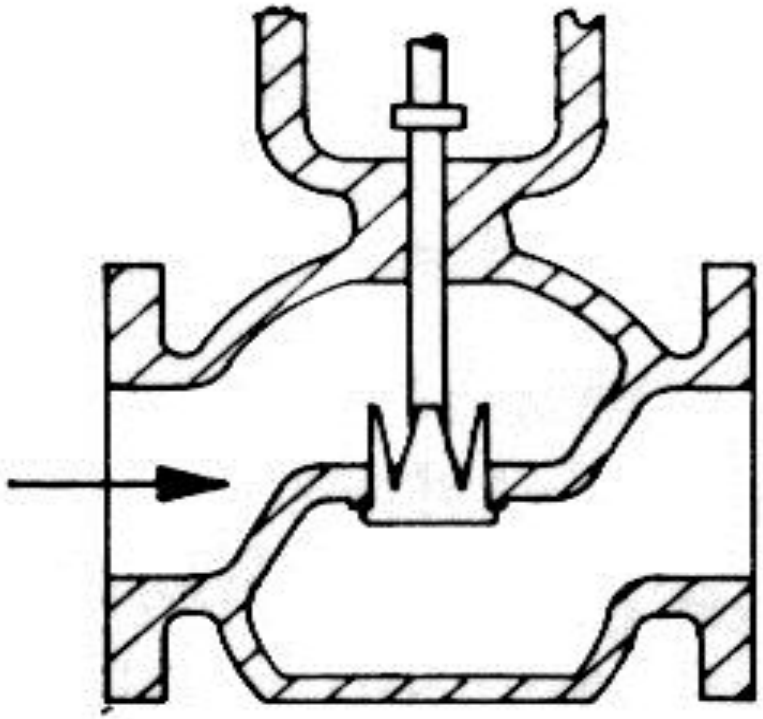
Direct-action double-seated

Reverse Action Double Seated



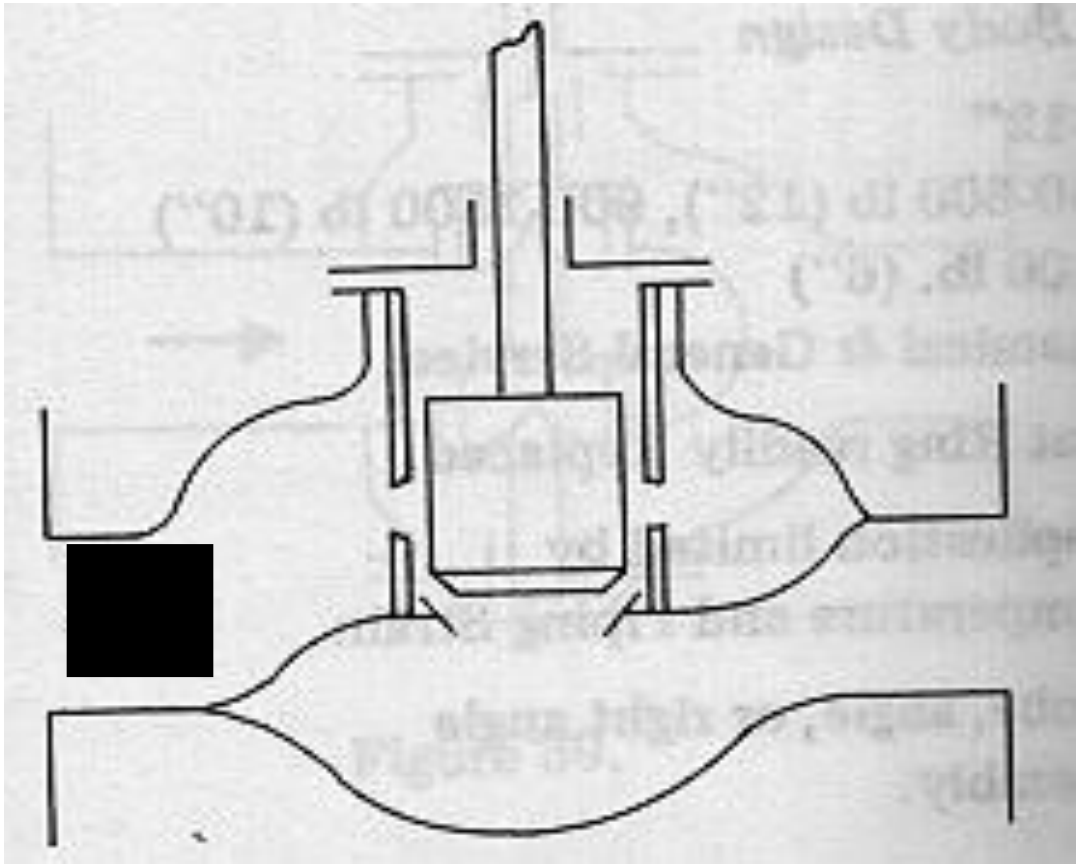
Reverse-action double-seated

Reverse Action Single Seated

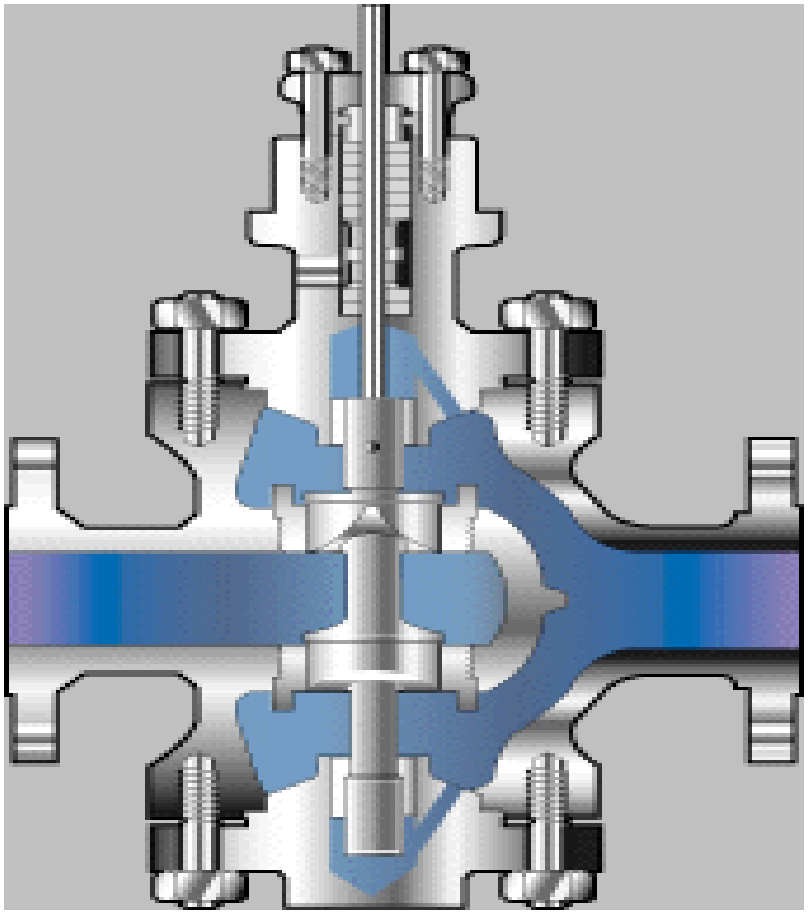


Reverse-action single-seated

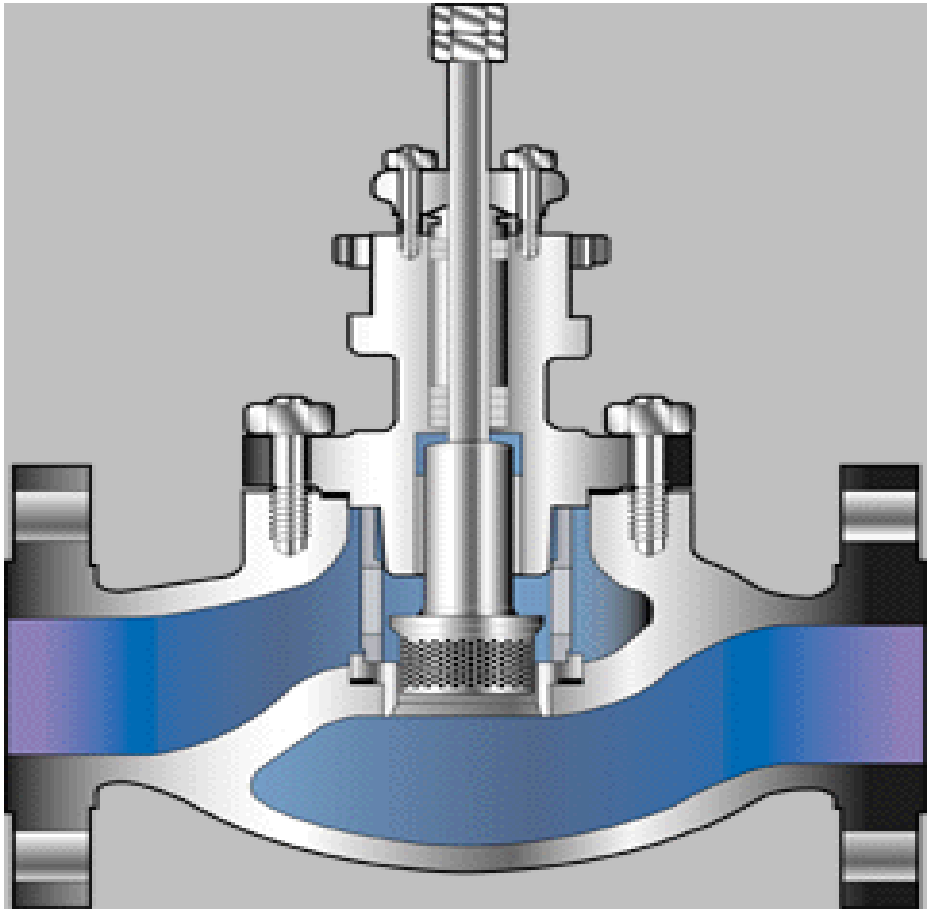
Cage



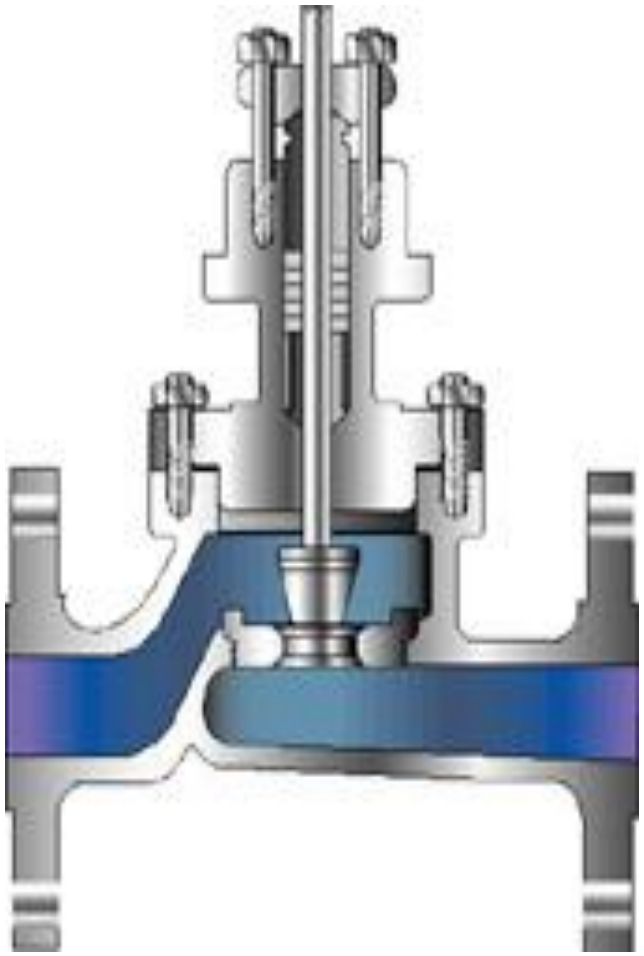
Double Seated – Top & Bottom Guided



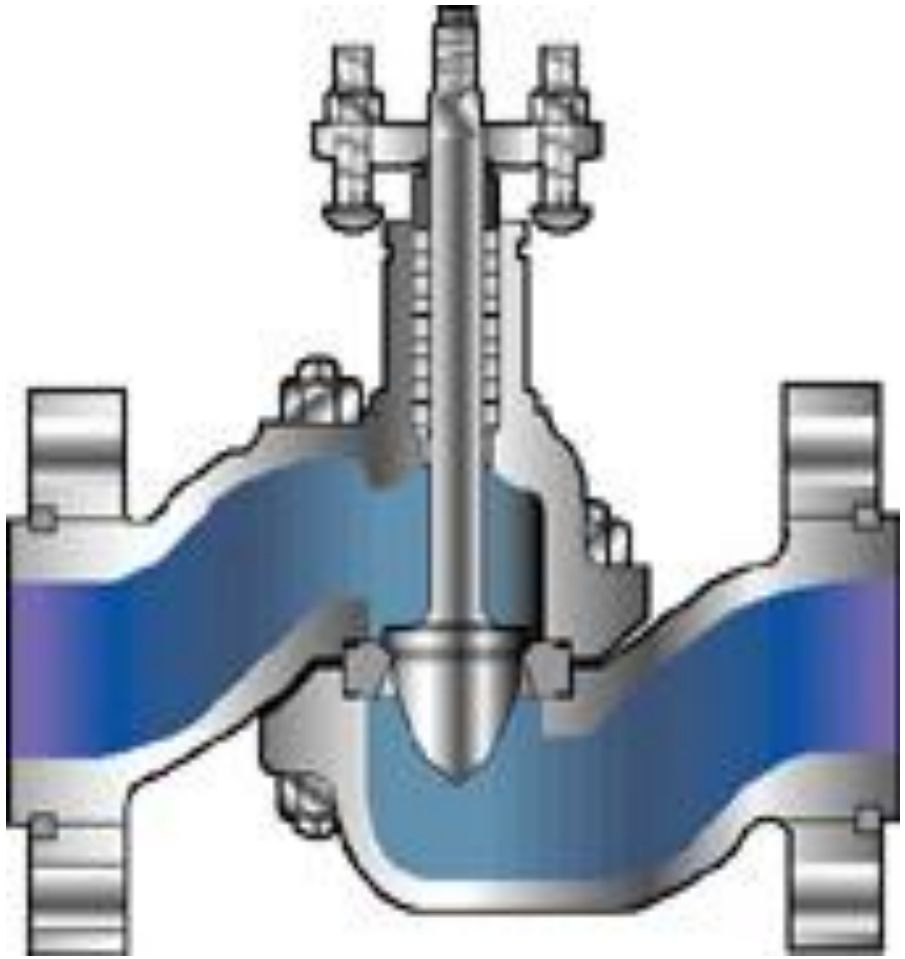
Single Seated -Top Guided



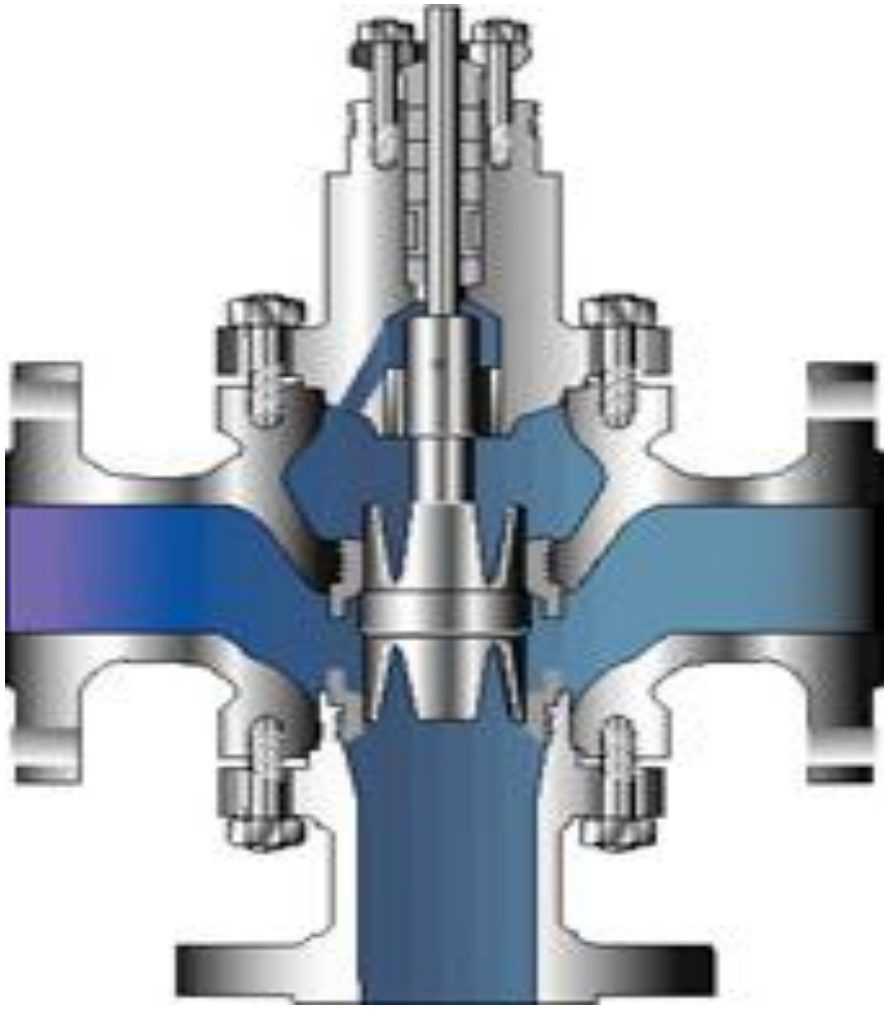
Single Seated



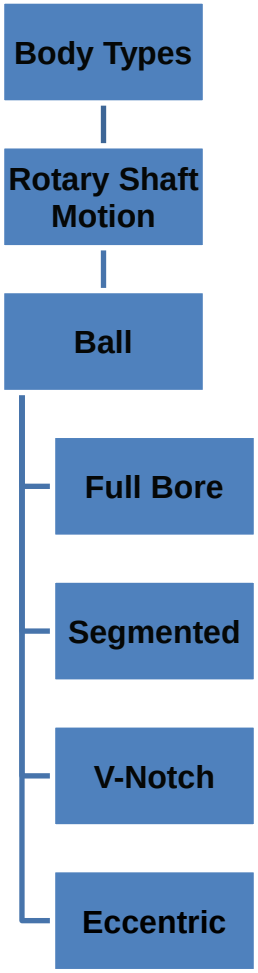
Linear Valve



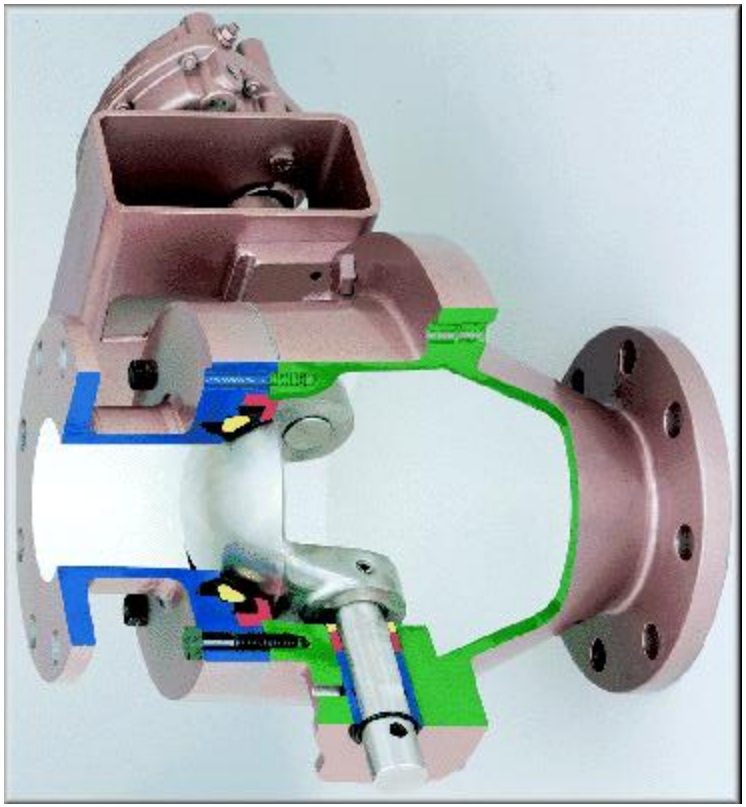
3 Way Valve

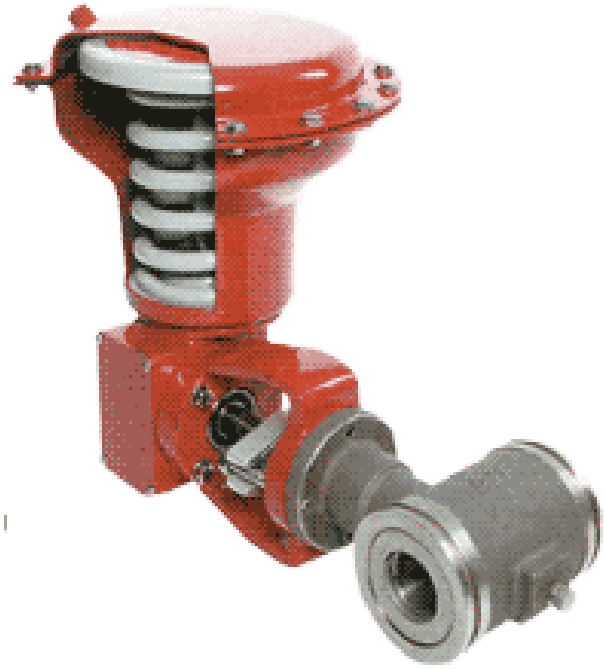


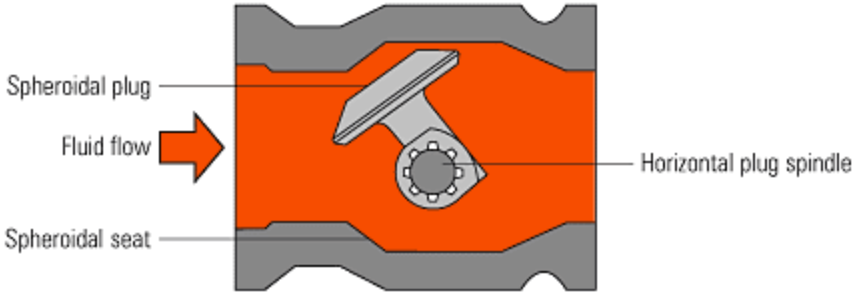
Ball Type


Body Types
Rotary Shaft Motion
Ball
Full Bore
Segmented
V-Notch
Eccentric

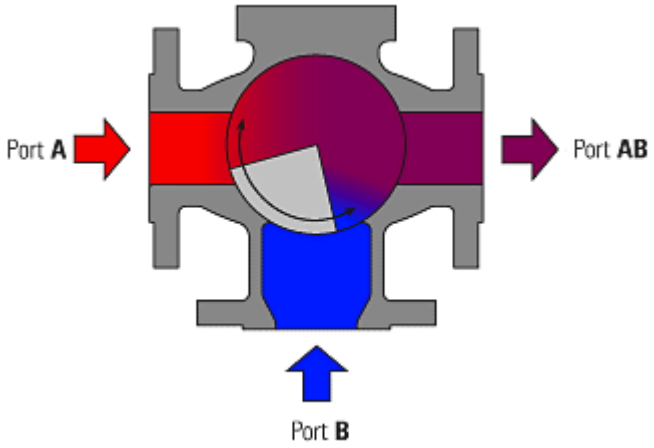
V-Notch Ball Valves

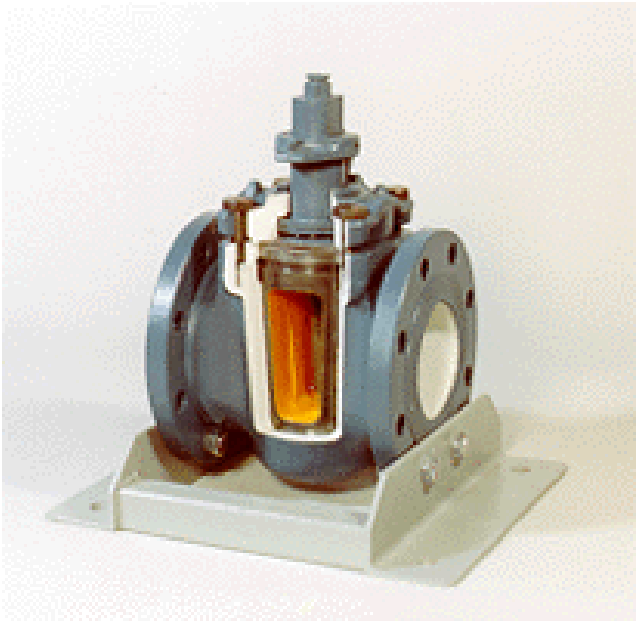






THREE WAY BODY





Valve Trim

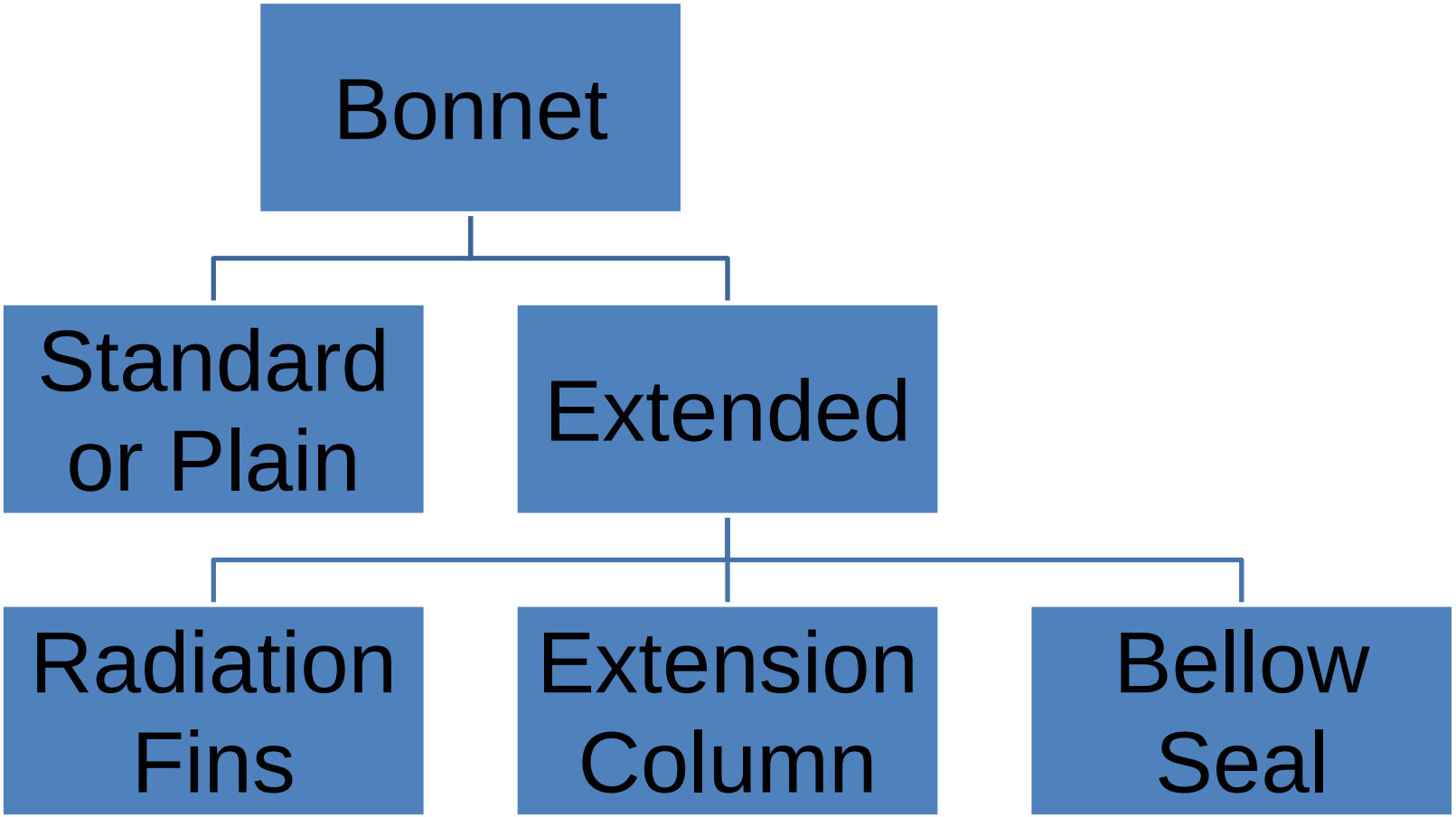
- Those parts of valve which comes in direct contact of fluid
- Trim Comprises of:
  - Plug
  - Seat Ring
  - Stem
  - Cage Guide Bushing
  - Stuffing Box


Bonnet

Valve Bonnets

- The valve bonnet or top closure is the removable upper portion of the valve body sub-assembly and is normally connected to the body by high strength bolting.
- It is a pressure-carrying part and is, therefore, subject to the same design requirements as the valve housing.
- Removal of the valve bonnet generally provides access to the valve trim.
- Some low-pressure valves, particularly in sizes below 2 inches, have a threaded bonnet connection which is more economical than a flanged joint.
- The upper portion of the bonnet contains the valve packing.

Types of Bonnets



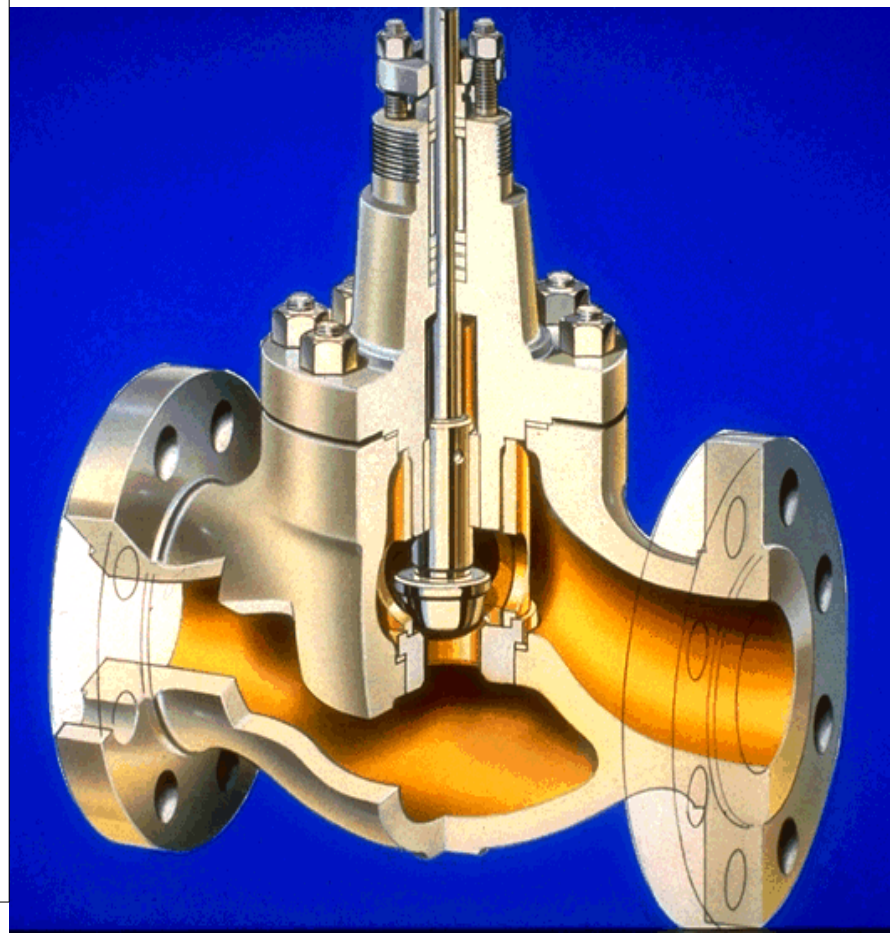
Bonnet Options

Bonnet Options

Standard vs Extended Bonnets

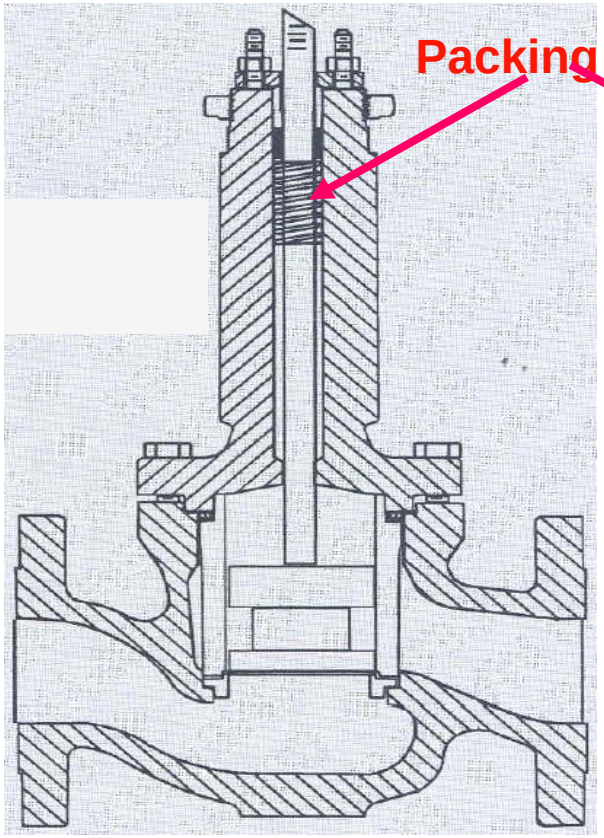
In applications where the fluid temperature is above or below the temperature rating of the packing material, an extension bonnet may be used. The purpose of the extension bonnet to increase the distance between the process fluid and the packing, thereby minimizing the effect of the fluid temperature on the packing.

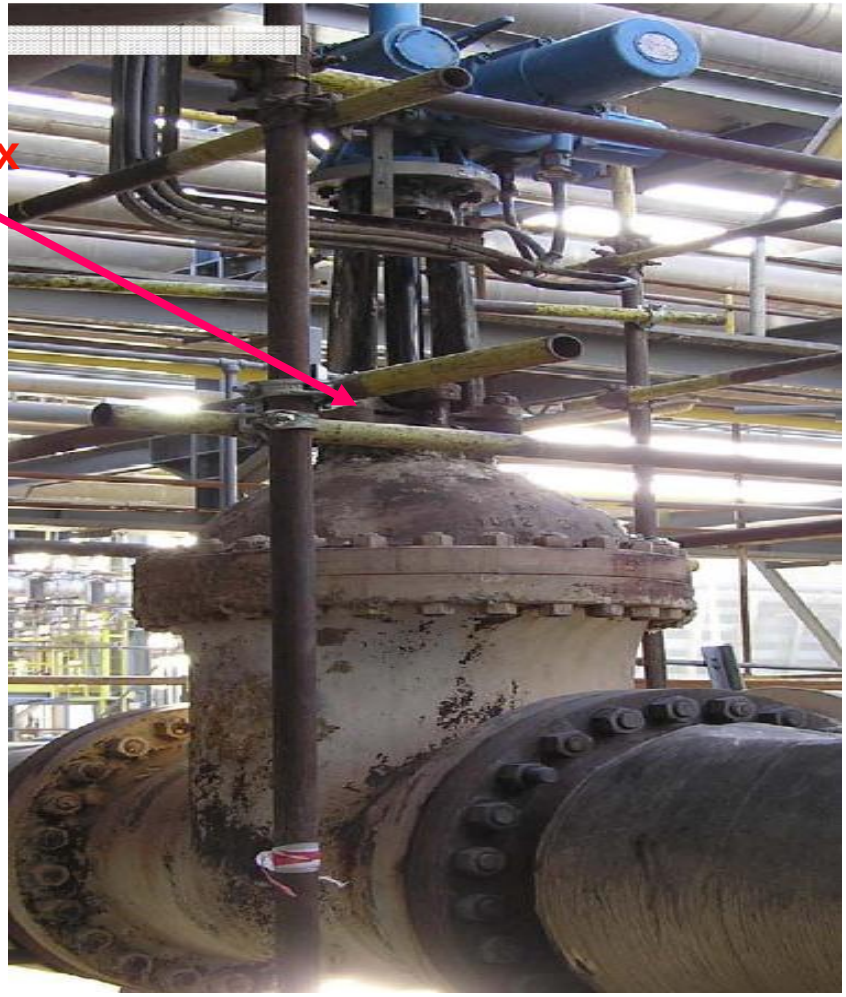
Standard Bonnet



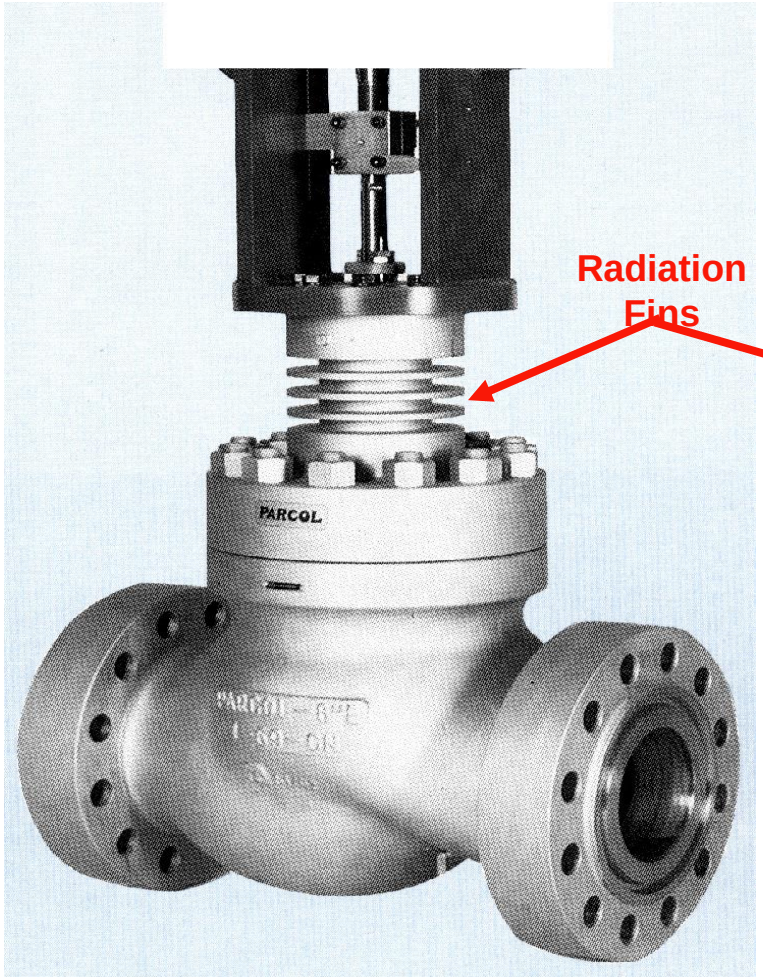
Standard Bonnet

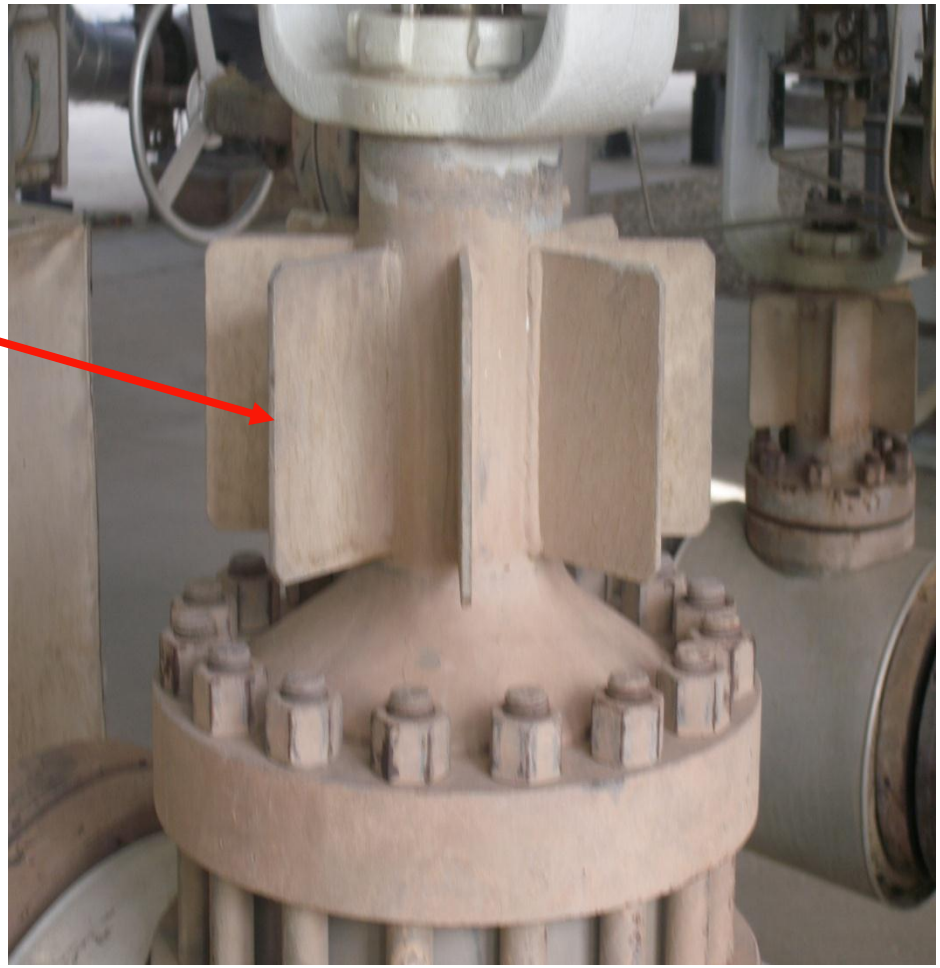
Extended Bonnet





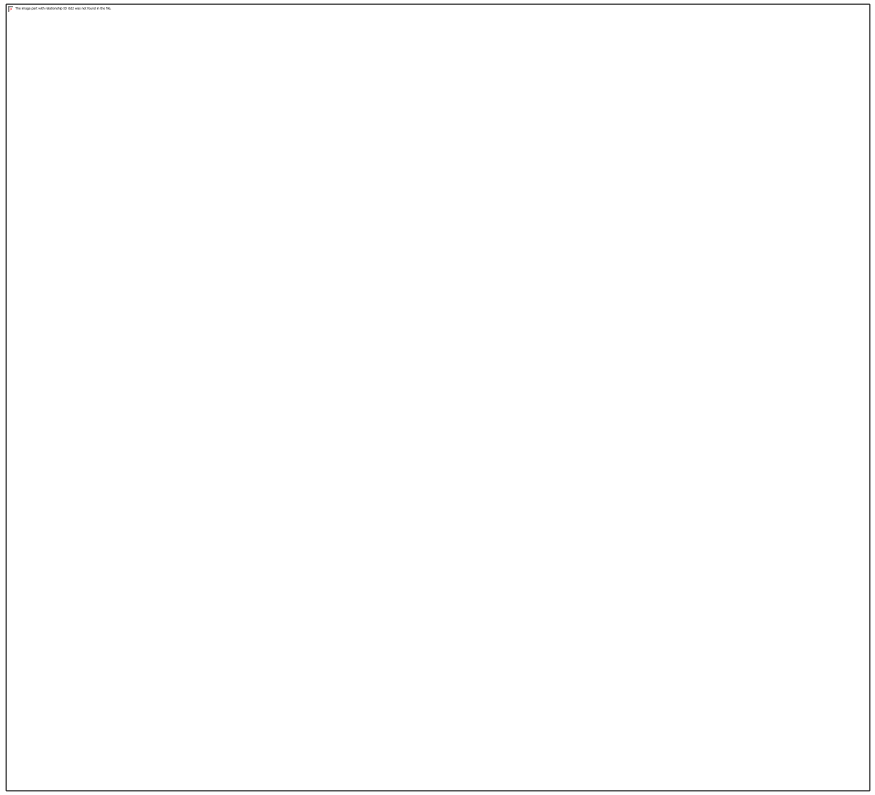
Thermal Radiation Fins Bonnet

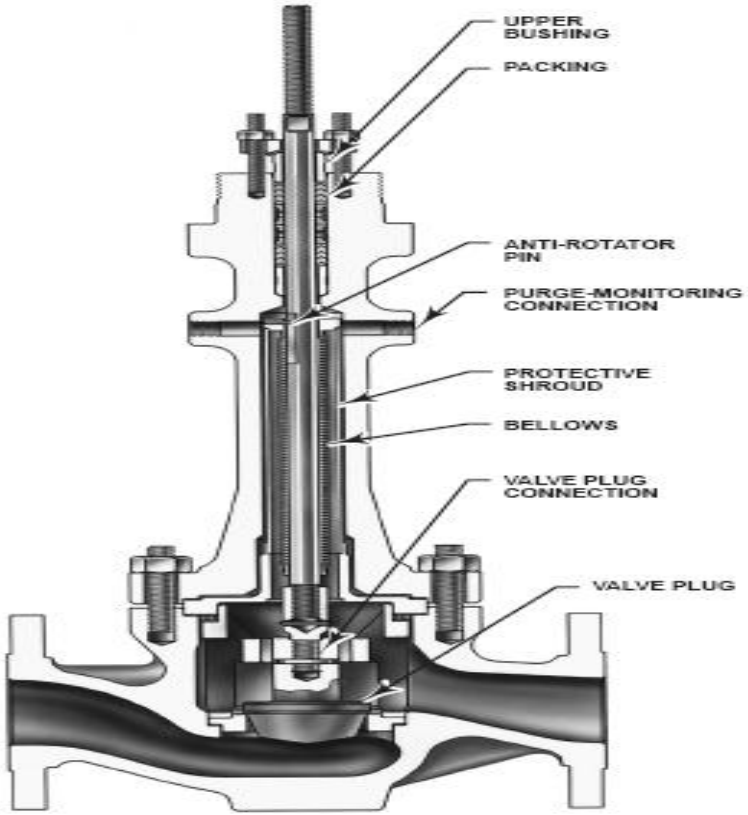




Bellows Seal Bonnet

In applications where stem leakage cannot be tolerated, or when conventional packing.- is not sufficient to, guarantee zero stem leakage, a bellows seal bonnet may be selected.





Bellows Seal Bonnet to Prevent Stem Leakage

Yoke

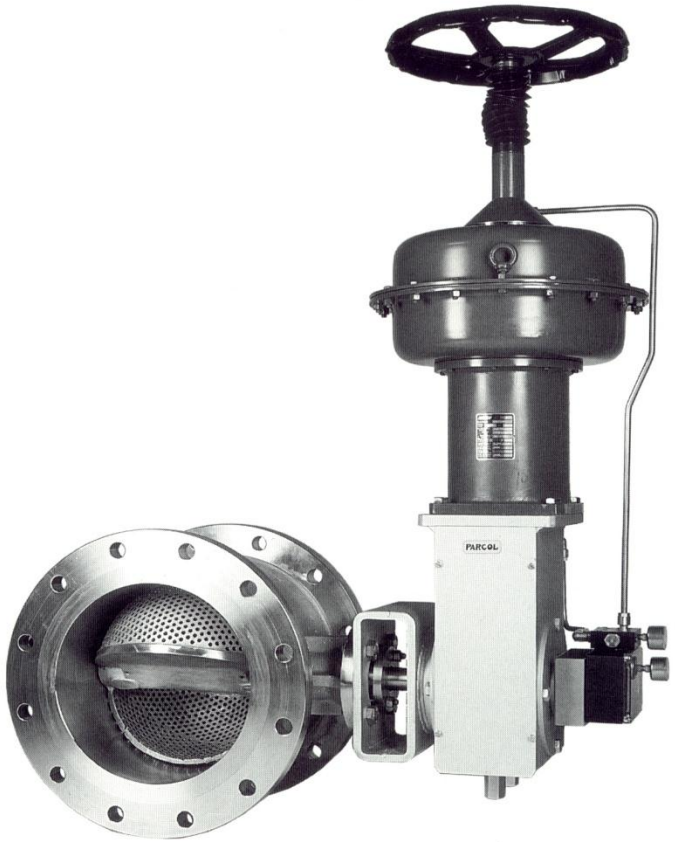
- Linkage between actuator and valve body
- Usually self aligned but needed very carefully to install.
- Tag, Name plate
  - All data about actuator
  - Supply Pressure
  - Bench set
  - Air to open or air to close

Yoke / Bonnet Marking

Hand Jack / Hand Wheels

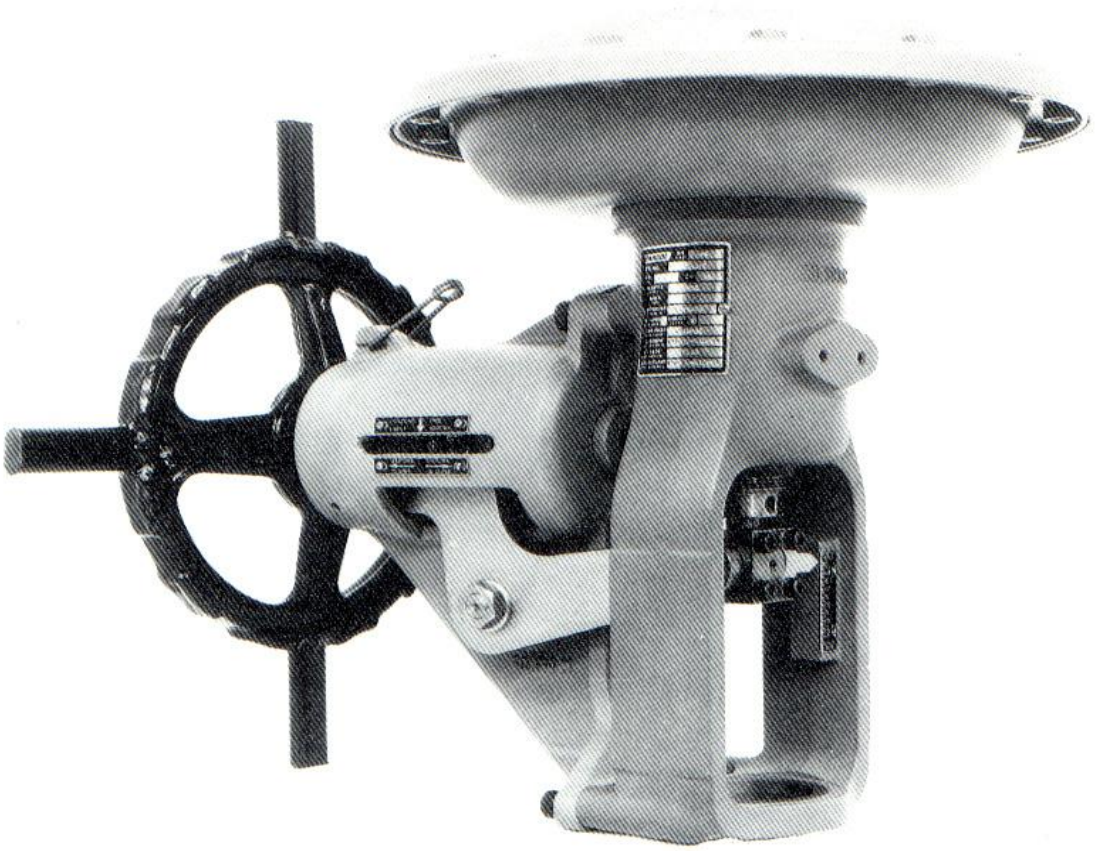
- Top Mounted
- Side Mounted
- Two Hand Jacks
- Hand Jacks can be used as Stopper
- Must have opened 5%, 10% or should not be closed more than 90%.

Different Type of Hand Wheels

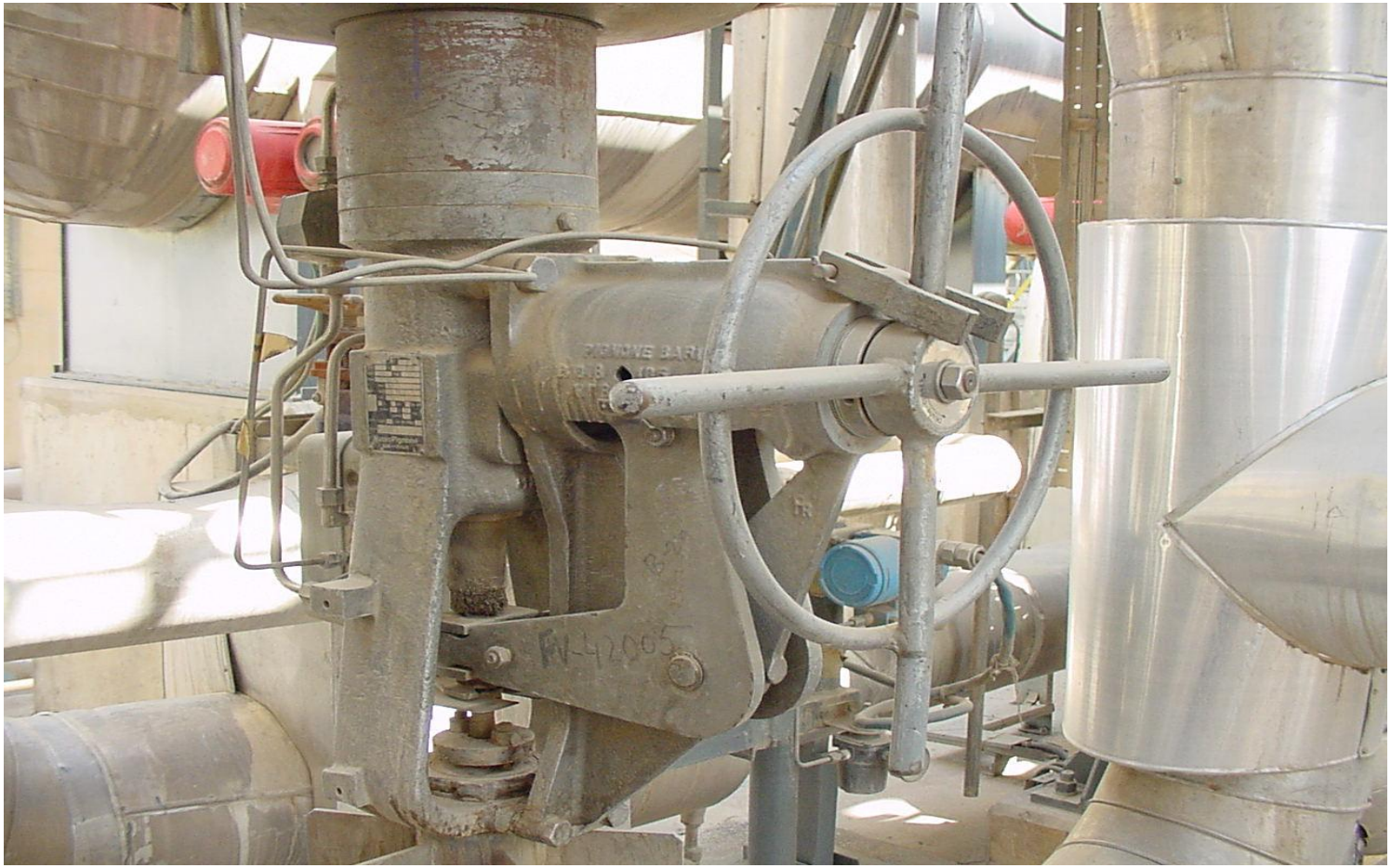


Different Type of Hand Wheels

Side Mounted Hand Jack



Side Mounted Hand Jack



Control Valve With Two H.Wheels

Hand Jack

Packing Box Assembly

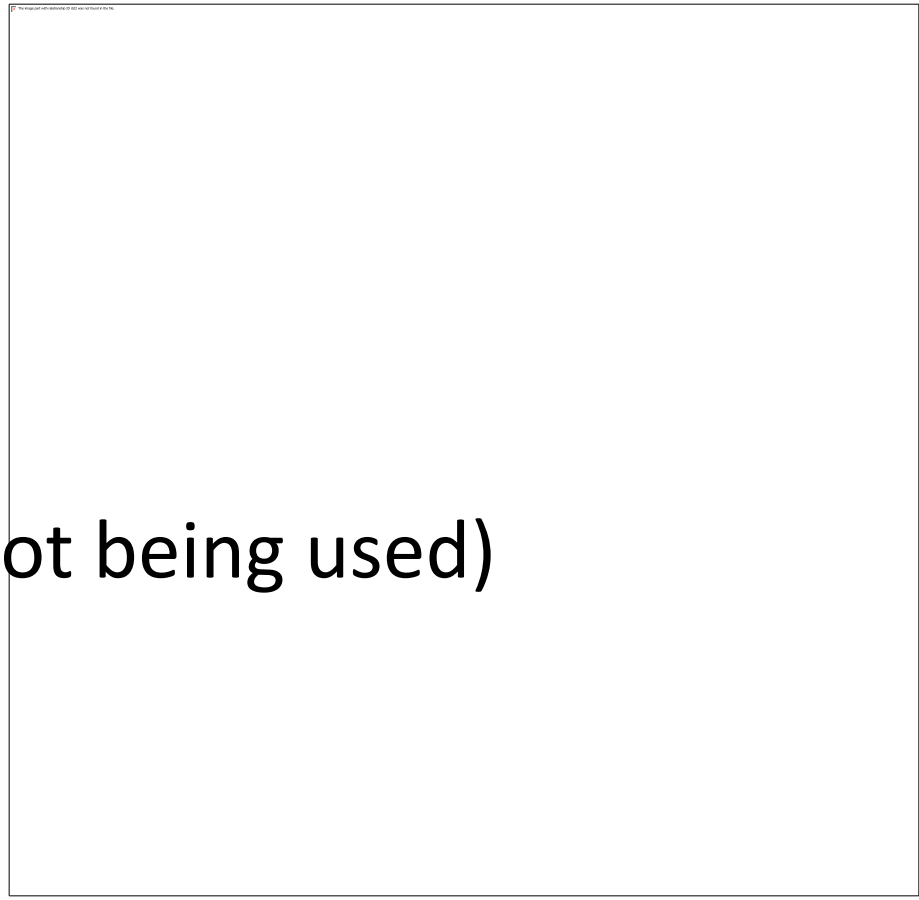
- The purpose of the packing box assembly is to contain an elastic means for preventing the leakage of a process fluid.
- Suitable adjustments should be provided for varying the compression of the packing material against the surface of the stem.
- The ideal packing material should be elastic and easily de formable.

Packing Box Assembly

- The assembly consists of a
  - Packing flange
  - Packing follower (Bush)
  - Lantern ring
  - A number of equally spaced packing rings.
  - The lantern ring provides a space for the insertion of lubricating grease though an isolating valve.

Packing Material

- Teflon → (PTFE)
- Graphite
- Grafoil
- Asbestos (Now a days not being used)
- Teflon Cord
- Graphite cord



Flashing / Cavitations in Valves

- Flashing
  - Just like a sand blasting
  - Flashing liquid contains vapours
  - Vapours acts like a sand and liquid acts like a carrier
- Cavitations
  - Two stage phenomenon
  - 1st stage → Formation of voids or cavitations with the liquid system
  - 2nd stage → Collapse or implosion of the cavitations back to the liquid

- Result → Cavitations → Damage of trim material of valves.

Flashing

Cavitations