VALVE TYPES

AND

SYMBOLS

VALVES

A valve is a mechanical device that controls the flow of fluid and pressure within a system or process.

A valve controls system or process fluid flow and pressure by performing any of the following functions:

- **Stopping and starting fluid flow**
- **Varying (throttling) the amount of fluid flow**
- **Controlling the direction of fluid flow**
- **Regulating downstream system or process pressure**
- **Relieving component or piping over pressure**

There are many valve designs and types that satisfy one or more of the functions identified above.

A multitude of valve types and designs safely accommodate a wide variety of industrial applications.

Regardless of type, all valves have the following basic parts:

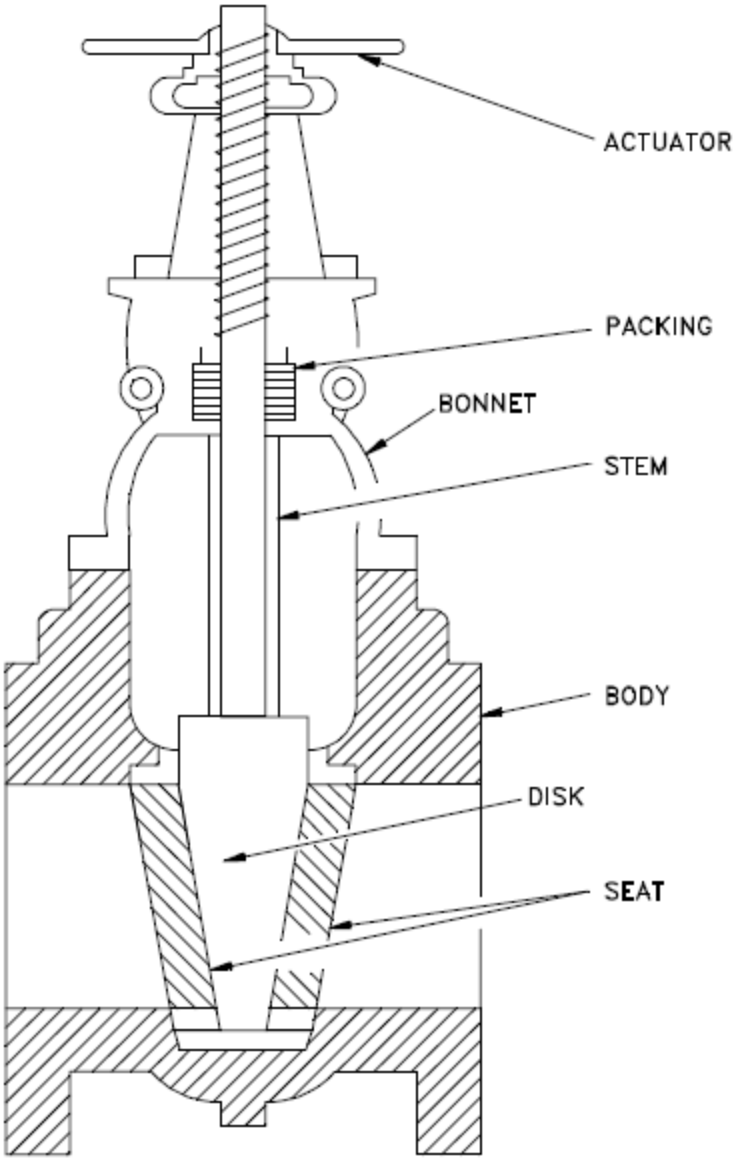
VALVE BODY

The *body,* sometimes called the shell, is the primary pressure boundary of a valve.

It serves as the principal element of a valve assembly because it is the framework that holds everything together.

The body, the first pressure boundary of a valve, resists fluid pressure loads from connecting piping.

It receives inlet and outlet piping through threaded, bolted, or welded joints.



BASIC PARTS OF VALVES

VALVE BONNET

The cover for the opening in the valve body is the *bonnet*.

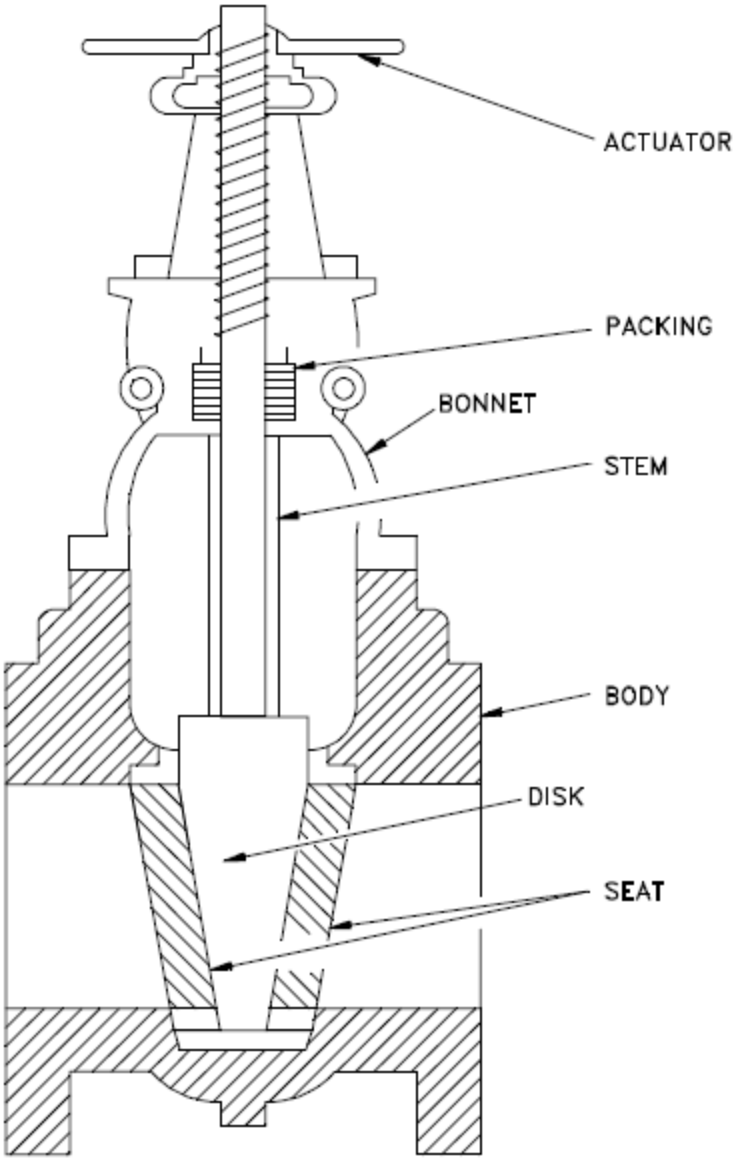
Some bonnets function simply as valve covers, while others support valve internals and accessories such as the stem, disk, and actuator.

The bonnet is the second principal pressure boundary of a valve, cast or forged of the same material as the body and is connected to the body by a threaded, bolted, or welded joint.

This means that the weld joint or bolts that connect the bonnet to the body are pressure-retaining parts.

Valve bonnets, although a necessity for most valves, represent a cause for concern.

Bonnets can increase valve size & cost, and are a source for potential leakage.



BASIC PARTS OF VALVES

VALVE TRIM

The internal elements of a valve are collectively referred to as a valve's trim.

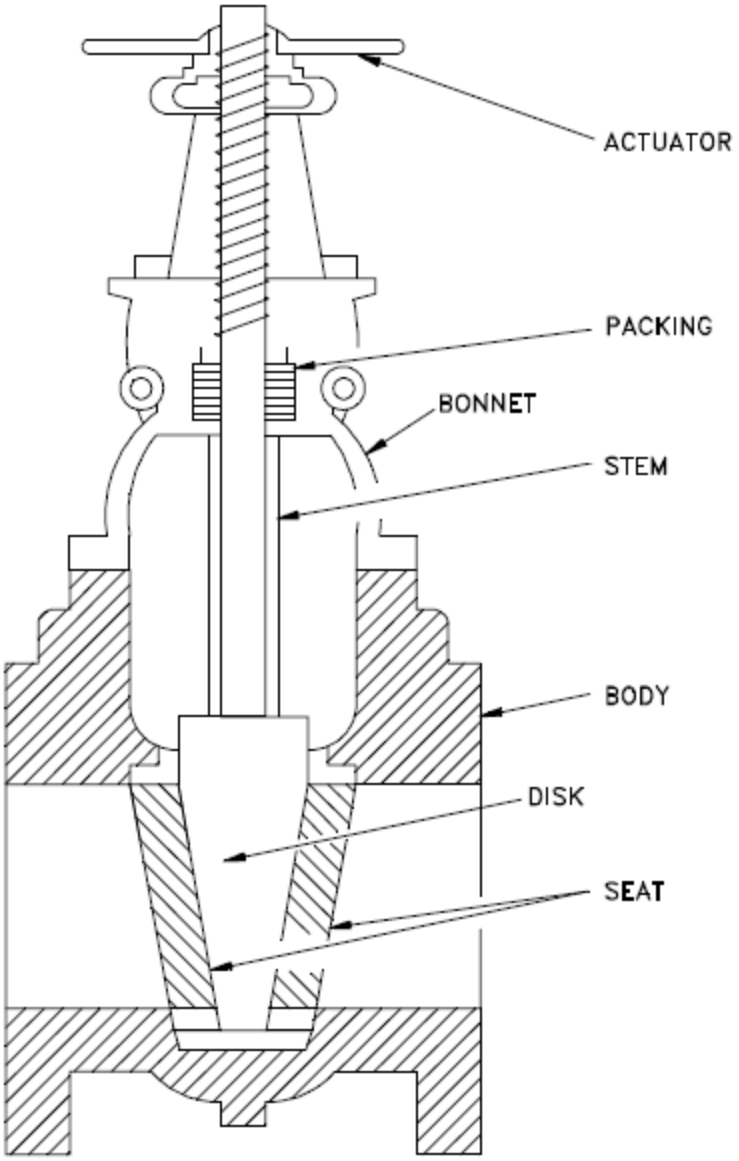
The trim typically includes a disk, seat, stem and sleeves needed to guide the stem.

A valve's performance is determined by the disk and seat interface and the relation of the disk position to the seat.

Because of the trim, basic motions and flow control are possible.

In rotational motion trim designs, the disk slides closely past the seat to produce a change in flow opening.

In linear motion trim designs, the disk lifts perpendicularly away from the seat so that an annular orifice appears.



BASIC PARTS OF VALVES

VALVE DISK

For a valve having a bonnet, the disk is the third primary principal pressure boundary.

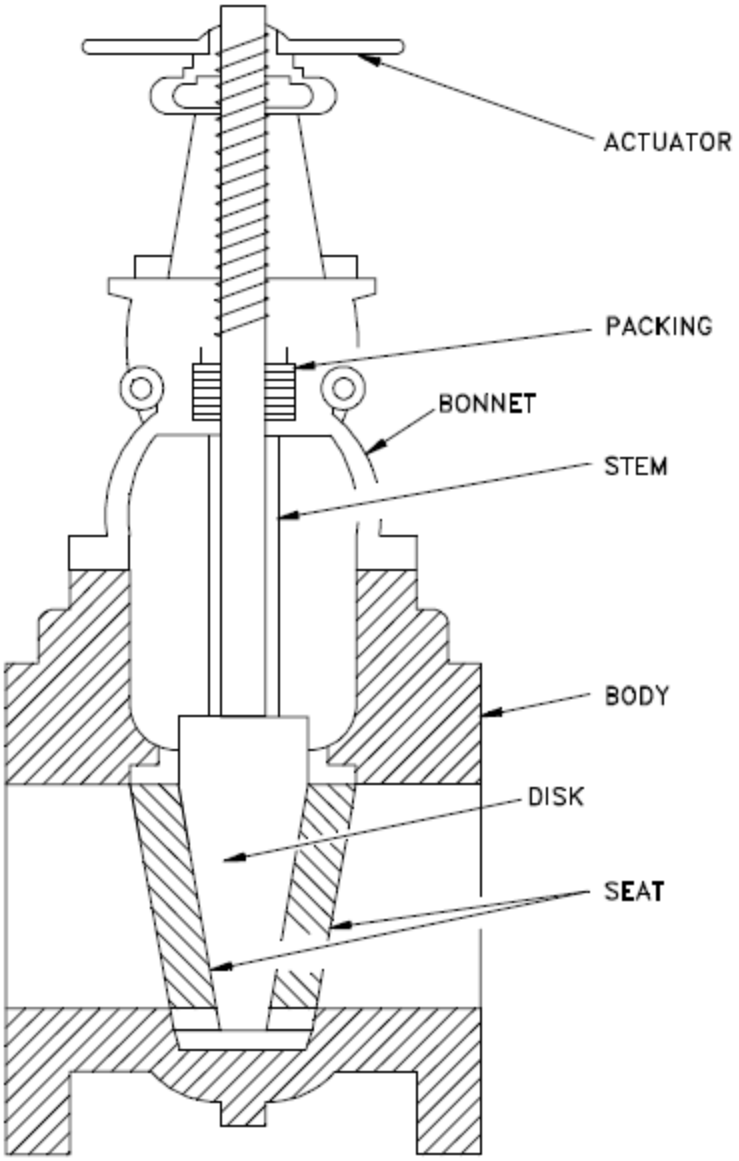
The disk provides the capability for permitting and prohibiting fluid flow.

With the disk closed, full system pressure is applied across the disk if the outlet side is depressurized. For this reason, the disk is a pressure-retaining part.

Disks are typically forged and, in some designs, hard-surfaced to provide good wear characteristics.

A fine surface finish of the seating area of a disk is necessary for good sealing when the valve is closed.

Most valves are named, in part, according to the design of their disks.



BASIC PARTS OF VALVES

VALVE SEAT

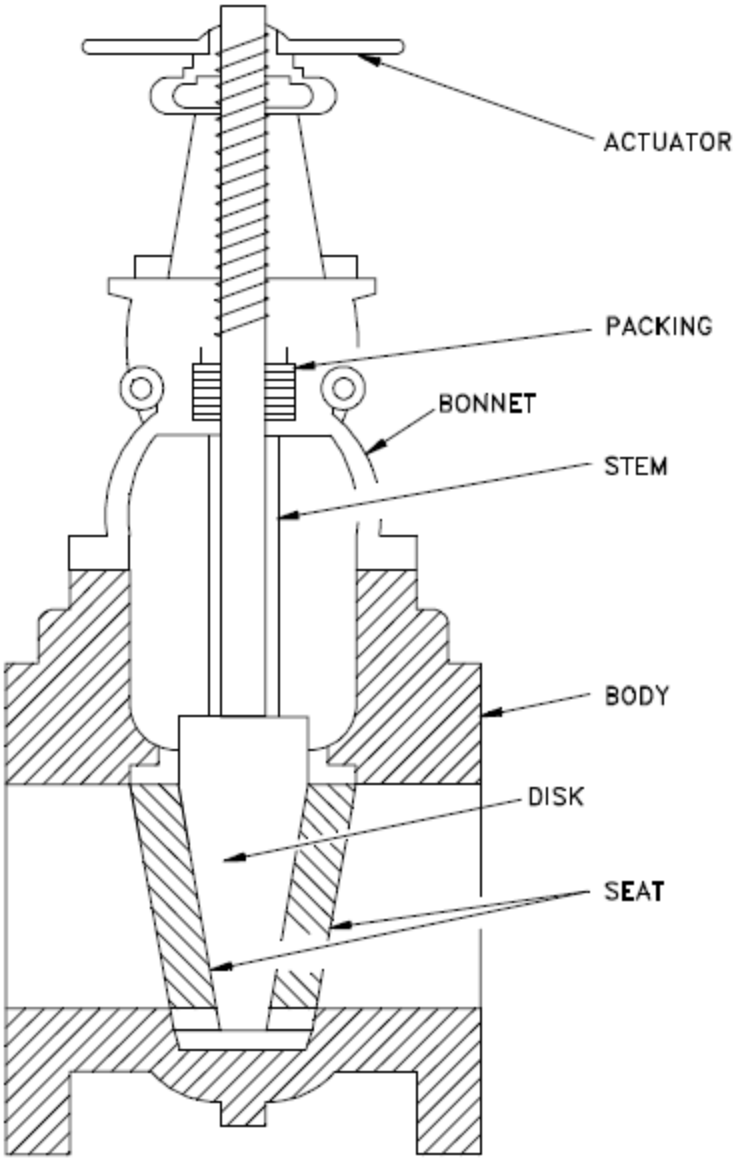
The seat or seal rings provide the seating surface for the disk.

In some designs, the body is machined to serve as the seating surface and seal rings are not used.

In other designs, forged seal rings are threaded or welded to the body to provide the seating surface.

A fine surface finish of the seating area is necessary for good sealing when the valve is closed.

Seal rings are not usually considered pressure boundary parts because the body has sufficient wall thickness to withstand design pressure without relying upon the thickness of the seal rings.



BASIC PARTS OF VALVES

VALVE STEM

The stem connects the actuator and disk. It is responsible for positioning the disk.

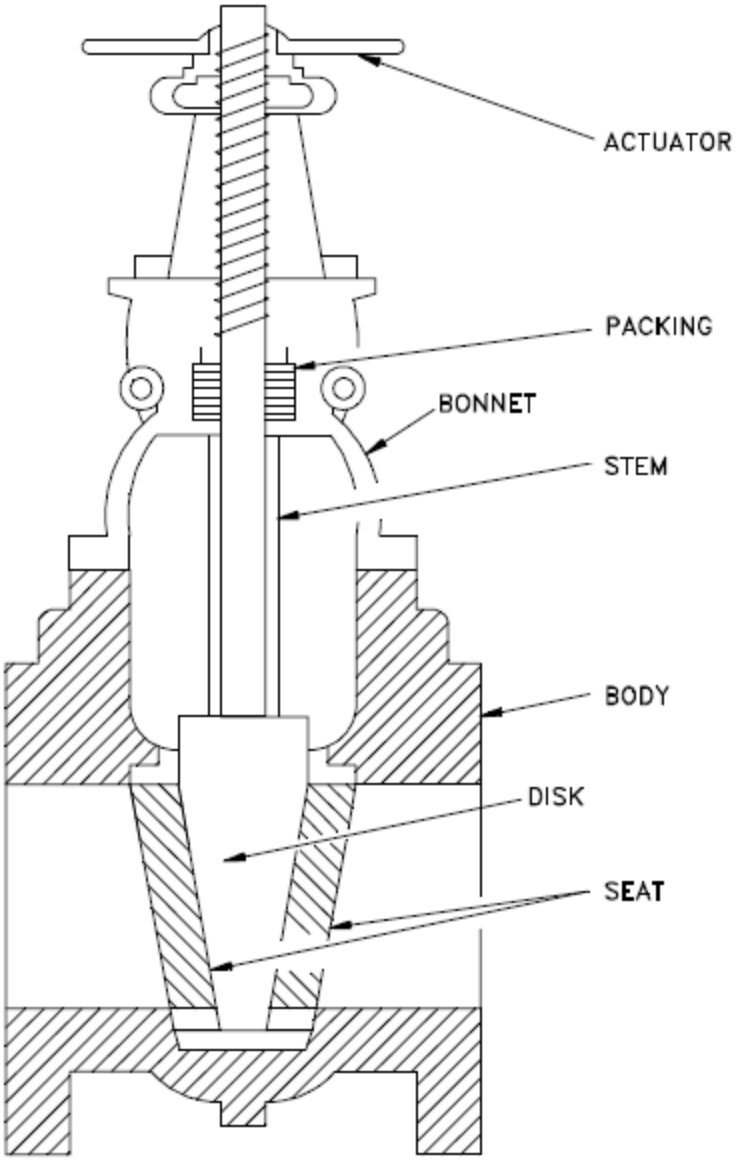
Stems are typically forged and connected to the disk by threaded or welded joints.

For valve designs requiring stem packing or sealing to prevent leakage, a fine surface finish of the stem in the area of the seal is necessary.

Typically, a stem is not considered a pressure boundary part.

Connection of the disk to the stem can allow some rocking or rotation to ease the positioning of the disk on the seat.

Alternately, the stem may be flexible enough to let the disk position itself against the seat. However, constant fluttering or rotation of a flexible or loosely connected disk can destroy the disk or its connection to the stem.



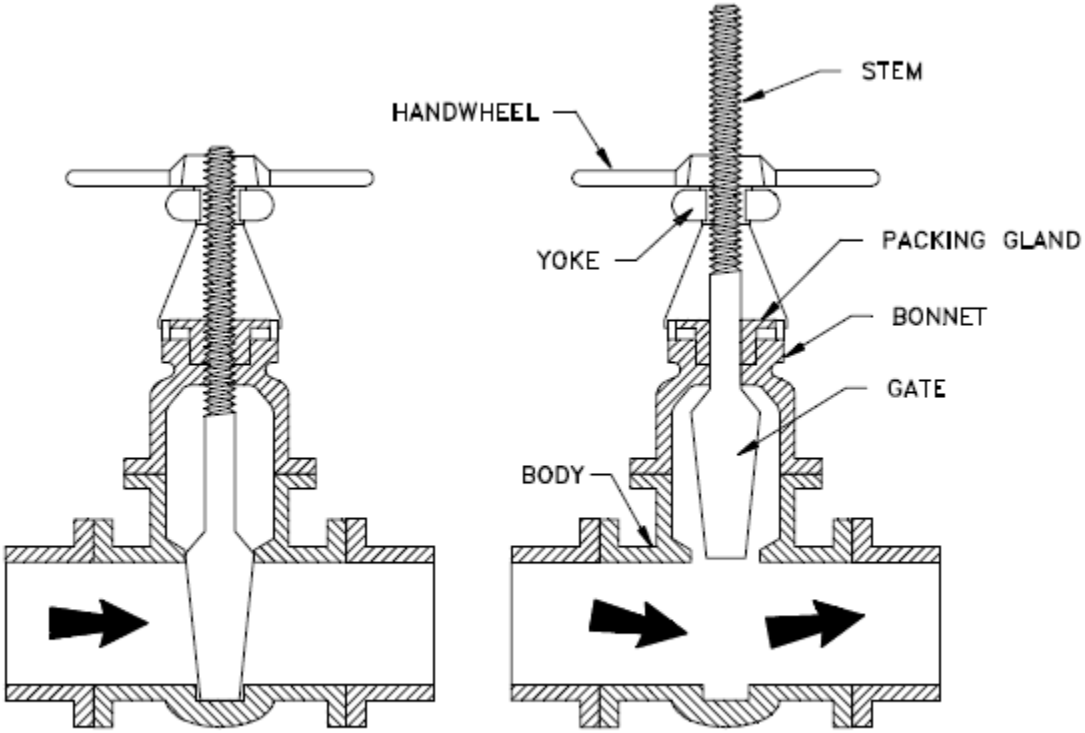
BASIC PARTS OF VALVES

RISING STEM VALVE

Two types of valve stems are rising stems and non-rising stems [Figures below], these two types of stems are easily distinguished by observation.

For a rising stem valve, the stem will rise above the actuator as the valve is opened.

This occurs because the stem is threaded and mated with the bushing threads of a yoke that is an integral part of, or is mounted to, the bonnet.

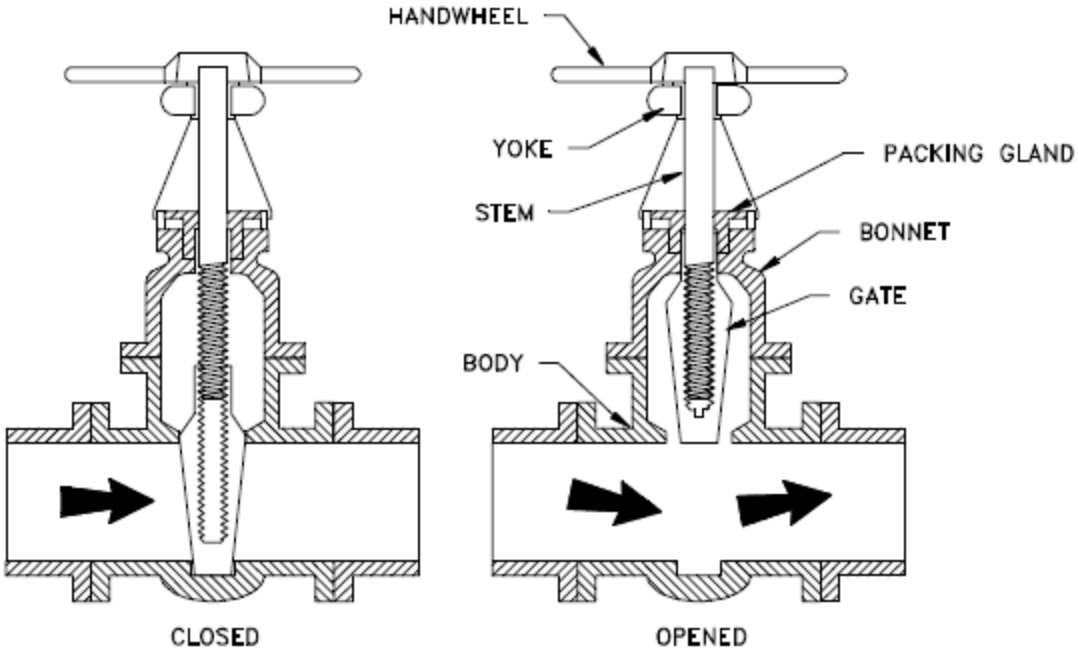


BASIC PARTS OF VALVES

NON- RISING STEM VALVE

There is no upward stem movement from outside the valve for a non-rising stem design.

For the non-rising stem design, the valve disk is threaded internally and mates with the stem threads.



BASIC PARTS OF VALVES

VALVE ACTUATOR

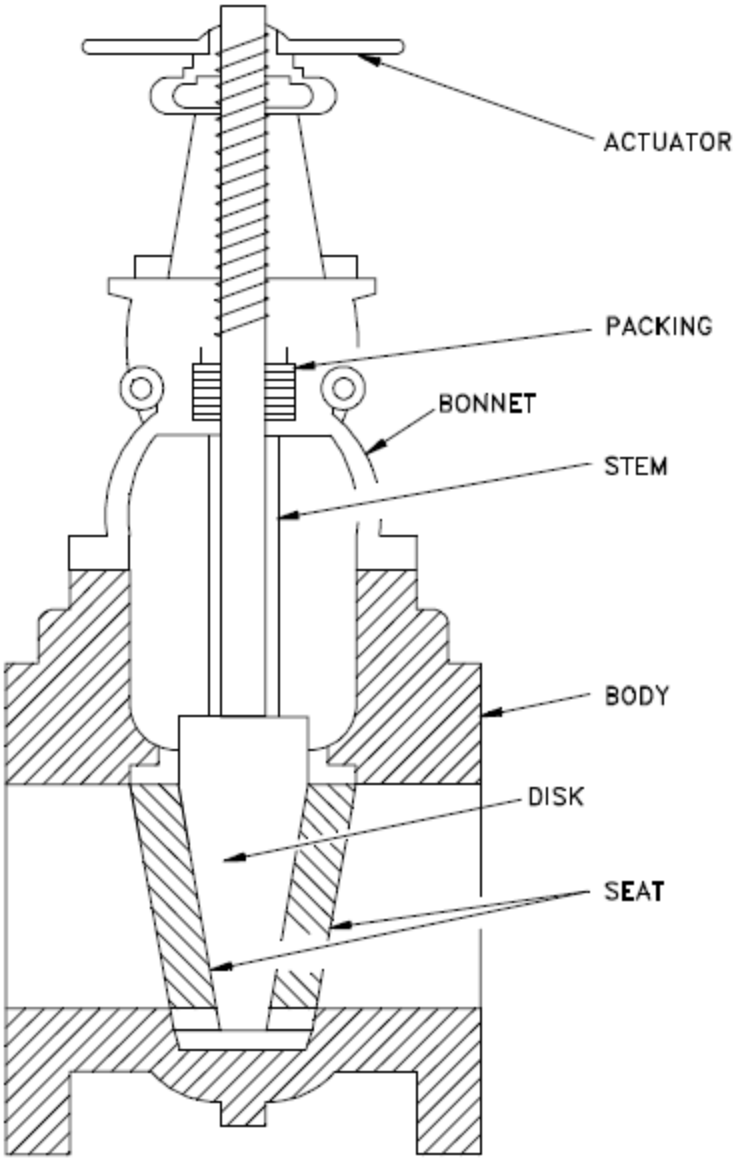
The actuator operates the stem and disk assembly.

An actuator may be a manually operated hand wheel, manual lever, motor operator, solenoid operator, pneumatic operator, or hydraulic ram.

In some designs, the actuator is supported by the bonnet. In other designs, a yoke mounted to the bonnet supports the actuator.

Except for certain hydraulically controlled valves, actuators are outside of the pressure boundary.

Yokes, when used, are always outside of the pressure boundary.



BASIC PARTS OF VALVES

VALVE PACKING

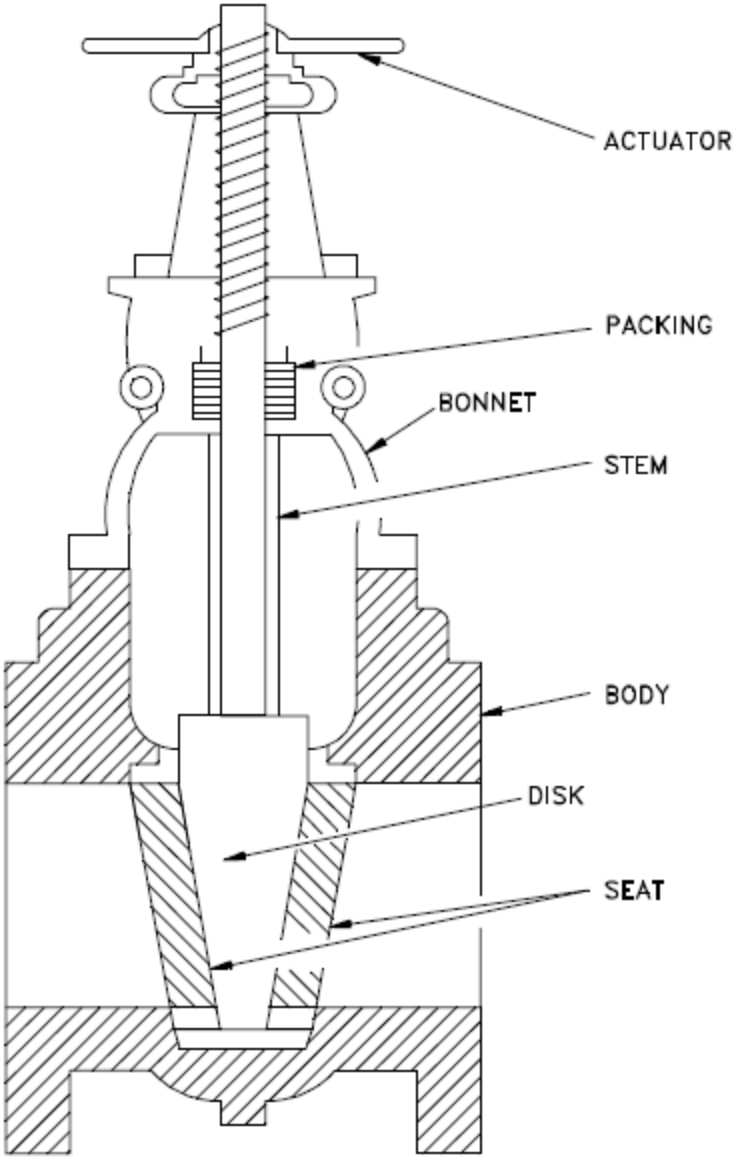
Most valves use some form of packing to prevent leakage from the space between the stem and the bonnet.

Packing is commonly a fibrous material (such as flax) or another compound (such as teflon) that forms a seal between the internal parts of a valve and the outside where the stem extends through the body.

Valve packing must be properly compressed to prevent fluid loss and damage to the valve's stem.

If a valve's packing is too loose, the valve will leak, which is a safety hazard.

If the packing is too tight, it will impair the movement and possibly damage the stem.



GENERAL TYPES OF VALVES

- **Due to the diversity of the types of systems, fluids, and environments in which valves must operate, a vast array of valve types have been developed.**

- **Examples of the common types are the globe valve, gate valve, ball valve, plug valve, butterfly valve, diaphragm valve, check valve, pinch valve, and safety valve.**

- **Each type of valve has been designed to meet specific needs. Some valves are capable of throttling flow, other valve types can only stop flow, others work well in corrosive systems, and others handle high pressure fluids.**

- **Each valve type has certain inherent advantages and disadvantages.**

- **Understanding these differences and how they effect the valve's application or operation is necessary for the successful operation of a facility.**

GENERAL TYPES OF VALVES

- **Although all valves have the same basic components and function to control flow in some fashion, the method of controlling the flow can vary dramatically.**
- **There are generally four methods of controlling flow through a valve.**

  1. **Move a disc, or plug into or against an orifice (for example, globe or needle type valve).**

  2. **Slide a flat, cylindrical, or spherical surface across an orifice (for example, gate and plug valves).**

  3. **Rotate a disc or ellipse about a shaft extending across the diameter of an orifice (for example, a butterfly or ball valve).**

  4. **Move a flexible material into the flow passage (for example, diaphragm and pinch valves).**

- **Each method of controlling flow has characteristics that makes it the best choice for a given application of function.**

GLOBE VALVE

GATE VALVE

BELLOWS SEAL VALVE

STEM LEAK-OFF VALVE

DIAPHRAGM VALVE

Globe Valves

A globe valve is a linear motion valve used to stop, start, and regulate fluid flow.

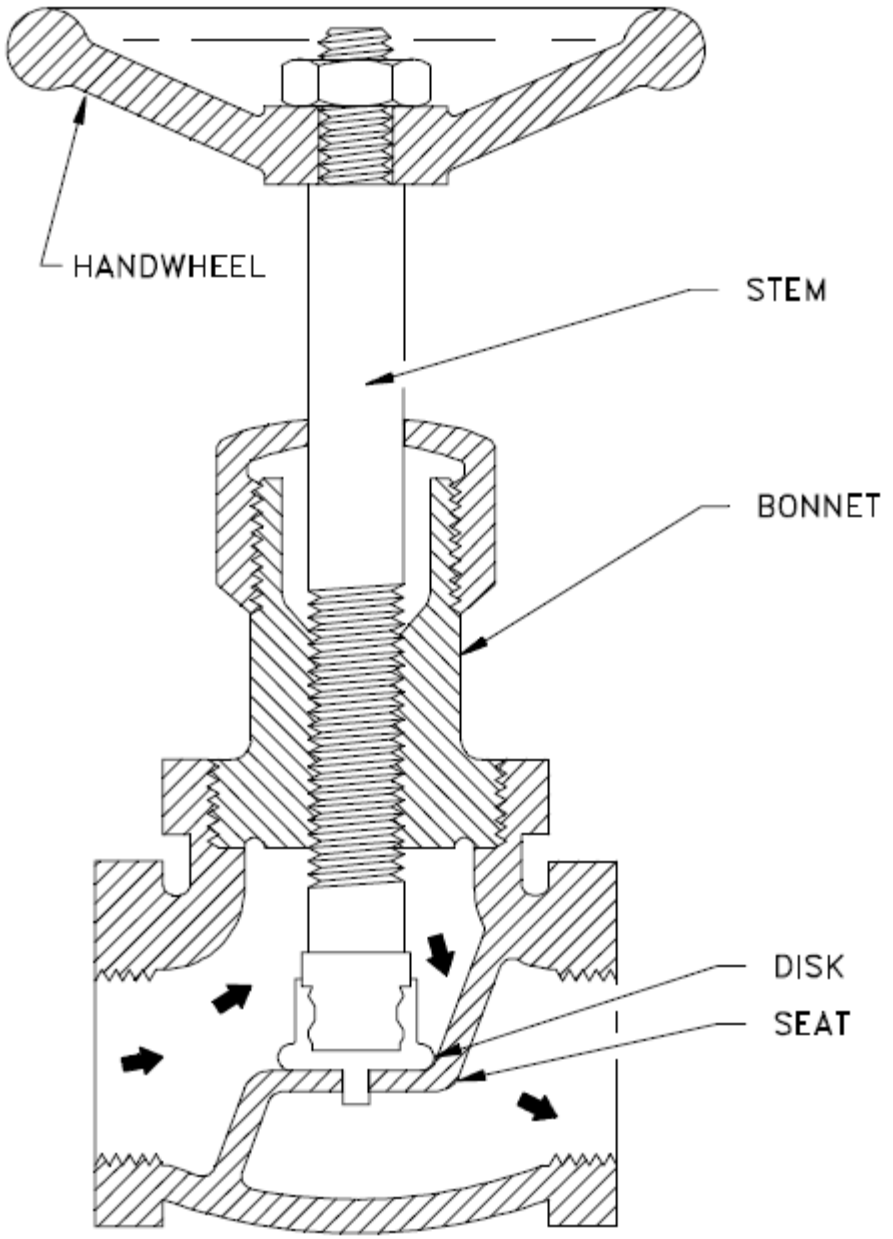
The globe valve disk can be totally removed from the flow path or it can completely close the flow path.

The essential principle of globe valve operation is the perpendicular movement of the disk away from the seat.

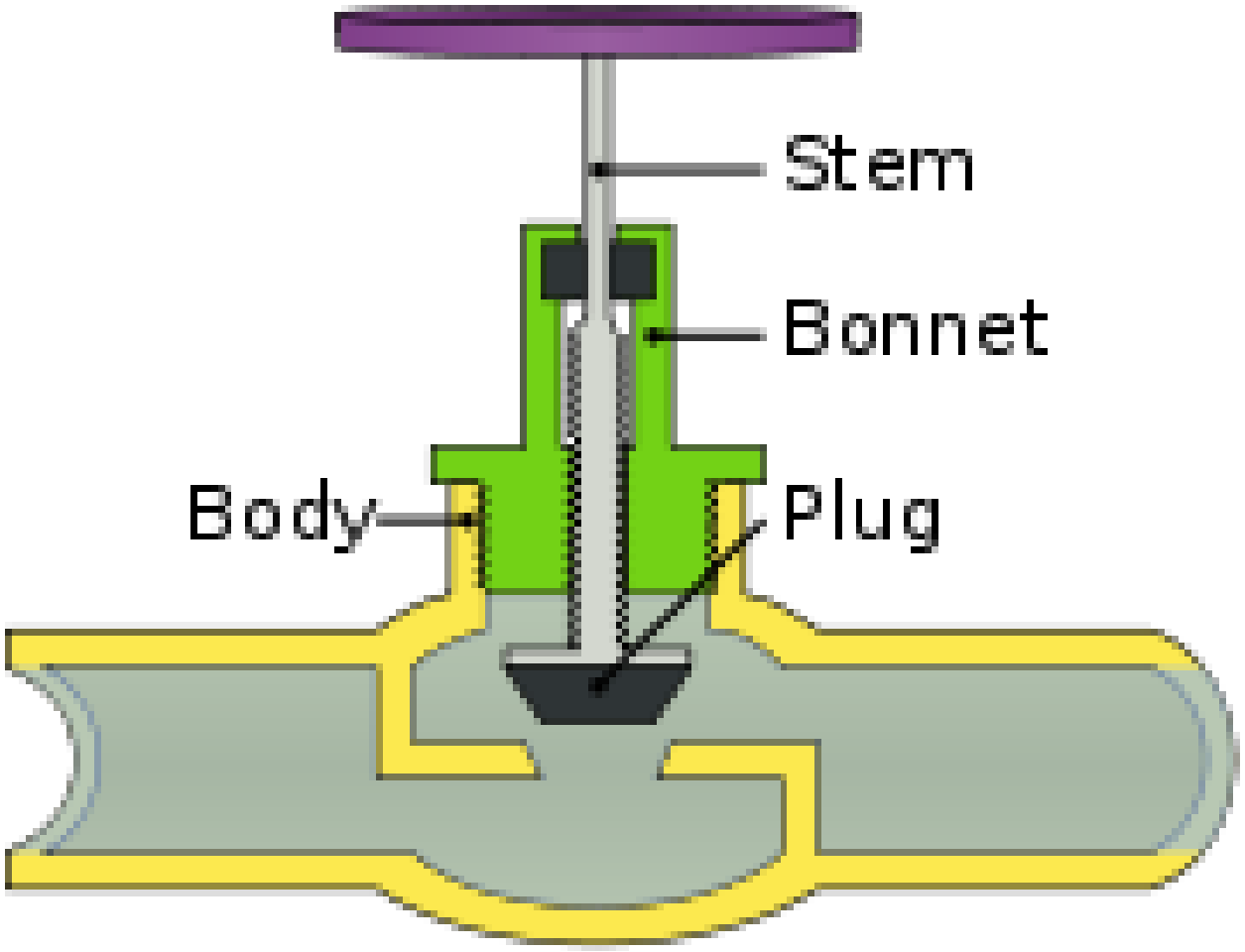
This causes the annular space between the disk and seat ring to gradually close as the valve is closed.

This characteristic gives the globe valve good throttling ability, which permits its use in regulating flow.

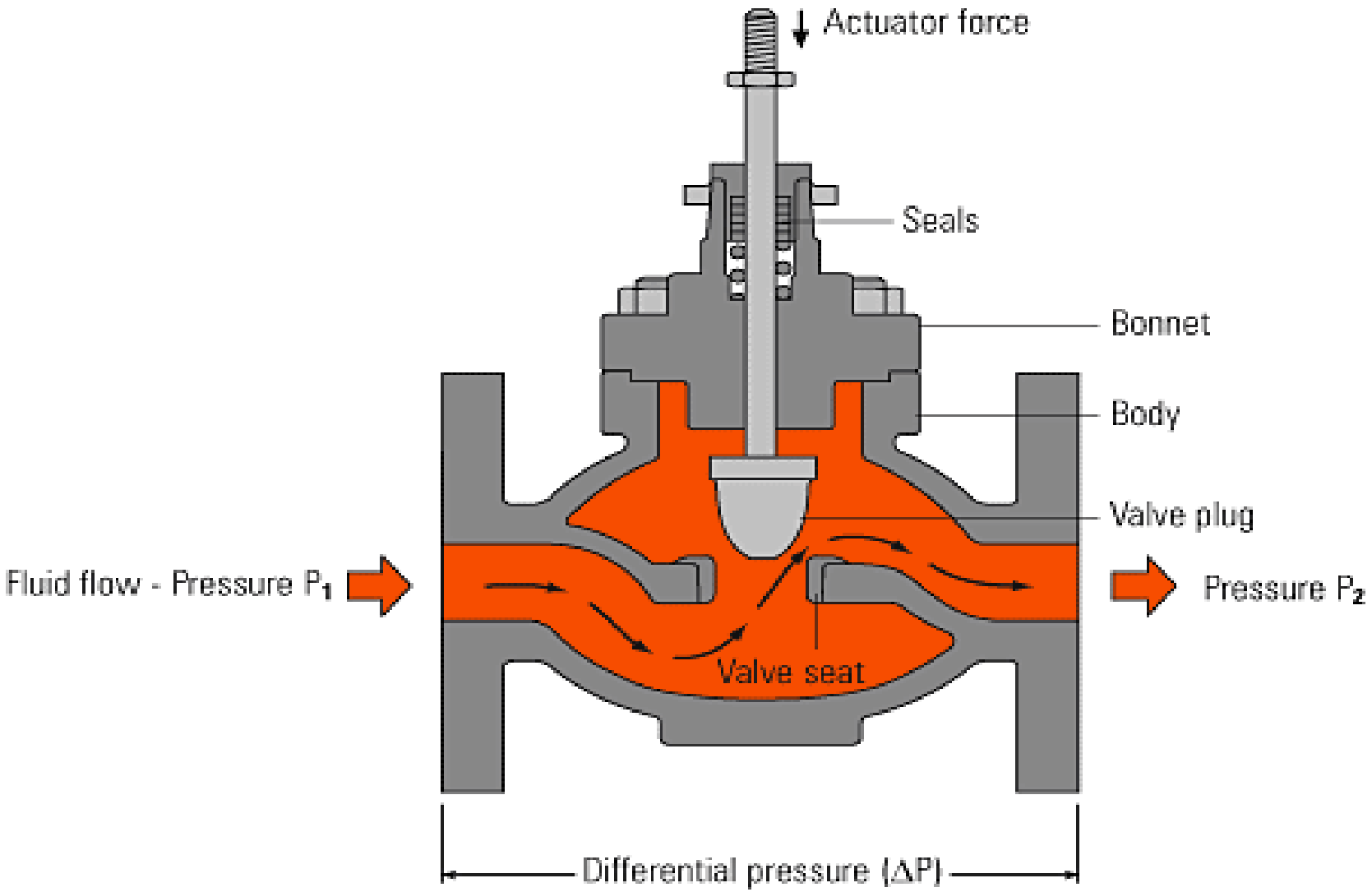
Therefore, the globe valve may be used for both stopping and starting fluid flow and for regulating flow.



Globe Valves



Globe Valves



Globe Valves

GLOBE VALVE

GATE VALVE

BELLOWS SEAL VALVE

STEM LEAK-OFF VALVE

DIAPHRAGM VALVE

Gate Valves

It is a linear motion valve used to start or stop fluid flow; however, it does not regulate or throttle flow.

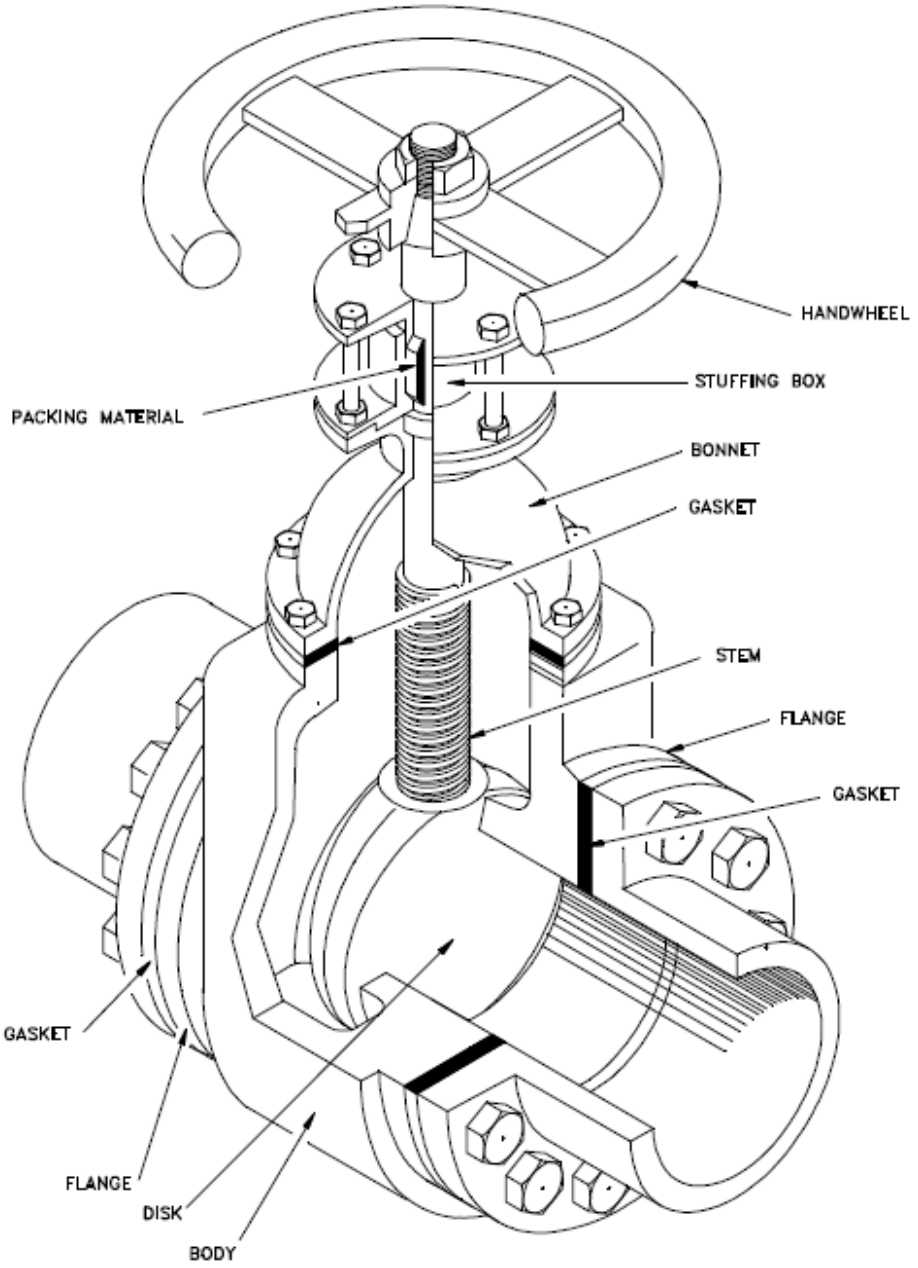
The name gate is derived from the appearance of the disk in the flow stream.

Its disk is completely removed from the flow stream when the valve is fully open.

This characteristic offers virtually no resistance to flow when the valve is open. Hence,
there is little pressure drop across an open gate valve.

When the valve is fully closed, a disk-to-seal ring contact surface exists for 360°, and good sealing is provided.

With the proper mating of a disk to the seal ring, very little or no leakage occurs across the disk when the gate valve is closed.



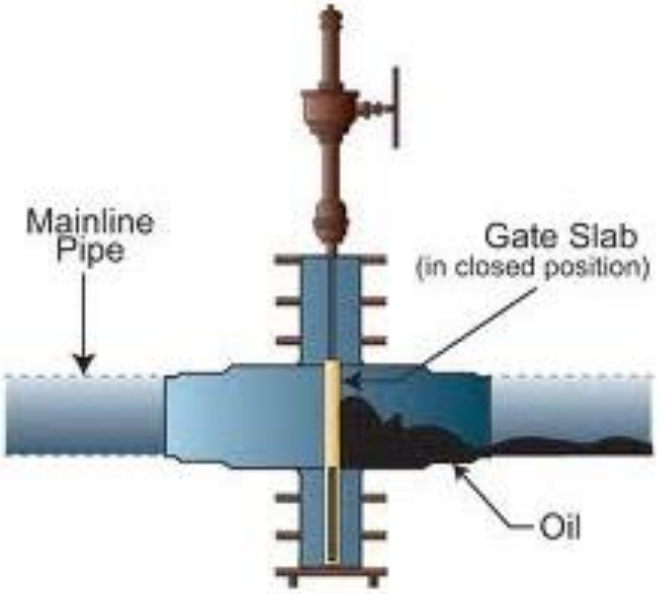
Gate Valves

On opening the gate valve, the flow path is enlarged in a highly nonlinear manner with respect to percent of opening.

This means that flow rate does not change evenly with stem travel.

Also, a partially open gate disk tends to vibrate from the fluid flow. Most of the flow change occurs near shutoff with a relatively high fluid velocity causing disk and seat wear and eventual leakage if used to regulate flow.

For these reasons, gate valves are not used to regulate or throttle flow.

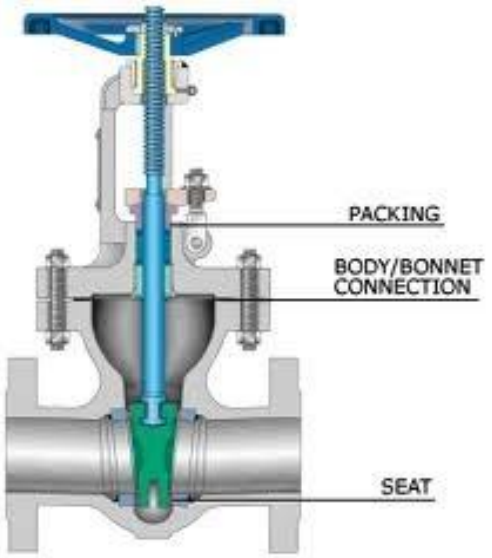


Gate Valves

A gate valve can be used for a wide variety of fluids and provides a tight seal when closed.

The major disadvantages to the use of a gate valve are:

- **It is not suitable for throttling applications.**
- **It is prone to vibration in the partially open state.**
- **It is more subject to seat and disk wear than a globe valve.**
- **Repairs, such as lapping and grinding, are generally more difficult to accomplish.**



GLOBE VALVE

GATE VALVE

BELLOWS SEAL VALVE

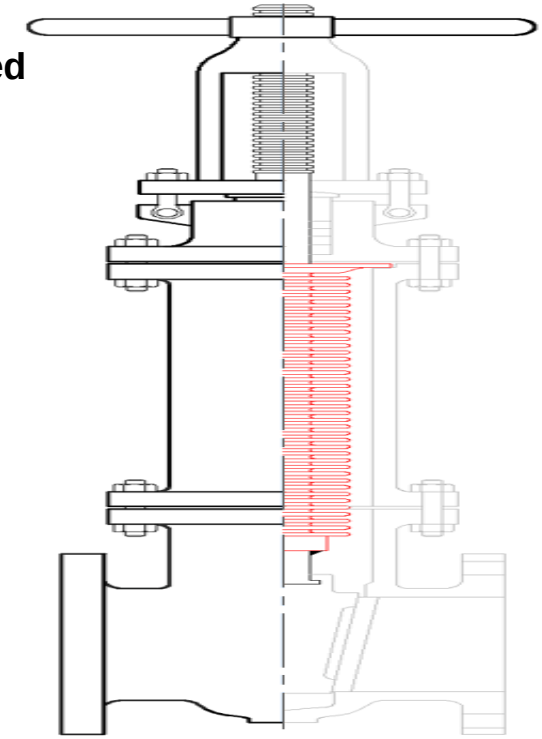
STEM LEAK-OFF VALVE

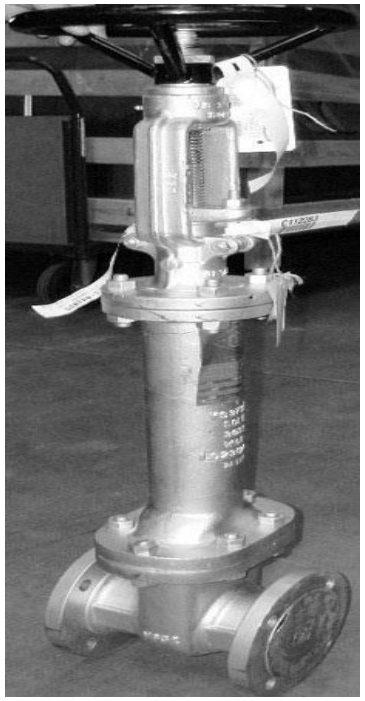
DIAPHRAGM VALVE

Bellows seal Valves

The word Bellow:

- **An apparatus for producing a strong current of air, as for sounding a pipe organ or increasing the draft to a fire, consisting of a flexible, valved air chamber that is contracted and expanded by pumping to force the air through a nozzle.**
- **(Engineering / Mechanical Engineering) a flexible corrugated element used as an expansion or means of transmitting axial motion**

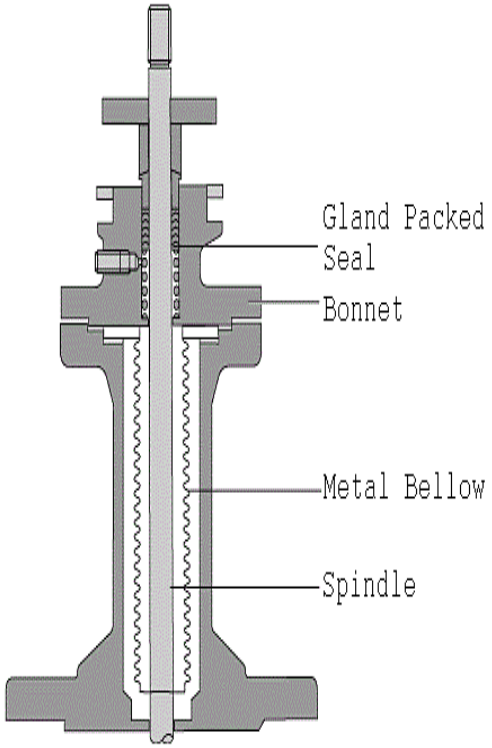




Leakage at various points in the valve may create radioactive emissions. Critical leakage points include flanged gasket joints and the Valve gland packing. Nuclear industry has to take care of environmental protection and it has responsibility to limit radioactive effluent leakage that is damaging to the environment.

WHY BELLOW SEAL VALVE???

- Valves are used for flow and pressure control of process fluid
- Very much chances of leakages are there
- Leakages mean:
  - Loss of material
  - Pollution (chemical/ radioactive)
- A better remedy for this problem is Bellow Seal Valve
- Also known as:
  - Zero leak valve
  - Emission free valve



BELLOW…

What is Bellow???

- A flexible corrugated element used as a mean of transmitting axial motion
- The bellow cartridge is welded to both the Valve Bonnet and the Valve stem
- The bellow cartridge has a number of convolutions and these convolutions become compressed or expanded depending upon the movement of Valve stem
- It can be sealed to the Valves in two different ways:

  i. It can be welded to the Valve stem at the top and the Valve body on the bottom. In this case the process fluid is contained inside the bellow.

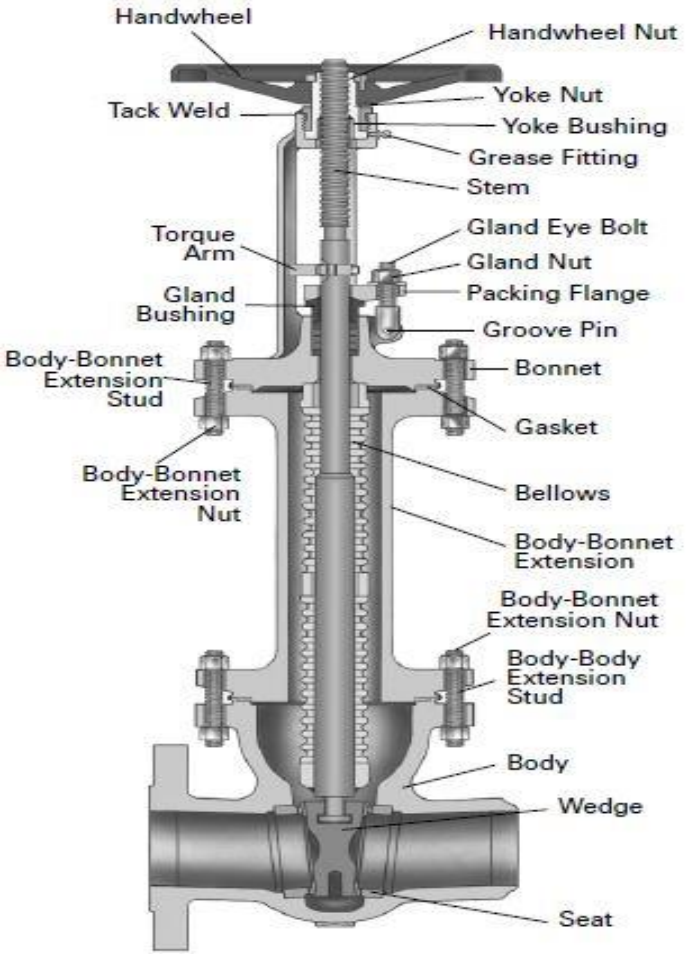
  ii. It can be welded to the Valve stem at the bottom and the body on the top. In this case the process fluid is contained in the annular region between the Valve Bonnet and bellow (from the outside).

Types of Bellow…

- There are two main types of bellow:
  i. Forged Bellow: These are made from rolling a flat sheet (thin wall foil) into a tube which is then longitudinally fusion welded. This tube is subsequently mechanically or hydrostatically formed into a bellow with rounded and widely spaced folds.
  ii. Welded Bellow: These are made by welding washer-like plates of thin metal together at both the inner and outer circumference of the washers - like plates. A welded leaf bellow has more folds per unit length as compared to forged bellows. These are shorter in length.
- Reportedly, mechanically forged bellows fail at random spots, while the welded leaf usually fails at or near a weld.

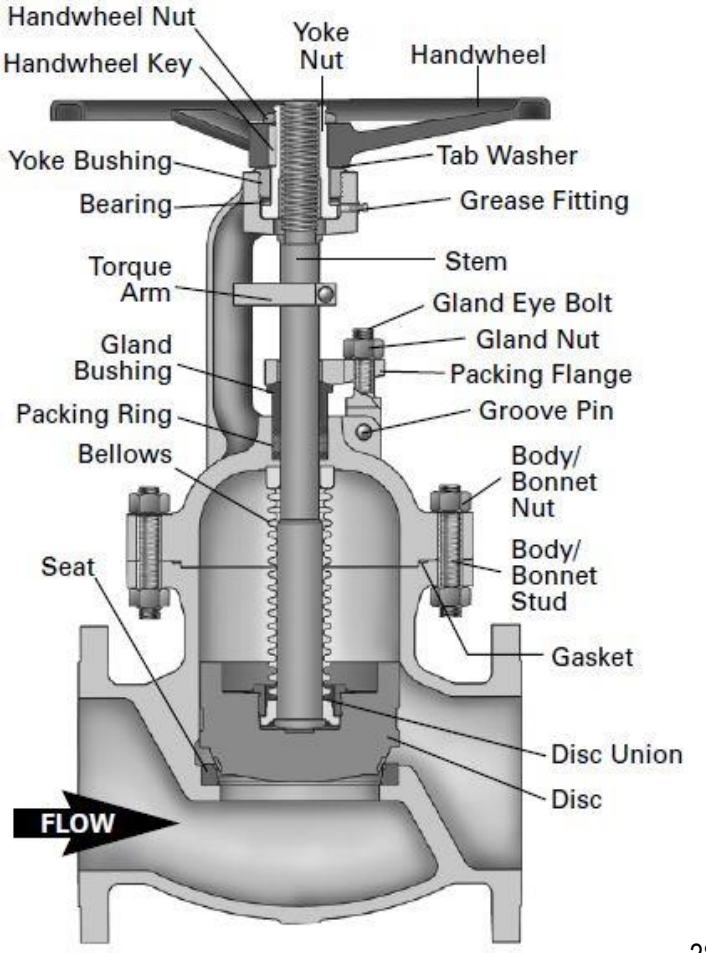
TYPES OF BELLOW SEAL VALVES…

Bellow Seal Gate Valve



Click the Figures to Play Corresponding Videos

Bellow Seal Globe Valve



MATERIAL OF CONSTRUCTION

- **Bellows can be made of:**
  - **Most popular stainless steel bellow material is AISI 316Ti which contain Titanium to withstand high temperatures**
  - **Inconel 600 or Inconel 625 have improve fatigue strength and corrosion resistance as compared with stainless steel bellows**
  - **Hast alloy C-276 offers greater corrosion resistance and fatigue strength than Inconel 625**

APPLICATIONS

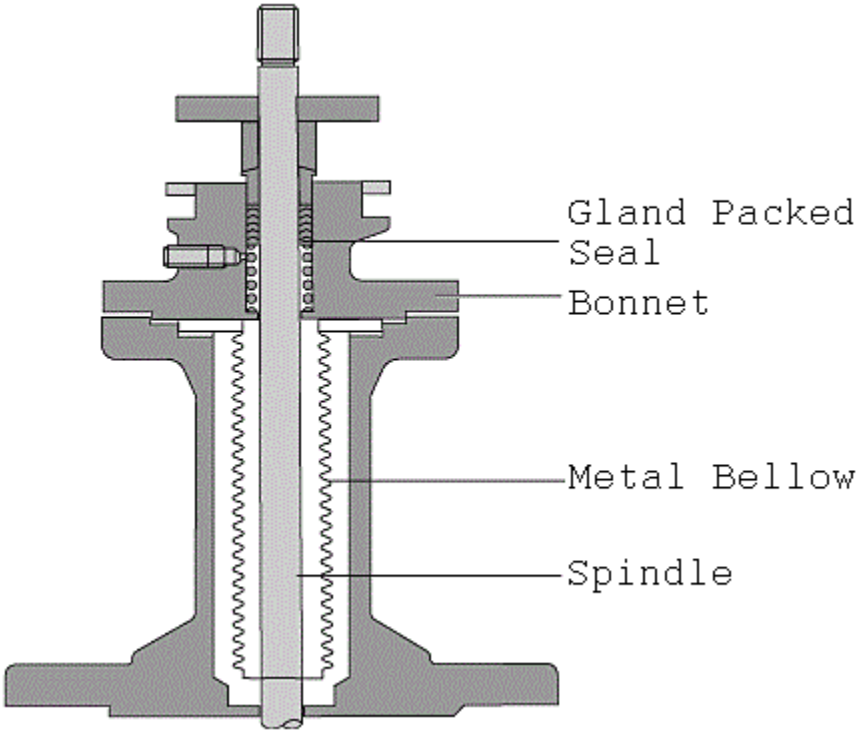
Bellow Seal Valves find their application in leak proof systems of:

- **Heat Transfer media**
- **Vacuum / ultra high vacuum**
- **Highly hazardous fluids**
- **Nuclear plant, heavy water plant**
- **Costly fluids**
- **Environmental standards**

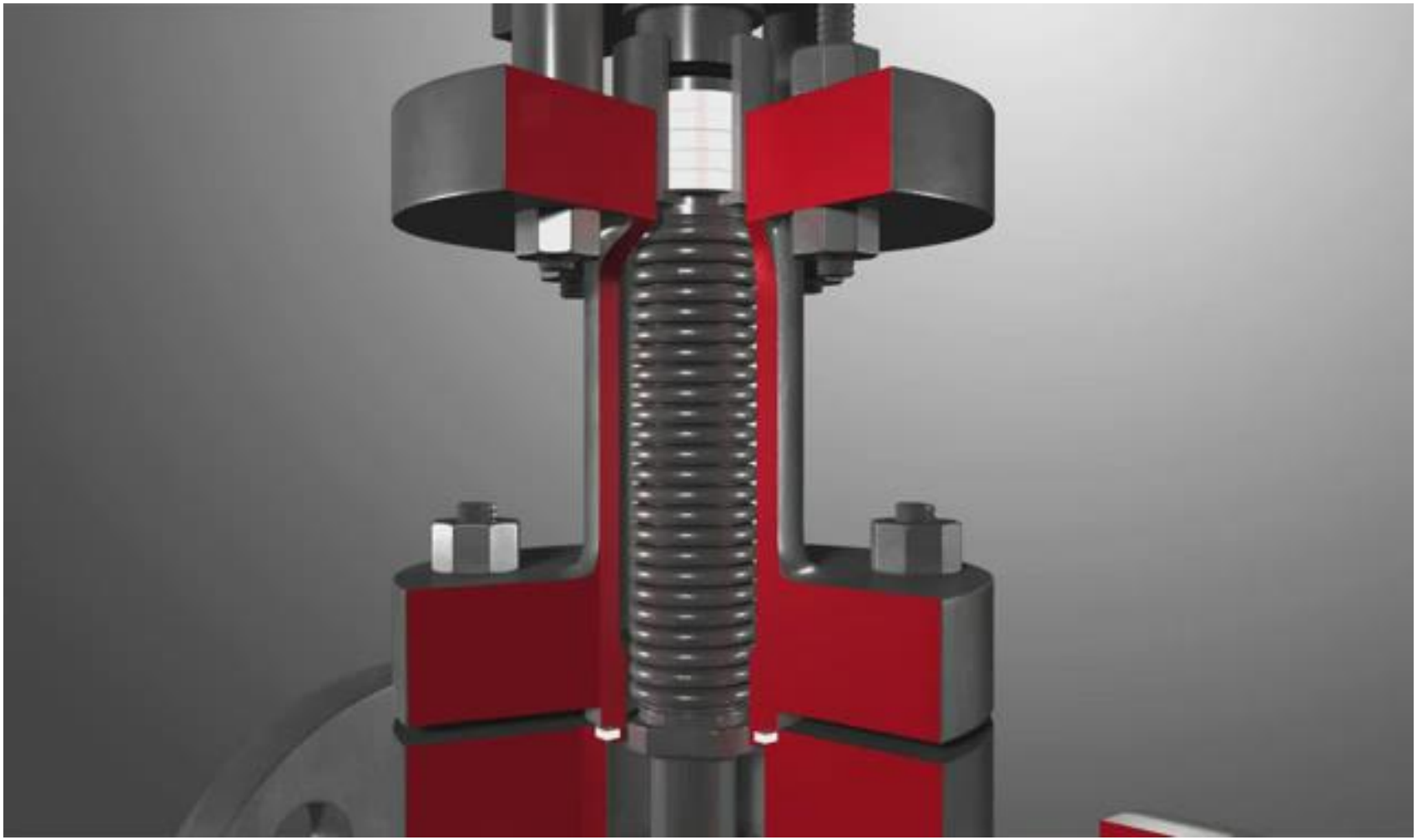
- **For Reference:**
  - http://www.wermac.org/valves/valves_bellows_sealed.html

Operation

- The bellow contracts and expands as the stem moves up and down
- Since the bellow is in tight contact of stem therefore, there is no chance of leakage.



Animation



GLOBE VALVE

GATE VALVE

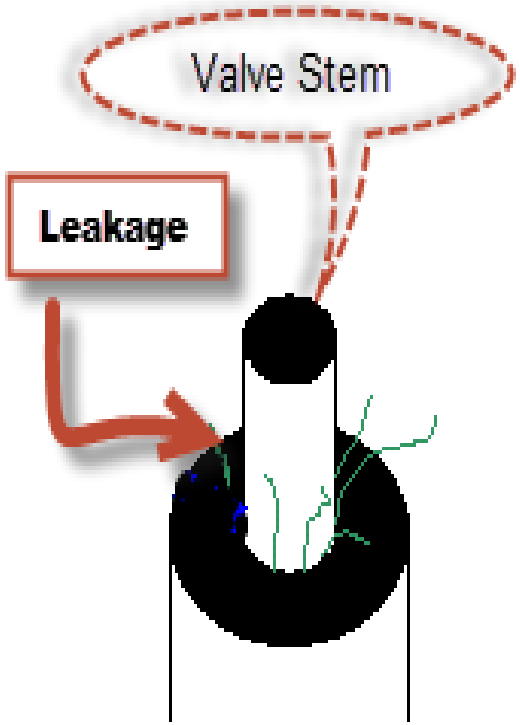
BELLOWS SEAL VALVE

STEM LEAK-OFF VALVE

DIAPHRAGM VALVE

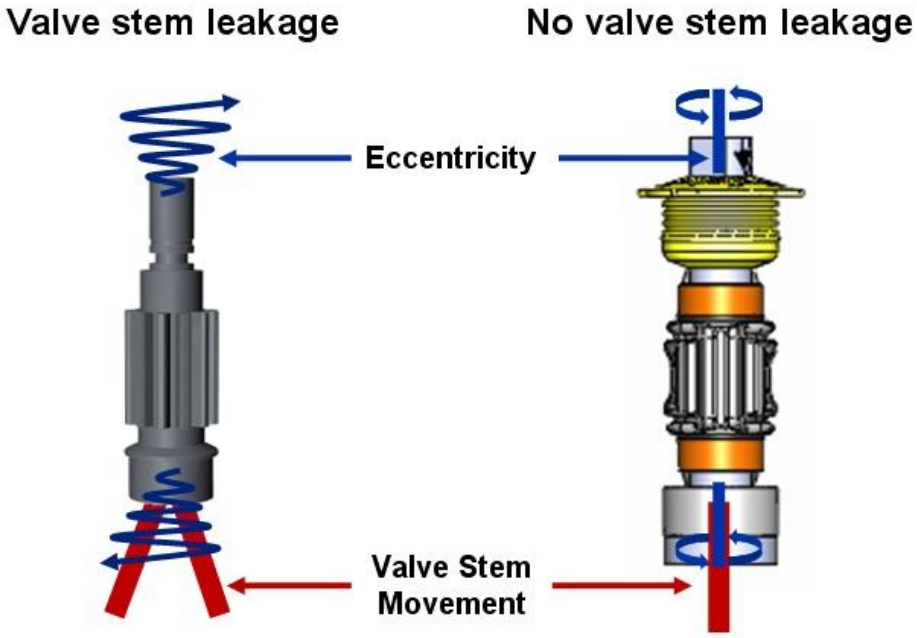
STEM LEAK OFF VALVE

- It has been reported that the majority of fugitive emissions or leakages on chemical sites especially nuclear power plants, come from leaking valves.
- In nuclear power plants, valves control the cooling of the nuclear reactors where continued flow of water around the nuclear core is essential for safety.
- Valves of primary loops of a nuclear power plant are Quality Group A components and their integrity must be maintained because they are the significant leak points of reactor coolant pressure boundary (RCPB).
- Uncontrolled leakage to the containment atmosphere such as from valve stem pickings and other sources that are not connected increase the humidity of the containment.



Leakage Through Valve Stem

- Typically, the engagement between the valve stem and the actuator is a major contributor to the stem side loading and valve stem leakage.
- Majority of the valve manufacturers do not offer 0% miss-alignment of actuators and eccentricity of valve stem.
- This misalignment is main cause of valve leakage.
- Stem leak off valves are so designed that even if they are to leak, they leak through stem so that the leakage can be collected.



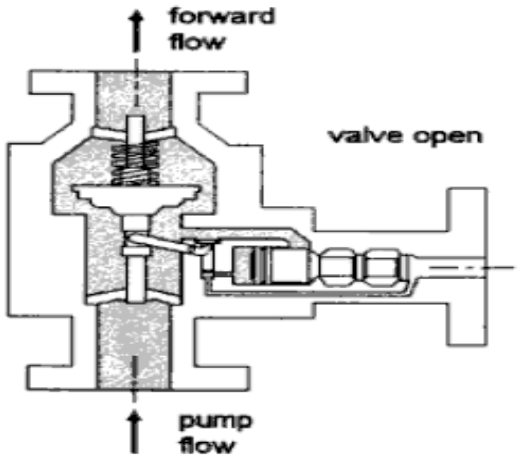
Operation of Stem Leak Off Valves

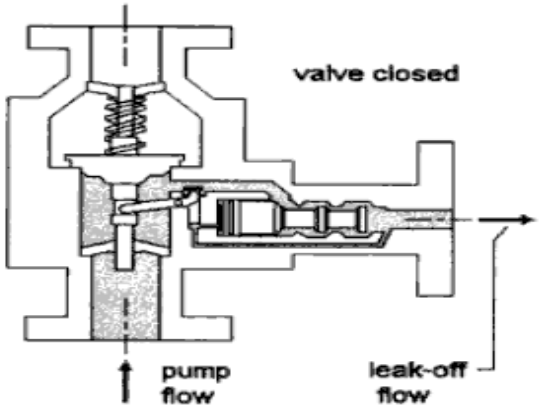
- For high pressure areas such as that in primary loop of a nuclear power plant, sometimes valves are so designed that even if they are to leak under high pressure conditions, they leak through their stem.
- If leakage occurs via this path, the provisions are so provided that these leakages are pumped to sumps or tanks.
- The water thus collected is directed towards sump tanks instead of leaking on the containment floor, vault or chamber.
- This way flow rate can be established and monitored during plant operation.
- Using these valves, leakages are practically isolated from containment atmosphere as per guidance of nuclear power plant regulatory guide.
- Such valves types are generally suitable in liquid flow environment as they may not be efficient enough in a gas flow environment such as through steam generators.

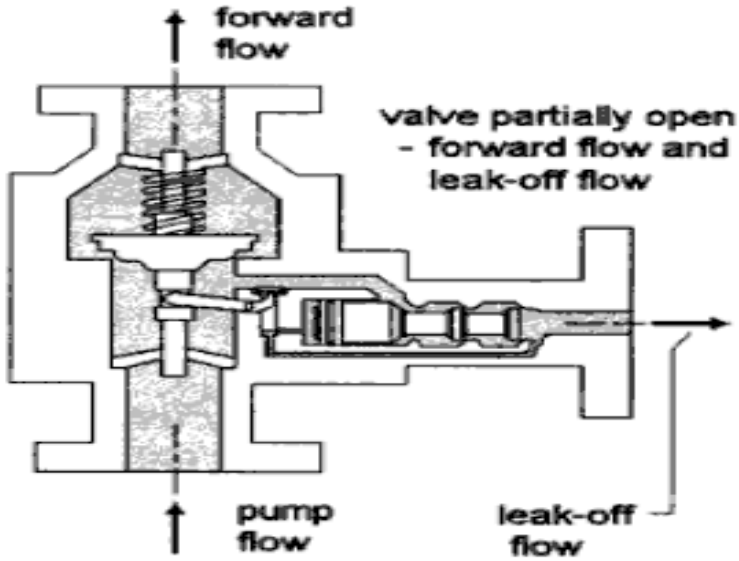
Stem Leak-Off Valves

- **Valves Providing leak-off, Pressure Reduction and outlet Non-Return Valve Functions**

- In all leak-off systems low flow protection is provided by the leak-off flow path being opened up as forward flow rate is reduced and the outlet non-return valve closes.







GLOBE VALVE

GATE VALVE

BELLOWS SEAL VALVE

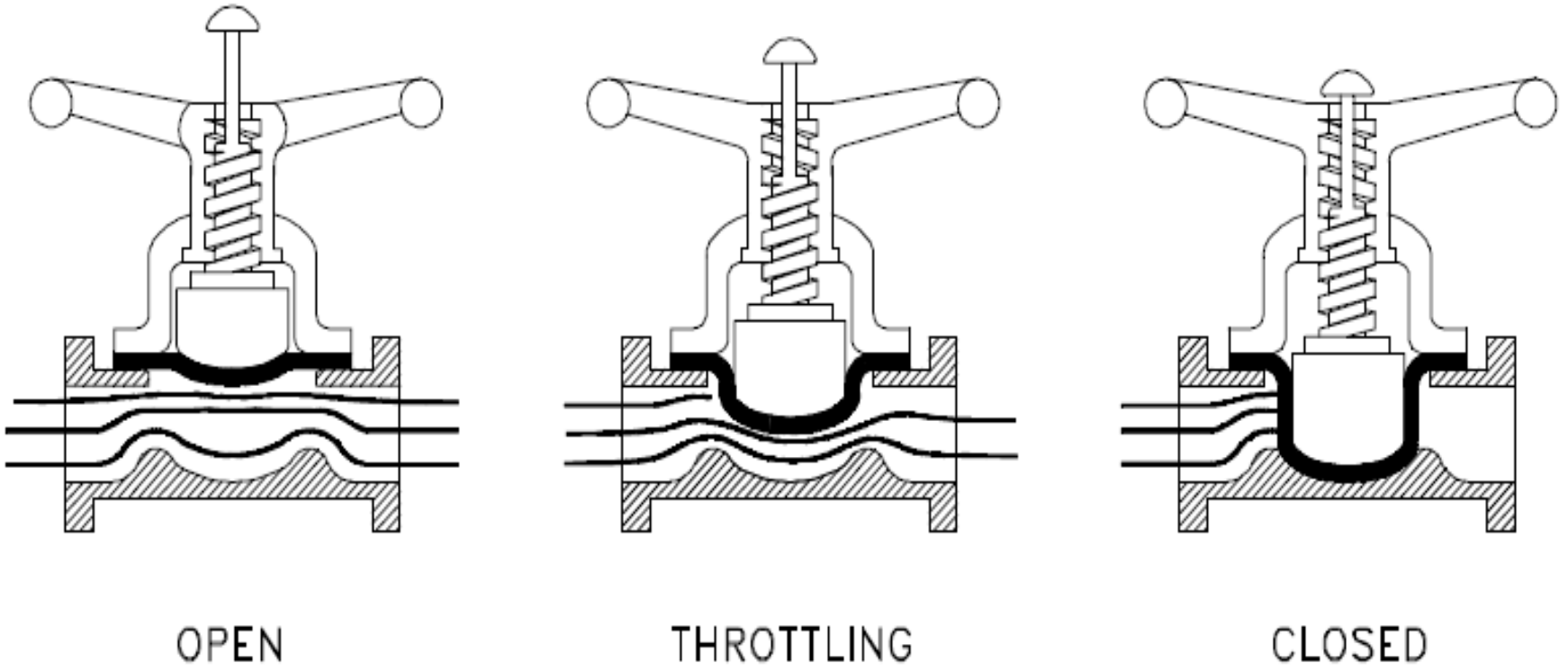
STEM LEAK-OFF VALVE

DIAPHRAGM VALVE

Diaphragm Valves

It is a linear motion valve that is used to start, regulate, and stop fluid flow.

The name is derived from its flexible disk, which mates with a seat located in the open area at the top of the valve body to form a seal.



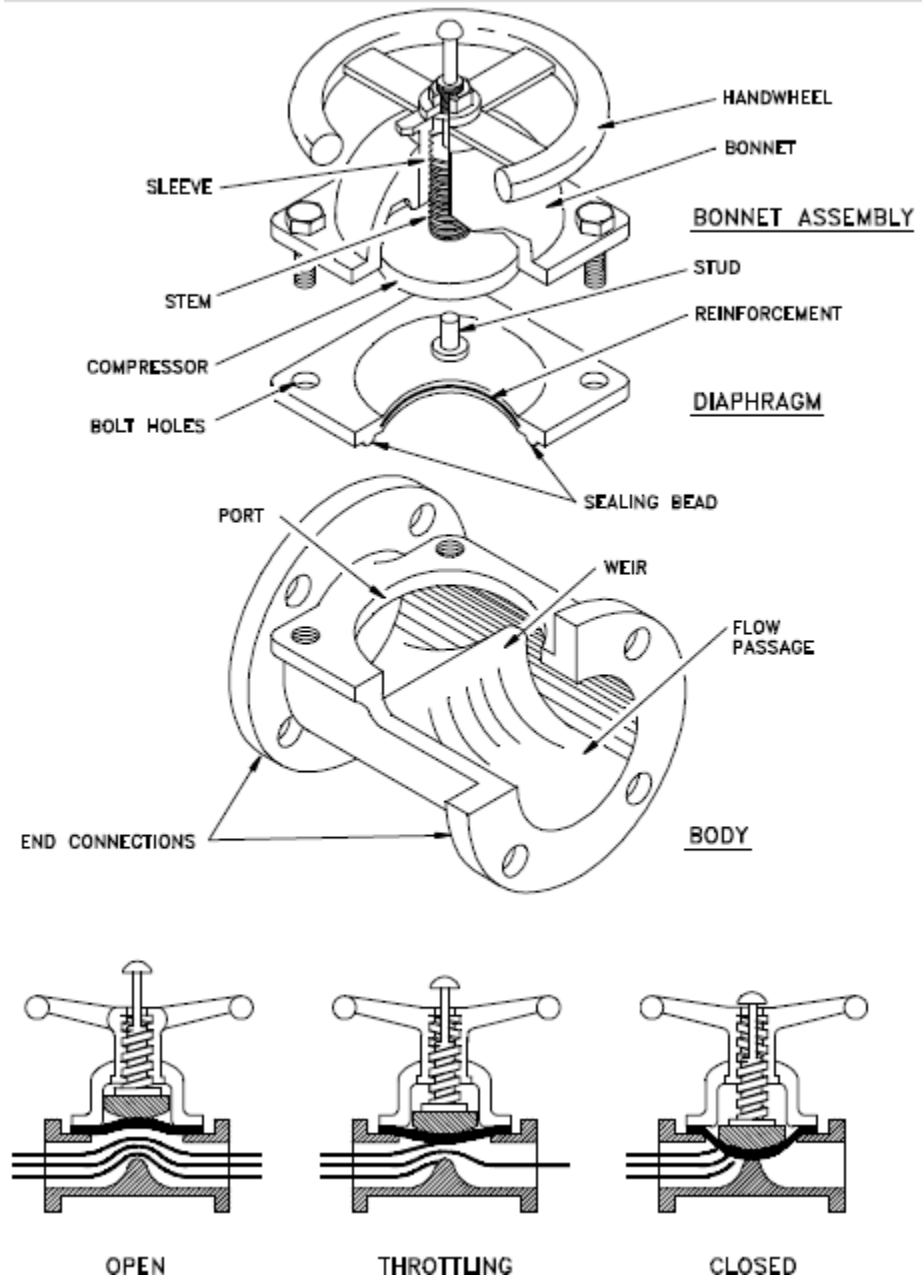
Diaphragm Valves

A resilient, flexible diaphragm is connected to a compressor by a stud molded into the diaphragm.

The compressor is moved up and down by the valve stem.

Hence, the diaphragm lifts when the compressor is raised.

As the compressor is lowered, the diaphragm is pressed against the contoured bottom in the straight through valve or the body weir in the weir-type.



Diaphragm Valves

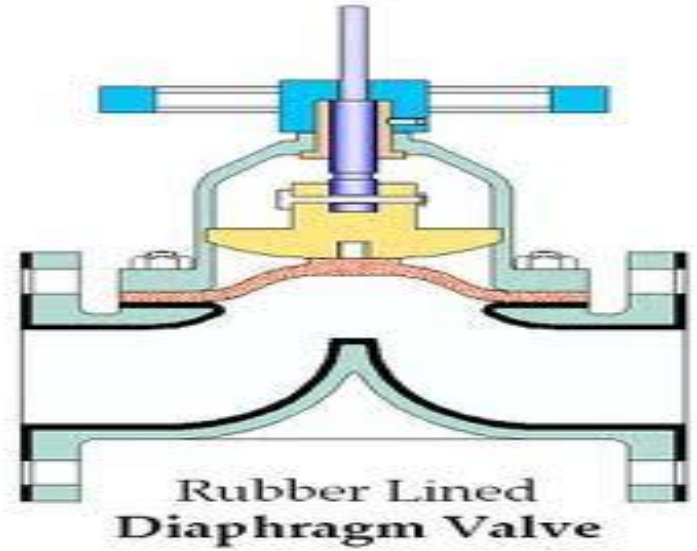
They can also be used for throttling service.

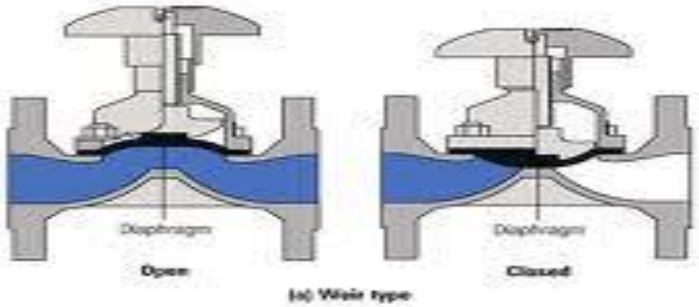
The weir-type is the better throttling valve but has a limited range.

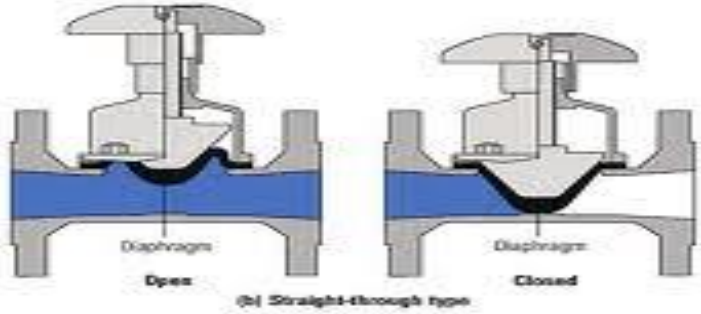
Its throttling characteristics are essentially those of a quick opening valve because of the large shutoff area along the seat.

A weir-type diaphragm valve is available to control small flows.

Some models use a two-piece compressor component.



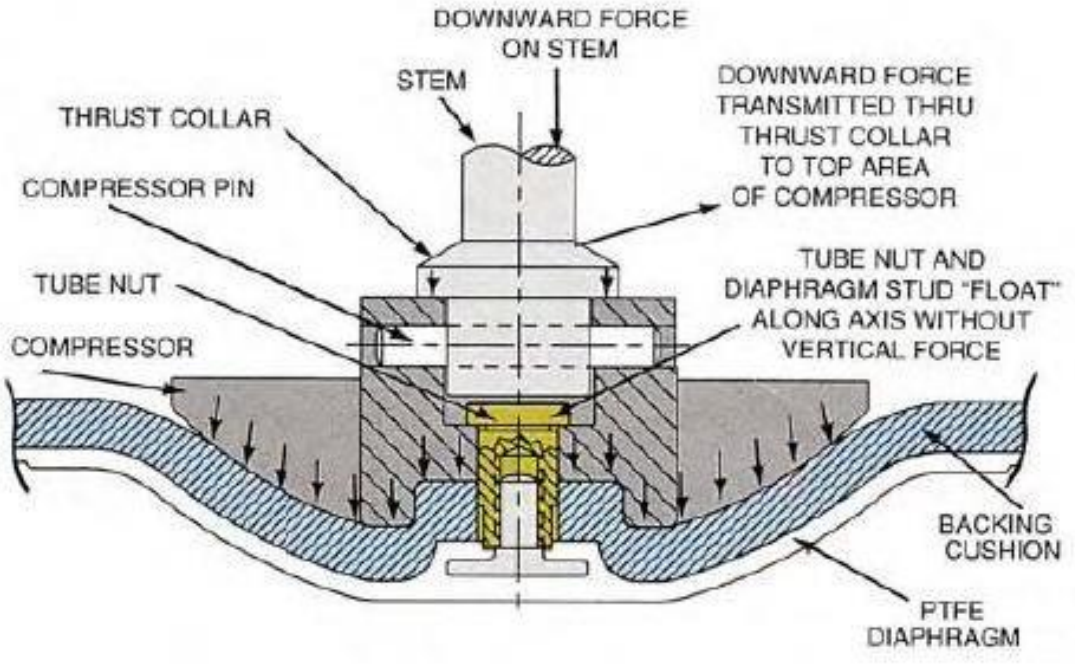




Diaphragm Valves

- **In this type, instead of the entire diaphragm lifting off the weir when the valve is opened, the first increments of stem travel raise an inner compressor component that causes only the central part of the diaphragm to lift.**
- **This creates a relatively small opening through the center of the valve.**
- **After the inner compressor is completely open, the outer compressor component is raised along with the inner compressor and the remainder of the throttling is similar to the throttling that takes place in a conventional valve.**

- **Diaphragm valves are particularly suited for the handling of corrosive fluids, fibrous slurries, radioactive fluids, or other fluids that must remain free from contamination.**



BALL VALVE

NEEDLE VALVE

THROTTLE VALVE

CONTROL VALVE

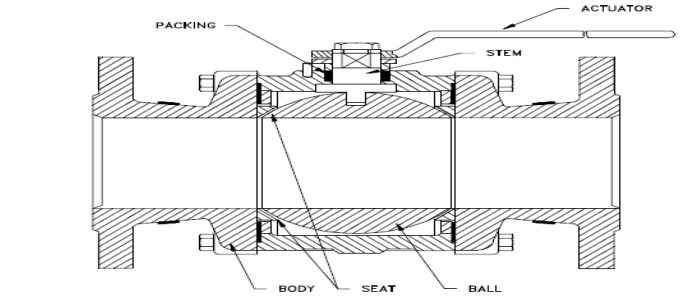
ANGLE VALVE

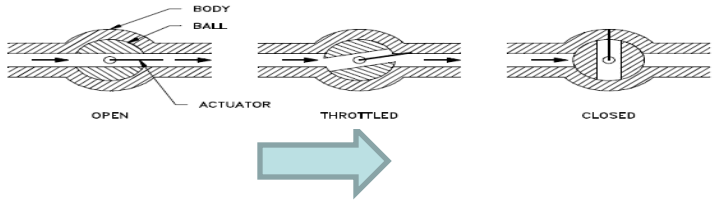
BALL VALVE

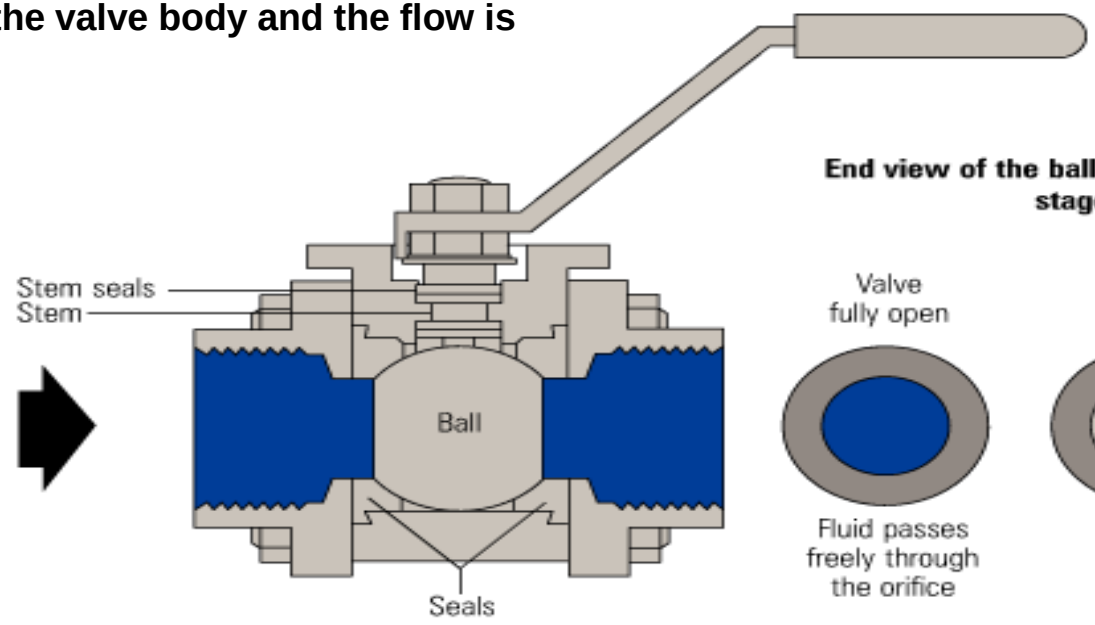
A ball valve is a rotational motion valve that uses a ball-shaped disk to stop or start fluid flow.

The ball performs the same function as the disk in the globe valve. When the valve handle is turned to open the valve, the ball rotates to a point where the hole through the ball is in line with the valve body inlet and outlet.

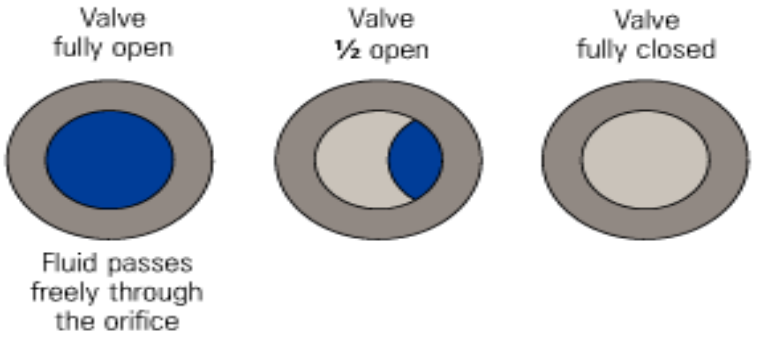
When the valve is shut, the ball is rotated so that the hole is perpendicular to the flow openings of the valve body and the flow is stopped.







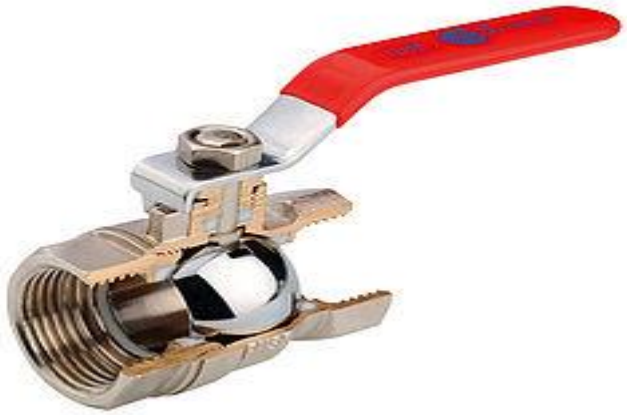
End view of the ball within the valve at different stages of rotation



BALL VALVE

Three types of ball valves:

- FULL PORT
- STANDARD PORT
- REDUCED PORT.



A full port ball valve has an oversized ball so that the hole in the ball is the same size as the pipeline resulting in lower friction loss. Flow is unrestricted, but the valve is larger.

A standard port ball has a smaller ball and a correspondingly smaller port. Flow through this valve is one pipe size smaller than the valve's pipe size.

In reduced port ball valves, flow through the valve is two pipe sizes smaller than the valve's pipe size resulting in restricted flow.

2-Piece ball valves

- Ball valves are available in a variety of body styles, including one-piece, two-piece, three-piece and flanged body construction. Each offers specific advantages depending upon the requirements of the given application. Similarly, they are designed using a wide variety of materials, as required by their application.
- The 2 piece full port valves are used in industrial and commercial applications for a wide range of fluids. The 15% glass reinforced PTFE seats increase the cycle life, temperature and pressure ratings. The superior low torque-low profile design results in economical operation and exceptional performance.

- **2-Piece Stainless used in a brewery.**

2-Piece ball valves

- The 3 piece full port valves are used in industrial and commercial applications for a wide range of fluids. The 3 piece construction with swing out center section is designed for easy maintenance and cleaning. The superior low torque-low profile design results in economical operation and exceptional performance.

3-piece ball valves

BALL VALVE

ADVANTAGES

- Low pressure drop
- Low leakage
- Small
- Rapid opening
- Can maintain and regulate high volume, high pressure and high temperature flow
- Long service life
- Low cost

DISADVANTAGES

- Seat can wear if used for throttling
- Quick open may cause hammer

➢ **Features**

In-line pattern, Bi-direction flow

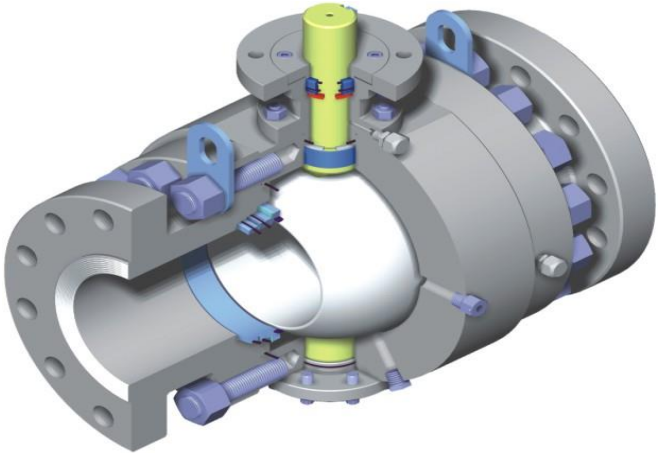
- Stainless Steel, Brass
- Alloy 400(Monel), A105

➢ **Maximum Operating Pressure**

- 1,000 psig (69 barg) @ 70°F (21°C)

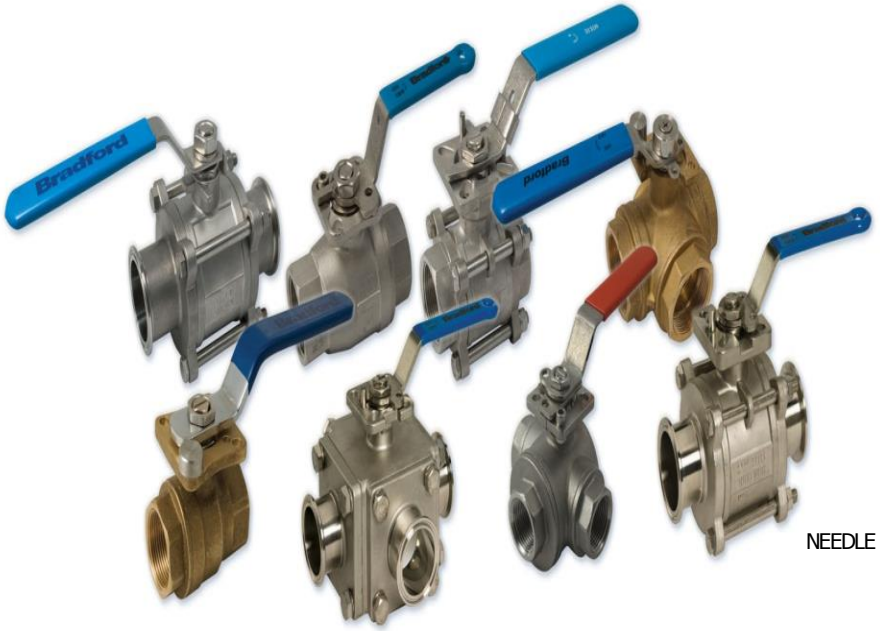
➢ **Operating Temperature Range**

- -65 °F (-54°C) to 450°F (232°C)



Motorized real

Manual real



NEEDLE VALVE (PE-17).pptx

Ball manufacture

BALL VALVE

NEEDLE VALVE

THROTTLE VALVE

CONTROL VALVE

ANGLE VALVE

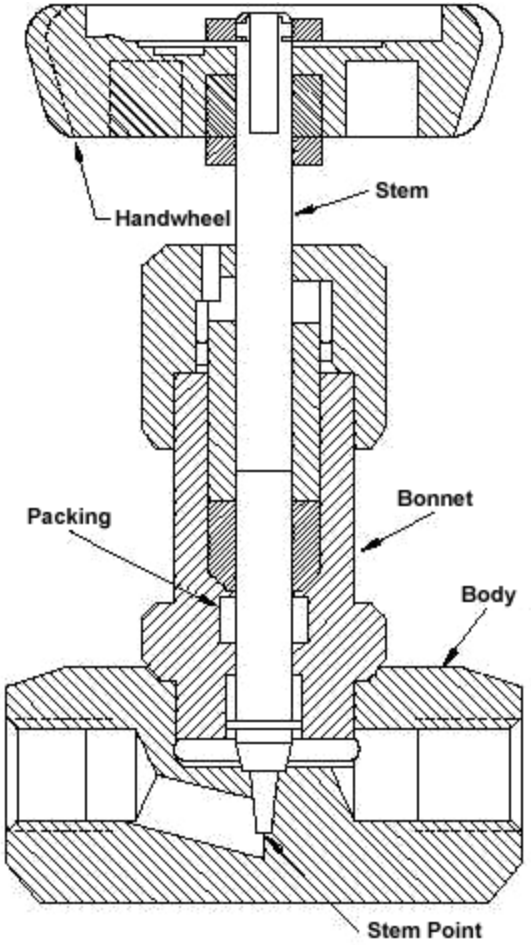
Needle valve

Description:

•A **needle valve** is a type of valve having a small port and a threaded, needle-shaped plunger. It allows precise regulation of flow, although it is generally only capable of relatively low flow rates.

•A needle valve has a relatively small orifice with a long, tapered seat, and a needle-shaped plunger, on the end of a screw, which exactly fits this seat.

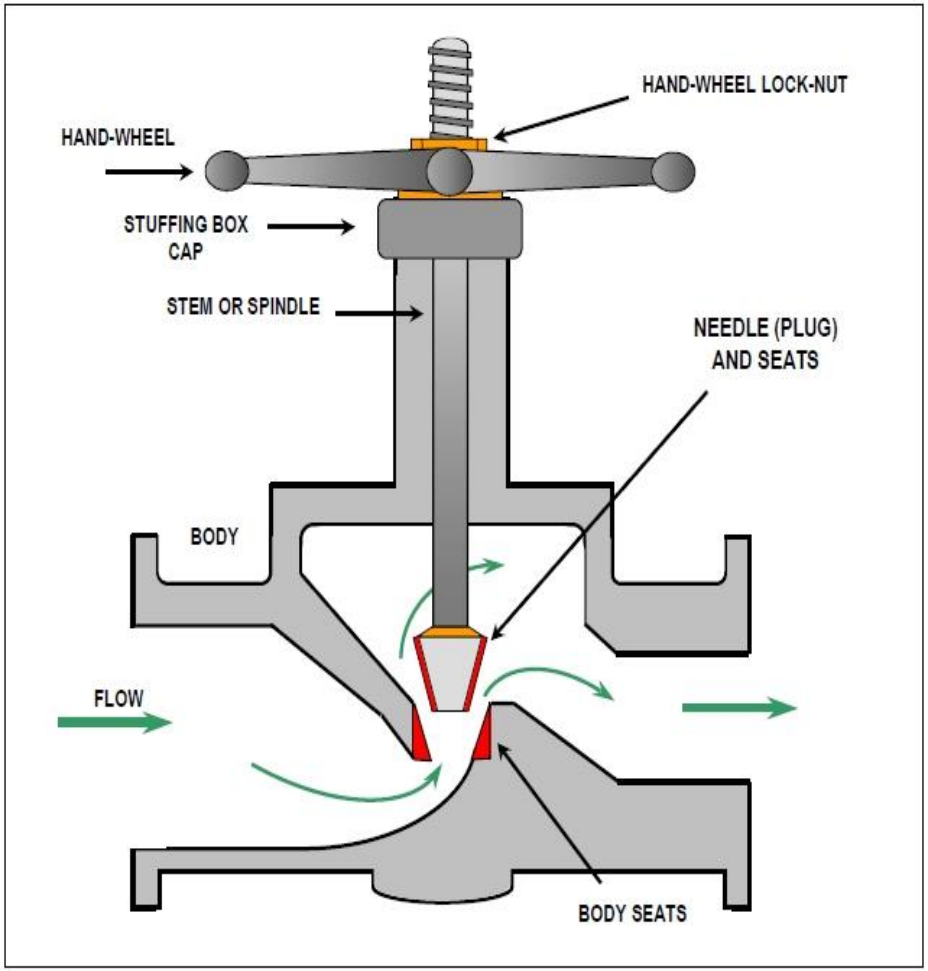
•As the screw is turned and the plunger retracted, flow between the seat and the plunger is possible; however, until the plunger is completely retracted the fluid flow is significantly impeded. Since it takes many turns of the fine-threaded screw to retract the plunger, precise regulation of the flow rate is possible.



Needle valve

- Stems with fine threaded have a slow linear movement when they turn, therefore a great number of turns are needed to have a full flow section. This makes the needle valve suitable for regulating flow, with a minimal waste and without cavitation at important differential pressures.
- This valve is also placed in the bypass of the turbine inlet valve. That valve is normally butterfly or spherical type and not prepared to open against all column water pressure. **Animation Links:**

1. http://www.oilennium.com/2010/08/19/e-learning-course-needle-valve-animation/
2. http://www.guenther-hotrunner.com/en/download/animation/animation-needle-valve.html



Needle valve

Uses:

•Needle valves are usually used in flow metering applications, especially when a constant, calibrated, low flow rate must be maintained for some time, such as the idle fuel flow in a carburetor.

•Note that the float valve of a carburetor (controlling the fuel level within the carburetor) is not a needle valve, although it is commonly described as one.

•It uses a bluntly conical needle, but it seats against a square-edged seat rather than a matching cone. The intention here is to obtain a well-defined seat between two narrow mating surfaces, giving firm shutoff of the flow from only a light float pressure.

•In fig. below **Needle valve** is at “B”.

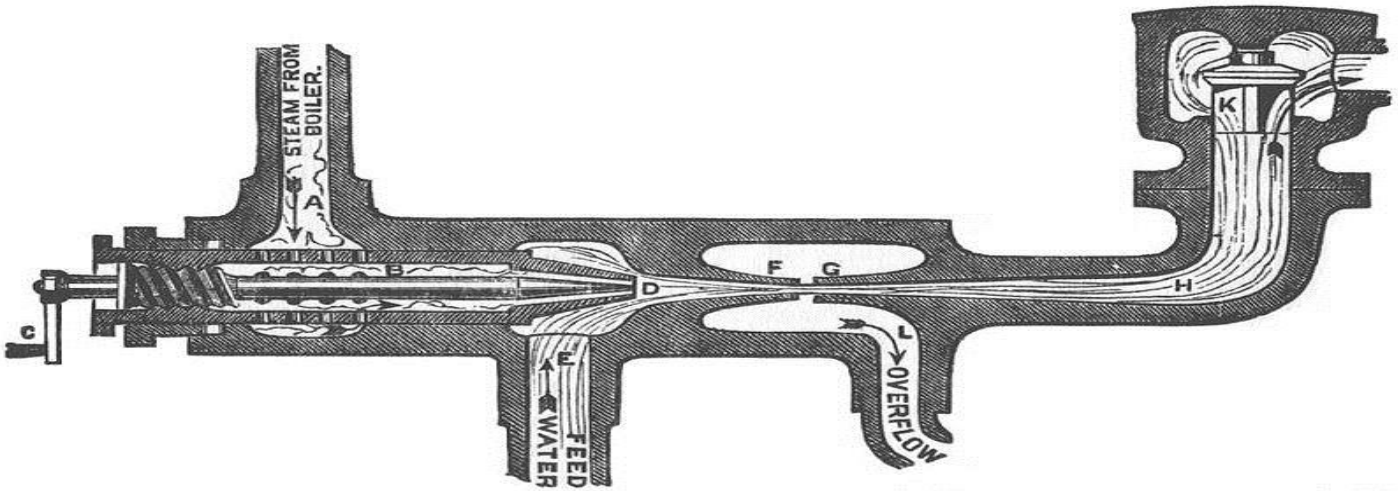


FIG. 6.— *Section of Giffard's Injector.*

Needle valve

Advantages and disadvantages:

•Since flow rates are low and many turns of the valve stem are required to completely open or close, needle valves are not used for simple shutoff applications

•Since the orifice is small and the force advantage of the fine-threaded stem is high, needle valves are usually easy to shut off completely, with merely "finger tight" pressure. The spindle and/or seat of a needle valve, especially one made from brass, are easily damaged by excessive turning force when shutting off the flow.

•Small, simple needle valves are often used as bleed valves in hot water heating applications.

•Unlike a ball valve, or valves with a rising stem, it is not easy to tell from examining the handle position whether the valve is open or closed.

BALL VALVE

NEEDLE VALVE

THROTTLE VALVE

CONTROL VALVE

ANGLE VALVE

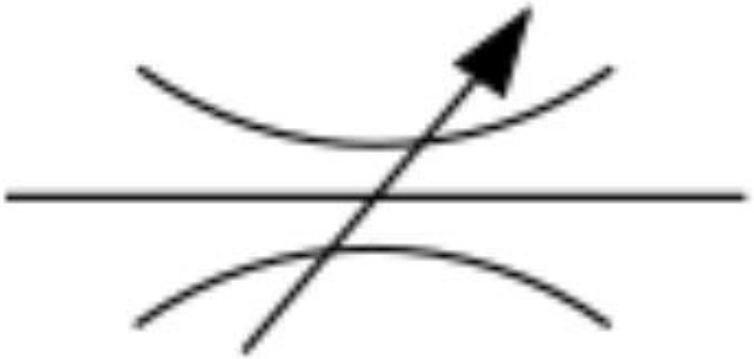
Function of Throttle Valve

- **A control valve that regulates the variable amount of fluid that is supplied to another fluid component such as an actuator**

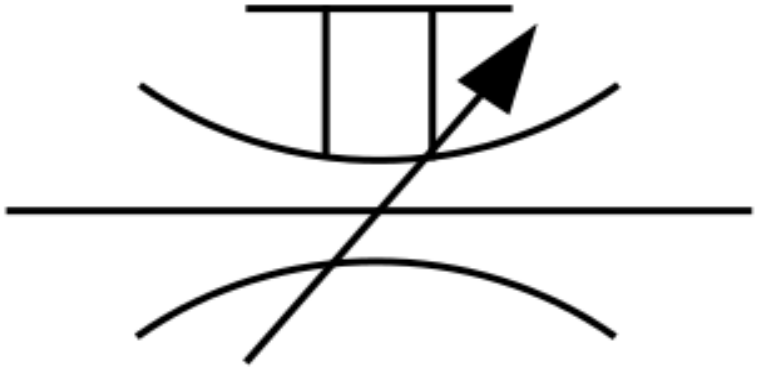
- **A "throttle valve" allows continuous control of the rate at which some fluid moves from a region of relatively high pressure into a region of relatively low pressure.**

- **An example would be in an automobile engine, where the throttle controls the rate at which air (at or above atmospheric pressure) enters the engine's intake manifold (near vacuum when the throttle is closed.)**

Cross section adjustable throttle valve

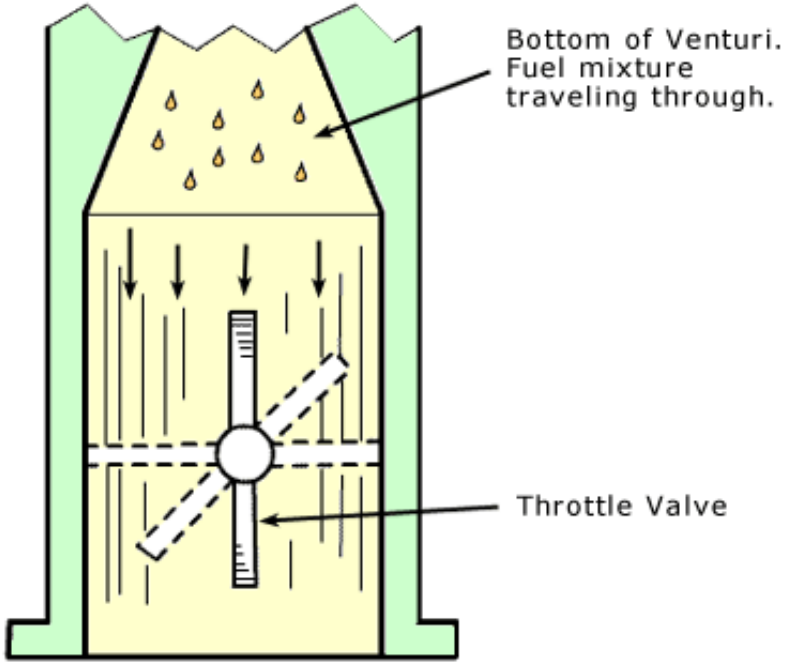


Cross section adjustable by hand



Throttle valve may be a type of butterfly valve

It throttles the flow by changing the cross sectional area



Throttle Valve as a type of Butterfly Valve

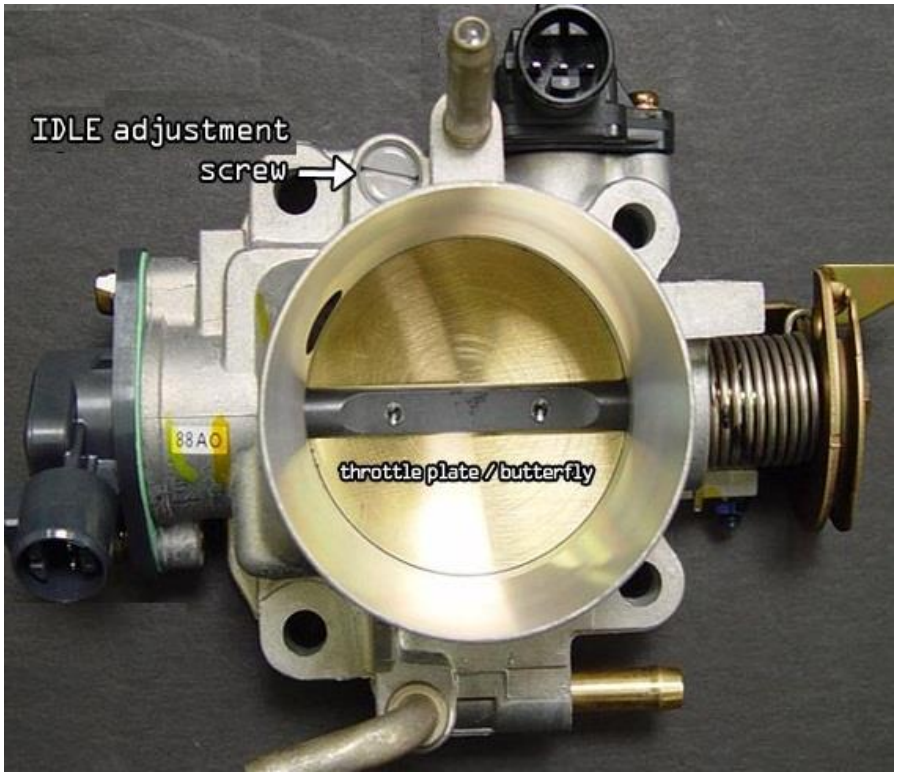
Throttle valves are extensively used in automobile industry

Cross sectional area changes as the throttle/butterfly plate is rotated

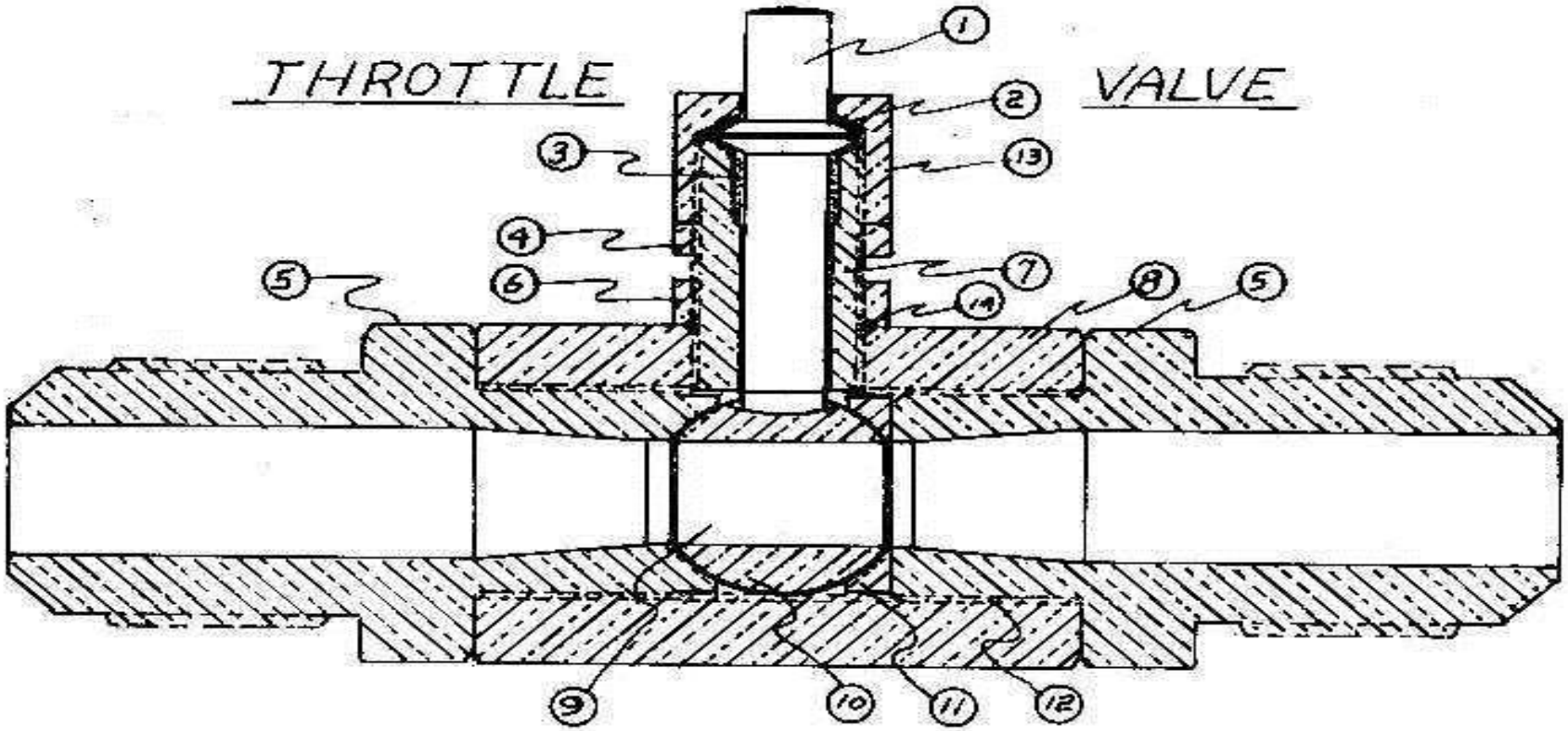
Maximum Flow: Plate is completely parallel to pipe and flow direction

Zero flow: Plate is perpendicular to pipe and flow direction

Video:



Front View: Throttle Valve for Car Engine`



1. Stainless steel (302) stem
2. Teflon thrust washer
3. Teflon stem packing
4. Lock nut
5. Standard 5/16" flare fittings altered as shown
6. Lock nut
7. Stem guide, 1/4-10 thread full length
8. 5/8 hex body
9. 3/16" dia. hole
10. Body is threaded 7/16-32 through. 3/8" dia. ball. Mill slot
11. Floating seal
12. Body is threaded 7/16-32 through
13. Thrust nut
14. Lock nut to body seal (Teflon)

BALL VALVE

NEEDLE VALVE

THROTTLE VALVE

CONTROL VALVE

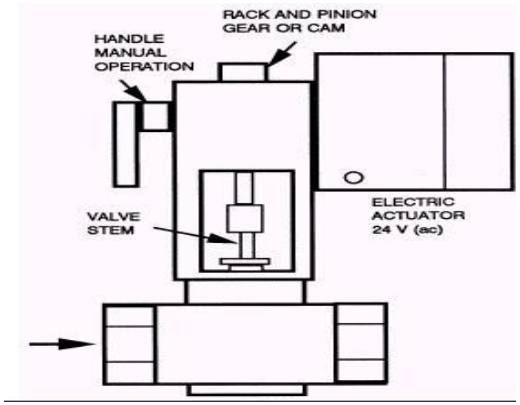
ANGLE VALVE

Control Valve

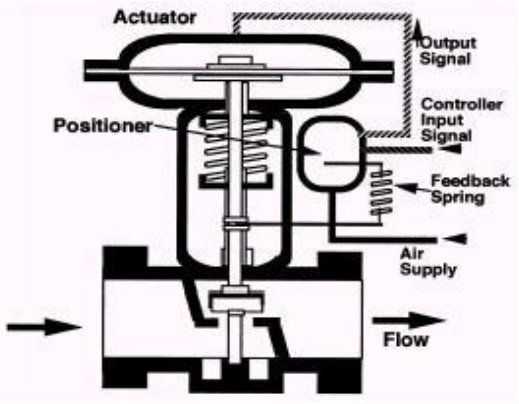
- The control valve is used to control the fluid flow. It may be considered as a variable orifice positioned by an electric or pneumatic actuator in response to impulses, or signals from the controller

Types of control valves

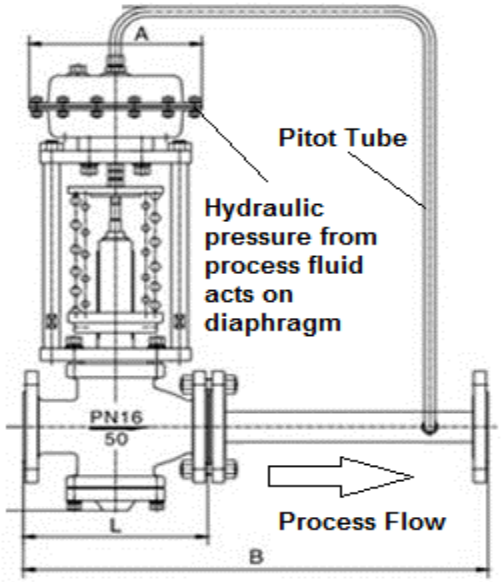
- ❑ Electric control valve
- ❑ Pneumatic control valves
- ❑ Self operated pressure control valves



Electric control valve pressure



Pneumatic control valve



Self operate control valve

BALL VALVE

NEEDLE VALVE

THROTTLE VALVE

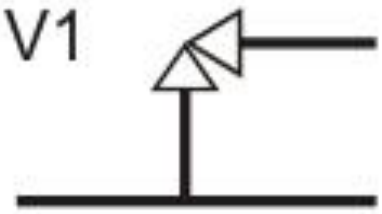
CONTROL VALVE

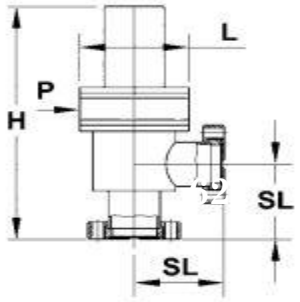
ANGLE VALVE

ANGLE VALVE

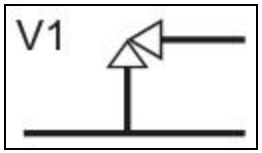
- An angle valve is a control valve in which one opening, or port, is aligned with the valve stem. The part that controls the opening and closing of the valve and the other is arranged at right angles to it.

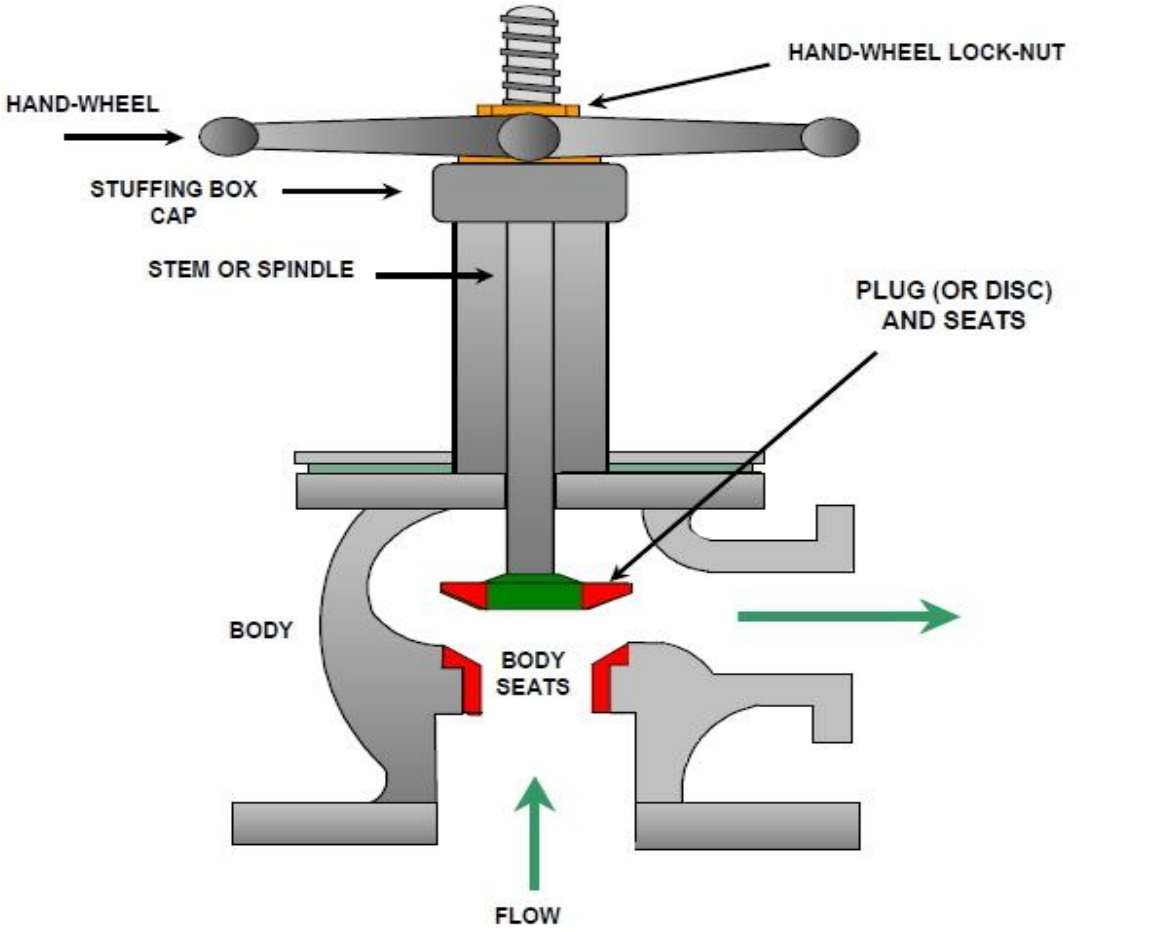
- Valv



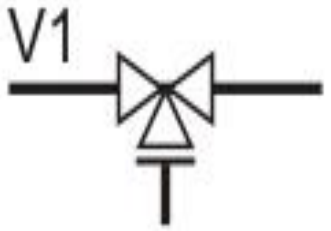


Angle Valve


V1


HAND-WHEEL LOCK-NUT
HAND-WHEEL
STUFFING BOX CAP
STEM OR SPINDLE
PLUG (OR DISC) AND SEATS
BODY
BODY SEATS
FLOW

3 WAY VALVE



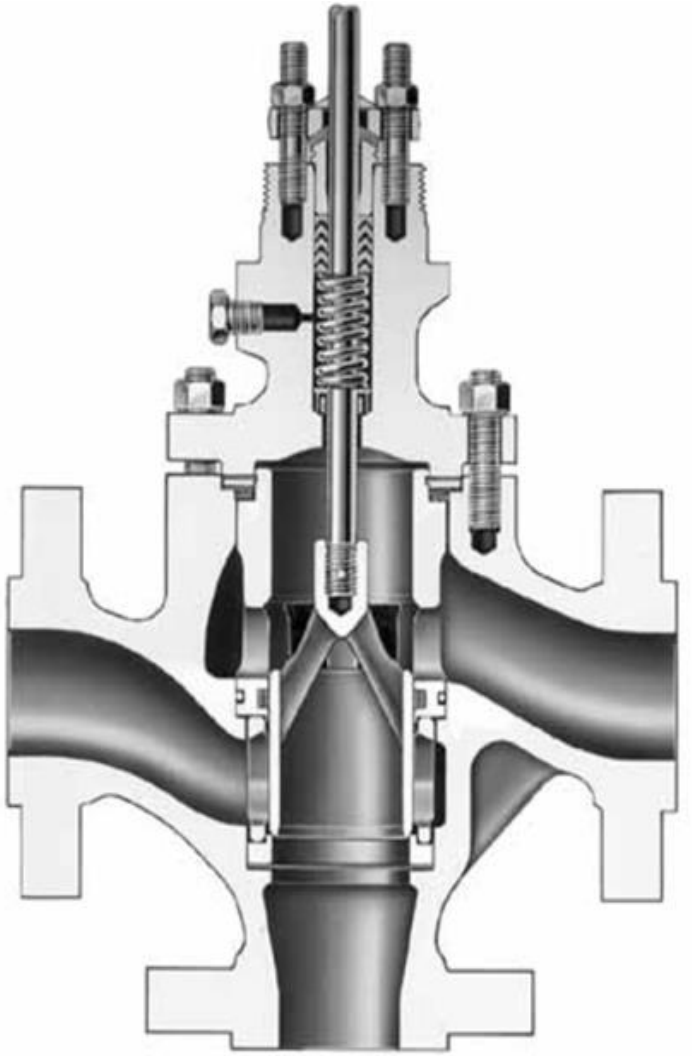
- Three pipeline connections provide general converging (flow mixing) or diverging (flow splitting) service
- Best designs use cage style trim for positive valve plug guiding and ease of maintenance
- Variations include trim materials selected for high temperature service
- Actuator selection demands careful consideration particularly for construction with unbalanced valve plug
- Valve symbol

ADVANTAGES

- The design of valve means it can be used not only as a control valve, but also as a physical piping elbow. The discharge from valve compares favorably with other types of valves in terms of flow rate and erosion.

Types

- Most valves control the flow of a single stream -- turning it on or off. Three-way valves redirect a stream between two different channels. Several different mechanisms are used to redirect the streams.
  - Three way valves may be
  - ➢Ball valve
  - ➢Solenoid operated
  - ➢Pneumatic operated
- Balanced valve plug style three-way valve body is shown with cylindrical valve plug in the down position.
- This position opens the bottom common port to the right-hand port and shuts off the left-hand port.
- The construction can be used for throttling mid-travel position control of either converging or diverging fluids



THREE-WAY VALVE

BUTTERFLY VALVE

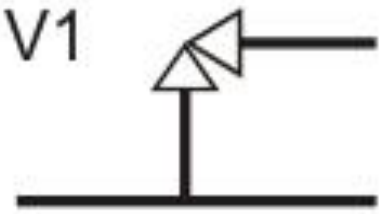
CHECK VALVE

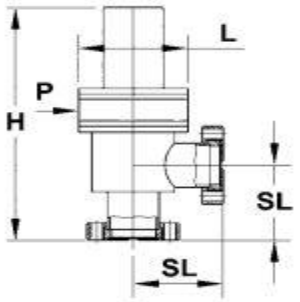
SPRING-LOADED SAFETY
OR RELIEF VALVE

ANGLE VALVE

- An angle valve is a control valve in which one opening, or port, is aligned with the valve stem. The part that controls the opening and closing of the valve and the other is arranged at right angles to it.

- Valv





3 WAY VALVE

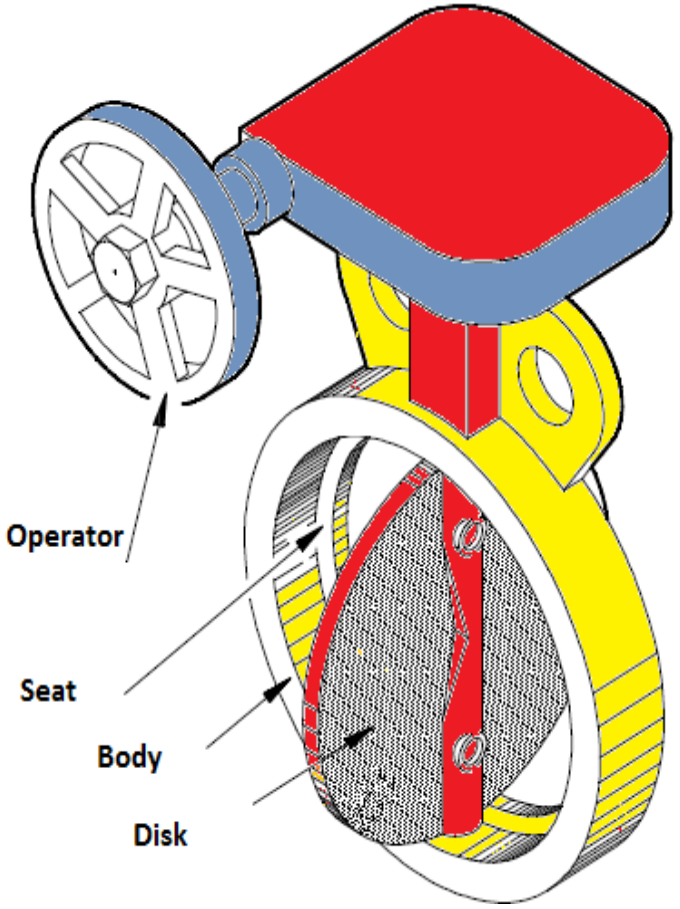
- Three pipeline connections provide general converging (flow mixing) or diverging (flow splitting) service
- Best designs use cage style trim for positive valve plug guiding and ease of maintenance
- Variations include trim materials selected for high temperature service
- Actuator selection demands careful consideration particularly for construction with unbalanced valve plug
- Valve symbol

ADVANTAGES

- The design of valve means it can be used not only as a control valve, but also as a physical piping elbow. The discharge from valve compares favorably with other types of valves in terms of flow rate and erosion.

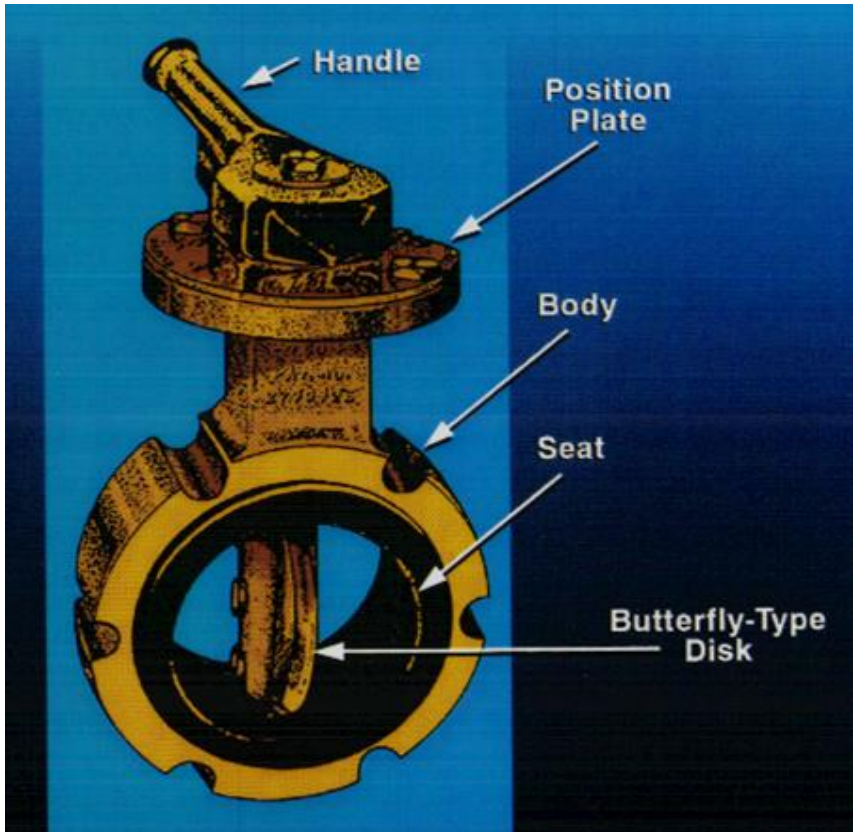
Description

- A butterfly valve is a rotary motion valve that is used to stop, regulate, and start fluid flow.
- Butterfly valves are easily and quickly operated because a 90^{o} rotation of the handle moves the disk from a fully closed to fully opened position.
- Larger butterfly valves are actuated by hand wheels connected to the stem through gears that provide mechanical advantage at the expense of speed.



Description(continued)

- Butterfly valves are built on the principle of a pipe damper. The flow control element is a disk of approximately the same diameter as the inside diameter of the adjoining pipe, which rotates on either a vertical or horizontal axis.
- When the disk lies parallel to the piping run, the valve is fully opened. When the disk approaches the perpendicular position, the valve is shut.
- Intermediate positions, for throttling purposes, can be secured in place by handle-locking devices.



THREE-WAY VALVE

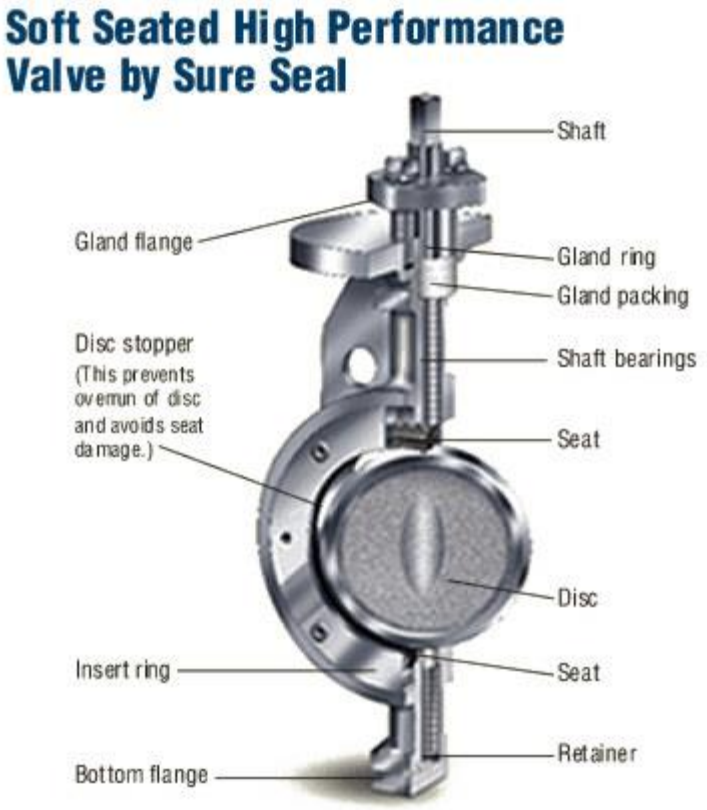
BUTTERFLY VALVE

CHECK VALVE

SPRING-LOADED SAFETY
OR RELIEF VALVE

Butterfly Valve seat Construction

- Stoppage of flow is accomplished by the valve disk sealing against a seat that is on the inside diameter periphery of the valve body. Many butterfly valves have an elastomeric seat against which the disk seals.
- Other butterfly valves have a seal ring arrangement that uses a clamp-ring and backing-ring on a serrated edged rubber ring. This design prevents extrusion of the O-rings.
- In early designs, a metal disk was used to seal against a metal seat. This arrangement did not provide a leak-tight closure.



Butterfly Valve Body Construction

- Butterfly valve body construction varies. The most economical is the wafer type that fits between two pipeline flanges.
- Another type, the lug wafer design, is held in place between two pipe flanges by bolts that join the two flanges and pass through holes in the valve's outer casing.
- Butterfly valves are available with conventional flanged ends for bolting to pipe flanges, and in a threaded end construction.

Wafer type

Lug wafer type

THREE-WAY VALVE

BUTTERFLY VALVE

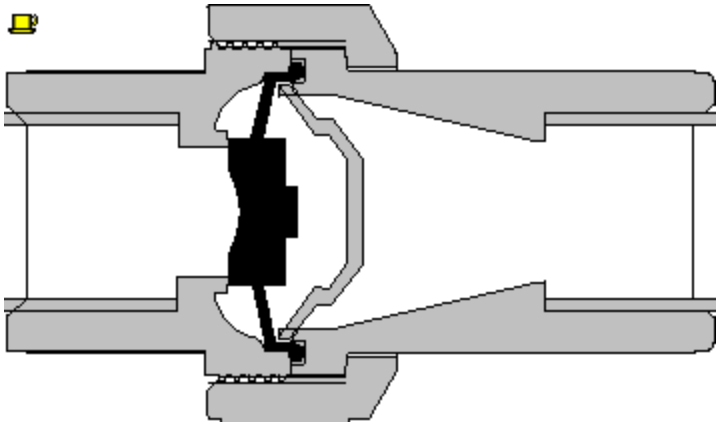
CHECK VALVE

SPRING-LOADED SAFETY
OR RELIEF VALVE

Introduction
Check Valves

- A check valve, clack valve, non-return valve or one-way valve is a mechanical device, a valve, which normally allows fluid (liquid or gas) to flow through it in only one direction.

- They are operated entirely by reaction to the line fluid and therefore do not require any external actuation.



Animation of a Check Valve

Reasons for using Check Valves

- Protection of any item of equipment that can be affected by reverse flow, such as flow meters, strainers and control valves.
- To check the pressure surges associated with hydraulic forces, for example, water hammer. These hydraulic forces can cause a wave of pressure to run up and down pipe work until the energy is dissipated.
- Prevention of flooding.
- Prevention of reverse flow on system shutdown.
- Prevention of flow under gravity.
- Relief of vacuum conditions.

Types of Check Valve

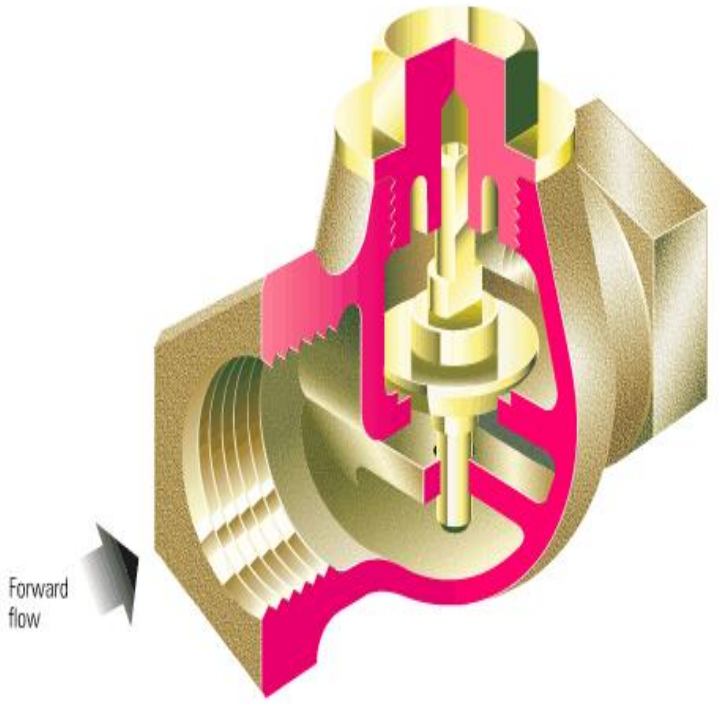
- Lift check valve
- Swing check valve for full boiled fluid
- Disc check valve
- Swing type water check valve
- Split disc check valve
- Ball check valve
- Diaphragm check valve
- Tilting disc check valve

Lift check valves

- Lift check valves are similar in configuration to globe valves, except that the disc or plug is automatically operated.

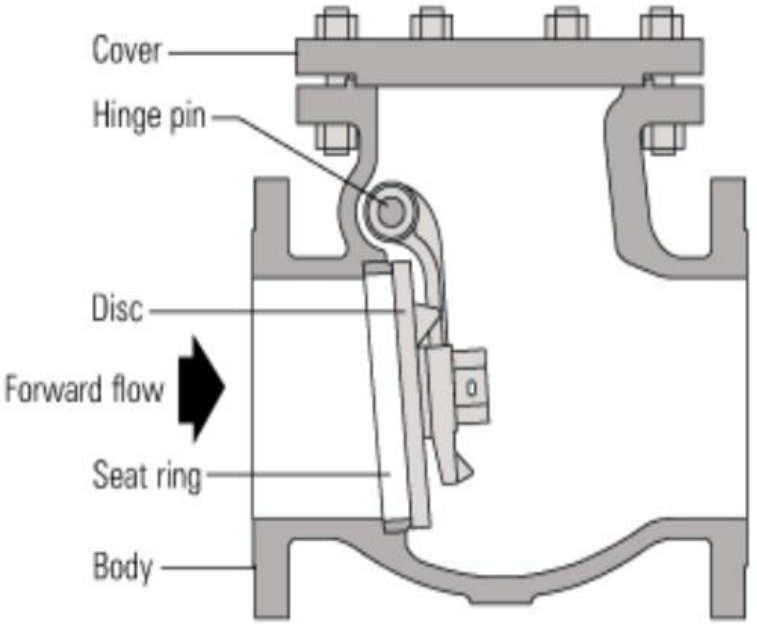
- The inlet and outlet ports are separated by a cone shaped plug that rests on a seat typically metal; in some valves, the plug may be held on its seat using a spring.

- When the flow into the valve is in the forward direction, the pressure of the fluid lifts the cone off its seat, opening the valve. With reverse flow, the cone returns to its seat and is held in place by the reverse flow pressure.



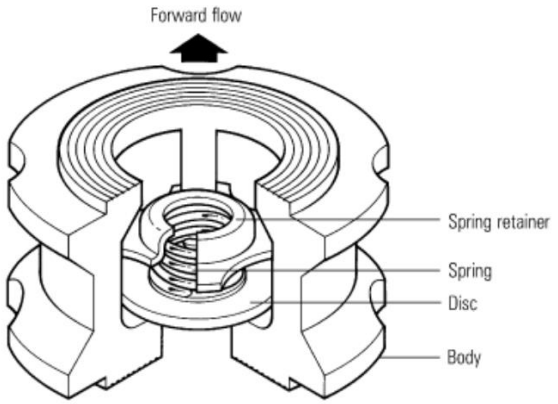
Swing check valve for Full Boiled Fluid

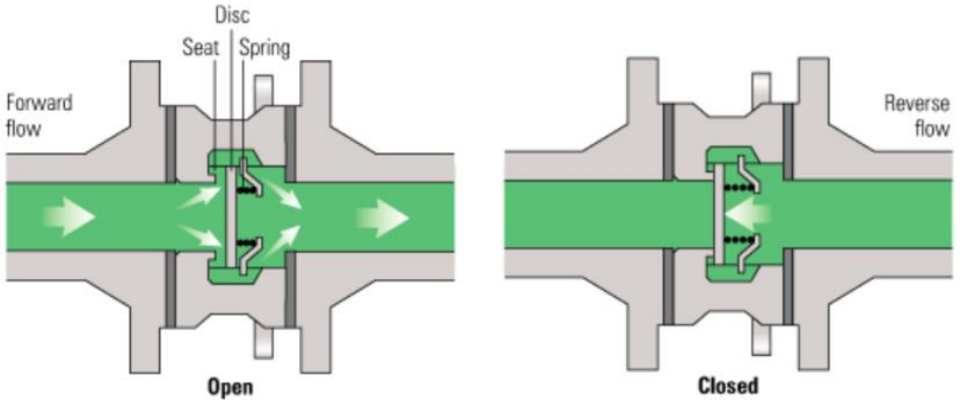
- A swing check valve consists of a flap or disc of the same diameter as the pipe bore, which hangs down in the flow path.
- With flow in the forwards direction, the pressure of the fluid forces the disc to hinge upwards, allowing flow through the valve. Reverse flow will cause the disc to shut against the seat and stop the fluid going back down the pipe.
- In the absence of flow, the weight of the flap is responsible for the closure of the valve; however, in some cases, closure may be assisted by the use of a weighted lever.



Disc check valve

- The disc check valve consists of four main components: the body, a disc, a spring and a spring retainer.
- The disc moves in a plane at right angles to the flow of the fluid, resisted by the spring that is held in place by the retainer.
- The body is designed to act as an integral centering collar that facilitates installation.
- Where a 'zero leakage' seal is required, a soft seat can be included.

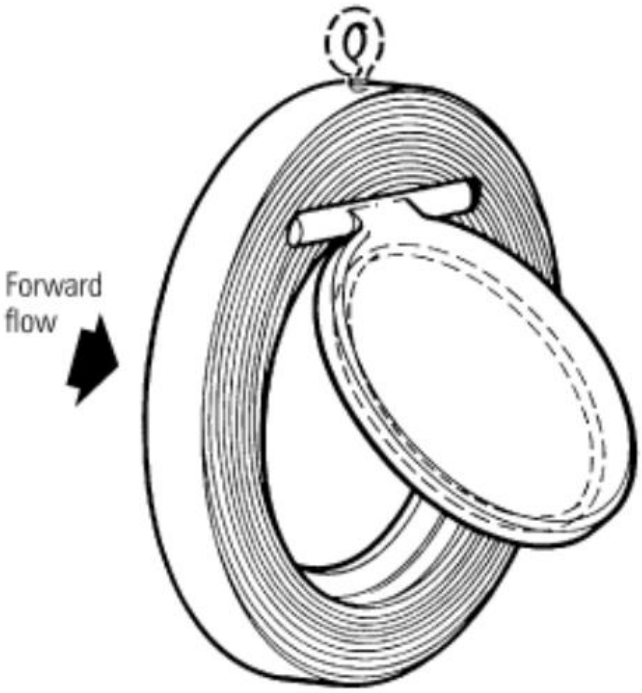




Swing type wafer check valve

- These are similar to the standard swing check valves, but do not have the full-bodied arrangement, instead, when the valve opens, the flap is forced into the top of the pipeline.

- Subsequently, the flap must have a smaller diameter than that of the pipeline, and because of this, the pressure drop across the valve, which is often high for swing type valves, is further increased.

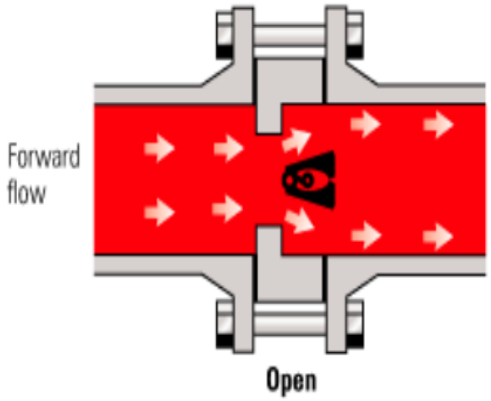


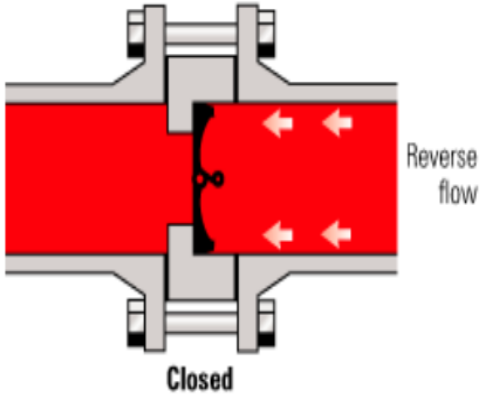
Split disc check valve

- The split disc check valve or dual plate check valve is designed to overcome the size and pressure drop limitations of the swing and disc type water check valves.

- The flap of the swing check valve is essentially split and hinged down its centre, such that the two disc plates will only swing in one direction.

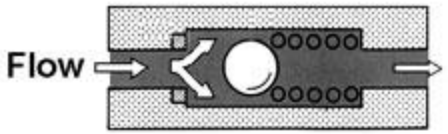
- The disc plates are held against the seat by a torsion spring mounted on the hinge.

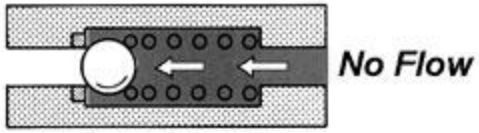


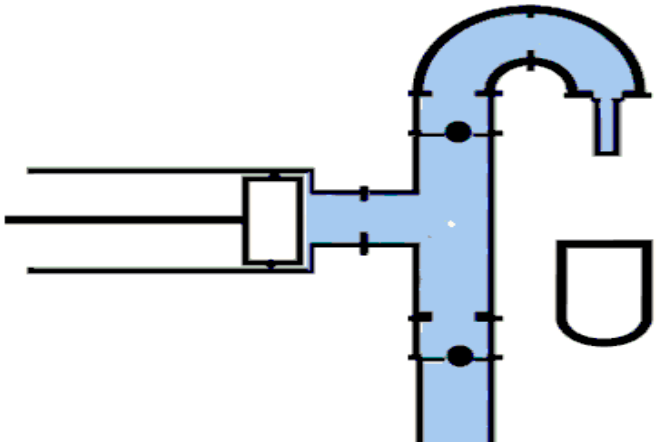


Ball check valve

- This consists of a rubber-coated ball that is normally seated on the inlet to the valve, sealing off the inlet.
- When pressure is exerted on the ball, it is moved off its seat along a guide rail, allowing fluid to pass through the inlet.
- When the fluid pressure drops, the ball slides back into its position on the inlet seat.
- Ball check valves are typically only used in liquid systems, as it is difficult to obtain a tight seal using a ball.



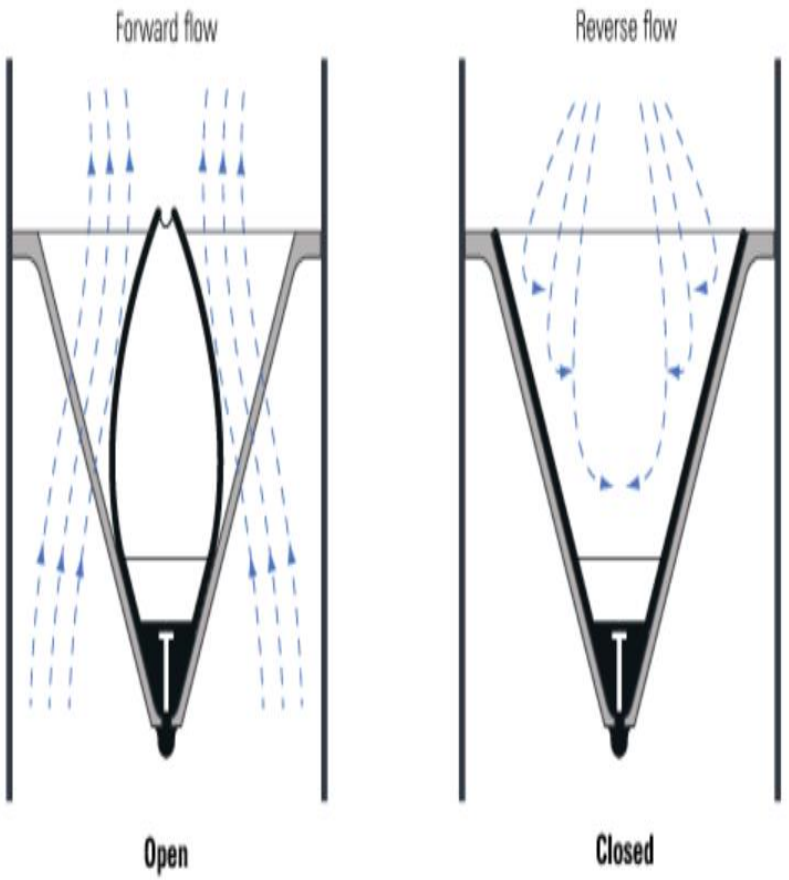




Animation of Ball Check Valve Application

Diaphragm check valve

- A flexible rubber diaphragm is placed in a mesh or perforated cone with the point in the direction of flow in the pipeline.
- Flow in the forwards direction deflects the diaphragm inwards, allowing the free passage of the fluid. When there is no flow or a backpressure exists, the diaphragm returns to its original position, closing the valve.
- The diaphragm material typically limits the application of the diaphragm check valve to fluids below 180°C and 16 bar.

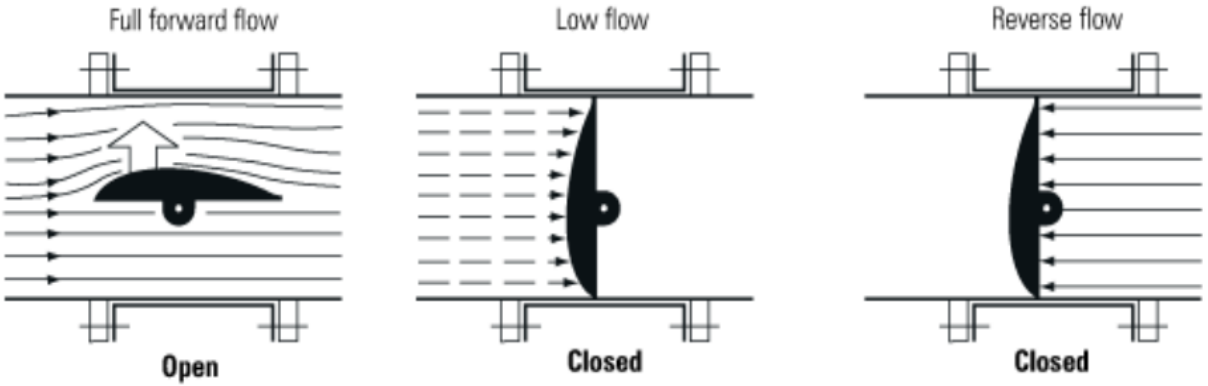


Tilting disc check valve

- This is similar to the swing type check valve, but with the flap pivoted in front of its centre of pressure and counterweighted or spring loaded to assume a normally closed position. When flow is in the forwards direction, the disc lifts and 'floats' in the stream offering minimum resistance to flow.

- The disc is balanced so that as flow decreases, it will pivot towards its closed position, closing before reverse flow actually commences. The operation is smooth and silent under most conditions.

- Due to the design of the tilting disc check valve, it is limited to use on liquid applications only.



THREE-WAY VALVE

BUTTERFLY VALVE

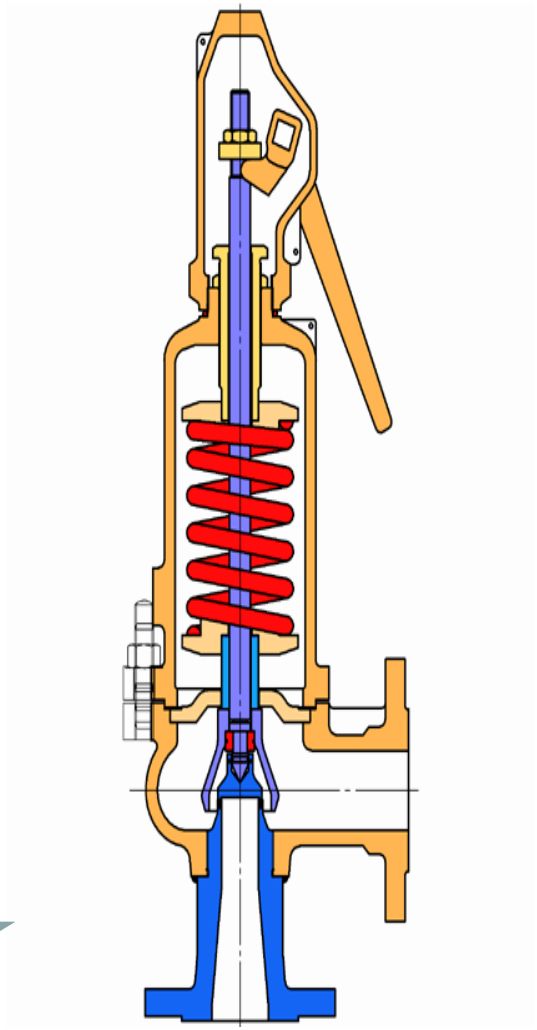
CHECK VALVE

SPRING-LOADED SAFETY
OR RELIEF VALVE

SPRING LOADED SAFETY VALVE

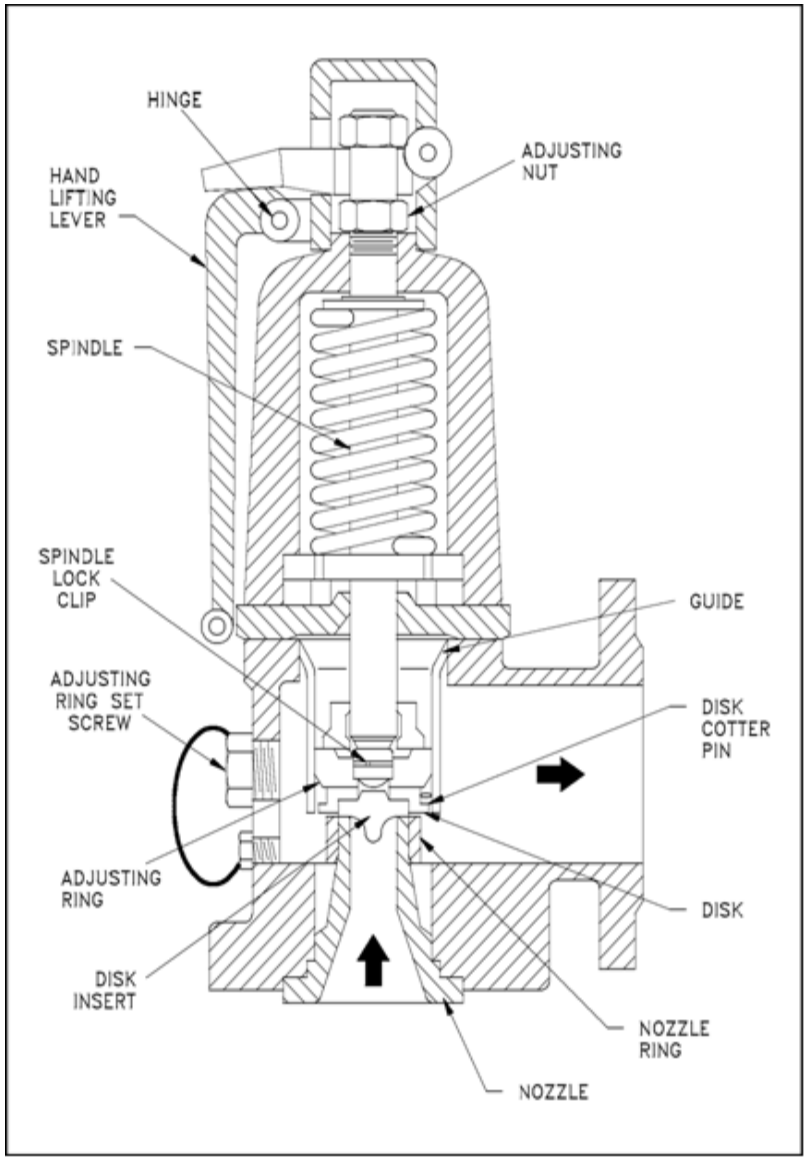
- Relief and safety valves prevent equipment damage by relieving accidental over-pressurization of fluid systems.

- A spring-loaded valve is held closed by the tension of the spring against the designed pressure of the pressure vessel, piping, pumps and other pressurized containments.



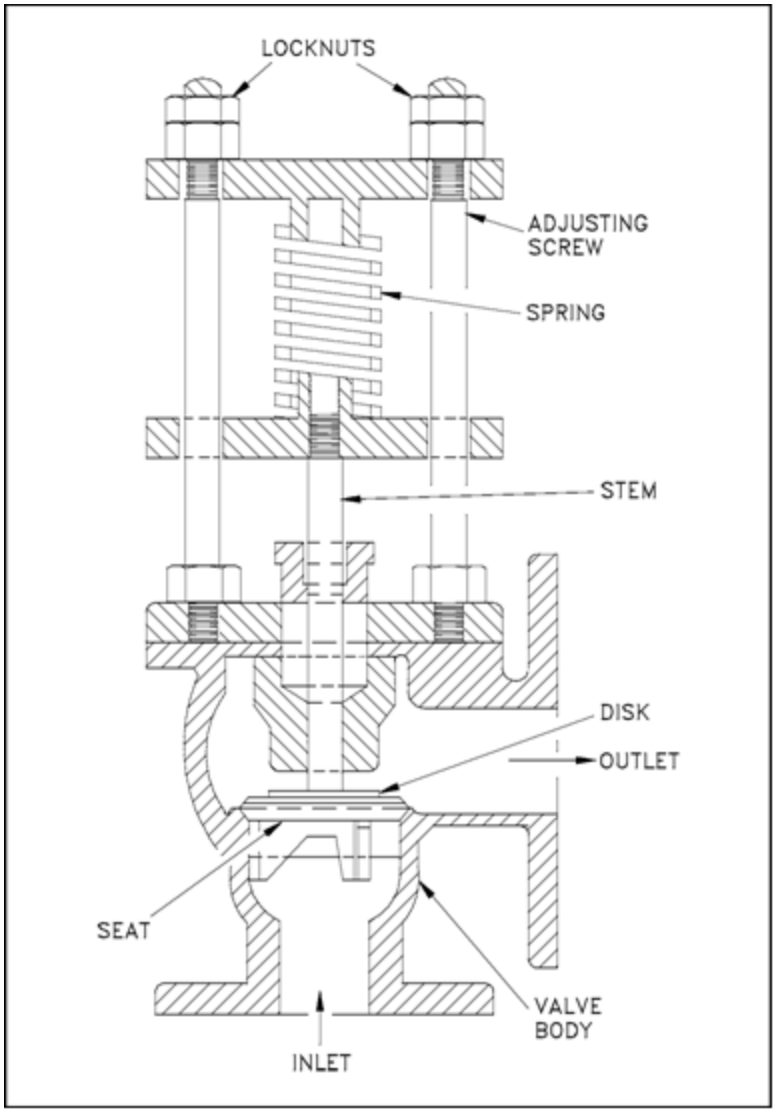
SAFETY VALVE

- These valves typically drain the excess liquid into a bilge or onto the floor.
- A safety valve rapidly pops fully open as soon as the pressure setting is reached. A safety valve will stay fully open until the pressure drops below a reset pressure.

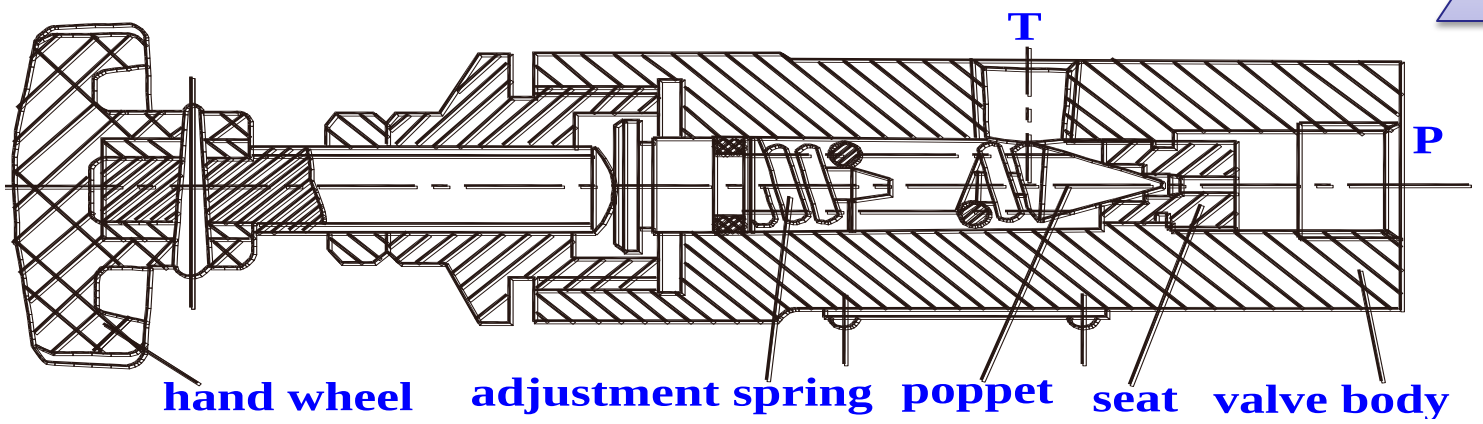


PRESSURE RELIEF VALVE

- These valves typically drain into another system or even into itself.
- A relief valve, gradually opens as the inlet pressure increases above the set point. A relief valve opens only as necessary to relieve the over-pressure condition.



STRUCTURE AND OPERATION



When the hydraulic force is less than the spring force, the poppet remains on its seat and no flow pass through the valve.

When the hydraulic force is greater than the spring force, the poppet will be forced off its seat, and fluid will flow back to the tank through port *T*.

Applications

- Relief valves are typically used for incompressible fluids such as water or oil.
- Safety valves are typically used for compressible fluids such as steam or other gases
- In nuclear industry these valves are used in
  a) Pressurizer
  b) Heat exchanger of SCV system(chemical & volume control system)

PILOT SAFETY OR RELIEF VALVE

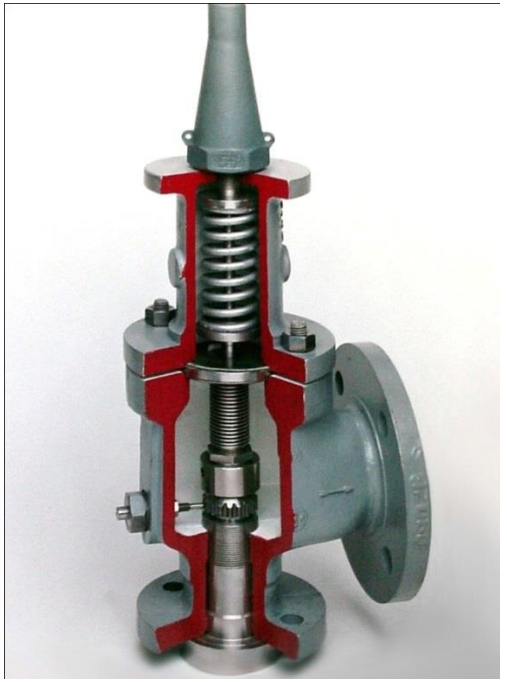
FOOT VALVE

COCK

PRESSURE REDUCING VALVE

Safety/Relief valves

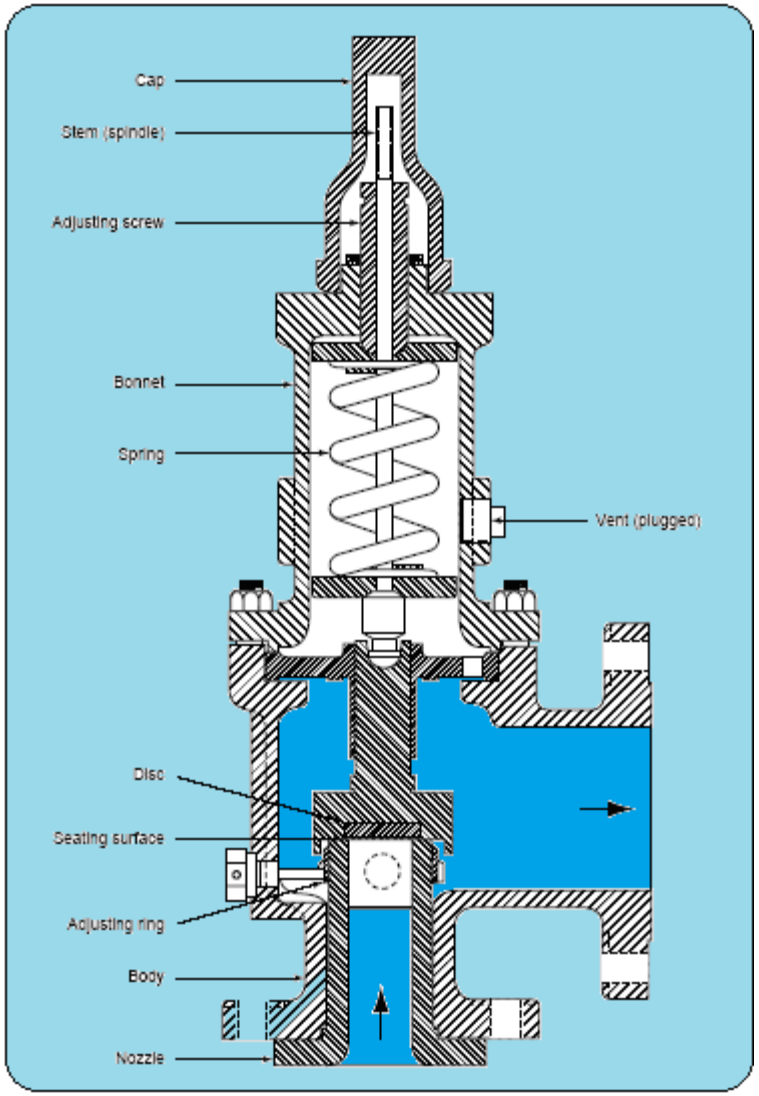
- When the pressure of fluid inside a relief valve exceeds the set-point pressure, valves opens automatically and pressure on it or the equipment is relieved.



It is also known as safety valve as it ensures safety of the instrument with which it is attached.

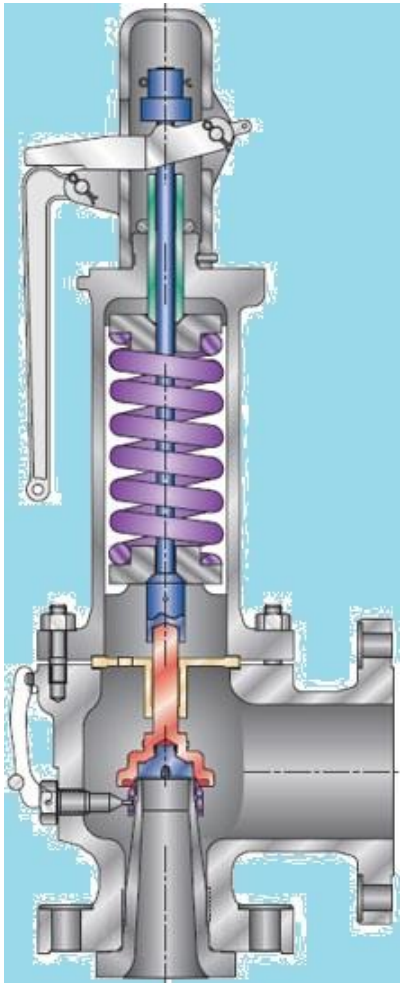
Safety valves

- The fluid exerts pressure on the disk of the valve but the valve remains close as spring attached does not allow the disk to move in other direction i.e. it prevents flow.



Safety valves

- When this pressure exceeds the mechanical set-point defined by the spring elastic constant the spring is compressed and the fluid flow starts



FOOT VALVE

PILOT SAFETY OR RELIEF VALVE

FOOT VALVE

COCK

PRESSURE REDUCING VALVE

Description

- Foot valves are a type of check valve and are placed at the pump's wet well.

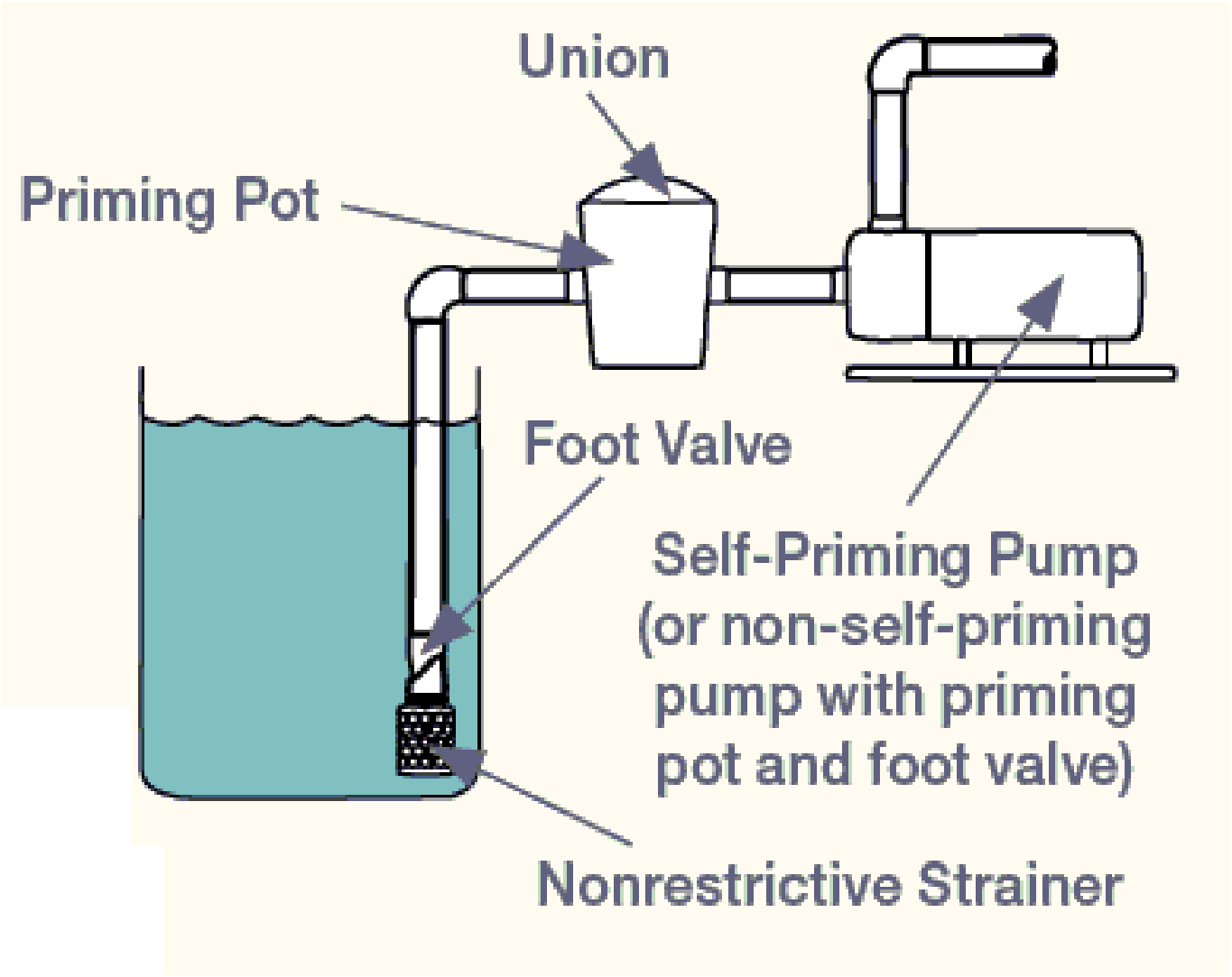
- Unlike other valves, a foot valve is created with a larger flow area than the actual pipe size to make sure that there is less head loss.

- They are known for keeping the continuous presence of suction within the pump.

- The basic function of foot valve is to prevent water from flowing back down the pipe. In other words, it is a valve to allow the pump to pull water up but does not allow the water to flow back down. This helps in keeping the pipe full of water while the pump is not running.

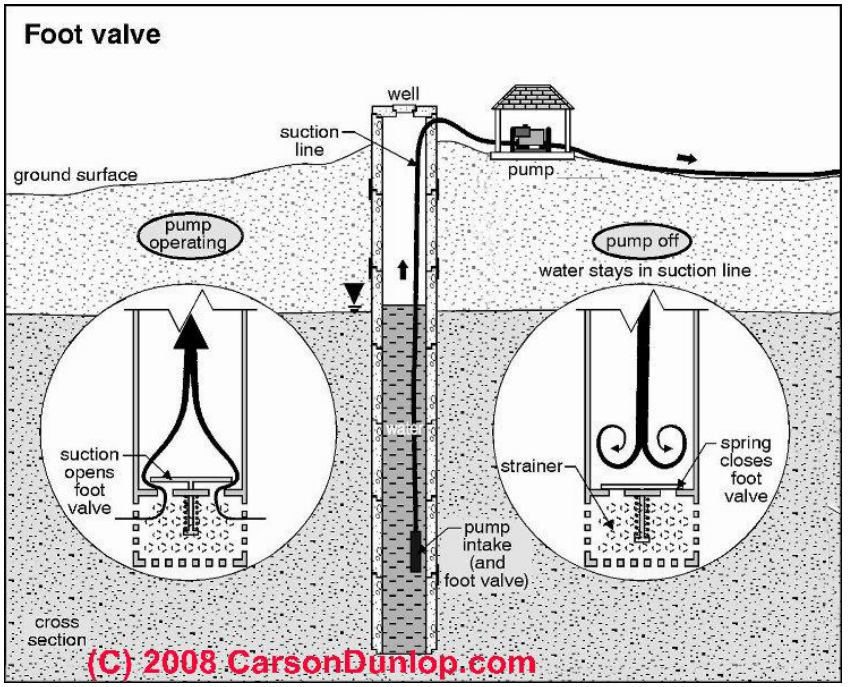
- The strainer prevents picking up large debris that could clog or jam the foot valve in its open position or that might damage the water pump itself.

- The spring loaded check valve closes when the well pump stops pumping.


Union
Priming Pot
Foot Valve
Self-Priming Pump
(or non-self-priming
pump with priming
pot and foot valve)
Nonrestrictive Strainer

Uses Of Foot Valve

1. They prevent the pump column from draining upon pump shutdown.
2. They are widely applied to all kinds of pneumatic system.
3. They are used in a suction line of the pumping system in a well.
4. They provide a positive sealing action at both low and high pressures without slamming.



Working and Installation of foot valve is shown in the Figure.

Parts Of Foot Valve

1. Top Body
2. Bottom Body
3. Ball
4. Ball Ring
5. Seat Ring

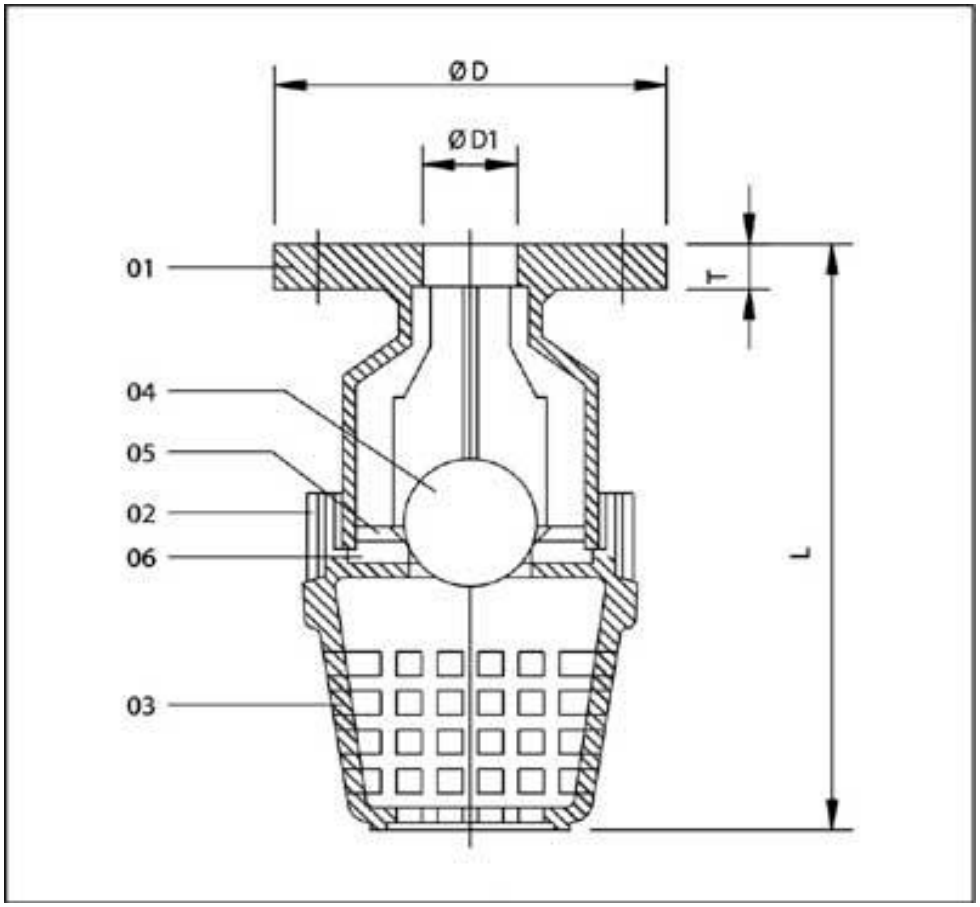


Figure: A longitudinal section of a foot valve

PILOT SAFETY OR RELIEF VALVE

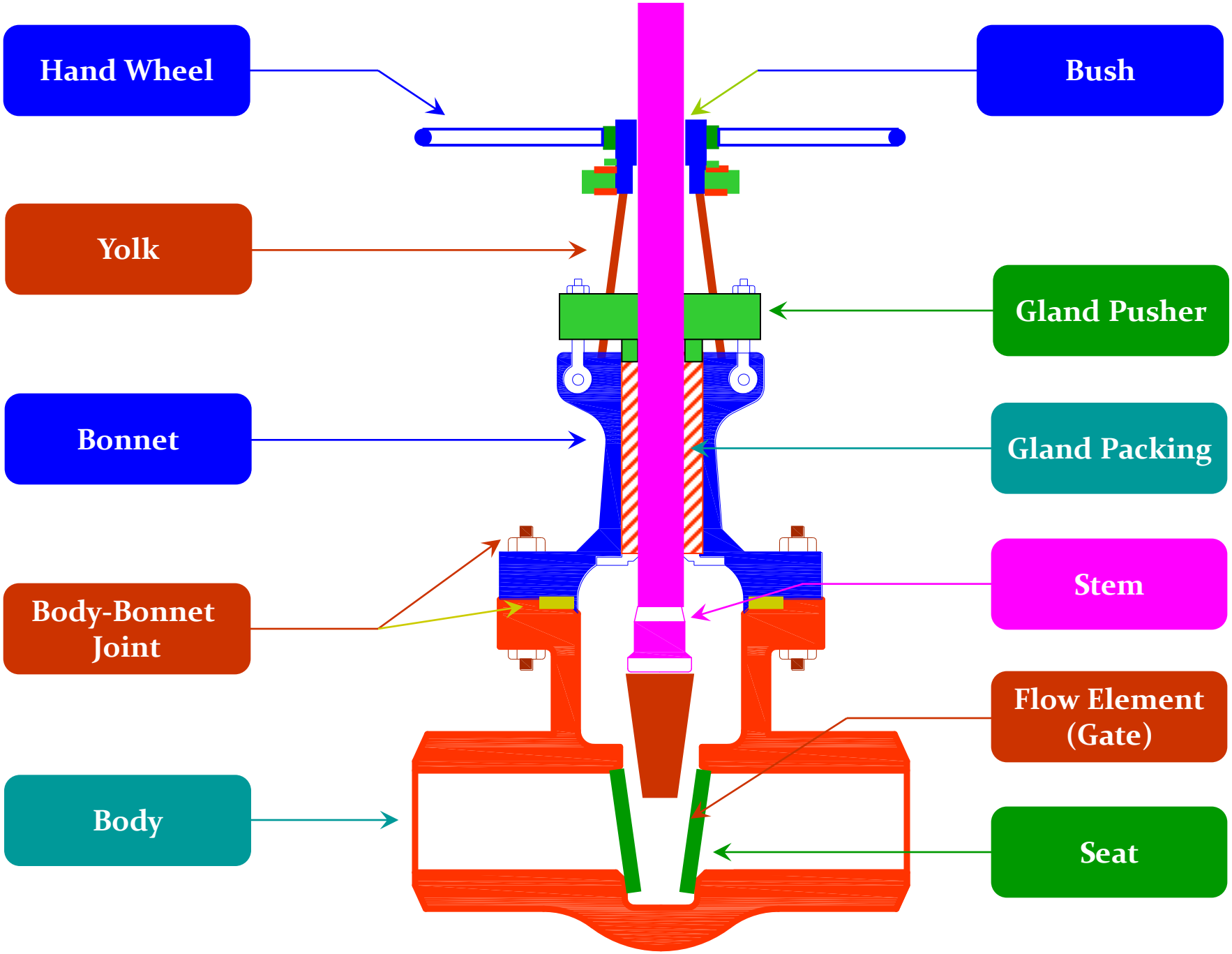
FOOT VALVE

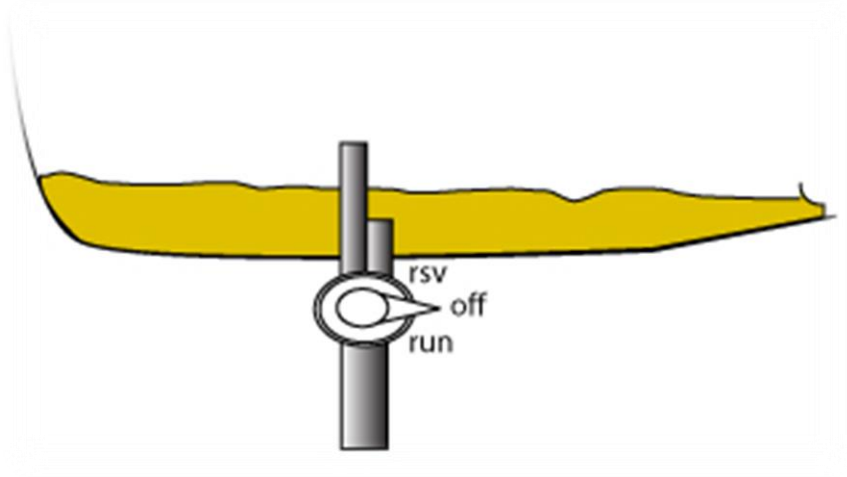
COCK

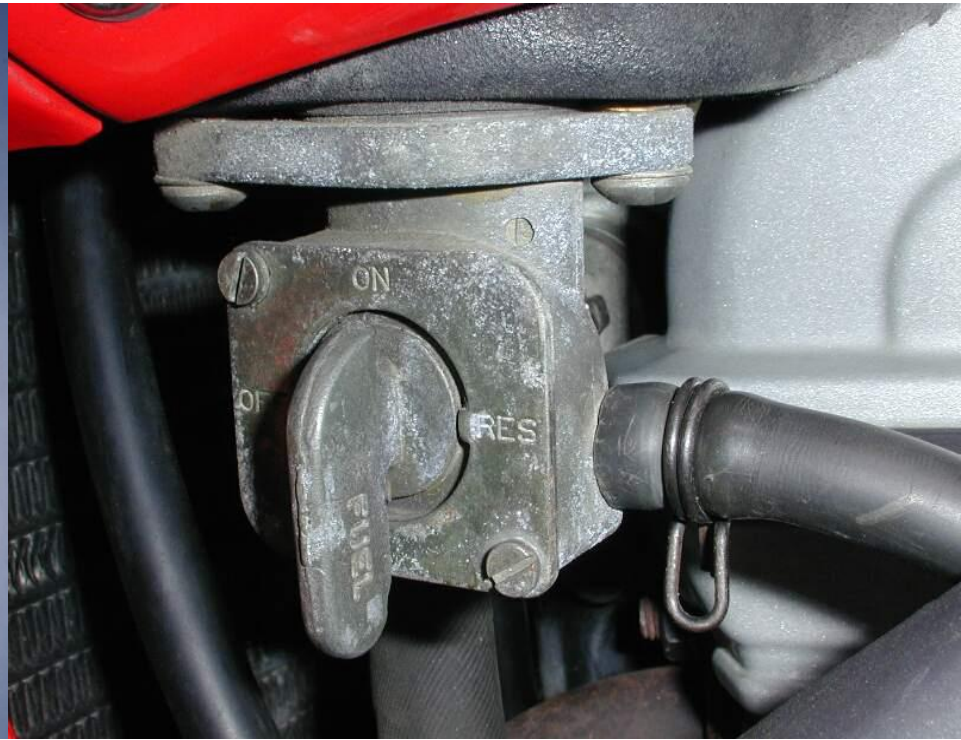
PRESSURE REDUCING VALVE

Cock Valve

- A cock is a valve with an axle rotating closure member used for turning on/off or setting and located at 90° to the direction of the flow which passes through it. Cocks are mainly used for turning on/off but can be adapted for regulating functions with a special throttle


Hand Wheel
Bush
Yolk
Gland Pusher
Bonnet
Gland Packing
Body-Bonnet Joint
Stem
Flow Element (Gate)
Body
Seat

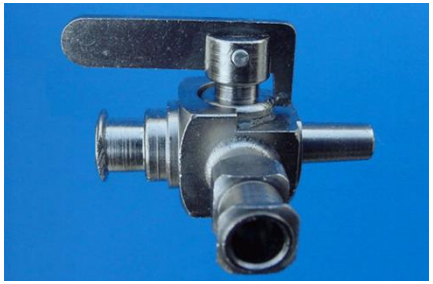

rsv
off
run


ON
RES
FUEL

Cock Valve

- There are several types of valves that are referred to as “cock”:
  - Stopcock: used to restrict fluid flow through a pipe
  - Petcock: used to control fluid flow rate
  - Bibcock: used for release of liquids or gases from a piping system
  - Sillcock: a threaded exterior faucet, usually for attaching a hose

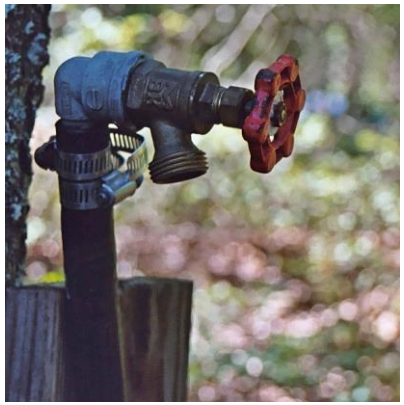
Stopcock



Petcock

Bibcock

Sillcock



Stopcock

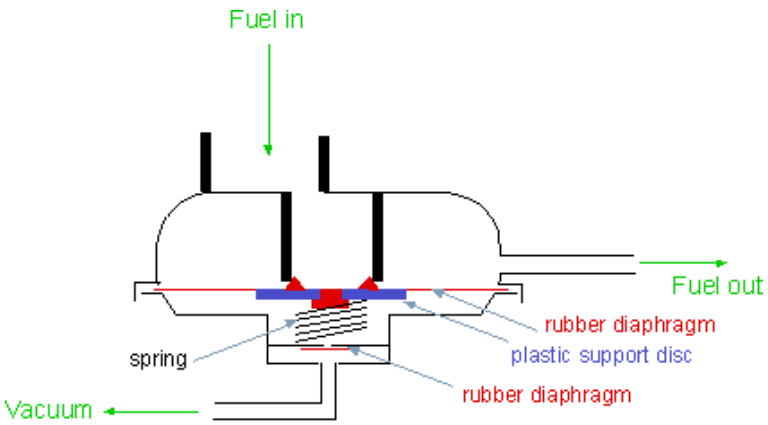
- These valves are more useful in controlling flow rate through a pipe
- They are often used in lab, medical and industrial equipment
- Three-way stopcocks can divide flow between two outlets
- They are rotational motion valves similar to ball valves
- The disk has an orifice in it which is exposed to flow when the actuator is rotated

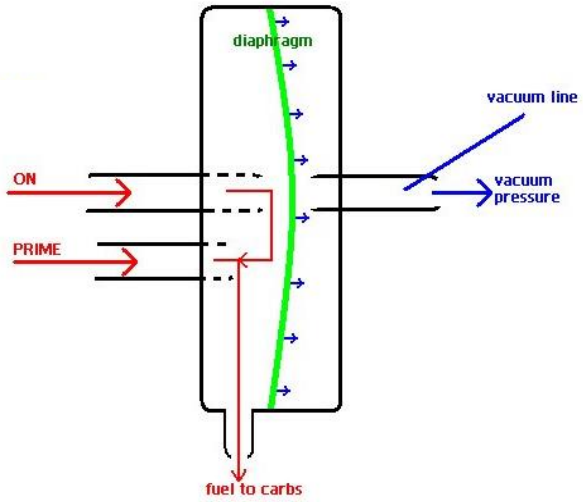
PTFE Stopcock

Glass Stopcock

Petcock

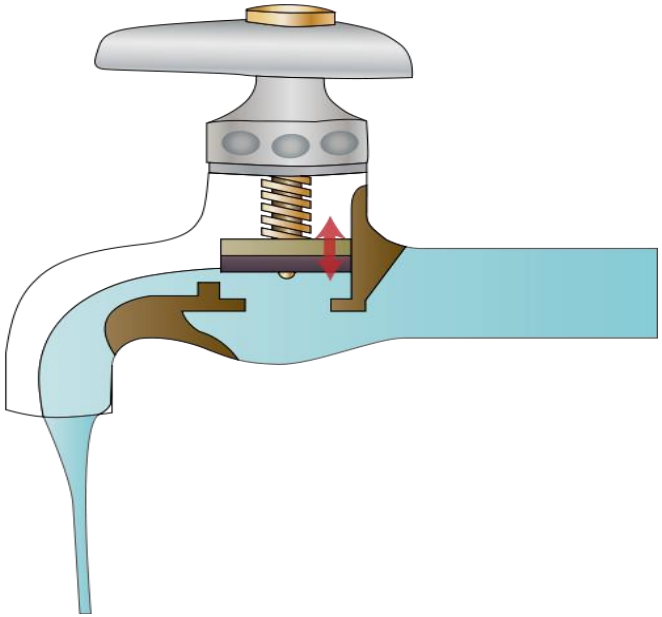
- These are small valves that are mainly used in fuel supply systems for engines
- Vacuum from a pneumatic line pulls the diaphragm back, compressing a spring and releasing pressure on a ball or other valve, this allows fuel to flow around the ball and to the outlet
- A manual control is provided to set the default position of the diaphragm

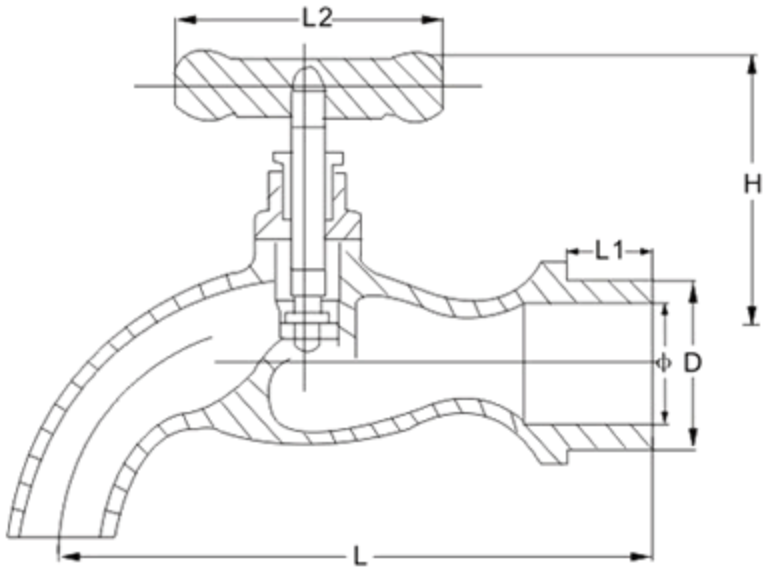




Bibcock

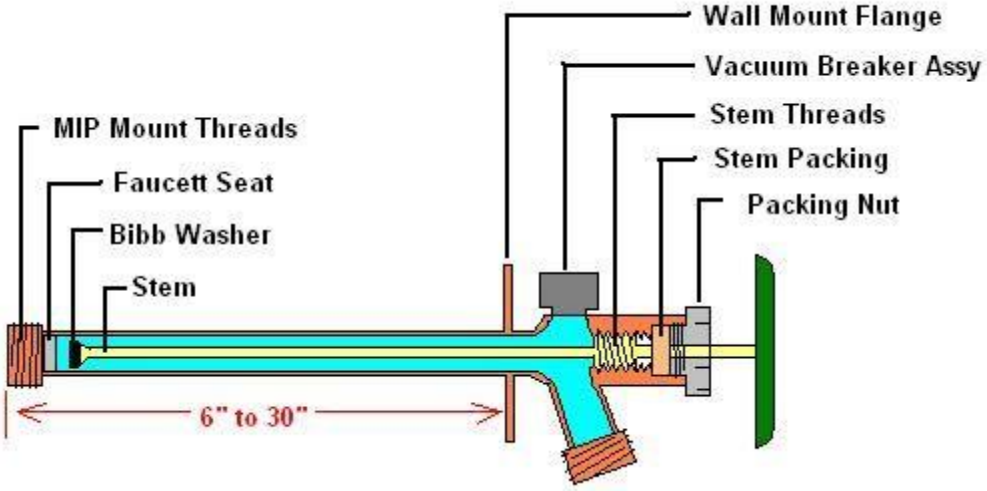
- It is similar in operation to a globe valve
- The disk moves vertically and inserts into the orifice
- It may be used for throttling or stopping/starting flow of liquid
- Usually we use bibcocks to extract liquid from a piping system





Sillcock

- A sillcock is also used to release fluid from a line
- The disk moves linearly, and completely covers an axially aligned orifice in the pipe
- The main purpose is starting or stopping flow
- Vacuum breakers may be provided to prevent siphoning



PILOT SAFETY OR RELIEF VALVE

FOOT VALVE

COCK

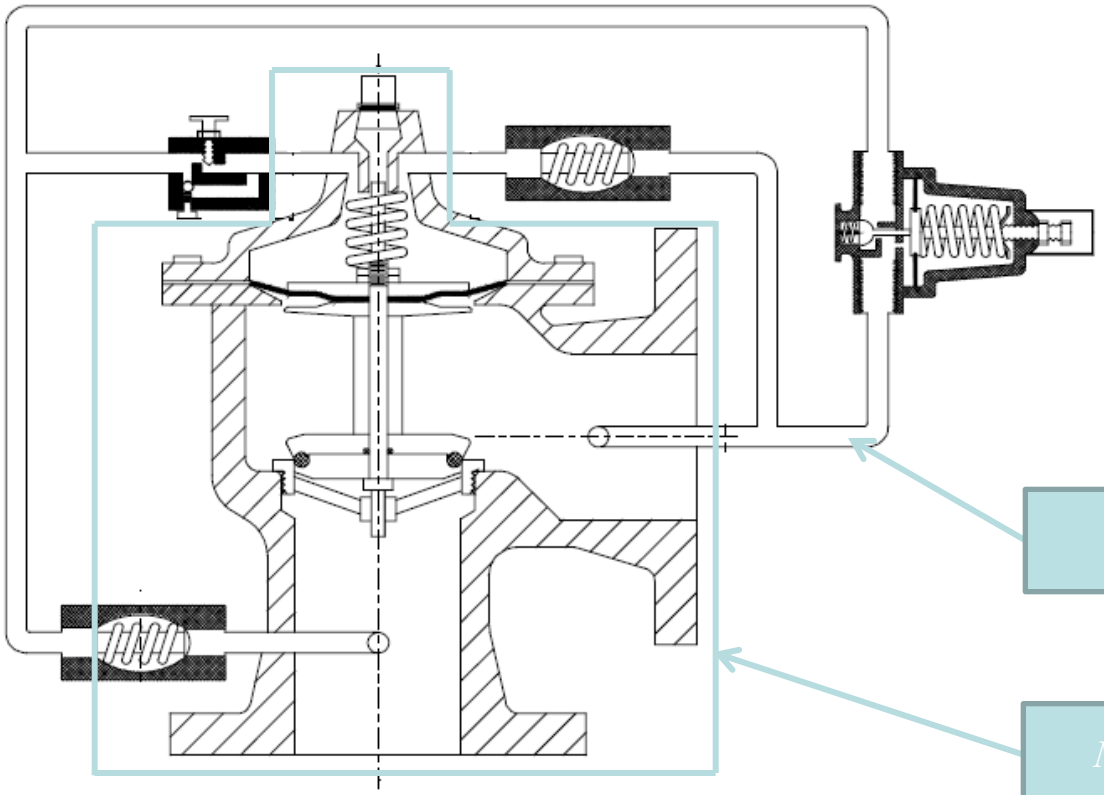
PRESSURE REDUCING VALVE

Pressure Reducing Valve

Objectives of PRV's

Providing a constant downstream pressure, independently of the upstream pressure and of the flow rate

Components of PRV's



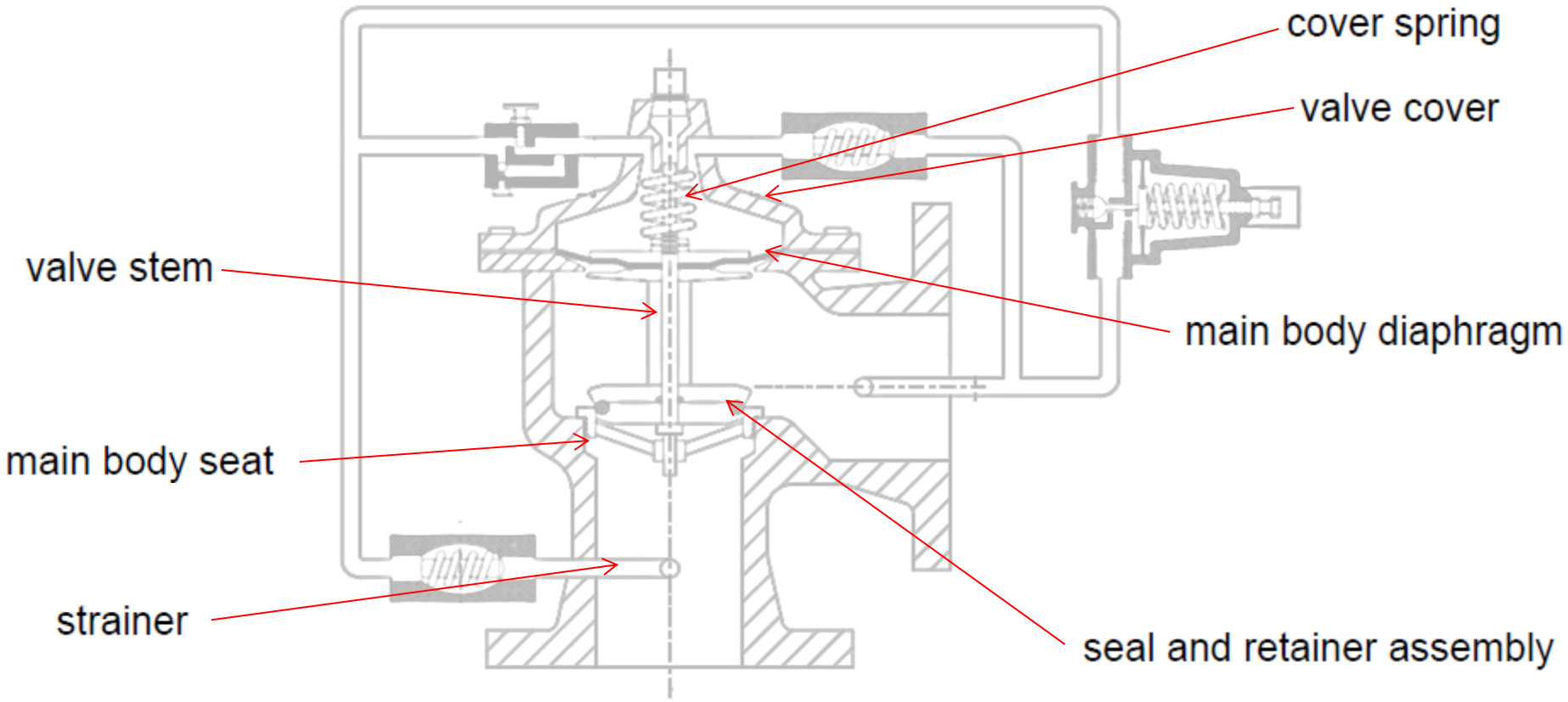
Parts of PRV

Pilot Assembly

Main Body Valve Assembly

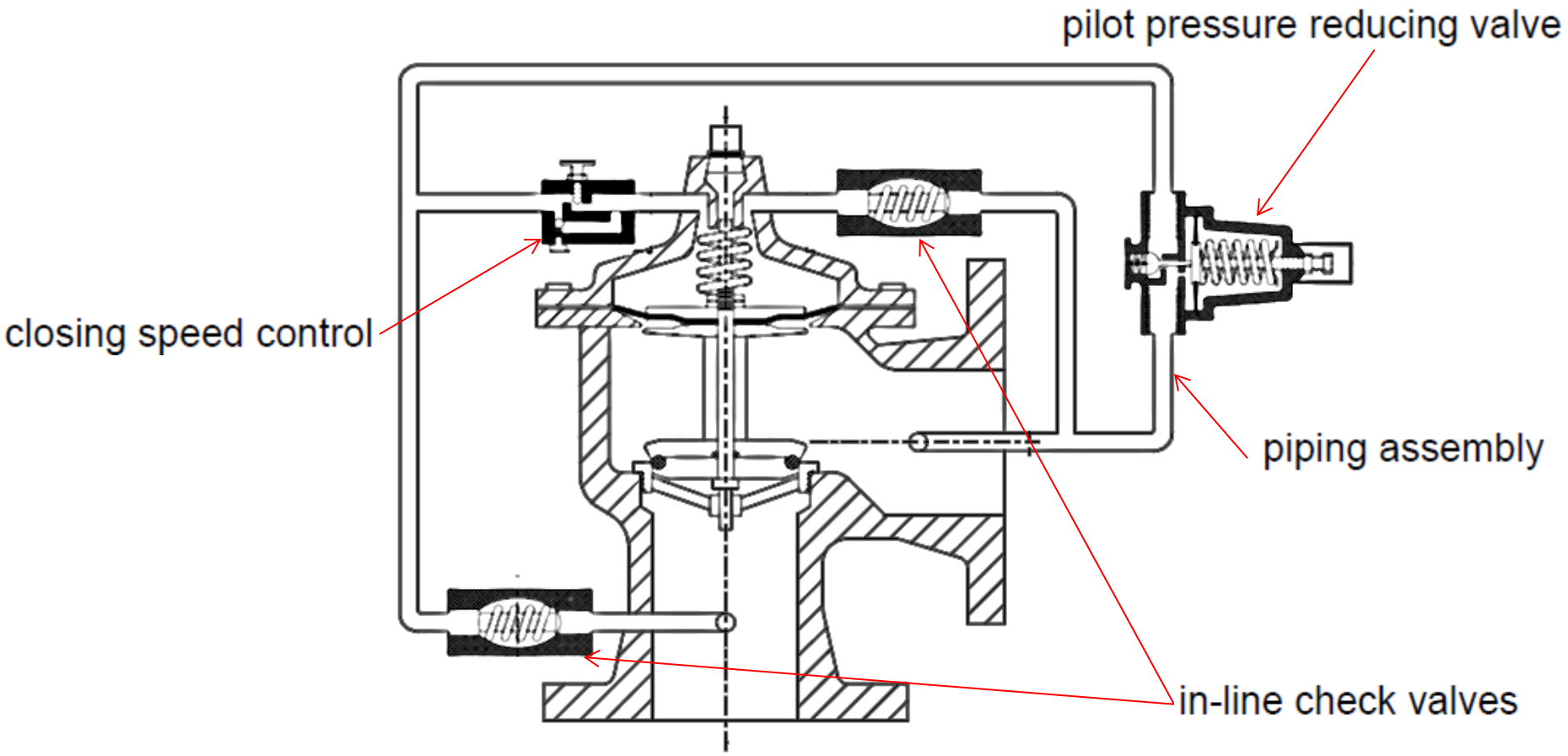
Main Body Valve Assembly

The main body valve assembly is the portion of the PRV through which the main flow travels



Pilot Assembly

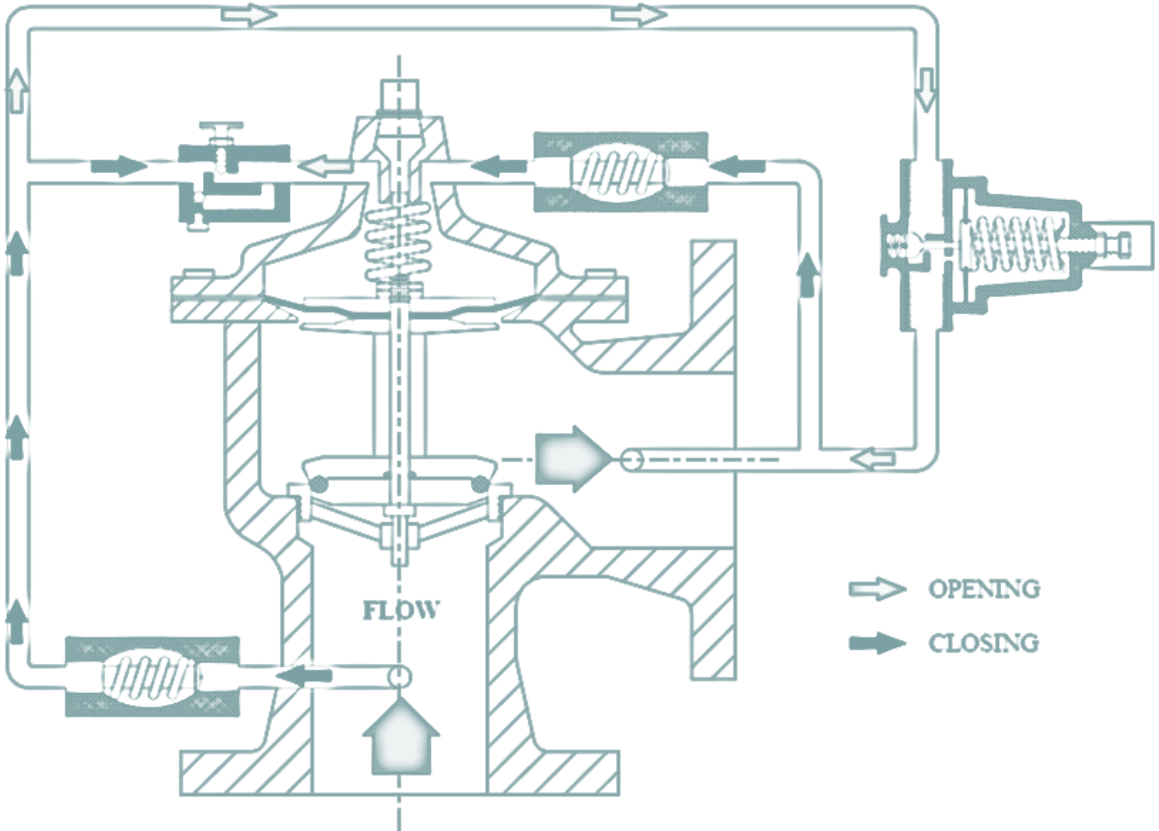
The pilot assembly controls the opening and closing of the main body valve. The main body valve is, in fact, slave to the pilot setting. Opening the pilot valve will open the main body valve. Closing the pilot will close the main body valve.



How the PRV's Work

Flow through the main body valve is controlled by varying the pressure in the pilot assembly. This is done by turning the set screw on the pilot pressure reducing valve.

- *Closing the screw closes the main valve*
- *Opening the screw causes the main valve to open*



PNEUMATIC VALVE
(FAIL OPEN)

PNEUMATIC VALVE
(FAIL CLOSED)

MOTOR-OPERATED VALVE

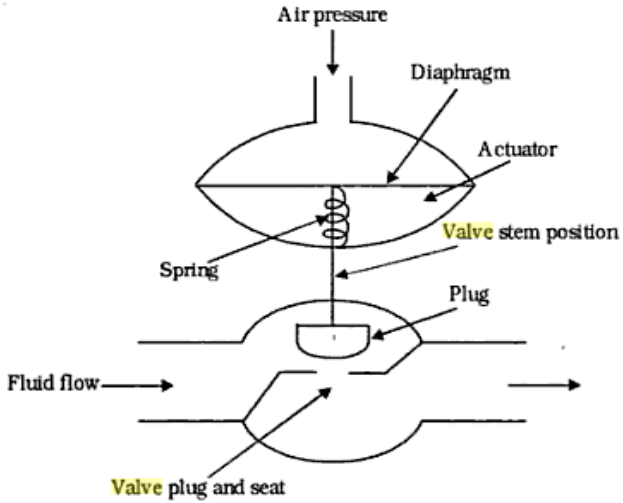
SOLENOID VALVE

EXTENSION STEM
OPERATING VALVE

PNEUMATIC VALVE
(Fail open and Fail safe)

PNEUMATIC VALVE

- A control valve is the predominant final control element in process industries.
- The pneumatic control valve is the most common type of final control element in chemical processing which regulates fluid flow.
- The word “pneumatic” means air driven and valve is shown below in figure:
- The control valve consists of an actuator and a valve.
- The valve itself is divided into body and trim.
- The body consists of housing for mounting the actuators and connections for attachment the valve to a supply line and a delivery line.
- The trim is enclosed in the valve body and consists of a plug, valve seat, and a valve stem.



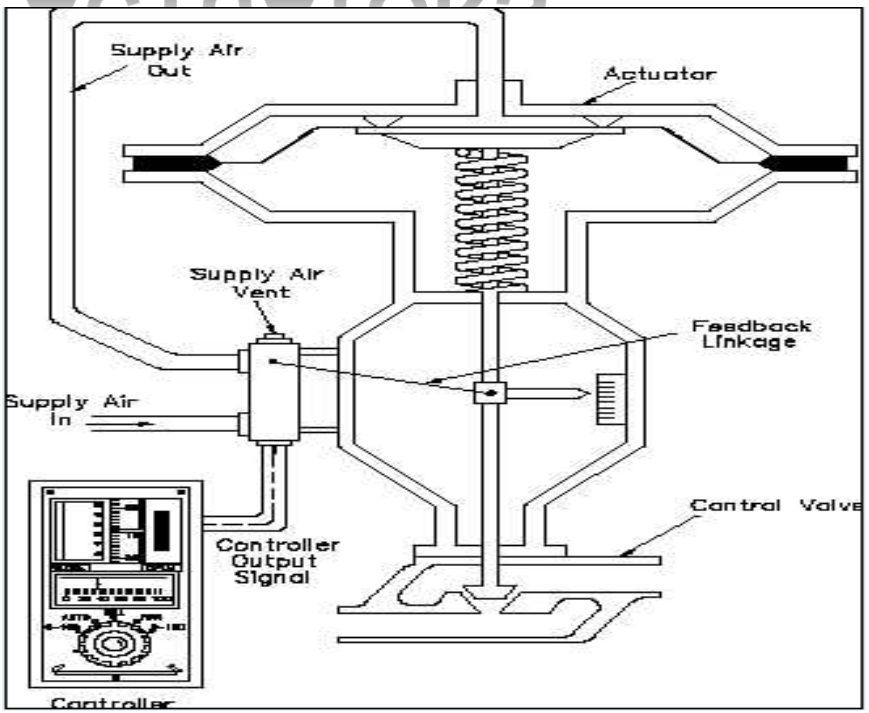
- A diaphragm and spring mechanism is used as actuator that takes an action according to the signal driven by controller.

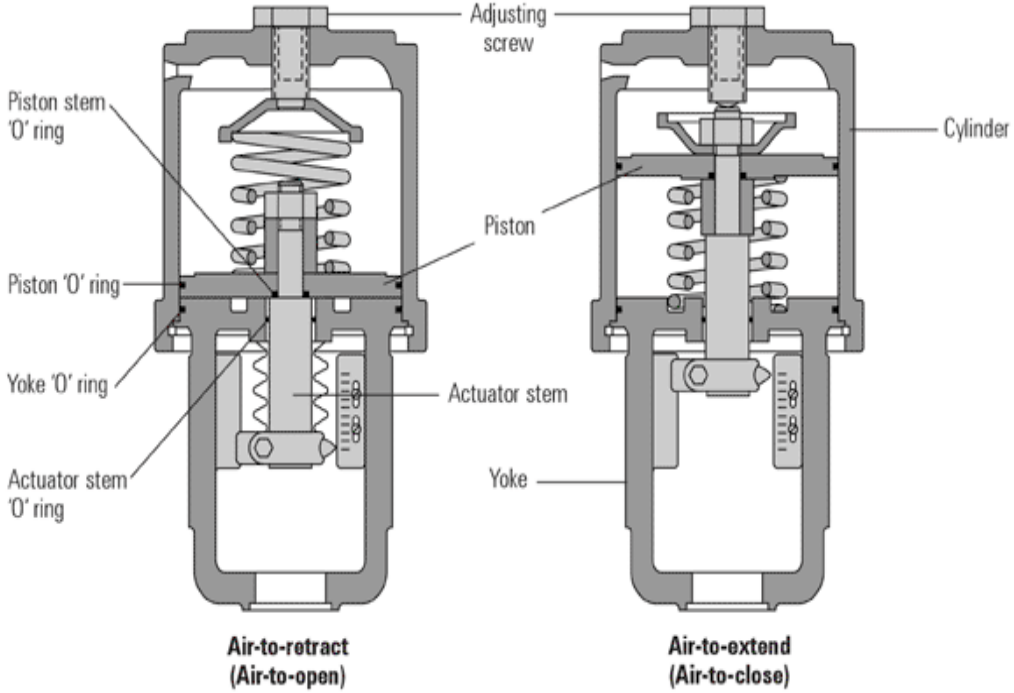
CONT….

Assembly and Disassembly of Pneumatic Actuator Animation

- The pneumatic valve is an air operated valve, which controls the flow through an orifice by positioning appropriately the plug.
- The plug is attached at the end of a stem which is supported on a diaphragm on the other end.
- The plug opens or closes the orifice opening as the stem is raised or lowered.
- On the basis of their functionality these are divided into two categories:
    1) Air to Open (AO)
    2) Air to Close (AC)
- As the air pressure above the diaphragm increases, the Stem moves down and consequently the plug restricts the flow through the orifice, such a valve is known as Air to close (AC) valve. If the air supply above the diaphragm is lost(drops to zero, for example, due to the instrument air supply line cut or freezing of pipeline during a cold winter), the valve will open since the spring would push the stem and plug upward.
- There are pneumatic valves with opposite actions, i.e . Air to Open (AO) which fail close by reversing the action of the plug to close the opening in the up position by reversing the locations of the spring and air pressure (with air pressure under the diaphragm).

WORKING OF PNEUMATIC ACTUATORS





- The above figures clearly illustrate the working mechanism as well as the connection of controller with actuator for pneumatically controlled valve.

Animation

PNEUMATIC VALVE
(FAIL OPEN)

PNEUMATIC VALVE
(FAIL CLOSED)

MOTOR-OPERATED VALVE

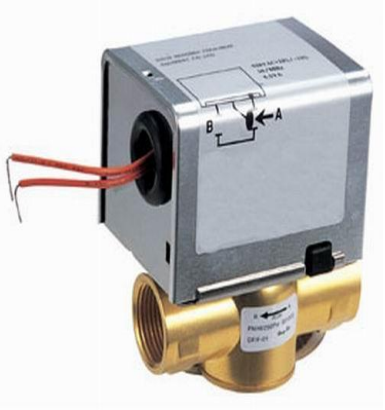
SOLENOID VALVE

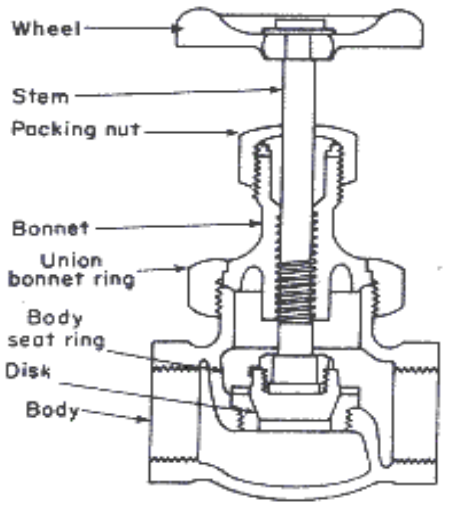
EXTENSION STEM
OPERATING VALVE

Motorized valve

Definition

A motorized valve is a valve type that use an electric motor to open or close its mechanism means actuated electrically.





Construction

The internal fluid control mechanisms of motorized valves are generally identical to their manual counterparts, valve actuation inputs are the only difference between the two.

The valves which are actuated electrically are called motor operated valves (MOV).

In figure construction of globe valve and motorized valve is shown

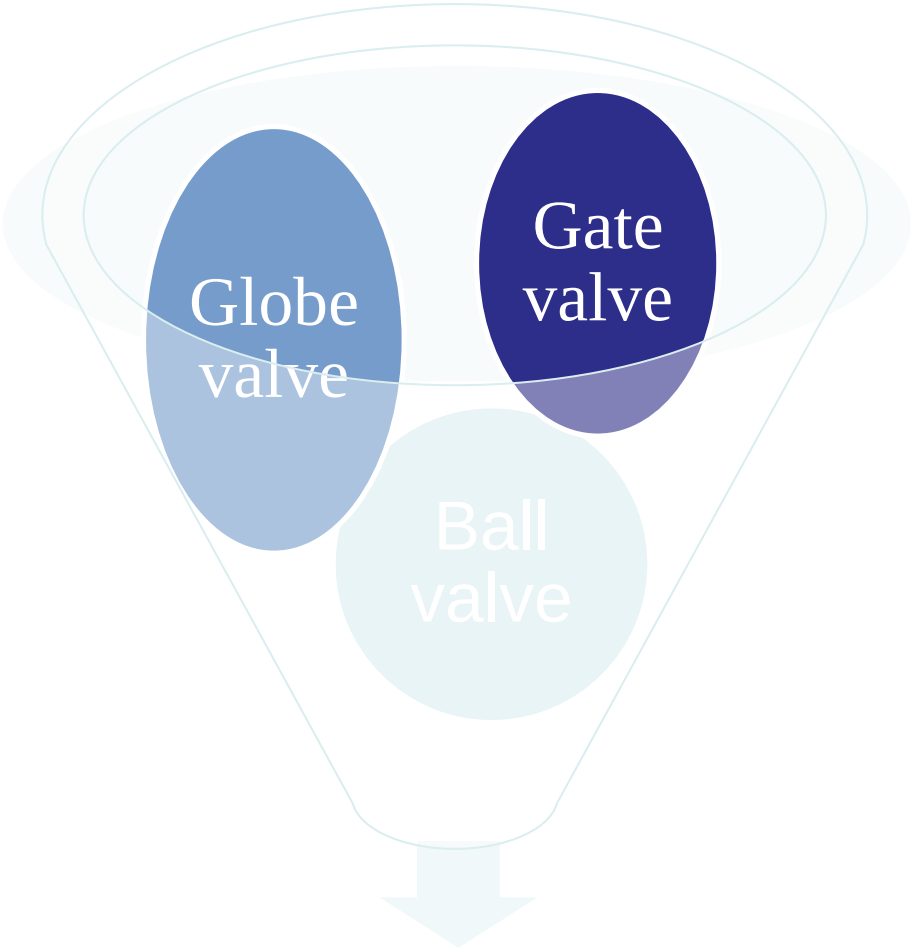
Working

Internally the motorized valve is generally identical to a manual valve of the same type. The only physical difference between the two is the inclusion of a motor and gear train assembly. Motorized valve mechanisms are prevented from advancing too far by using a set of electrical limits which cut the motor supply when a valve is either fully opened or closed. When the valve needs to be adjusted again, the motor's direction is simply reversed to turn the valve in the opposite direction.

Motorized valve

Types

MOV globe valve
MOV gate valve
MOV two port valve
MOV butterfly valve



Motorized valves

Motorized valve

Description

Linear motion valve

Motorized valves typically feature an electric motor that drives an advance mechanism through a gear train to open or close them. The particular advance mechanism depends on the type of valve. Vertical travel valves such as gate or sluice valves usually use a lead screw mechanism that lifts or drops the gate plate and are usually found in larger systems such as water mains. Globe valves also use a screw advance mechanism to position the tapered plug which controls the fluid flow in high precision metering applications.

Rotary motion valve

Rotary or quarter turn motorized valves are the valve type with the quickest actuation times and typically use a cam or central spindle advance mechanism. These valves are among the most common motorized valve types and include ball and butterfly valve varieties. These valves are not suitable for flow control but do feature the best sealing characteristics of all the valve types. They are commonly used on high pressure fuel lines and on aircraft deicing systems.

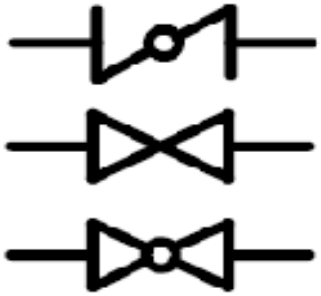
Motorized valve

Application

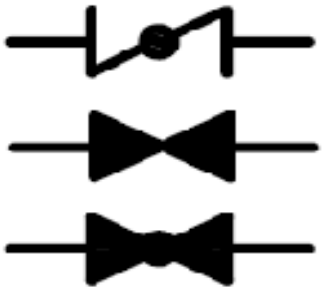
- *remote fluid control*
- *aircraft deicing*
- *agricultural irrigation*
- *automated fire suppression*
- *remote flow control*

SOLENOID VALVE
(FAIL OPEN)

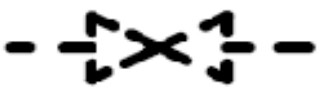
SOLENOID VALVE
(FAIL CLOSED)



NORMALLY OPEN VALVE



NORMALLY CLOSED VALVE

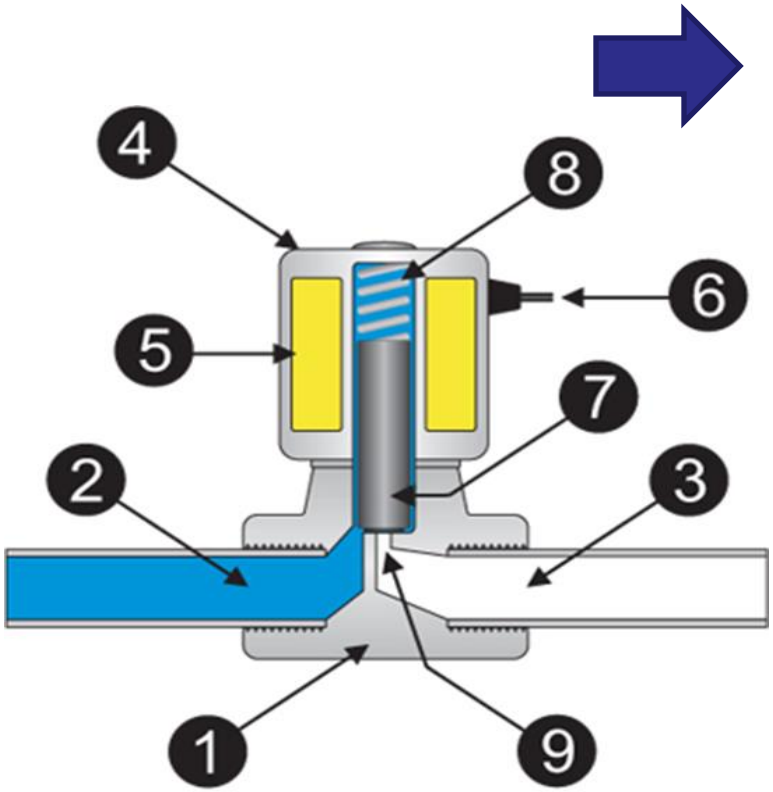


OTHER SYSTEM VALVE

Solenoid Valve

Solenoid Valve Definition

- The solenoid converts electrical energy into mechanical energy which, in turn, opens or closes the valve mechanically.
- The fluid controlled by the solenoid valve enters the valve through the inlet port.
- The fluid must flow through the orifice before continuing into the outlet port.
- The orifice is closed and opened by the plunger.
- Solenoid valves are the most frequently used control elements in fluidics.



1. Valve Body	**4. Coil / Solenoid**	**7. Plunger**
2. Inlet Port	**5. Coil Windings**	**8. Spring**
3. Outlet Port	**6. Lead Wires**	**9. Orifice**

Mechanism Of Valve Operation

- The purpose of a solenoid valve coil is to convert electrical energy into linear motion. The coil consists of copper wire (or aluminum) wound around a hollow form. When electric current flows through the coil, a magnetic field is created. This is accomplished by placing a ferromagnetic core inside the coil.
- In a solenoid valve, the ferromagnetic core is called the valve plunger. When the current flows through the coil, the lines of magnetic flux turn the plunger into an electromagnet.
- The magnetic field causes the plunger to slide further up into the coil, opening the valve body orifice or pilot orifice.

Types Of Solenoid Valves

1. **Direct acting solenoid valve**

- The double poppet armature is held by a spring against the inlet orifice sealing the supply at port.
- Outlet port is connected to exhaust port.
- When the coil is energised the armature is pulled up closing the exhaust orifice and connecting the supply port to the outlet port.

2. Many variations are possible on the basic, one way, one solenoid valve described above:

- ❑one or two solenoid valves.
- ❑direct current or alternating current powered.
- ❑different number of ways and positions.

Common Uses Of Solenoid Valves

- Solenoid valves are used in fluid power pneumatic and hydraulic systems, to control cylinders, fluid power motors or larger industrial valves.
- Automatic irrigation sprinkler systems also use solenoid valves with an automatic controller. Domestic washing machines and dishwashers use solenoid valves to control water entry into the machine.
- Solenoid valves are used in dentist chairs to control air and water flow.
- In the paintball industry, solenoid valves are usually referred to simply as "solenoids." They are commonly used to control a larger valve used to control the propellant (usually compressed air or CO_2).
- Besides controlling the flow of air and fluids, solenoids are used in pharmacology experiments, especially for patch-clamp, which can control the application of agonist or antagonist.

PNEUMATIC VALVE
(FAIL OPEN)

PNEUMATIC VALVE
(FAIL CLOSED)

MOTOR-OPERATED VALVE

SOLENOID VALVE

EXTENSION STEM
OPERATING VALVE

Extension Stem Operating Valve

➢A Valve **Stem Extension** extends the length of a valve stem for bringing the operating device close to the surface, eliminating the need for heavy, long Valve struggling to find the operating device.

➢Extension stems are used where valves are to be operated from a distance, with or without floor stands. Inquiries should specify the length of the stem required. Extra-long stems must be guided by supports.

➢Extension stems are normally furnished complete with rod, coupling, top nut (or hand wheel), set screw and pins.

➢Extension Stems are used to raise the elevation of both buried and “in-plant” valves having a 2″ square operating nut.

Extension Stem Operating Valve

- The extension stem is made up of an extension rod (or pipe), a 2″ square top wrench nut (or hand wheel), and a bottom wrench nut coupling. The wrench nut coupling fits over the 2″ square nut of the valve stem being raised and is held to the nut by a set screw threaded in the bottom coupling.
- The top nut (or hand wheel) and bottom coupling are pinned to the extension rod (or pipe) which is drilled to receive stainless steel spring pins. The top nuts and bottom couplings are available in either ductile iron, or stainless steel.

FEATURES:

- Less cost
- Bar stock
- Stainless steel fabrication
- Easy to fitted with any valves
- Optional extension stem state length
- Require no maintenance

SELF CONTROL VALVE (BACK PRESSURE CONTROL)

Application

Back pressure valve is used to the applicable conditions that the common controlling system can not be used, as a kind of special pressure control valves, it commonly match with automatic recirculation valve to protect pump system. Back pressure valve is used to control upstream pressure, enables to achieve factory technological setting pressure value and system required pressure value, preventing vaporization and corrosion phenomena. Carefully matched technological condition between automatic recirculation valve and back pressure valve, ensure pump get the best protection, guarantee long-term stability for safe operation system.

Working Principle

This valve is self-support type, do axial movement along valve disc by spring force function, so as to generate differential pressure around back pressure valve. Meanwhile, valve seat hole opening bigger and bigger gradually until pressure differential reaches setting point.

Maintenance

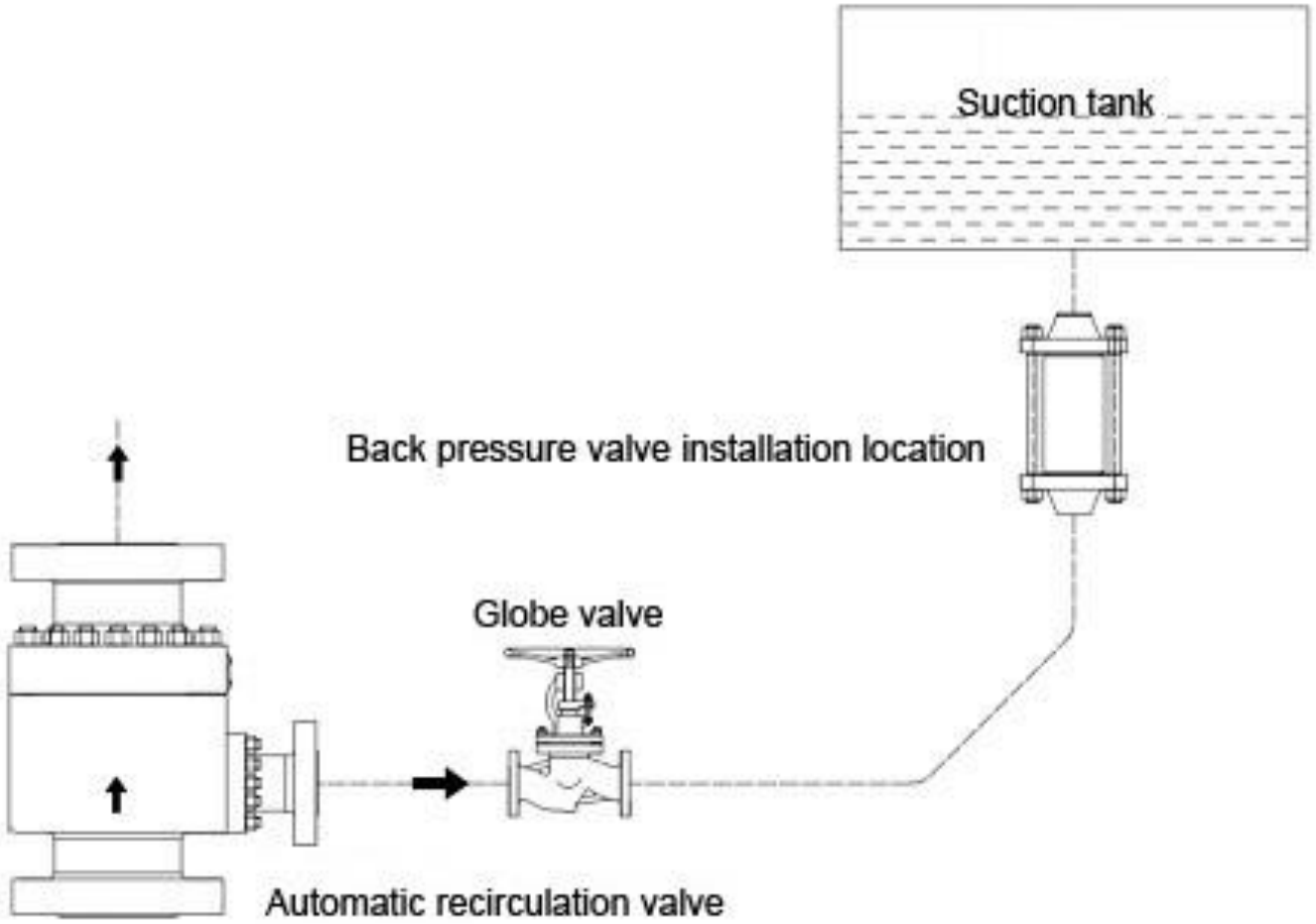
- Be easy to operation and maintenance. We can provide installation and maintenance manual.

Pressure Range

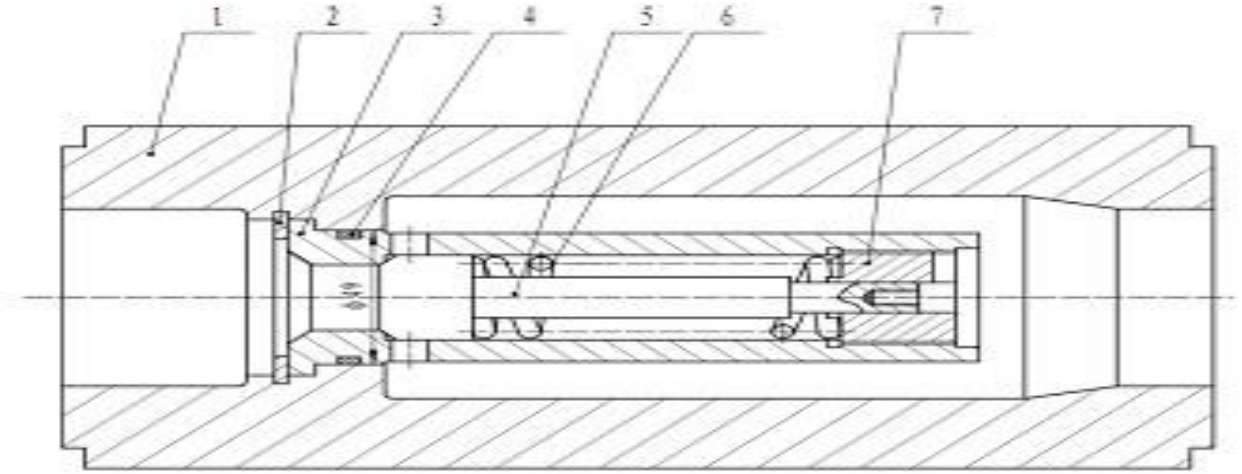
- Nominal pressure range: PN10~PN400（ANSI 150Lbs~ANSI 2500Lbs. Other pressure range is according to requirement.

Installation

In order to make the valve to achieve best performance, back pressure valve should be installed in the downstream of the protected valve, since valve outlet velocity flow is high, installation location should near close to deaerator or tankents



Parts and Materials



NO	Name	Material（Commonly used）			
1	Body	A105	LF2	F304	F316
2	Elastic block circle	2Cr13	2Cr13	304	316
3	Seat	2Cr13+STL	2Cr13+STL	304+STL	316+STL
4	O ring	EPDM	EPDM	EPDM	EPDM
5	Trim	2Cr13+STL	2Cr13+STL	304+STL	316+STL
6	Spring	60Si2Mn	60Si2Mn	1Cr18Ni9Ti	316
7	Pressed nut	2Cr13	2Cr13	304	316

SELF CONTROL VALVE

Upstream Pressure Control Valve

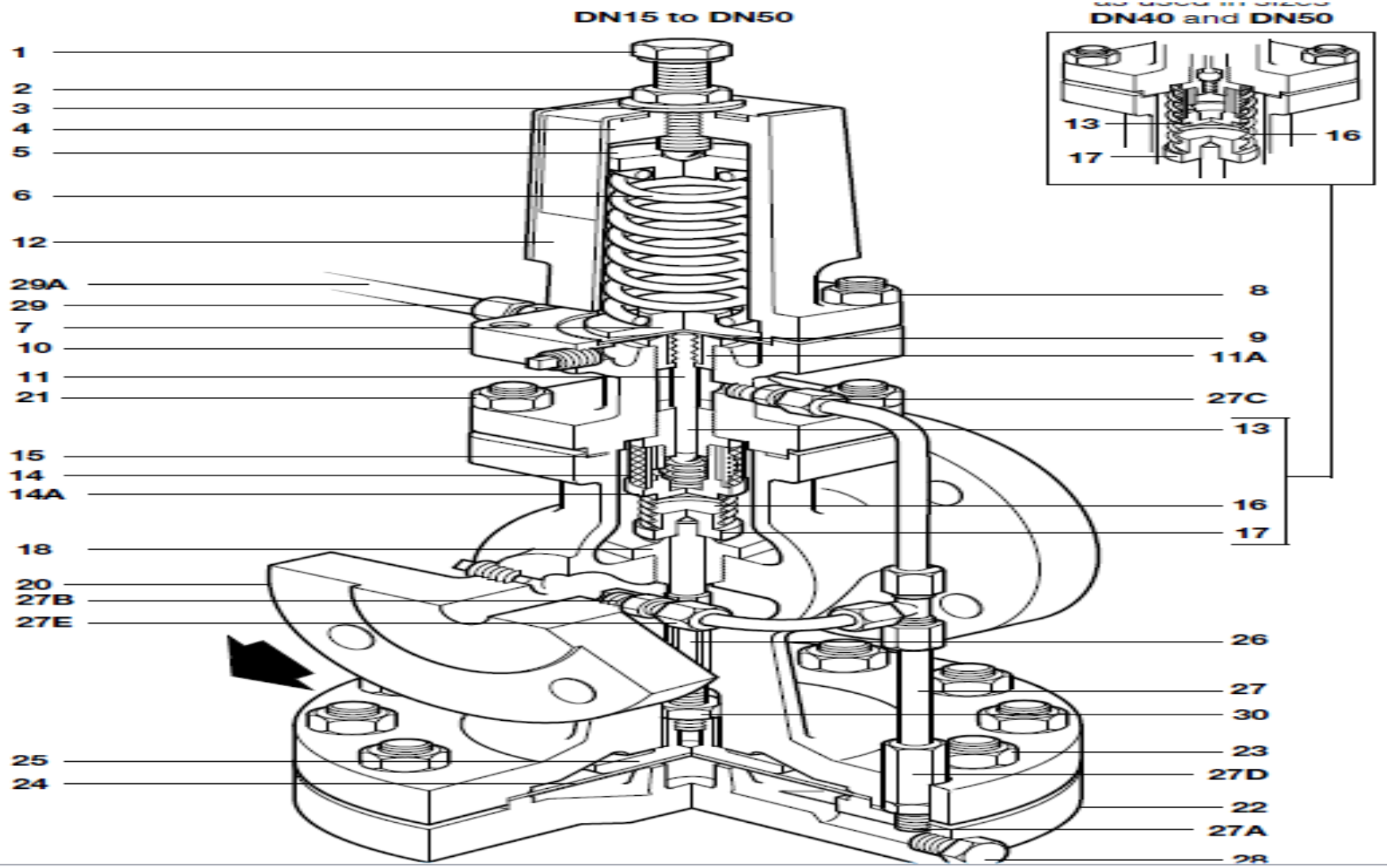
Upstream Pressure Control Valve

- Self regulating control valves are valves that regulate the pressure of a line constant by either opening or closing using a feedback from the process as its drive. The pressure regulating position of the pressure regulating element of the pressure regulating unit is regulated on the basis of the predetermined functional relationship between the pressure regulating position of the pressure regulating element and the controlled pressure so that the pressure regulating element is positioned properly to regulate the controlled pressure to the set pressure. The self-regulated pressure control valve is capable of controlling the controlled pressure at a high response speed.

Applications…..???

- These valves are used in different industries like nuclear power plant, Hydraulic power plant, oil industry, and HVAC systems etc.
- These valves are used for the control of gases, steam and water system control.
- These valve may Hydraulically, pneumatically, or electrically operated valves.
- Following figures gives their detail description.

Upstream Pressure Control Valve



Upstream Pressure Control Valve

- Names of the main parts those were labeled are:

(1) adjustment screw
(2) adjustment lock-nut
(3) washer
(5) top spring plate
(6) adjustment spring
(9) Pilot diaphragms
(13) Pilot valve and seat unit
(14) Internal strainer
(17) main valve
(18) Main valve seat
(24) Main diaphragms

INTRODUCTION

SELF CONTROL VALVE (PRESSURE DIFFERENCE CONTROL)

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Differential Pressure Control Valves

The use of Differential Pressure Control Valves is essential in:

- Modern hydronic systems.
- They provide **dynamic balancing** to **react** to pressure changes from the pump and to keep **constant pressure** in the circuits.
- This constant circuit pressure enables the system to **balance** and be **accurately controlled**.

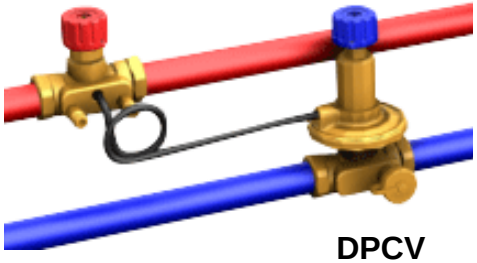
The **outcome** of using DPCV's is:

- -Good control whether the system is running at **full** or **partial capacity**
- -**High** control valve **authority**
- -Improved **user comfort**
- -Maximised pump **energy savings**

DPCV's are installed on the **return pipe** of the circuit. **partner valve** are used on the **flow pipe**.

An **impulse tube** is installed from the **partner valve** to the **DPCV** and allows the **flow** pressure to act upon the top of the **valve diaphragm**

Partner Valve



DPCV

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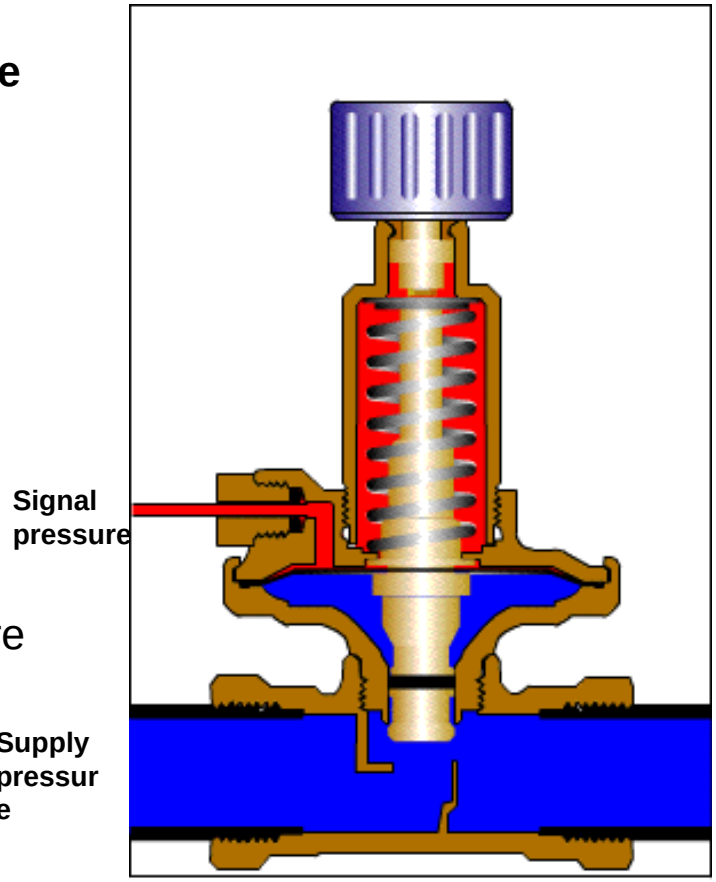
Differential Pressure Control Valves

- The **return** pressure acts upon the **underside** of the diaphragm.
- The **spring** within the valve is set by the installer, using an allen key, to deliver a **set circuit pressure loss**.
- The diaphragm along with the spring **act together** to react to system changes and to keep this **constant pressure loss**.
- So as the system pressure **rises,** the diaphragm moves the **valve cone down**, to keep a **controlled circuit pressure**.
- The signal pressure is the any desire pressure that we want to maintain.



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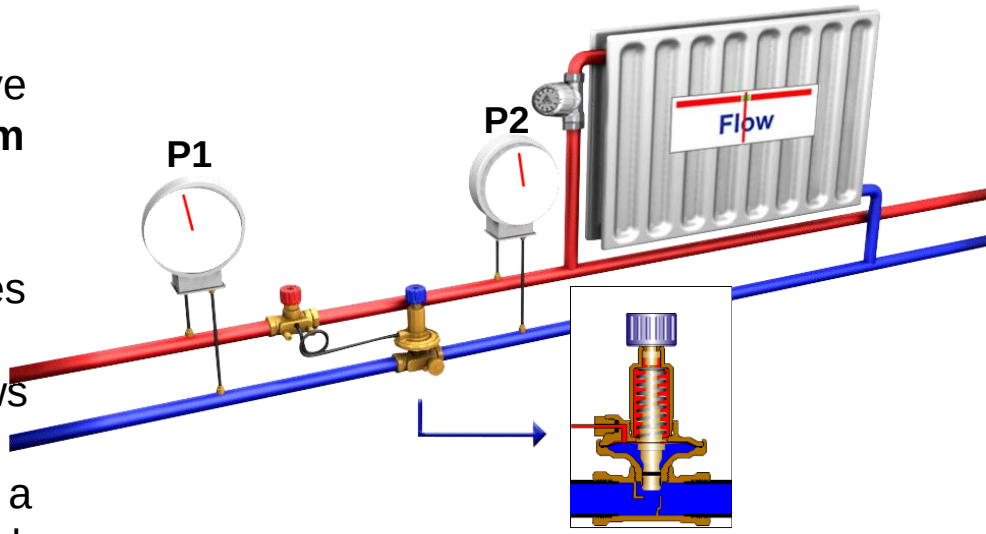
Differential Pressure Control Valves

- The pressure in the system (P1) is **variable** as the pump **modulates** to match the systems requirements.
- As the Differential Pressure Control Valve **detects a change** in the variable **system pressure** it reacts to keep a constant circuit pressure (P2).
- This constant pressure in the circuit gives the radiators a **controlled flow**.
- The controlled flow to the radiators allows the
- Thermostatic Radiator Valve to achieve a **controlled temperature**. This controlled temperature **improves comfort** for the users.
- capable of handling valve pressure losses as **high as 250 kPa**.



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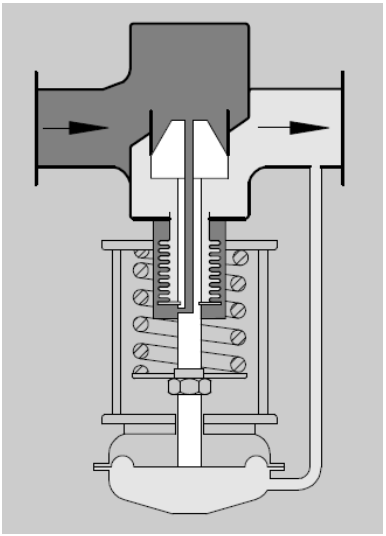
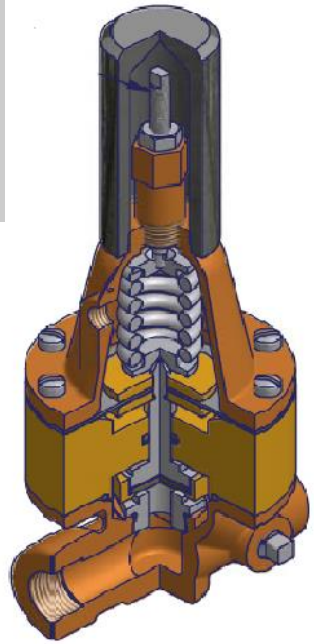
Differential Pressure Control Valves

- By using at each terminal, we create a **self balancing system** with every coil receiving only its desired flow.
- By combining the control and balancing valve we **more than half** the number of valves installed,
- and **reduce commissioning time** by up to 2/3's
- Variable flow systems are used to improve the **energy**
- **efficiency** of heating and cooling systems.
- The **spring** within the valve is set by the installer, using an allen key, to deliver a set **circuit pressure loss**.
- The **diaphragm** along with the **spring act together** to react to system changes and to keep this constant pressure loss.





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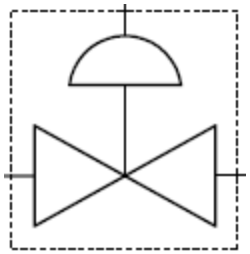
Self Control Valve (Pressure Difference Control)

Introduction



- Self actuated pressure control valves do not depend on any external signal for pressure control. As the name suggests, pressure in the process line itself is used as an actuating signal to open or close the pressure control valve.
- Since self-operated regulators are very reliable in fulfilling their switching and control functions, even or especially when the energy supply fails, they are ideally suited as safety equipment.
- The performance of work requires energy. Self-operated regulators withdraw this energy from the medium to be controlled.

How it Works?

- Using the medium pressure (see Fig.), the sensor unit of the self-operated regulator builds up a pressure which creates the required positioning forces on an actuator diaphragm or a so-called operating element.

How it Works? (Continued..)

- The high pressure line is connected to the diaphragm housing via C1 and the low pressure line to the diaphragm housing via C2. Any change of differential pressure across the diaphragm which is connected to the valve mechanism above or below the set point will cause the diaphragm to change its position.

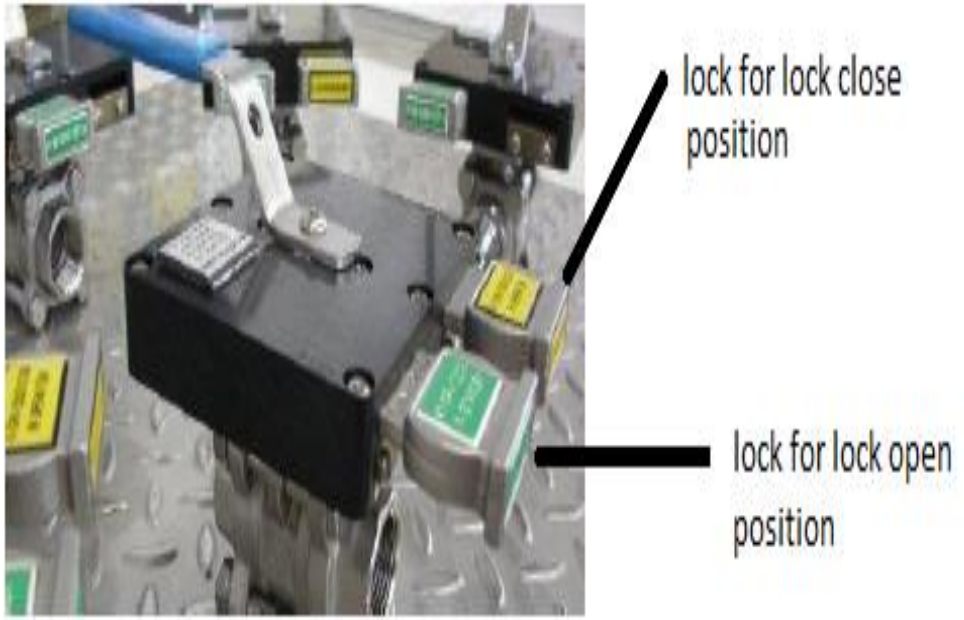
How it Works? (Continued..)

- If higher than set pressure the valve will move to close, if lower than set pressure the valve will move to open, until the system is once again in balance.

Locked Close/Open Valve

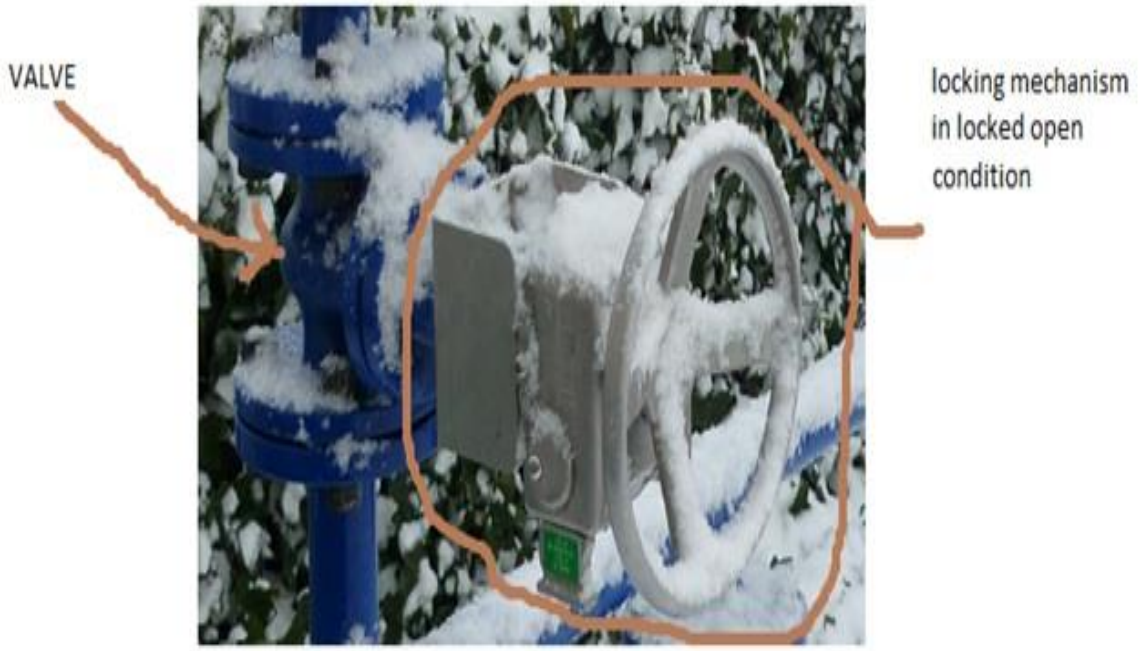
- Symbol

- Valve lockout devices block access to valves, keeping them in the closed or open position. Lockout devices ensure employees are kept safe around equipment.
- If the valve is opened and locked, the valve is called as locked open valve.
- If the valve is closed and locked, the valve is called as locked close valve.



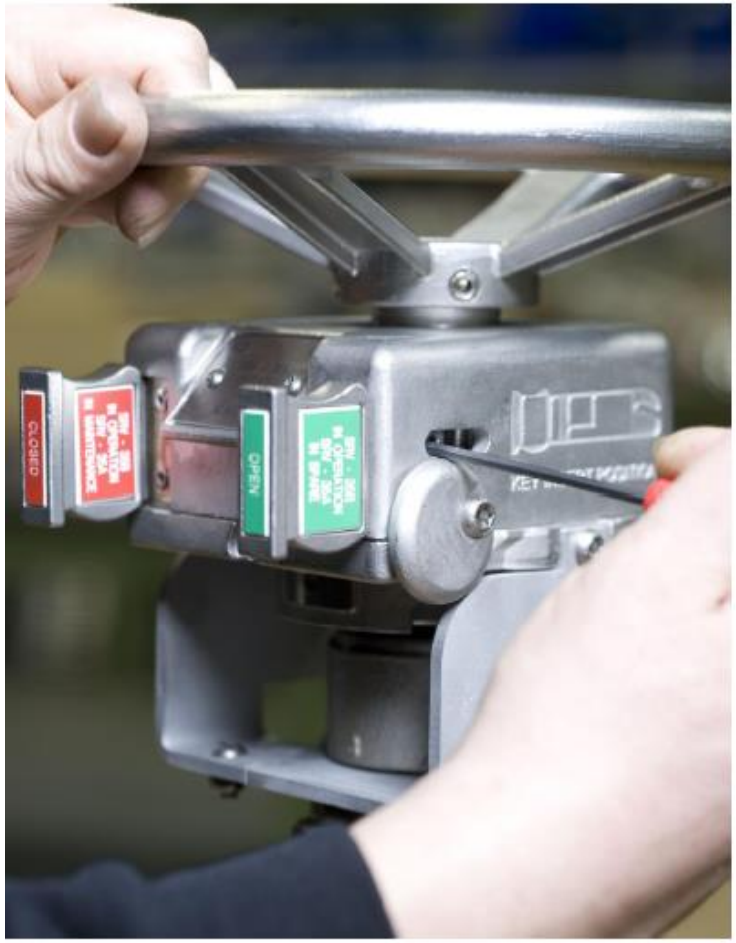
Locked open/close valve

It may be Ball Valve, Gate Valve, Universal Valve, Butterfly Valve with exception that the valve is locked in open or closed condition by using a locking mechanism according to requirement.



Multi Rotation Lock(MRL)

- The Multi Rotation Lock (type MRL)is one of the manually locking mechanisms and is suitable for all hand wheel-operated valves like gate-, globe- and gearbox-operated valves.
- The MRL can be mounted without any alteration to the host valve, and the characteristics of the valve remain unchanged.
- The lock is installed as an integral part of the valve, with the
- original hand-wheel removed and replaced with a new, same sized Stainless Steel hand wheel.



Advantages

- It is used where high level of safety is required.
- Robust, reliable and simple design with a minimal amount of parts.
- Mounting can be done without shutting down the plant or making modifications to the valve.
- Help full in avoiding the accidents due to the fault of operator.