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

- Valve
  - Bonnet
  - Valve Body
  - Accessories
Control Valve

ACTUATOR

VALVE BODY ASSEMBLY

BONNET

BODY
## Classification of Valves

<table>
<thead>
<tr>
<th>Type</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS Gate Valve</td>
<td>VS BW or Flanged</td>
</tr>
<tr>
<td>VD Globe Valve</td>
<td>VS SW or Threaded</td>
</tr>
<tr>
<td>VR Plug Valve</td>
<td>VD BW or Flanged</td>
</tr>
<tr>
<td>VB Ball Valve</td>
<td>VD SW or threaded</td>
</tr>
<tr>
<td>VDR Check Valve</td>
<td>VR or VB BW or Flanged</td>
</tr>
<tr>
<td></td>
<td>VR or VB SW or threaded</td>
</tr>
<tr>
<td></td>
<td>VDR BW or Flanged</td>
</tr>
<tr>
<td></td>
<td>VDR BW or Threaded</td>
</tr>
</tbody>
</table>
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 $\Delta P$
- 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

Outlet Pressure
MINIMUM

Inlet Pressure
MAXIMUM

OPEN
CLOSE
GLOBE VALVE - CLASSIFICATION

Angle

Y-Pattern

Needle
Y Style

- $\frac{3}{4}$ - 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

DISC
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)

/off/  BASED ON STEM

- Rising Stem Gate Valve
- None Rising Stem Gate Valve

/off/  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 $\Delta P$
- 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 90o 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 Open
- Suitable for:
  - Slurries
  - Viscous Fluids
  - Gases
  - Vapors
  - Corrosive Fluids
  - Clean Fluids
Plug

• Plug types depend upon flow characteristic:
  – Quick Opening
  – Linear
  – Parabolic or Equal Percentage
Plug → Linear

(Conical)
Plug $\rightarrow$ Equal Percentage

(Tapered)
Plug → Quick Opening

(Flat)
Different Shapes of Plugs
## Characteristics of Different Plugs

<table>
<thead>
<tr>
<th>Valve Opening</th>
<th>30 %</th>
<th>70 %</th>
<th>100 %</th>
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</thead>
<tbody>
<tr>
<td>Quick Opening</td>
<td>62</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Linear</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Equal %</td>
<td>8</td>
<td>33</td>
<td>100</td>
</tr>
<tr>
<td>V-Port</td>
<td>6</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

$C_v$
Valve Characteristic

![Graph of Valve Characteristic](image)

- Percent of Rated Flow Coefficient
- Percent of Rated Travel

- Quick Opening
- Linear
- Equal Percentage
$C_v$

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.

\[
Q = C_v \sqrt{\frac{\Delta P}{G}}
\]

Rearrange to Solve for \( C_v \)

\[
C_v = Q \sqrt{\frac{G}{\Delta P}}
\]

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
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
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
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 $\Delta P$ decreases as flow rate increases
Plug and Cage
**CHECK VALVES**

**GENERAL CHARACTERISTICS**

- Low $\Delta P$
- 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

- Pump A
- Pump B

Check Valve
Isolation Valve
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 CORROSIVE 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/ABRSSION RESISTANCE AND SERVICE TEMPERATURE

– SIZES COMMONLY AVAILABLE ARE UPTO 12”
PINCH VALVES
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 CONTROLS 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 COMPARATIVELY MORE DIRECT FLOW PATH. FLOW PATH IS LESS TORTUOUS 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 SIGNAL IS REMOVED
– PRODUCED TO OPERATE IN ONLY TWO MODES
  • FULL OPEN
  • FULL CLOSE
– 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. PREFERRED 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

- Control Valve
- Volume Booster
- Positioner
- Regulator
- 3 to 15 PSI Signal
- 110 V DC
- SOV
- NRV
- Capacity Tank
SOV

Energized

Supply 1 → Out Put 2

Bleed 3

De-Energized

1 → 2

3
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 WHERE HEAD ROOM IS LIMITED.
# Valve Types for Specific Services

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

Body Types

Linear Stem Motion
- Globe
- Single Seated
- Double Seated
- 3 Way
- Angle
- Gate
- Rising Stem
- Rising Disc
- Needle
- Cage & Plug
- Plug
- Diaphragm
- Y-Style

Rotary Shaft Motion
- Butter Fly
- Ball
- Plug
- Conventional
- Full
- 2 Way
- Concentric
- Half
- 3 Way
- Eccentric
- V-Notch
- 4 Way
Valve Body
Valve Body Components

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

Bonnet
Valve Body
Valve Body
Ball Valve
Jacketed Valve
Single Seated-Top Guided
Direct Action Double Seated
Reverse Action Double Seated
Reverse Action Single Seated
Cage
Double Seated – Top & Bottom Guided
Single Seated - Top Guided
Single Seated
Linear 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
  - Standard or Plain
    - Radiation Fins
  - Extended
    - Extension Column
  - Bellow Seal
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
Extended Bonnet

Packing box
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.
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 deformable.
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 through 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