Control Valves

Control Valve

- Control valve is used for controlling the flow of fluid by varying the size of passage of flow according to the controller and enable direct control over the flow rate. This results in control over process quantities like temperature, liquid level and pressure. It is termed as final control element in automatic control terminology.
- The principle behind the working of control valve is that it can control the fluid rate which is based on controller input.

- **Main Parts of Control Valve**

1. **Valve actuator:** It is used to move valve modulating elements like butterfly or ball.
2. **Valve positioner:** It is used to check that desired degree of opening is reached or not which overcome the issues of wear and friction.
3. **Valve body:** It contains modulating element, globe, a plug, butterfly or ball.

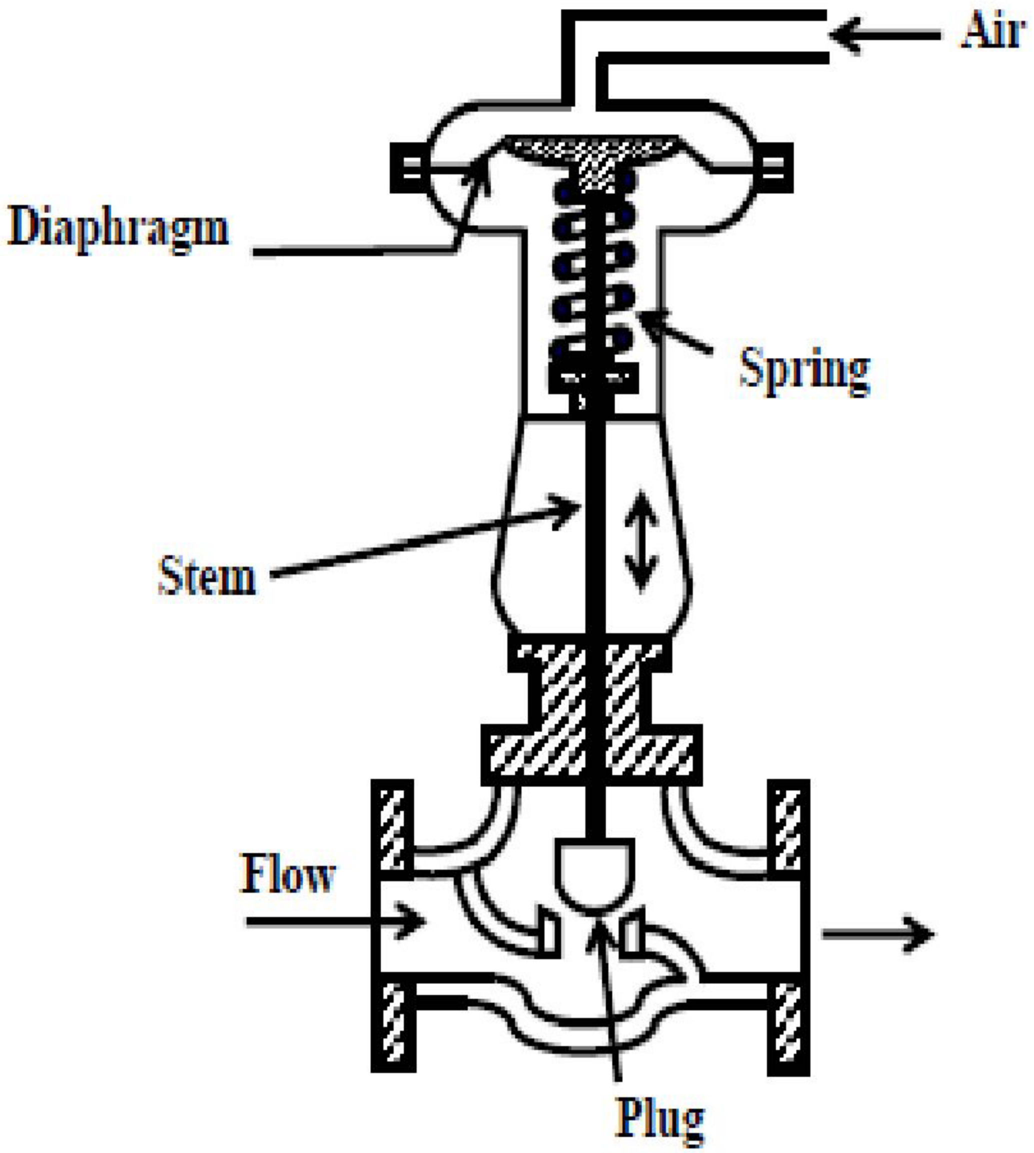


Fig. 1 Control valve

- **two control actions are possible.**

1. Air or current to close: Increment of flow restriction as the control signal value increases.
2. Air or current to open: Decrement of flow restriction as the control signal value increases.

- **Advantages of Control Valves**

1. It provides control over flow rate.
2. It has effective and rapid functioning.
3. It has durable service life.
4. It has compact design which facilitates minimal consumption of space.
5. It have minimum pressure drop.

- **Disadvantages of Control Valves**
- The only disadvantage of control valves is that they require control signal throughout its working period.

- **Materials of Construction of Control Valves**
- Carbon steel material is chosen for the use of non corrosive use. Stainless steel is used for seat rings and valve plugs. For less corrosive applications, stainless steel is used for making valve housing. Exotic alloys like titanium are used high corrosive fluids.

- **Applications of Control Valves**

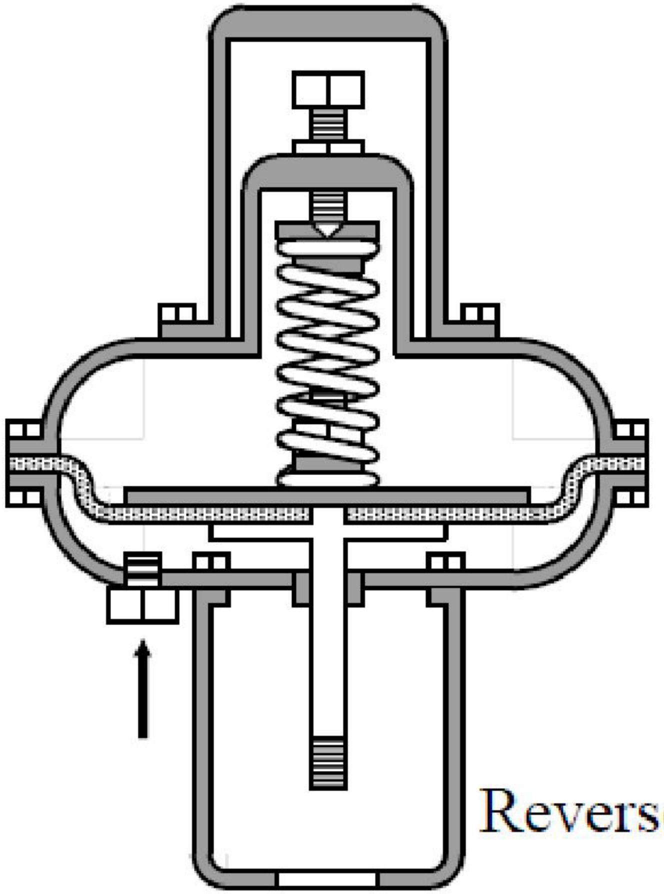
1. Used for on – off applications.
2. It can be used for throttling purposes.
3. It can be used for pressure and flow control.
4. Low pressure applications and large flow control.
5. Can be used for corrosive liquids at low pressure and temperature.

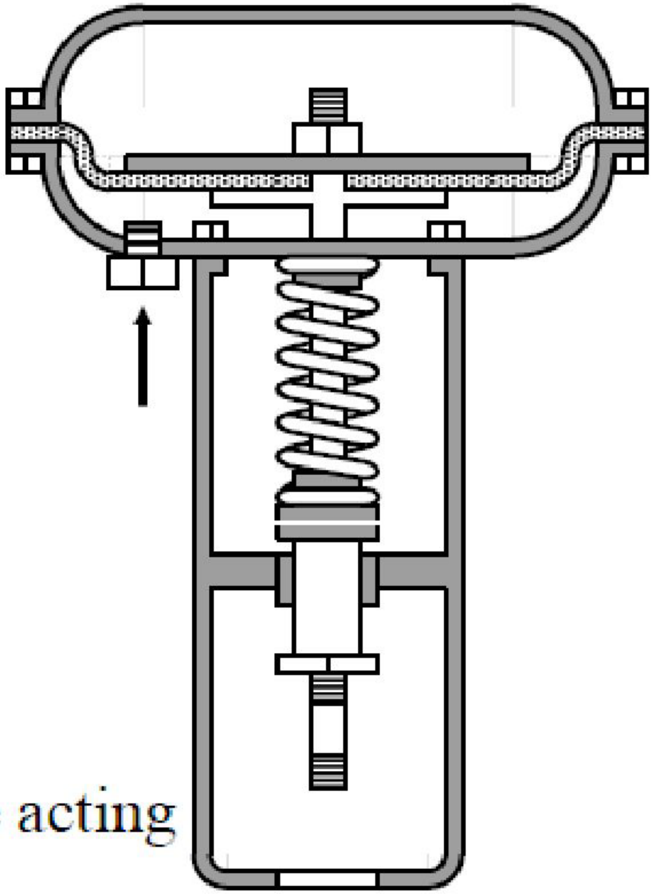
Control valve selection criteria

- Flow Medium
- Flow Regulation
- Valve size
- Line Pressure vs. Valve pressure Drop
- Pressure Temp Rating
- MOC
-

- Fail-Closed: A condition wherein the valve closure member moves to a closed position when the actuating energy source fails.
- Fail-Open: A condition wherein the valve closure member moves to an open position when the actuating energy source fails.
- Fail-Safe: A characteristic of a valve and its actuator, which upon loss of actuating energy supply, will cause a valve closure member to be fully closed, fully open, or remain in the last position, whichever position is defined as necessary to protect the process and equipment. action can involve the use of auxiliary controls connected to the actuator.

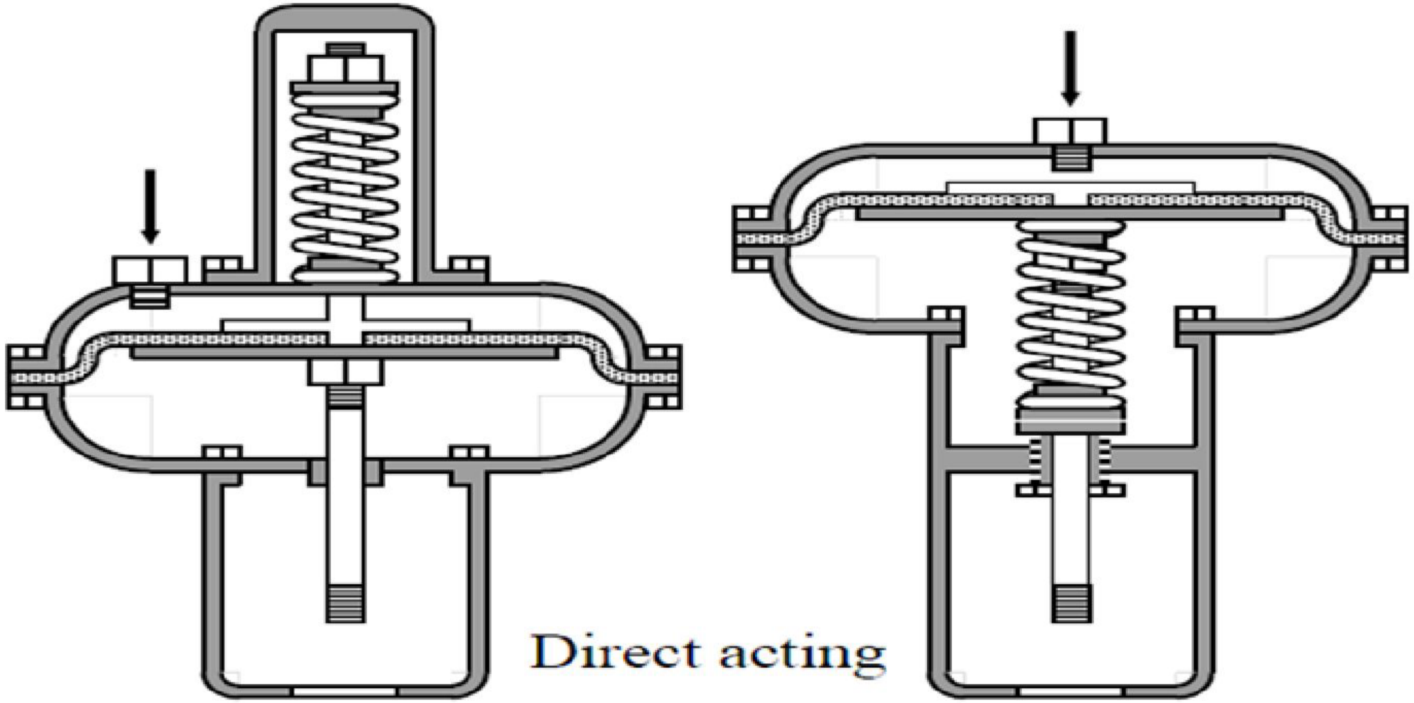
- Inherent Flow Characteristic: The relationship between the flow rate and the closure member travel as it is moved from the closed position to rated travel with constant pressure drop across the valve.
- Installed Flow Characteristic: The relationship between the flow rate and the closure member travel as it is moved from the closed position to rated travel as the pressure drop across the valve is influenced by the varying process conditions.
- Rangeability: The ratio of the largest flow coefficient (Cv or Kv) to the smallest flow coefficient (Cv or Kv) within which the deviation from the specified flow characteristic does not exceed the stated limits. A control valve that still does a good job of controlling when flow increases to 100 times the minimum controllable flow has a rangeability of 100 to 1. Rangeability can also be expressed as the ratio of the maximum to minimum controllable flow rates.





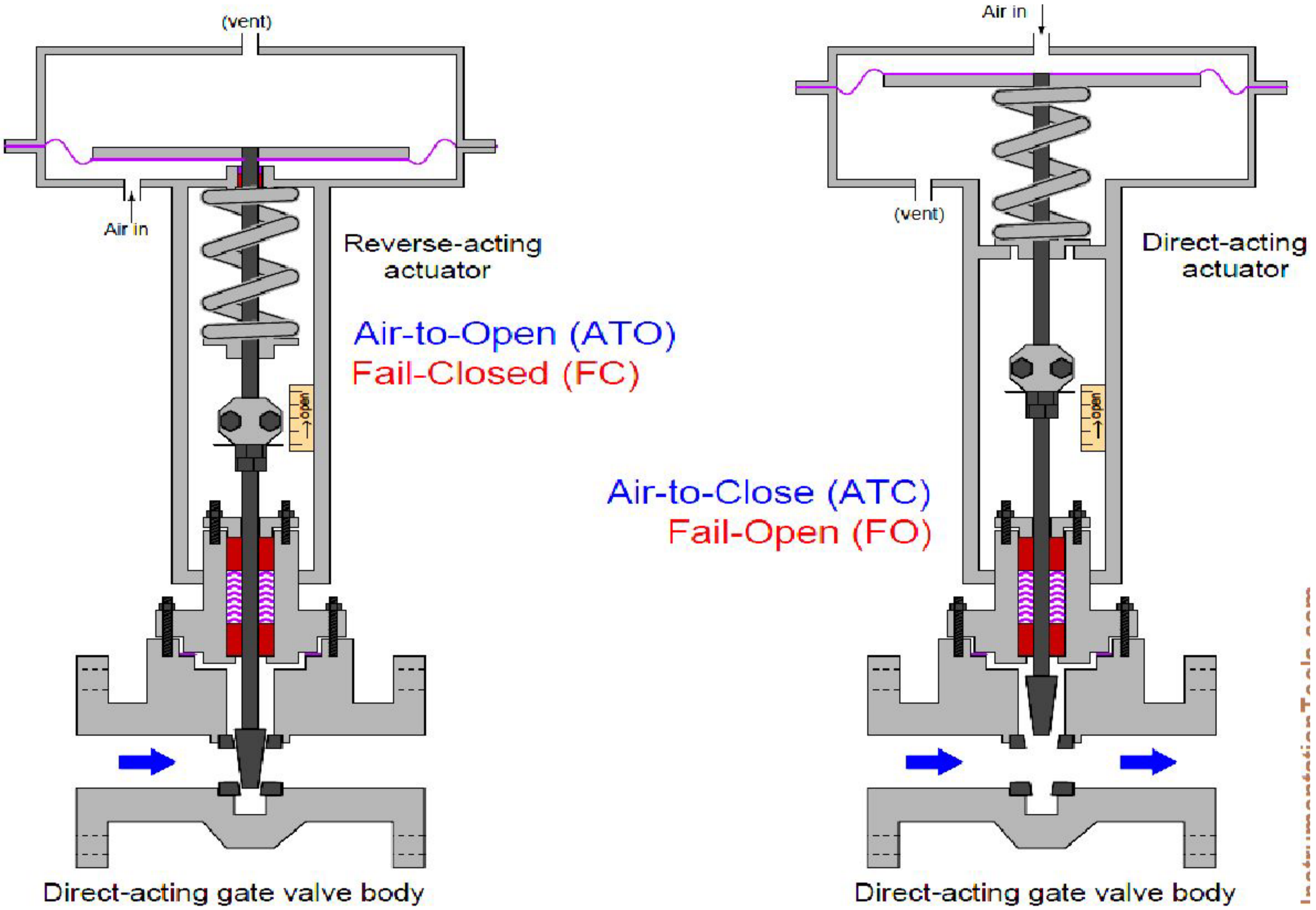
Reverse acting

In a **reverse acting actuator** an increase in the pneumatic pressure applied to the diaphragm lifts the valve stem (in a normally seated valve this will open the valve and is called ‘air to open’).



In a **direct acting actuator**, an increase in the pneumatic pressure applied to the diaphragm extends the valve stem (for a normally seated valve this will close the valve and is called ‘air to close’).

The choice of valve action is dictated by safety considerations. In one case it may be desirable to have the valve fail fully open when the pneumatic supply fails. In another application it may be considered better if the valve fails fully shut.

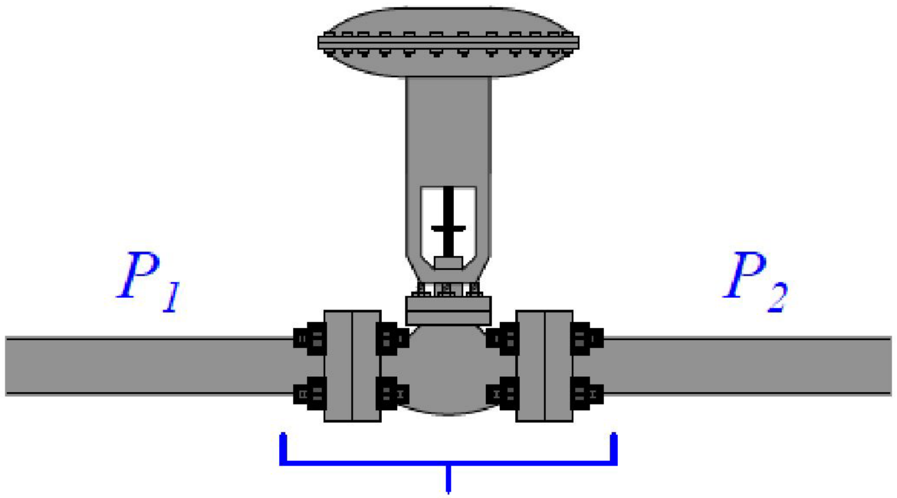

(vent)
Air in
Reverse-acting
actuator
Air-to-Open (ATO)
Fail-Closed (FC)
open
Direct-acting gate valve body
Air in
(vent)
Direct-acting
actuator
Air-to-Close (ATC)
Fail-Open (FO)
open
Direct-acting gate valve body

Inherent and Installed Flow characteristics

- The inherent characteristic of a valve is the characteristic published by the manufacturer, based on tests performed in a system where great care is taken to ensure that the pressure drop across the test valve is held constant at all valve openings and flow rates.
- The inherent characteristic, therefore, represents the relationship between valve flow capacity and valve opening when there are no system effects involved
- The installed characteristic is the plot of flow against opening of valve using actual pressure drops experienced in practice.

With a fluid of constant density and a constant pressure drop across the valve, flow rate becomes directly proportional to the valve's flow coefficient (Cv).
This is clear from an examination of the basic valve capacity equation, if we replace the pressure and specific gravity terms with a single constant k:

$$Q = C_v \sqrt{\frac{P_1 - P_2}{G_f}}$$

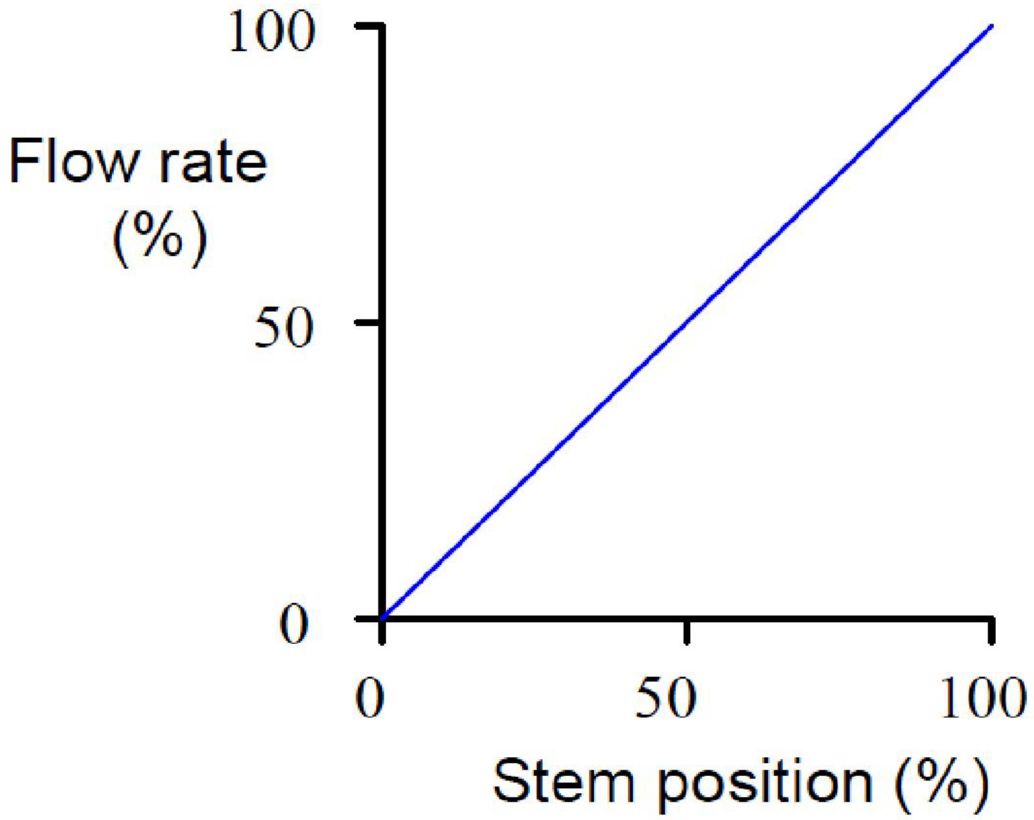


(If pressures and specific gravity are constant . . .)

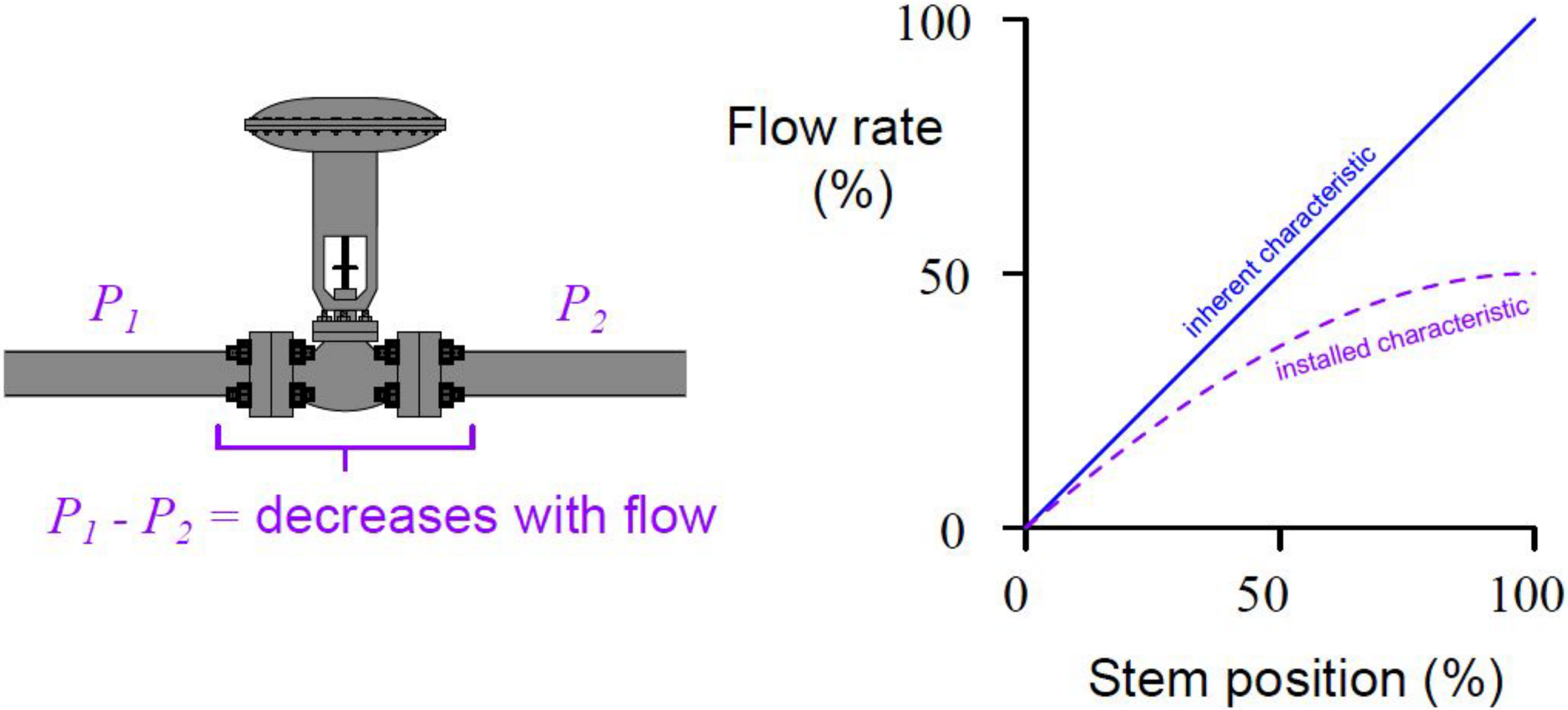
Q = k.Cv

If a control valve is designed such that the combined effect of these two parameters vary linearly with stem motion, the Cv of the valve will likewise be proportional to stem position.

If such a valve is placed in a laboratory flow test piping system with constant differential pressure and constant fluid density, the relationship of flow rate to stem position will be linear.



- However, most real-life valve installations do not provide the control valve with a constant pressure drop. Due to frictional pressure losses in piping and changes in supply/demand pressures that vary with flow rate, a typical control valve “sees” substantial changes in differential pressure as its controlled flow rate changes.
- The result of this pressure drop versus flow relationship is that the actual flow rate of the same valve installed in a real process will not linearly track valve stem position. Instead, it will “droop” as the valve is further opened.



P1
P2
P1 - P2 = decreases with flow
Flow rate (%)
100
50
0
inherent characteristic
installed characteristic
0
50
100
Stem position (%)

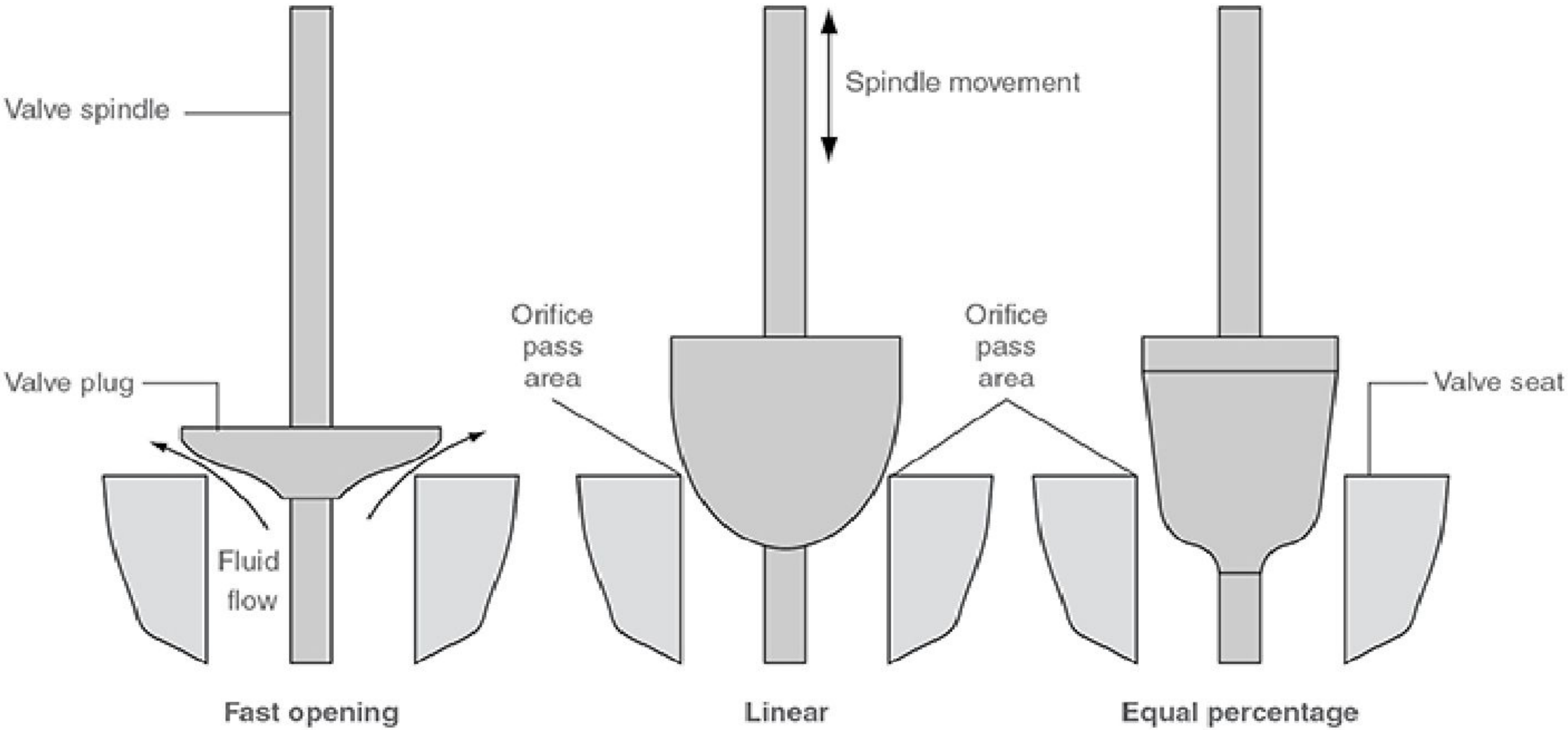
- The physical shape of the plug and seat arrangement, sometimes referred to as the valve ‘trim’, causes the difference in valve opening between these valves.
- the valve is a globe valve (up and down movement of the plug relative to the seat)

or

- a rotary valve (lateral movement of the plug relative to the seat).

- **Globe valves may be fitted with plugs of differing shapes, each of which has its own inherent flow/opening characteristic. The three main types available are usually designated:**

- Quick Opening
- Linear
- Equal Percentage


Valve spindle
Spindle movement
Orifice pass area
Orifice pass area
Valve plug
Valve seat
Fluid flow
Fast opening
Linear
Equal percentage

- **Fast opening characteristic**
- The fast opening characteristic valve plug will give a large change in flowrate for a small valve lift from the closed position. For example, a valve lift of 50% may result in an orifice pass area and flowrate up to 90% of its maximum potential.
- A valve using this type of plug is sometimes referred to as having an ‘on/off’ characteristic.

- The linear characteristic valve plug is shaped so that the flowrate is directly proportional to the valve lift (H), at a constant differential pressure. A linear valve achieves this by having a linear relationship between the valve lift and the orifice pass area
- For example, at 40% valve lift, a 40% orifice size allows 40% of the full flow to pass.

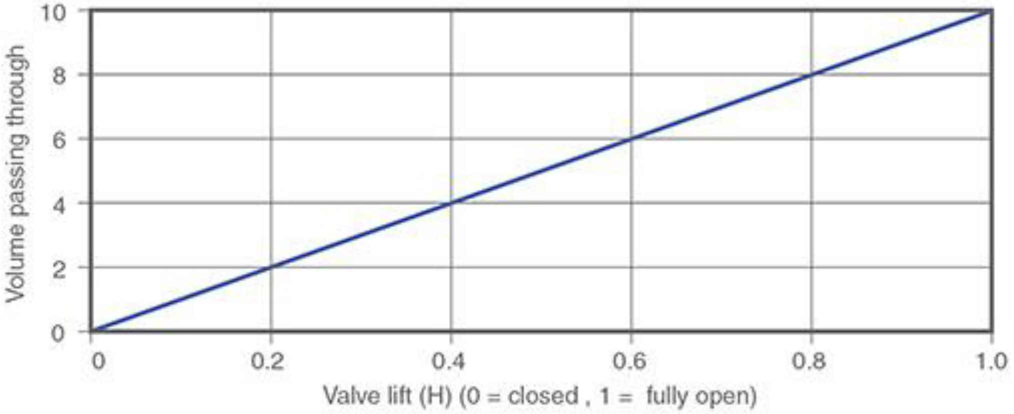
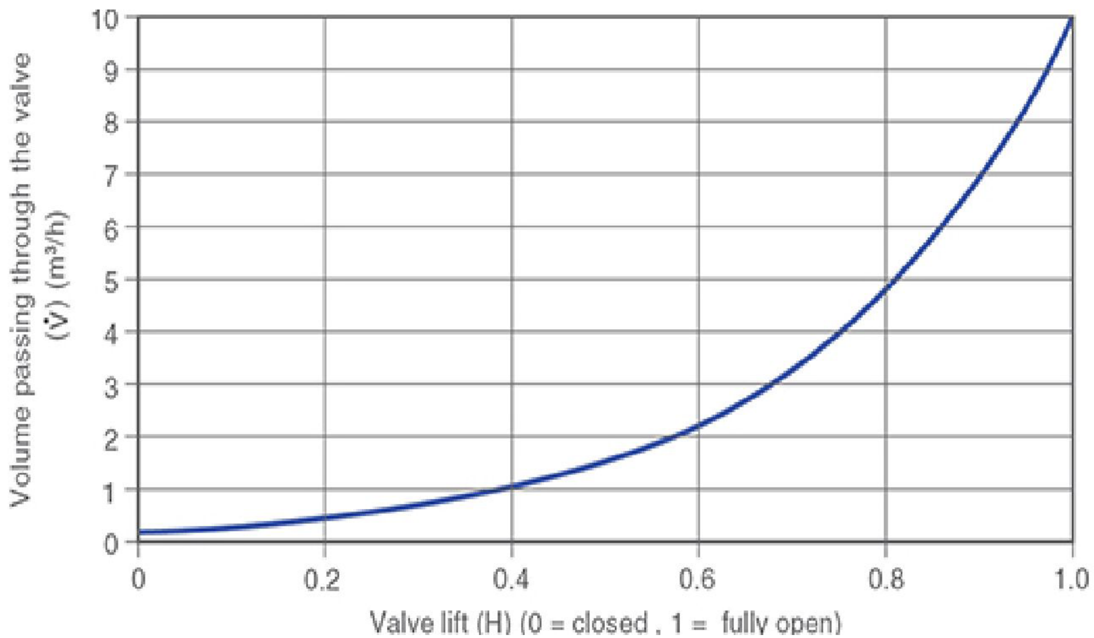
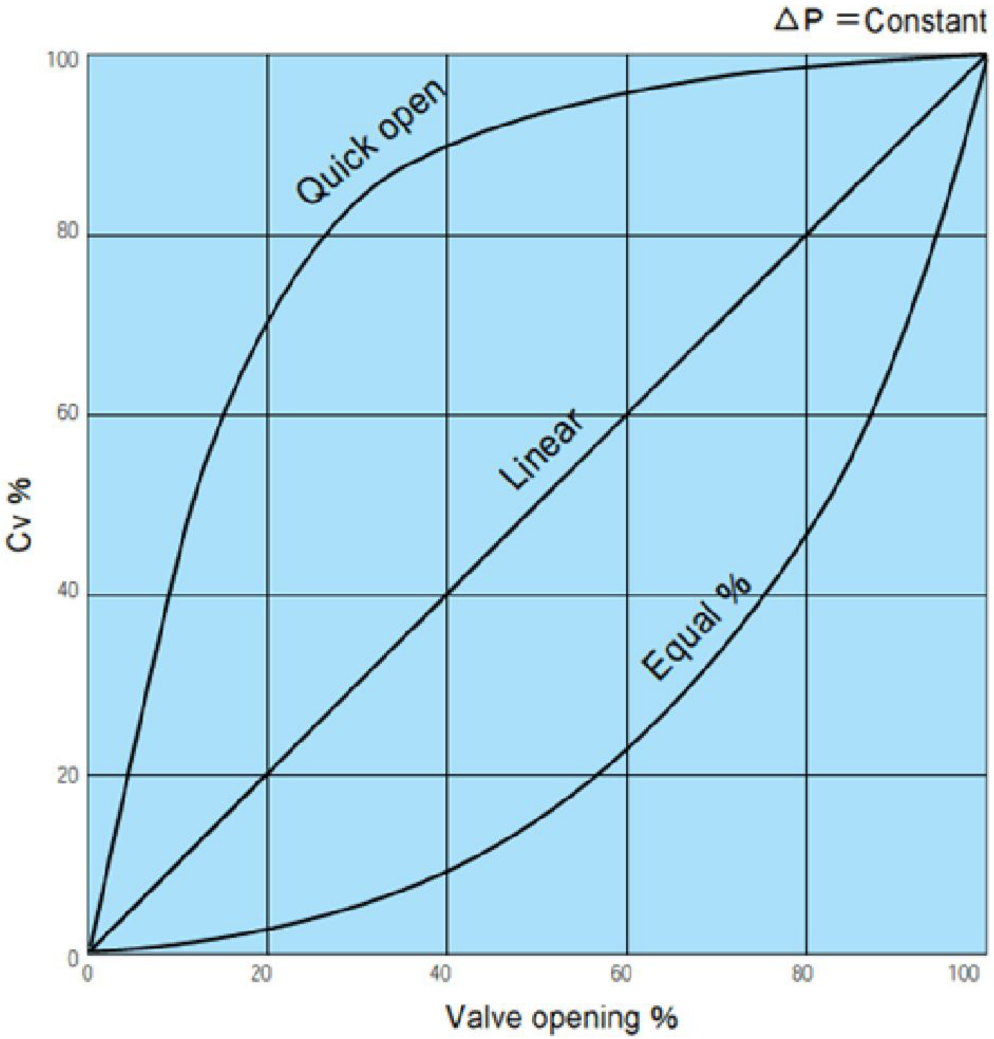


Fig. 6.5.3 Flow / lift curve for a linear valve

- These valves have a valve plug shaped so that each increment in valve lift increases the flowrate by a certain percentage of the previous flow. The relationship between valve lift and orifice size (and therefore flowrate) is not linear but logarithmic, and is expressed mathematically
- The increase in volumetric flowrate through this type of control valve increases by an equal percentage per equal increment of valve movement:
- When the valve is 50% open, it will pass 1.414 m^3/h, an increase of 48% over the flow of 0.956 m^3/h when the valve is 40% open.
- When the valve is 60% open, it will pass 2.091 m^3/h, an increase of 48% over the flow of 1.414 m^3/h when the valve is 50% open.



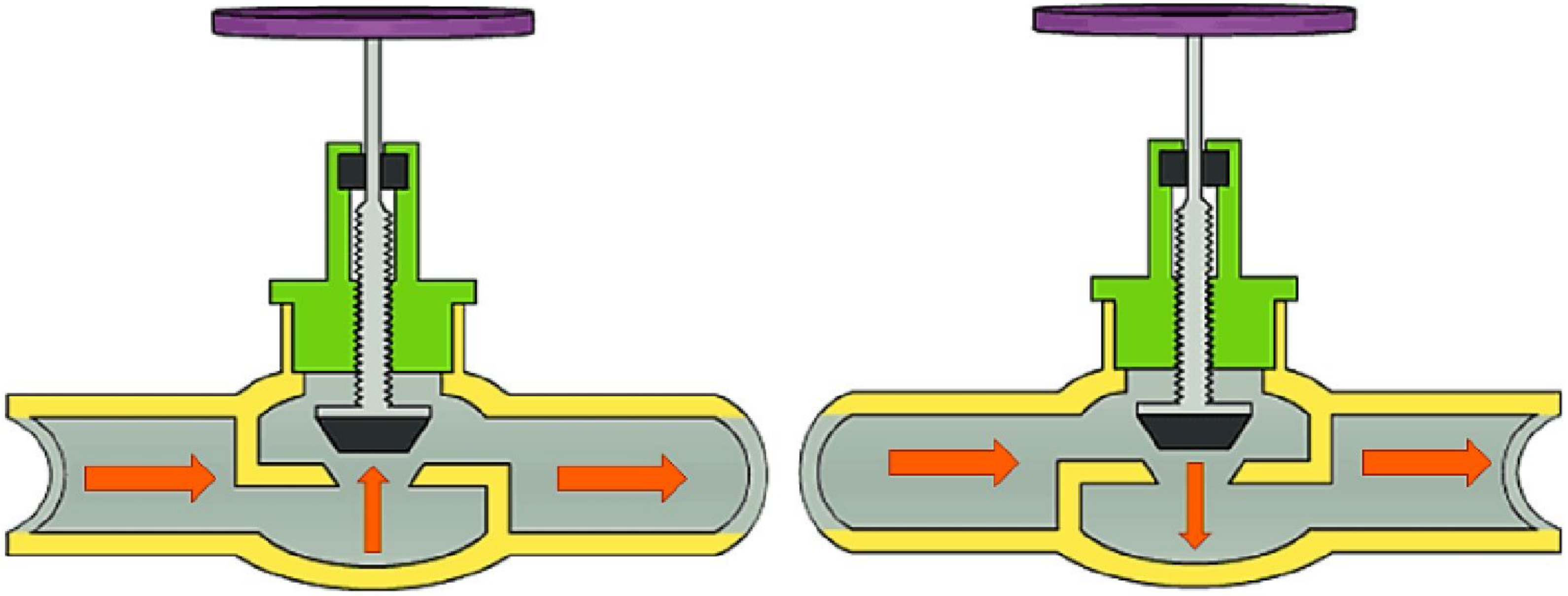
Volume passing through the valve
(V̇) (m³/h)
10
9
8
7
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1.0
Valve lift (H) (0 = closed , 1 = fully open)



Commonly observed inherent flow characteristic types

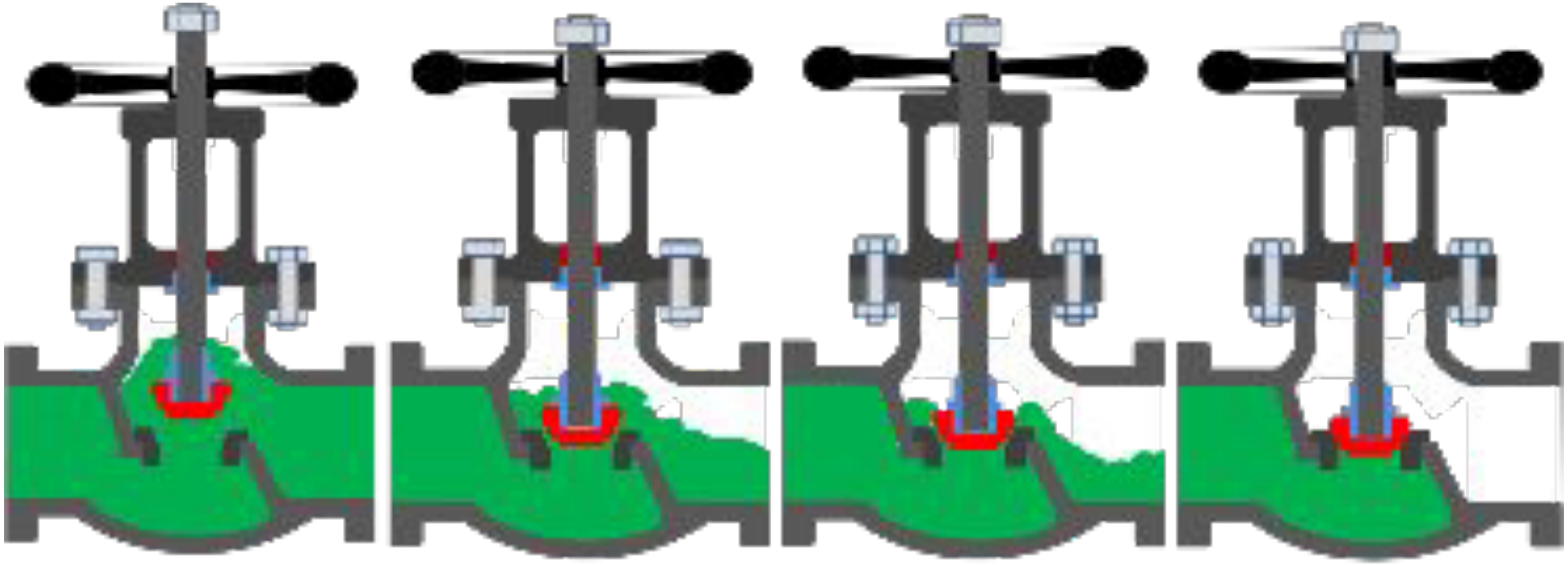
Globe Valve

- A **globe valve** is a linear motion valve which is used to start,stop and regulate the flow of liquid in the pipeline.
- The disc of valve moves perpendicular to the seat as the valve opens and closes.



Disk Close Against the Flow Direction

Disk Close In Flow Direction



1,Fully Open 2.Throttling 3.Throttling 3,Fully Closed

Applications

- Globe valves are useful in a variety of applications where flow must be regulated but a constant flow of fluid is not required. Here are a few examples of common applications for globe valves:
- 1.Cooling water systems in which the flow must be regulated

2.A fuel oil system in which the flow is regulated and leak tightness is critical

3.When leak tightness and safety are important considerations, use high-point vents and low-point drains.

4.Systems for feedwater, chemical feed, condenser air extraction, and extraction drain

5.Boiler vents and drains, as well as main steam vents and drains and heater drains

6.Seals and drains for turbines

7.Turbine lube oil system, among other things

Advantages

- Advantages of globe valve
- 1.Shutoff capability is good.
  2.Moderate to good throttling capability
  Shorter stroke (compared to a gate valve)
  3.Available in tee, wye, and angle patterns, each offering unique capabilities
  4.Easy to machine or resurface the valve seats
  5.With disc not attached to the stem, valve can be used as a stop-check valve

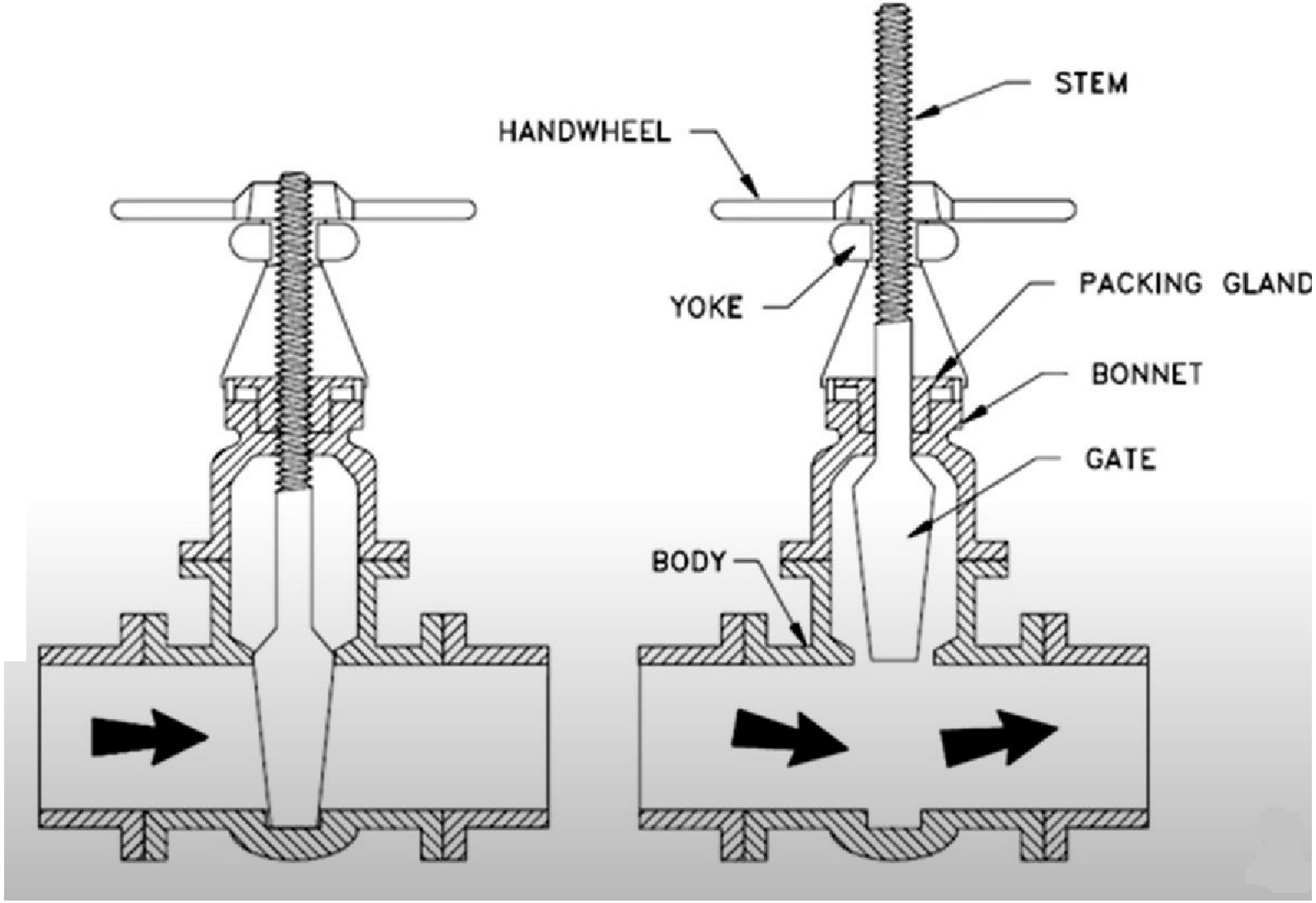
disadvantages

- a greater pressure drop (compared to a gate valve)

To seat the valve, more force or a larger actuator is required (with pressure under the seat)

Gate valve


Gate Valves


STEM
HANDWHEEL
YOKE
PACKING GLAND
BONNET
GATE
BODY

Advantages

- Pressure drop during the operation is less.
- Easy to install and pressure drop at the time of operation is less.
- The fluid residence of the wall is small.
- The opening and closing of it are more convenient.
- It has wide application in the industry. in addition to steam, oil, and other media, it can be used in a medium containing granular solid and with large viscosity.
- It can also be used as a venting value and low vacuum system value.
- A gate valve is a wall that has dual flow directions. It is not subject to the flow direction of the medium. Therefore, it is suitable for use in the pipeline where the medium may change the flow direction.

Disadvantages

- We cannot use a gate valve for controlling the flow of fluid.
- It has a slow operation. Takes more time in opening and closing.
- When it is partially opened it creates a lot of vibration and noise.
- Repairing this type of valve is very difficult due to limited access.

Applications

- The great valve can be used for all types of fluid like air, fuel gas, lube oil, steam, hydrocarbon, and any other services.
- Gate valves can be used in demanding environments such as high temperature and high-pressure environments.
- A special type of gate valve is used in slurry and powder production also called the knife Gate valve.
- At very low pressure and low-temperature systems like fire protection systems and water distribution pipelines, Gate valves are commonly used.
- Gate valve is often used in the petroleum industry.

Butterfly Valve

- A **butterfly valve** is a types of valve that isolates and regulates the flow of a fluid by a disc provided across the bore of a ring body having the same radial dimensions as the pipe in which it is fitted.
- The valve is quick acting if required,as only a quarter of a turn of the spindle is required to move the valve from the fully open to the fully closed positions.
- A “butterfly” is a disk attached to a rod. It closes when the rod rotates the disc a quarter turn to a perpendicular position to the flow direction.
  When the valve is opened, the disk rotates back to allow flow.

Advantages

- Compact design requires considerably less space, compared to other valves
- Quick operation requires less time to open or close
  Light in weight

  Low-pressure drop and high-pressure recovery
  Available in very large sizes
- Require less maintenance
- Required less space compare to other valves.
- Easy and fast to open or shut off.

Disadvantages

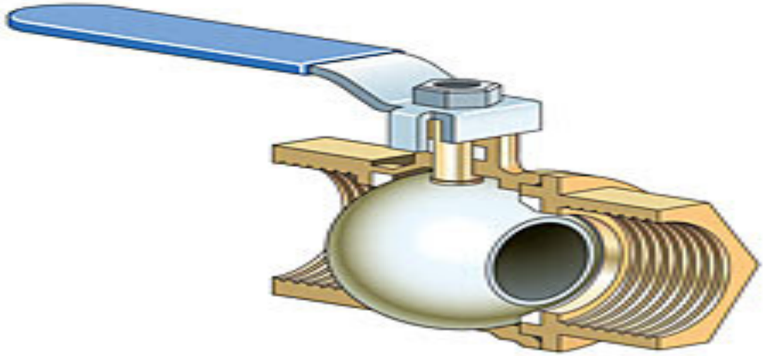
- Cavitation and choked flow are two potential concerns
- Throttling service is limited to low differential pressure
- Disc movement is unguided and affected by flow turbulence
- Poor sealing functions

Applications

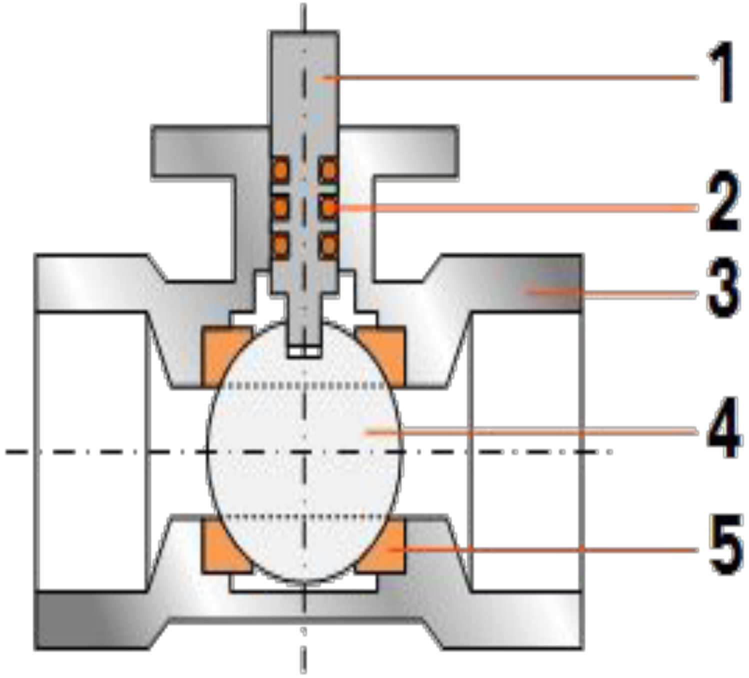
- 1.Cooling water, air, gases, and other similar applications such as fire protection, water circulation, and so on.
  2. Corrosive services that necessitate lined valves
  3. Services in food processing, chemical and pharmaceuticals
  4. Slurry and related services
  5. Services involving high-pressure and high-temperature water and steam
  6. Low differential pressure throttling service, such as in cooling water or air supply systems
  7. Vacuum services

Ball Valve

- A ball valve is a shut off valve that controls the flow of a liquid or gas by means of a rotary ball having a bore. By rotating the ball a quarter turn (90 degrees) around its axis, the medium can flow through or is blocked. They are characterized by a long service life and provide a reliable sealing over the life span, even when the valve is not in use for a long time. As a result, they are more popular as a shut off valve then for example the gate valve.



The 5 main components can be seen in the ball valve diagram The valve stem (1) is connected to the ball (4) and is either manually operated or automatically operated (electrically or pneumatically). The ball is supported and sealed by the ball valve seat (5) and their are o-rings (2) around the valve stem. All are inside the valve housing (3). The ball has a bore through it, as seen in the sectional view in Figure 1. When the valve stem is turned a quarter-turn the bore is either open to the flow allowing media to flow through or closed to prevent media flow. The valves circuit function, housing assembly, ball design, and operation types all impact the ball valves operation are are discussed below.



Advantages

- 1.Efficiency :- Ball valves require no lubrication and provide a bubble-tight seal with very little torque.
  2.Affordability: They can often be purchased at a considerably lower cost than comparable products for the same job.
  3.Durability: They have a long service life and will provide many years of reliable service when used properly. Ball valves are less likely to be damaged than other valve types, and the plastic variety isn't corrosive.
- 4.Easy to use :-It is simple to install and operate, and plastic ball valves are lightweight and easy to handle.
  5.versatile :-They're versatile enough to be used in a wide range of industrial applications where liquid or gas flow must be controlled.
  6.Strong:-Ball valves are capable of maintaining and regulating high pressure, volume, and temperature flow.
  7.Simple to repair :-When a valve needs to be repaired, the seats are easily accessible.

Disadvantages

- 1.Poor throttling characteristics: In a throttling position, high velocity flows may cause erosion of the partially exposed seat. As a result, they’re not recommended for long-term throttling.
- 2.Wear and tear :-Ball valves can stick in place and become jammed when used to regulate the wrong types of fluids, such as slurries, due to suspended particles being trapped. This can lead to the valve wearing out, becoming damaged, or becoming stuck.

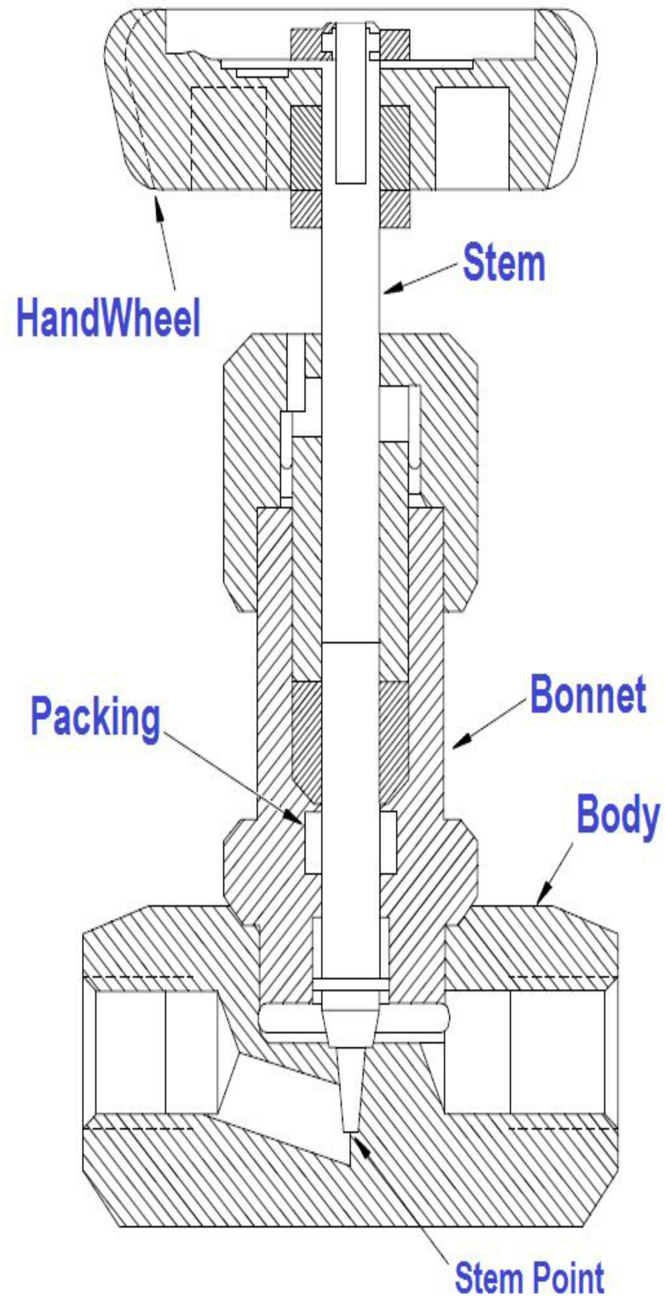
Applications

- 1.Valves for shutting down and isolating liquid and gaseous services that require leaktight valves.
  2.Valves for shutting down the system in the event of an emergency.
  3 Control valves with a low differential pressure.
  4.Steam service control and shut-off valves.
  5.For liquid and gaseous services, there are vent and drain valves.
  6.Surge control valves for pipelines.

Needle Valve

- A needle valve is a type of valve that can be used to regulate or complete the isolation of the fluid. The unique feature of the valve is the structure of a small plunger with the shape of a Needle. The plunger features a small handle to operate in the easy and precise operation of the valve. When fully attached, the extended end of the valve fits exactly into the seat, a part of the appliance that is being regulated. In case of valve opened by mistake, then also space between and needle and seat are so less, that a minimal amount of substance will be allowed to pass through it.

Needle Valve



Advantages of Needle Valve

- The main advantages that a needle valve serves are
  With the help of this valve flow control at a very low rate with higher accuracy is possible.
  Needle valves are smaller in size. So, there is not an issue of space during its installation.
  Throttling even with less volume of fluid is possible with this valve.
  Flow rates can be adjusted precisely.
  Its operation is easier.

Disadvantages of Needle Valve

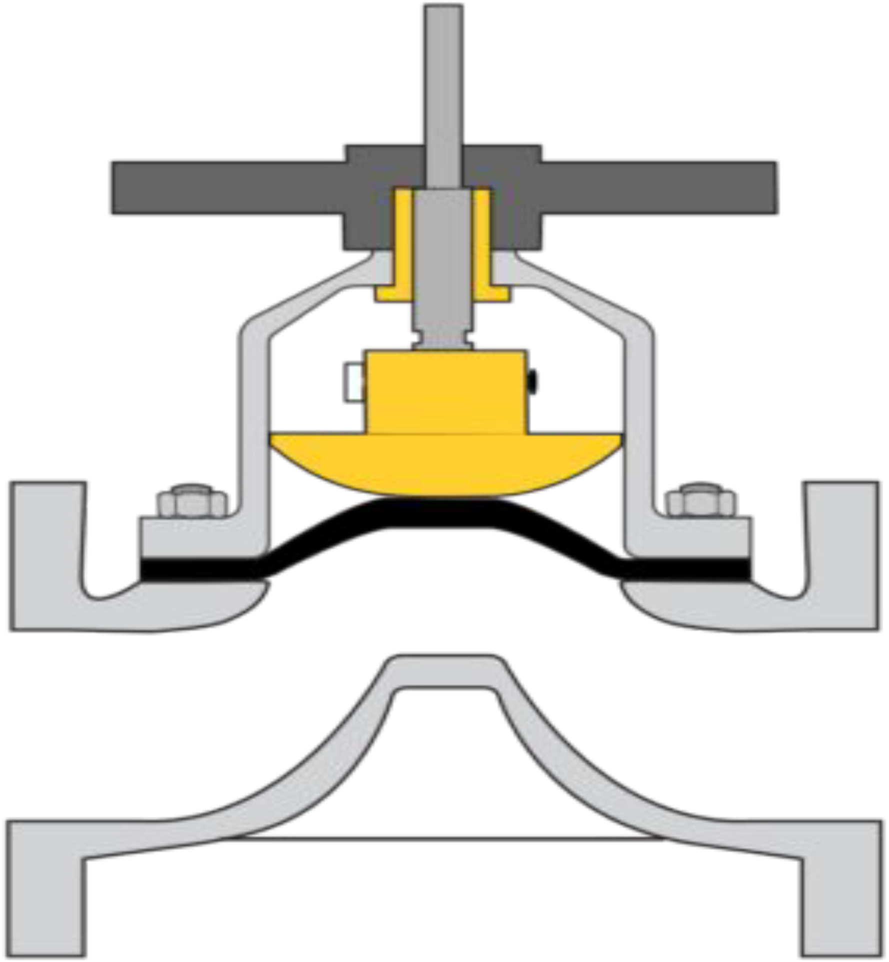
1. There is a high-pressure loss in the needle valve because of the high restriction of fluid flow.
2. They can be used only for low flow rate piping systems.
3. There can be damage to the seat and needle if the fluid has solid particles.
4. It is not possible to say if it is in an open or close position just by examining the handle position.
5. Immediate opening or closing is not possible in these types of valves. Immediate operations can damage the seat of the need valve.

Applications of Needle Valve

- All analog field instruments are installed with a needle valve to control the flow movement.
- Needle valves help in situations where the flow needs to stop gradually.
- The needle valve can be used as an on/off and throttle valve.
- This can be used where metering applications required such as steam, air, gas, oil, or water.
- A needle valve is helpful with sample points in piping where a very little flow rate is required.
- This valve can be used on gas bleeder lines.
- Needle valves are used in automated combustion control systems in which accurate flow regulation is required.
- It is used with constant pressure pump governors in order to reduce the fluctuation in the pump discharge

Diaphragm Valve

Diaphragm valves (or membrane valves) consists of a valve body with two or more ports, a diaphragm, and a “weir or saddle” or seat upon which the diaphragm closes the valve. The valve body may be constructed from plastic, metal, wood or other materials depending on the intended use.



Advantages of Diaphragm Valve

- Diaphragm valves can also be used for throttling service.
- Its throttling characteristics are essentially those of a quick opening valve because of the large shutoff area along the seat.
- A weir-type diaphragm valve is available to control small flows.
- Diaphragm valves are particularly suited for the handling of corrosive fluids, fibrous slurries, radioactive fluids, or other fluids that must remain free from contamination.
- The operating mechanism of a diaphragm valve is not exposed to the media within the pipeline. Sticky or viscous fluids cannot get into the bonnet to interfere with the operating mechanism.

Pinch Valve

- The Pinch Valve is made up of three parts:
- Body / Housing
- Internal rubber sleeve
- End connections

The rubber sleeve inside the body of the valve is the part that closes it. When in the open position, the Pinch Valve has a full and true bore. To close the valve, air pressure is supplied into an air nipple on the outer body, which then travels through into the internal part of the valve, pushing down onto the rubber sleeve which fully collapses and closes tightly.

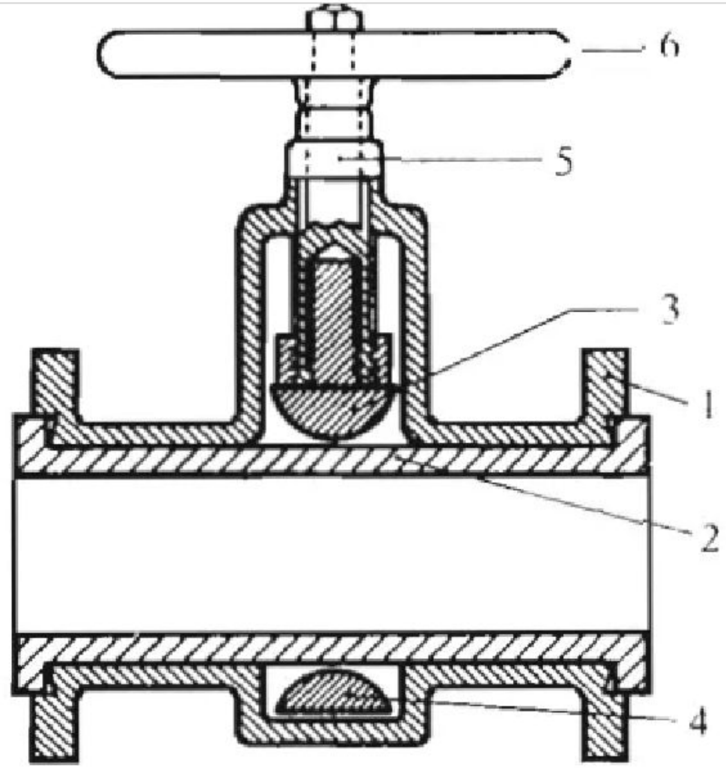
Advantages Pinch Valve

- Low & easy maintenance
- Low weight
- No clogging
- Compact, simple, robust & straight through design
- Very fast opening/closing times
- Less air consumption
- Self cleaning
- Permanent seal with tight shutoff
- Minimal turbulence & friction
- No mechanical parts, and no bearings, seals or packing required.
- Only one replaceable part (elastomer sleeve)

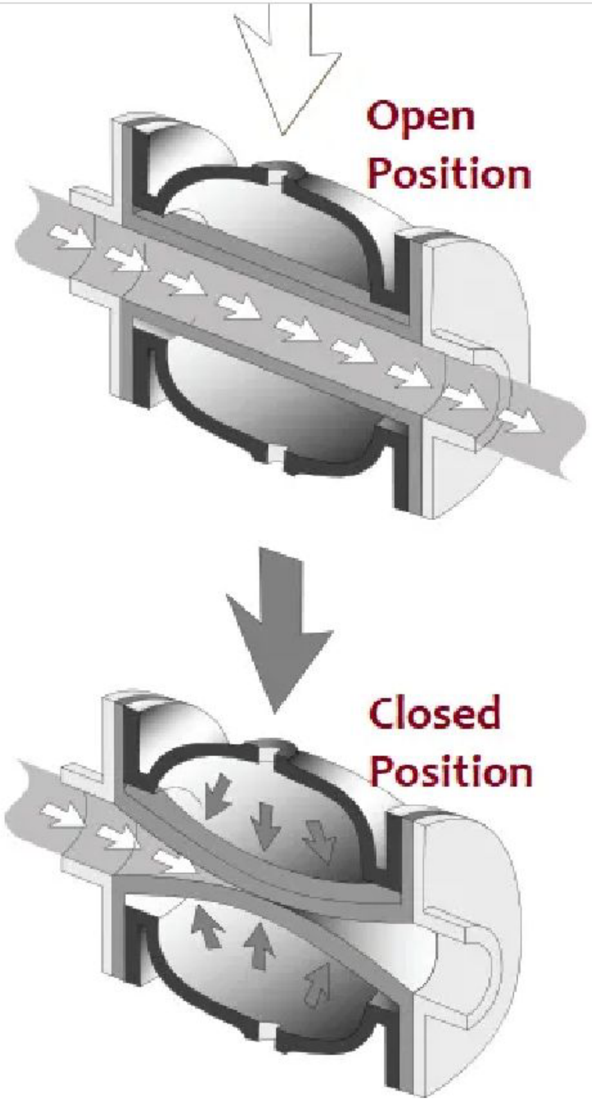
Diaadvantage

- Not good for high pressure drops.
- Poor control characteristics

- Applications
- Cement industry
- Plastic industry
- Pneumatic Conveying industry
- Wastewater industry/Sewage treatment plants
- Ceramic Industry
- Environmental industry
- Chemical industry



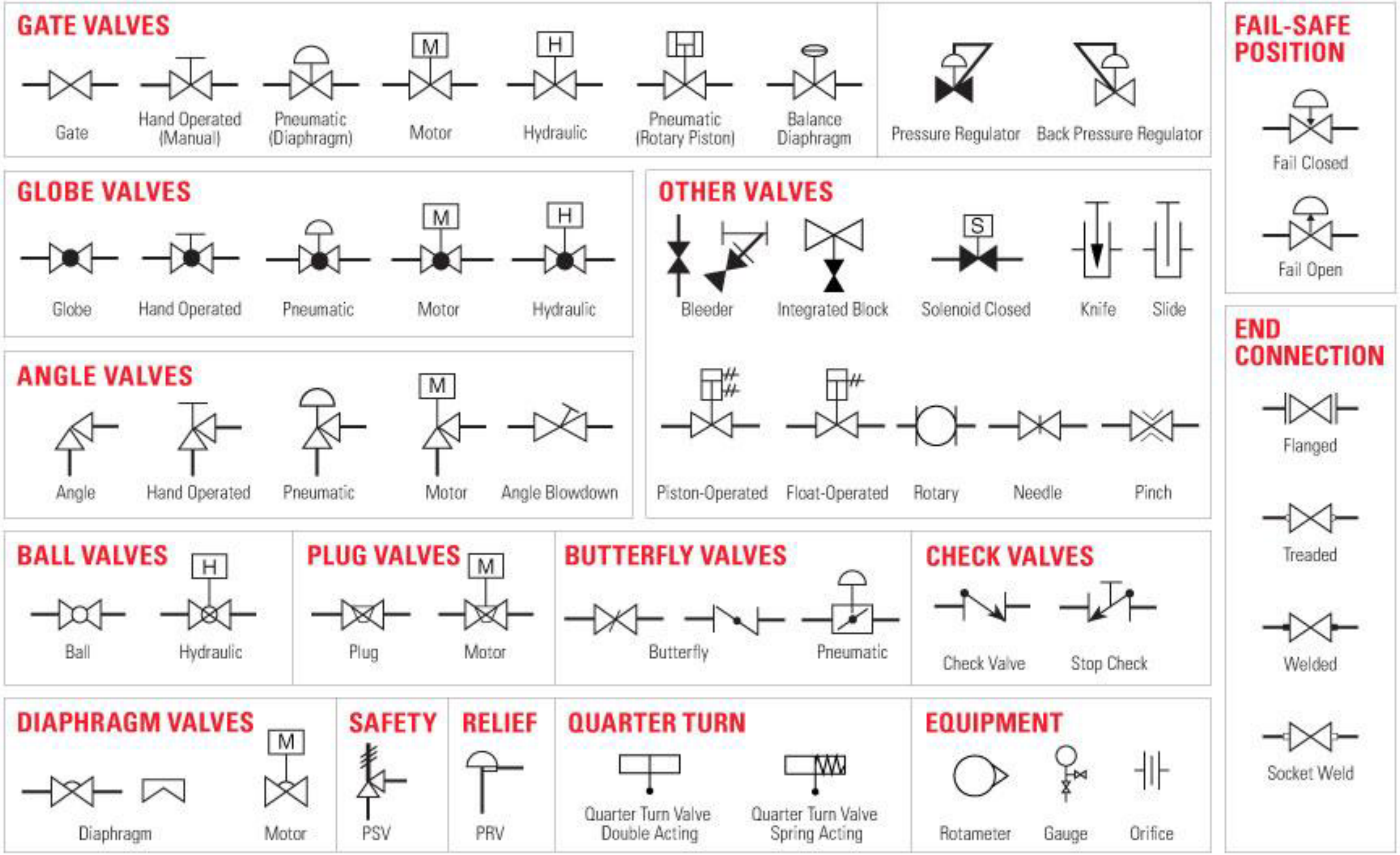
1. Body 2. Rubber Tube
3. Upper Pinch bar
4. Lower pinch bar
5. Spindle 6. Handwheel



Diadvantages of Diaphragm valve

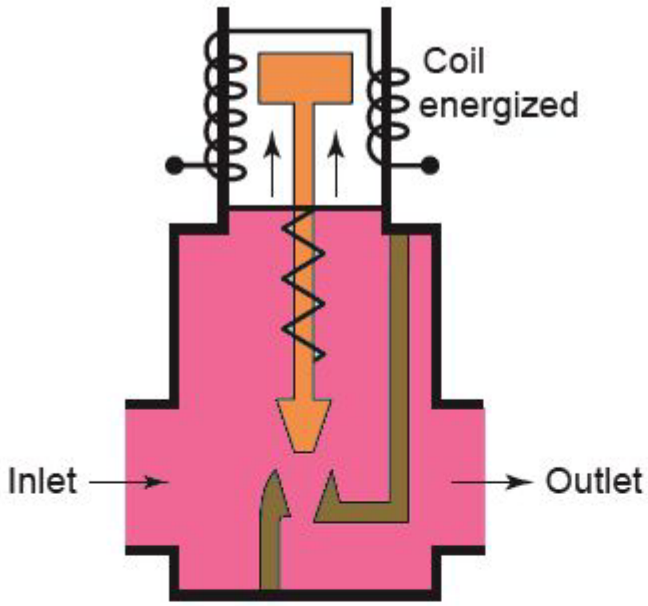
- The hydrostatic pressure that can be applied to the diaphragm is limited.
- Dimensions of diaphragm valves are limited. They are produced in DN15-DN300 dimensions.

Symbols of different valves

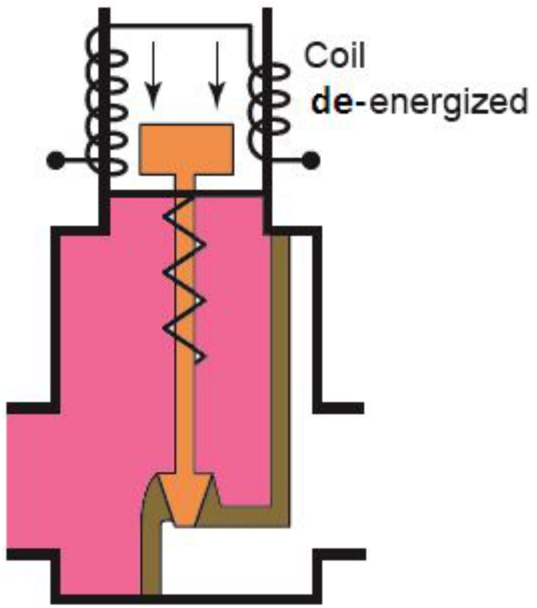


Solenoid Valve

- A solenoid valve consists of two basic units: an assembly of the solenoid (the electromagnet) and plunger (the core), and a valve containing an orifice (opening) in which a disc or plug is positioned to control the flow of fluid.
- The valve is opened or closed by the movement of the magnetic plunger.
- When the coil is energized, the plunger is drawn into the solenoid (electromagnet), and flow through the orifice is allowed.
- The valve returns automatically to its original position when the current ceases due to the pressure of spring and flow through the orifice is restricted.



Valve orifice opened



Valve orifice closed

Advantages

- Low energy use
- Remotely operated
- Cost-effective to maintain and service
- Compatible with AC and DC voltages
- Extremely fast open and shut times
- Capable of operating in extreme temperatures
- Safety external leakage block
- Operates both vertically and horizontally
- Solenoid valve applications are extremely diverse

Disadvantages

- The potential for the coil to need replacing during its lifetime
- The need for the control signal to remain during its operation
- Sensitivity to voltage fluctuations or changes
- Unintended partial closure of the valve if the magnetic field isn't properly set up

	Type of Valve				
	Gate	**Plug (Ball)**	**Globe**	**Butterfly**	**Diaphragm**
Type of Service	On/off (Sliding)	On/off (Rotary)	Throttling	Throttling	Throttling
Advantages	Virtually no pressure loss across the valve face Can be used when the fluid contains suspended solids	Similar properties to gate valves Lightweight, compact design High capacity Good rangeability Tight shut-off	Good sealing characteristics Can be used in frequent open/ closing service Quick change of trim without removing valve from line High capacity God rangeability Low-noise trim available Smooth control	Lightweight, compact design Minimal pressure loss across valve face Low cost High throughput capacity Smaller shaft and actuator	Almost no leakage; process fluid is isolated from valve stem Self-cleaning
Disadvantages	Poor sealing characteristics	Sealability poor with metal seats used at high temperatures Limited-temperature range with resilient seats Choke flow problems Cavitation problems Requires removal for maintenance	High-pressure losses due to contorted path through the valve Low-noise trim reduces capacity	Poor sealing characteristics Good control limited to 60-deg. opening Tight shut-off requires special lining: plus over-sized shaft and actuators Lining imposes temperature limitations	Limited operating pressure Limited temperature High wear and tear Poor control over 50%-opening
Sealing Method	Gate face slides parallel to the seal surface. Gate and seal in constant shear contact	Radial seal, shaped to conform with ball surface	Disk motion is perpendicular to valve seat. Only contact is in fully closed position	Throttle blade is mashed into mated seal	Diaphragm material is forced onto valve seat. Only contact is in fully closed position
Recommendations	Not for frequent valve opening/ closing service Not for when throttling control is required	Not for service with highly corrosive fluids Most suitable for handling slurries	For flow regulation When tight shut-off is required	Low-pressure applications	Water-treatment service Chemical and abrasive service

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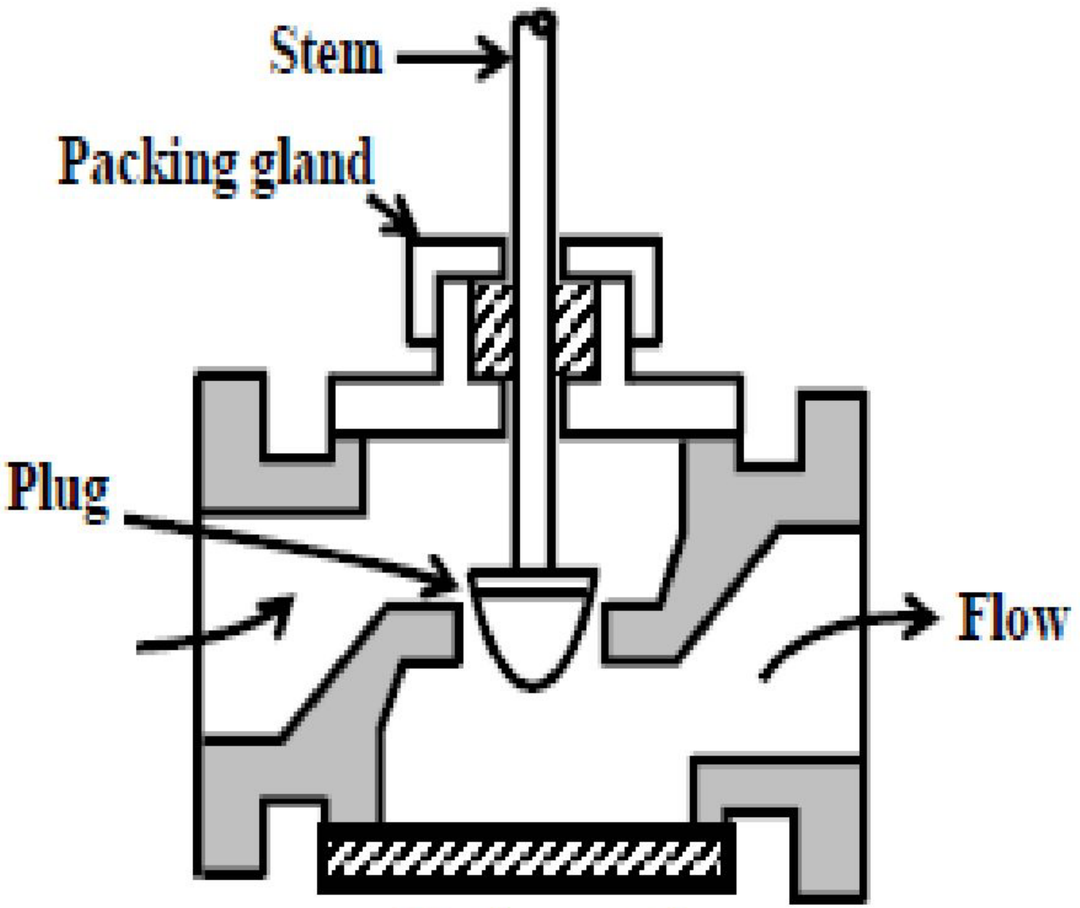
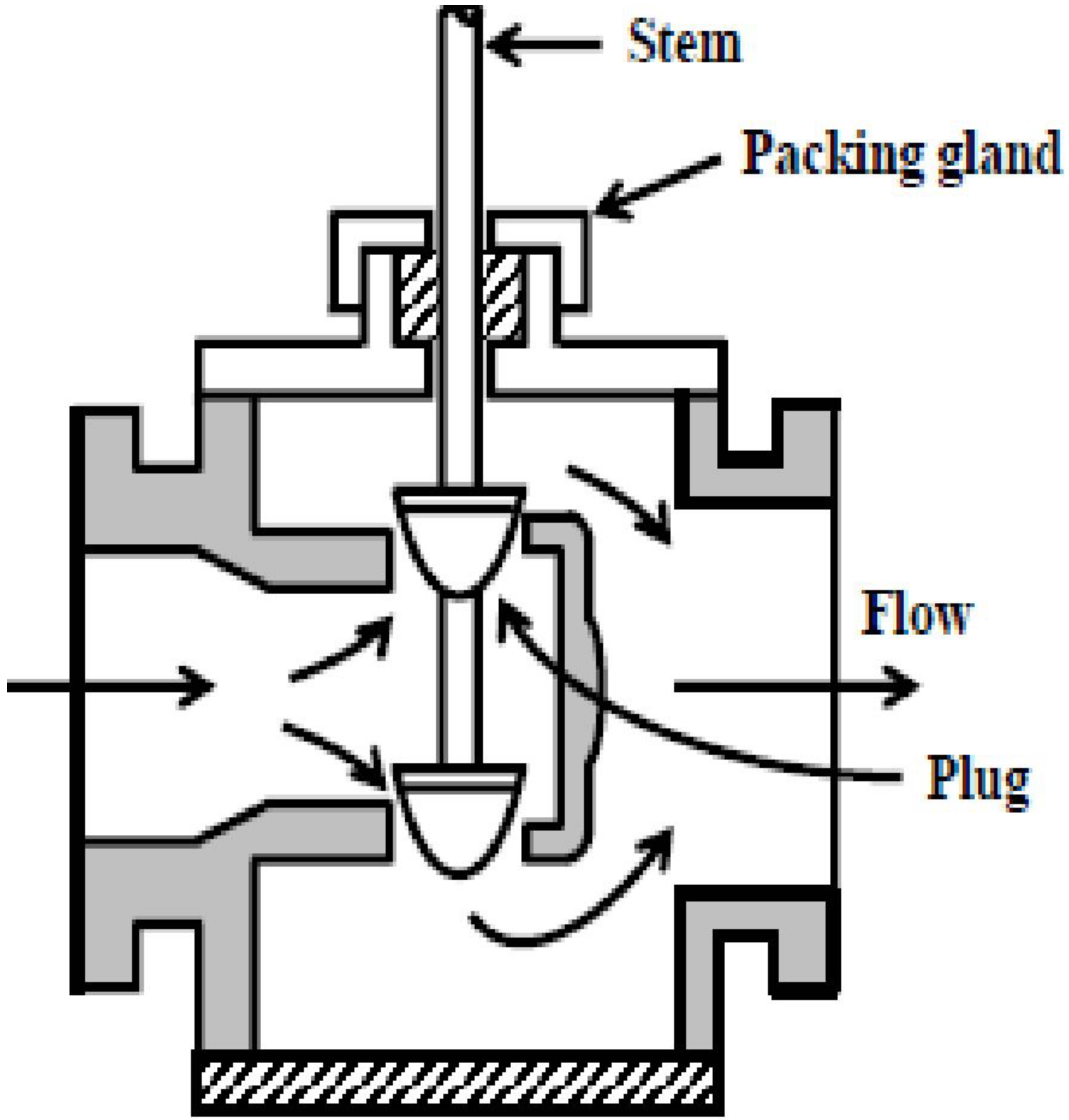


Single-seated
control valve



Double-seated
control valve

- **Process Control Valves**
- Control valve terminology: Rangeabilty, Turndown; Valve size
- Control valve capacity and valve gain
- Air to Open(AO), Air to Close (AC)
- Selection criterion
- MOC (Material of construction)
- type of actuation .
- applications, advantages, disadvantage of - Globe, Ball, Needle, Butterfly,
- Diaphragm, Pinch, Gate, Solenoid, Smart control valves, and special designs
- of Globe valves.
- Flow characteristics (Inherent and Installed)
- Valve positioners: necessity, types-motion balance and force-balance, effect on performance of control valve.
- Control Valve Actuators- Electrical, Pneumatic, Hydraulic, Electro-mechanical, and Digital actuators.
- Selection criteria of valve actuators

Disadvantages

- We cannot use a gate valve for controlling the flow of fluid.
- It has a slow operation. Takes more time in opening and closing.
- When it is partially opened it creates a lot of vibration and noise.
- Repairing this type of valve is very difficult due to limited access.

Applications

- The great valve can be used for all types of fluid like air, fuel gas, lube oil, steam, hydrocarbon, and any other services.
- Gate valves can be used in demanding environments such as high temperature and high-pressure environments.
- A special type of gate valve is used in slurry and powder production also called the knife Gate valve.
- At very low pressure and low-temperature systems like fire protection systems and water distribution pipelines, Gate valves are commonly used.
- Gate valve is often used in the petroleum industry.

Valve Positioner

- Functioning of a valve positioner is actually a closed-loop control system itself, which applies as much or as little pressure to the actuator in order to achieve the commanded valve stem position at all times. Mechanical valve positioners use levers, cams, and other physical components to achieve this closed-loop control.

- Types
- Force balance type
- Motion balance type
- Electronic

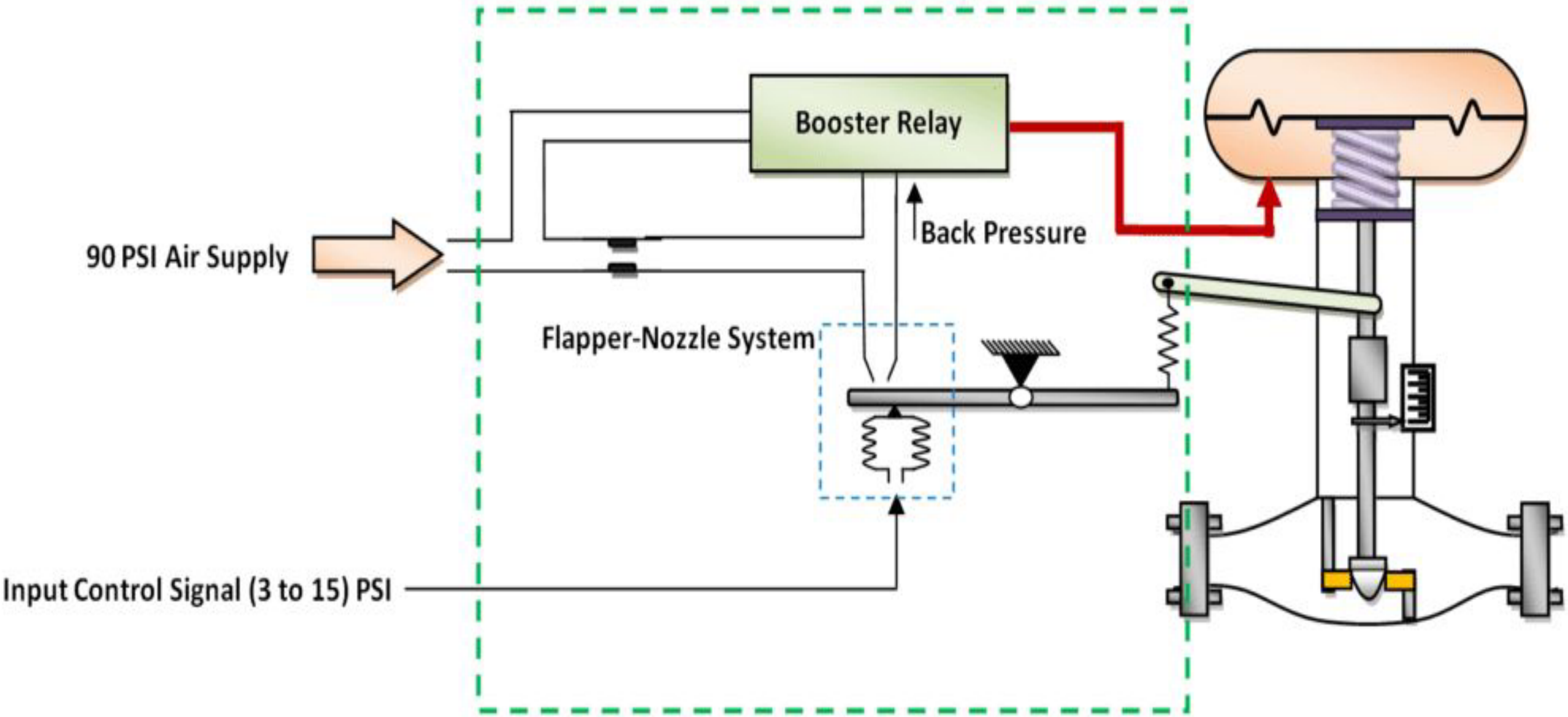


Figure- Force Balanced Valve Positioner

- The control signal for the valve is a (3 to 15) PSI pneumatic signal, coming from either from I/P transducer or from pneumatic controller. This control signal pressure applies an upward force on the force beam, such that the baffle tries to approach the nozzle. Increasing backpressure in the nozzle causes the pneumatic booster relay to output a greater air pressure to the valve actuator, which in turn lifts the valve stem up (opening up the valve). As the valve stem lifts up, the spring connecting the force beam to the valve stem becomes further stretched, applying additional force to the right-hand side of the force beam. When this additional force balances the bellows' force, the system stabilizes at a new equilibrium.

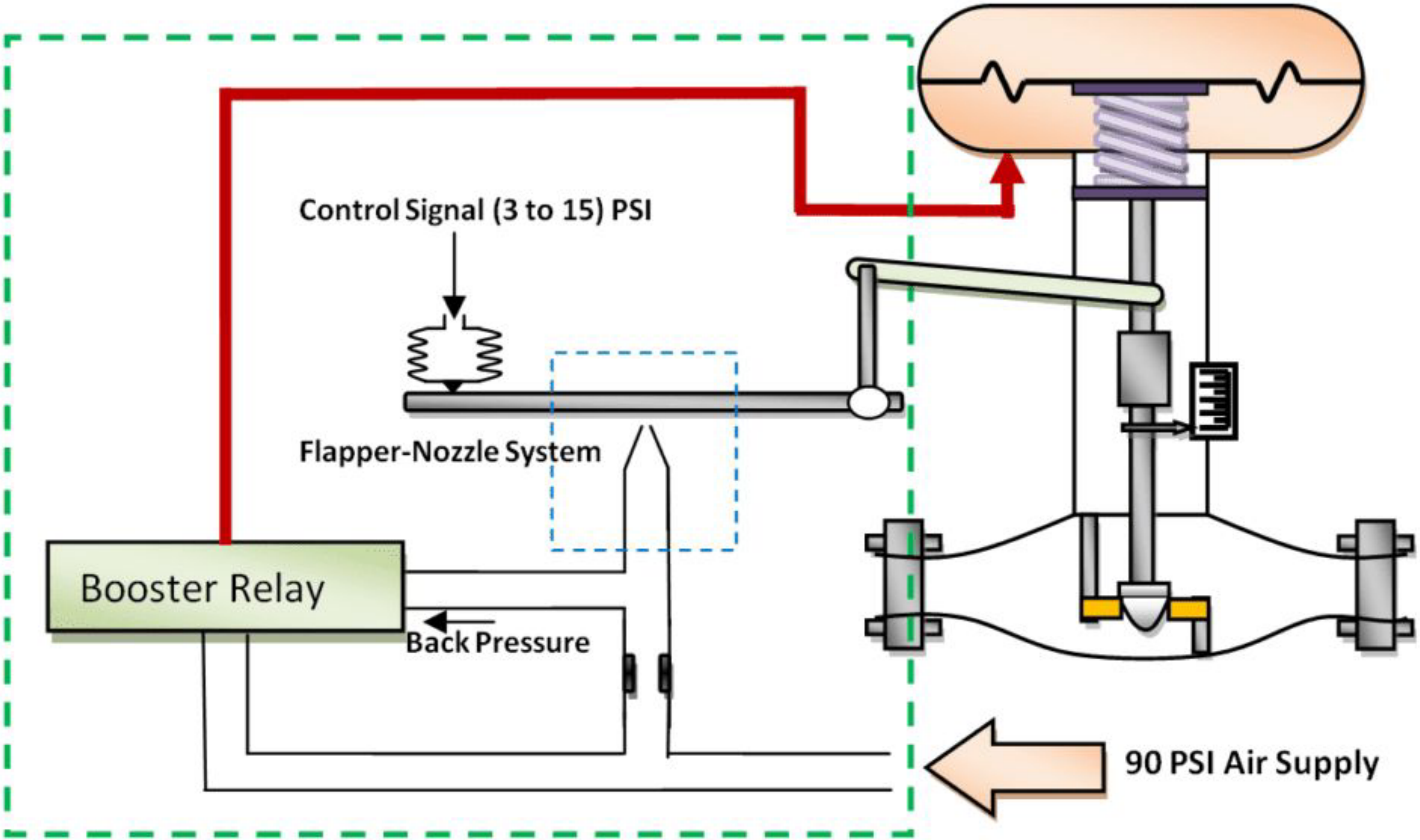


Figure- Motion Balanced Valve Positioner

- In motion-balance mechanism, an increasing signal pressure causes the beam to advance toward the nozzle, generating increased nozzle backpressure which then causes the pneumatic amplifying relay to send more air pressure to the valve actuator. As the valve stem lifts up, the upward motion imparted to the right-hand end of the beam counters the beam’s previous advance toward the nozzle. When equilibrium is reached, the beam will be in an angled position with the bellows’ motion balanced by valve stem motion.

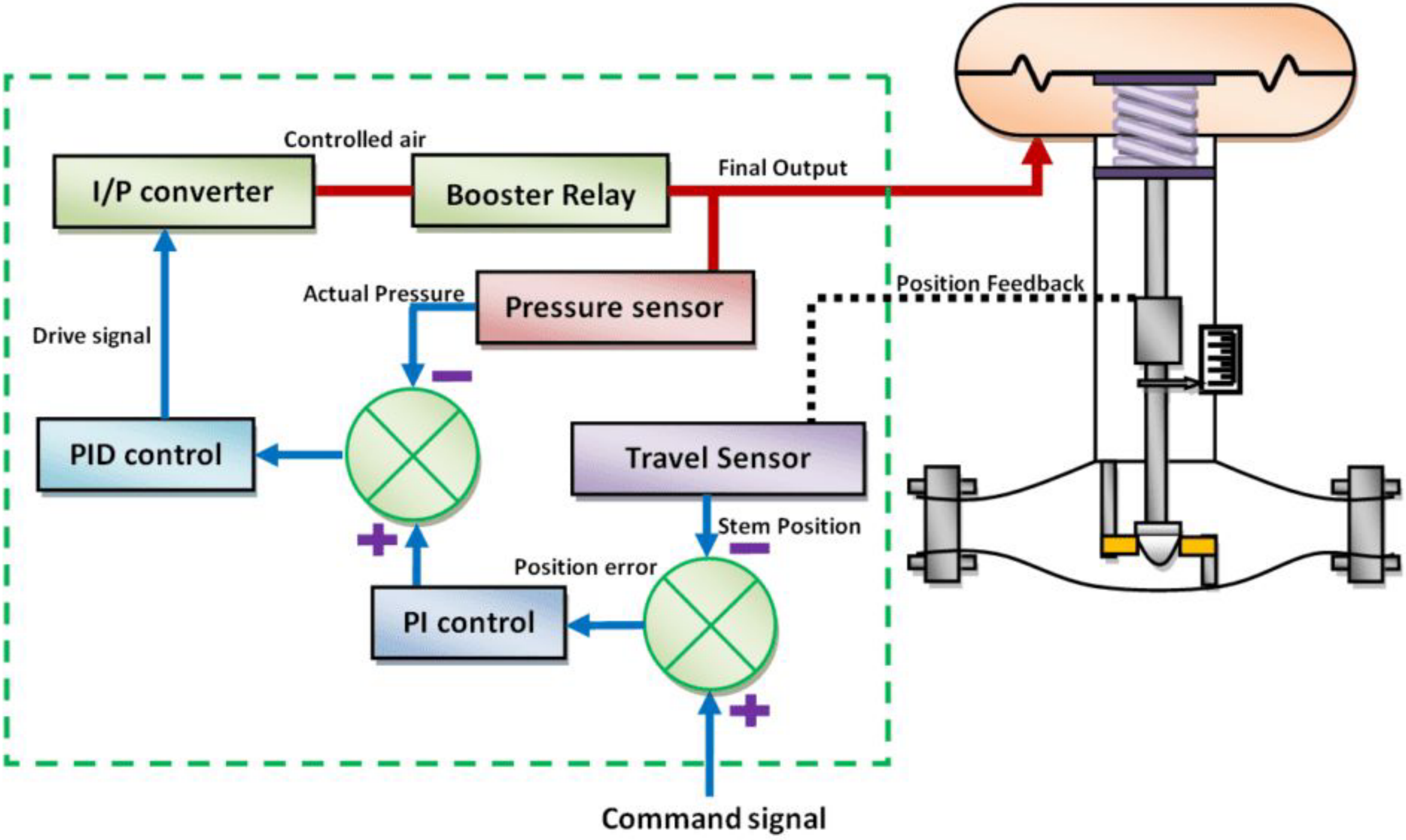


Figure- Electronic Valve Positioner

- an electronic valve positioner, uses an electronic sensor (hall based sensor) to detect valve stem position, a microprocessor to compare that stem position feedback against the control signal.
    - **Position error = (Position Feedback – Command Signal)**
- Here Position error determines where the valve's stem to be positioned. The error signal is fed to controller inside the positioner (PI) calculates how much air pressure at the actuator should be needed to achieve the requested stem position. The next controller (PID) drives the I/P (current-to-pressure) converter as much as necessary to achieve that pressure. If anything causes the valve stem to not be at the commanded position, the two controllers inside the positioner work together to force the valve to its proper position i.e. two control algorithms working together to maintain proper valve position in which one monitoring position feedback and another one controlling pressure applied to the actuator.