Process Valves

- Types
- Classification
- Materials of Construction
- Operations
- Identification
- Uses and Limitations
- Faults
- Variations

What are Valves used for ?

- **Regulating** – Control of flow, pressure or volume
- **Isolation** – Complete shut off
- **Non return** – Allow flow in one direction and prevent back flow
- **Safety relief** – Safe discharge to prevent over pressurisation of equipment (eg: boilers and compressed air systems)

Valve selection criteria

- **Temperature** – Refrigeration, superheat, ambient
- **Pressure** – Positive, vacuum,
- **Volume** – amount of product flow
- **Product** – Liquid, gaseous, slurry, powder, solid – Acidic, abrasive, corrosive
- **Method of operation** – Manual, automatic
- **Environment** – Access to operate, position (horizontal, vertical)
- **Size** – May restrict access or operability, space availability
- **Weight** – May require extra or independent support

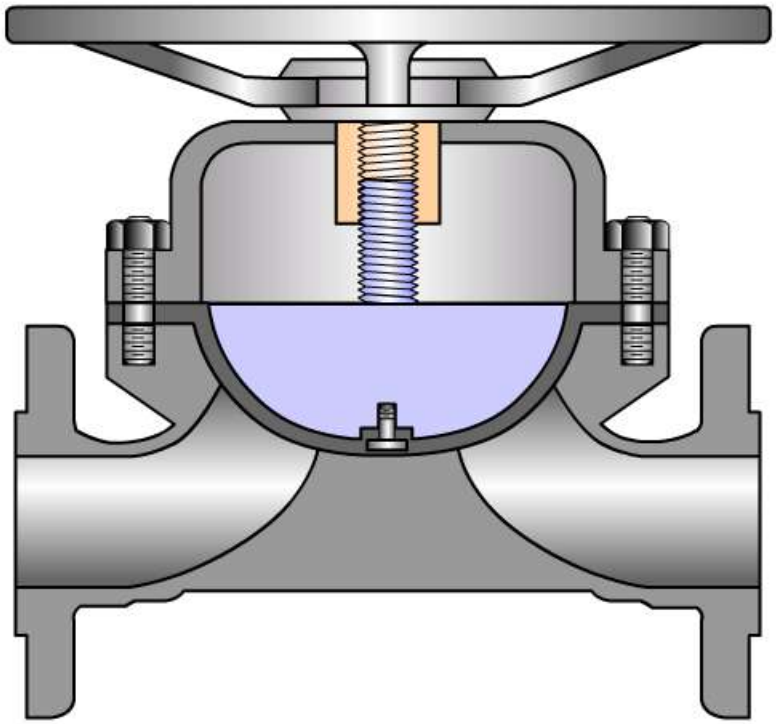
Valve types - manual

1) Diaphragm
2) Plug
3) Slide
4) Globe
5) Ball
6) Butterfly
7) Needle
8) Check – non return
9) Safety relief
10) Rotary - Star

Diaphragm Valve

VALVE TYPES
DIAPHRAGM VALVES

3D model



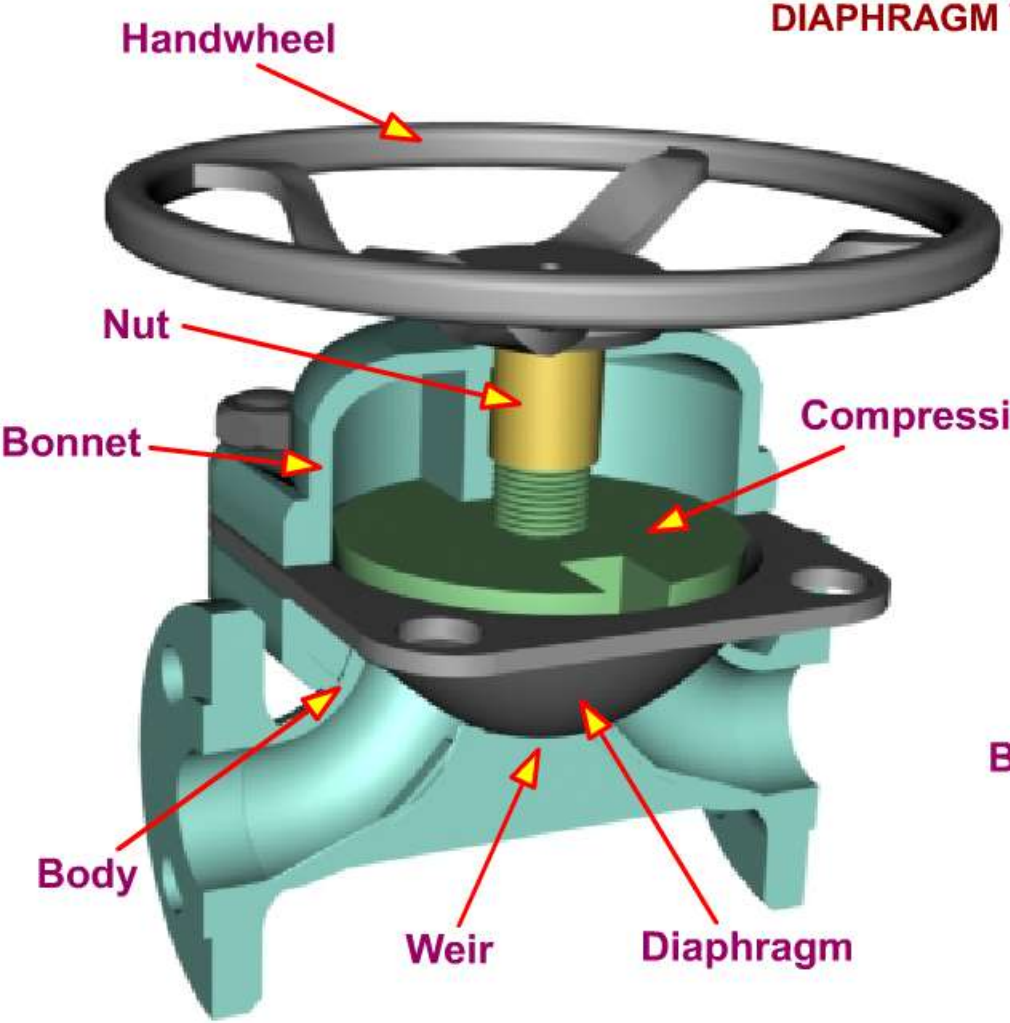
2D cross-section

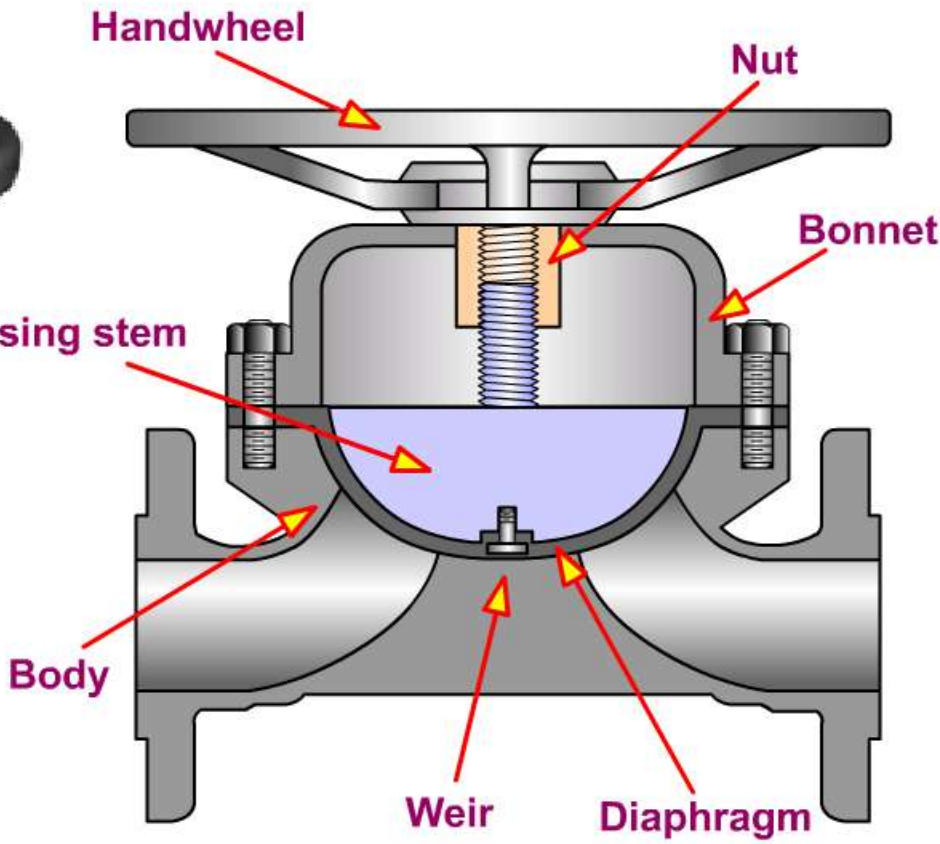
A typical model and the 2D cross-section of a diaphragm valve is illustrated.

Diaphragm valves are suitable for moderate throttling applications and offer several advantages over other valves in low pressure applications. The fluid passage is smooth and streamlined, which minimizes the pressure drop. The valve exhibits excellent leak-tight properties, even when conveying liquids containing suspended solids.

VALVE TYPES

DIAPHRAGM VALVES

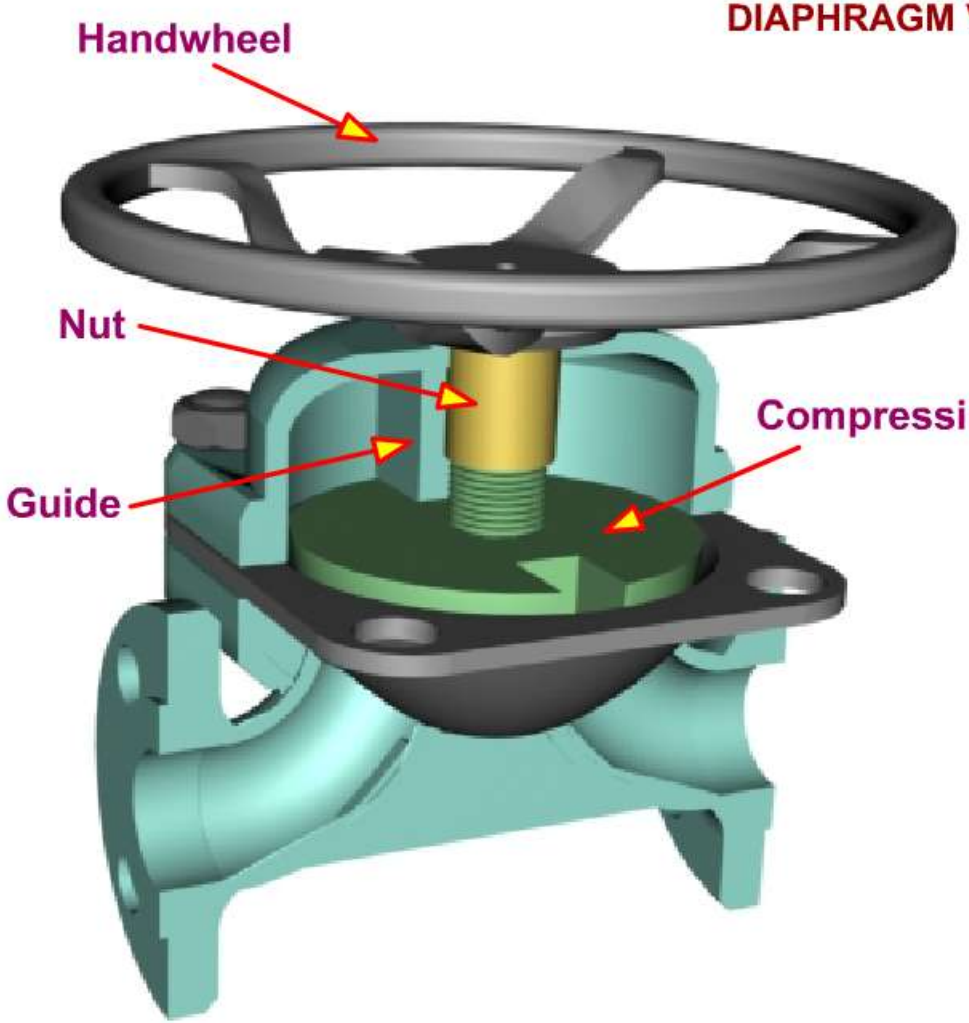


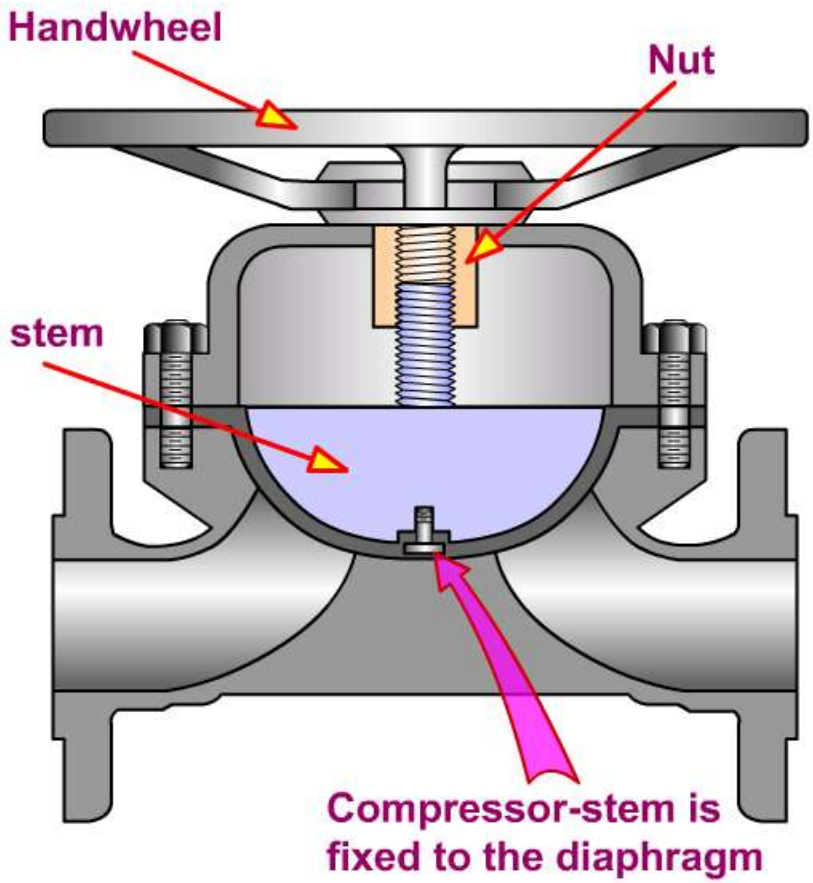


The valve consists of a rigid body formed with a weir placed in the flow-path, a flexible diaphragm which forms the upper pressure boundary of the valve, a stem which compresses the diaphragm against the weir, bonnet and handwheel.

VALVE TYPES

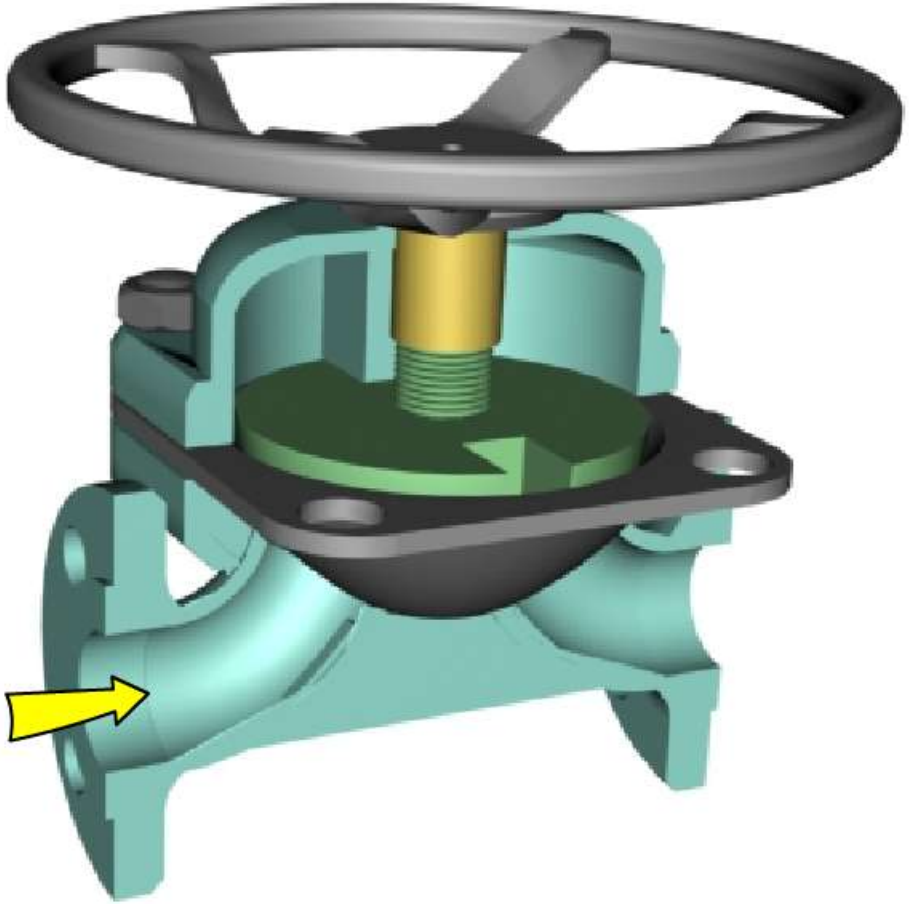
DIAPHRAGM VALVES

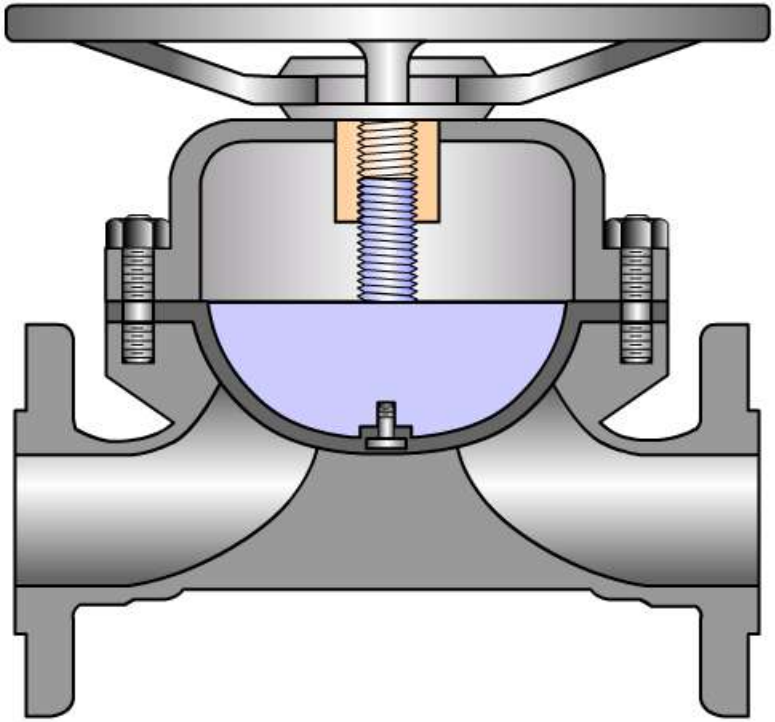




In the arrangement, the handwheel is positively locked with the nut. The compressor-stem screws into the nut and is fixed to the diaphragm at the compressing end. The compressor-stem traverses along suitable guides in the body. Thus when the handwheel is rotated, the nut also rotates and the compressor-stem moves up and down.

VALVE TYPES
DIAPHRAGM VALVES

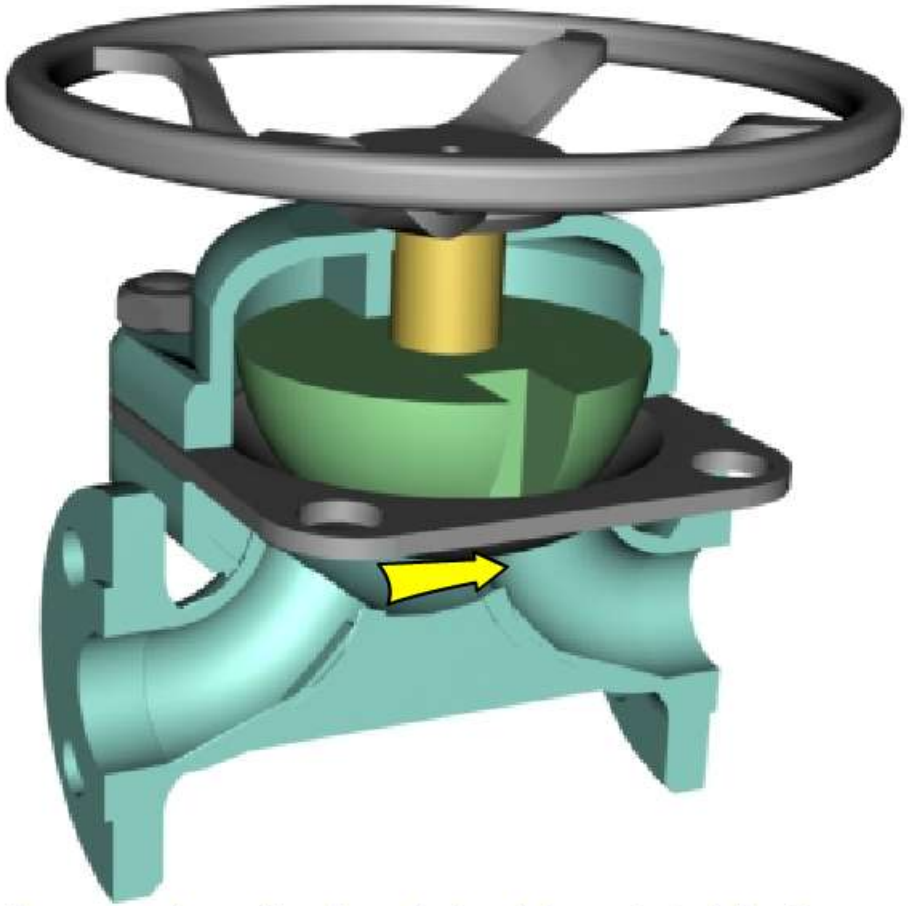


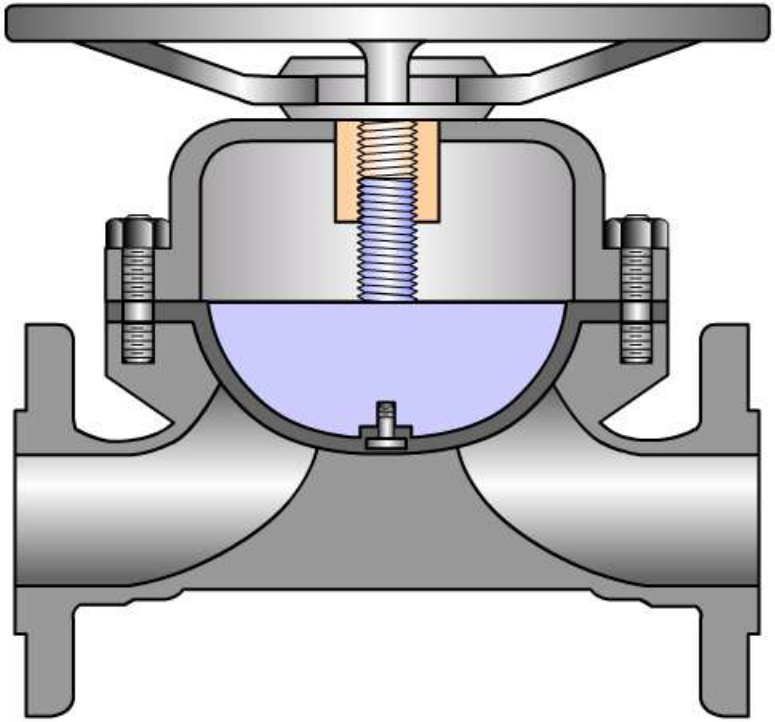


Depiction shows the closed position of the valve. The compressor-stem presses the diaphragm against the weir thus stopping the flow.

VALVE TYPES

DIAPHRAGM VALVES

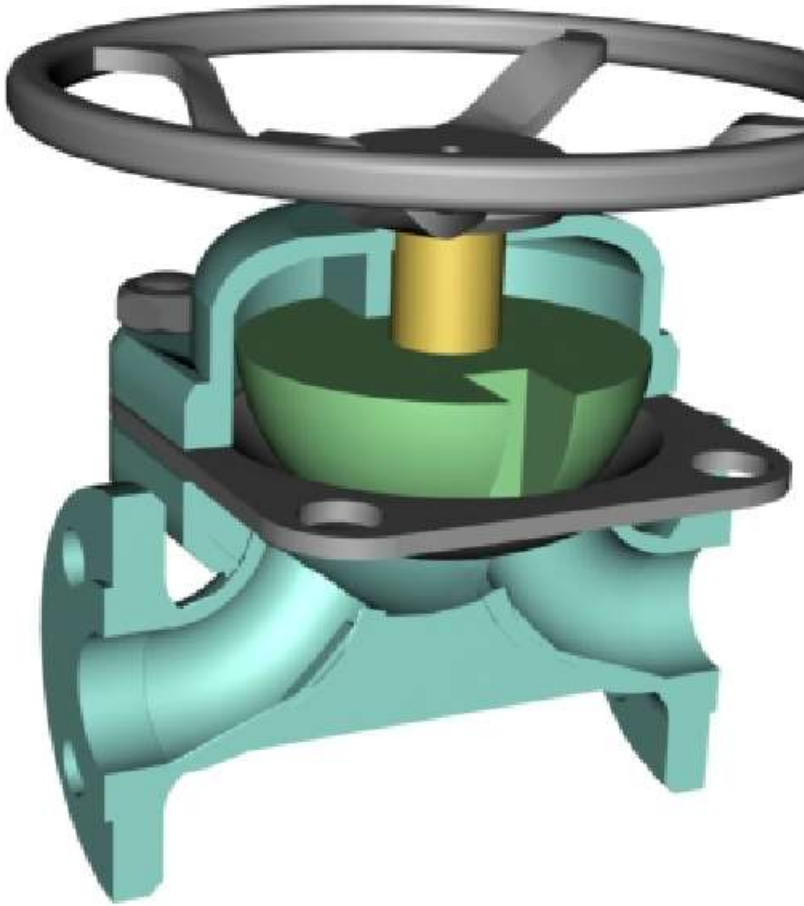


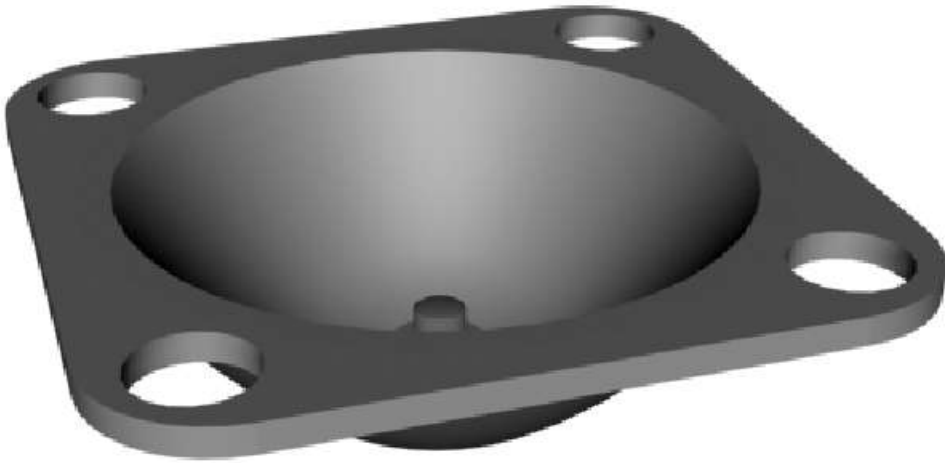


As shown, when the handwheel is rotated in the anti-clockwise direction, the compressor stem moves upwards and pulls the diaphragm along with it thus opening the valve.

It should be noted that the fluid stream is completely isolated from the valve-working parts, which prevents contamination of fluid and corrosion of operating mechanism. There is no leak path around the valve stem and this feature makes the valve very useful in services where leakage into or out of the system cannot be tolerated.

VALVE TYPES
DIAPHRAGM VALVES





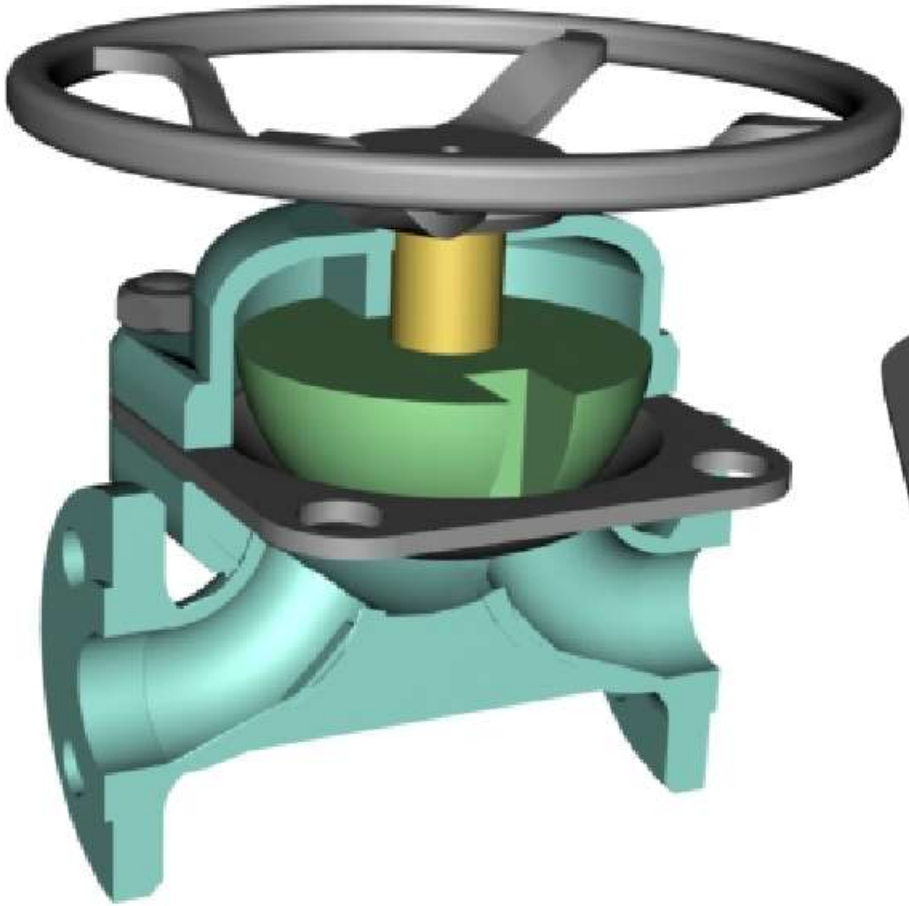
Diaphragm - closed position

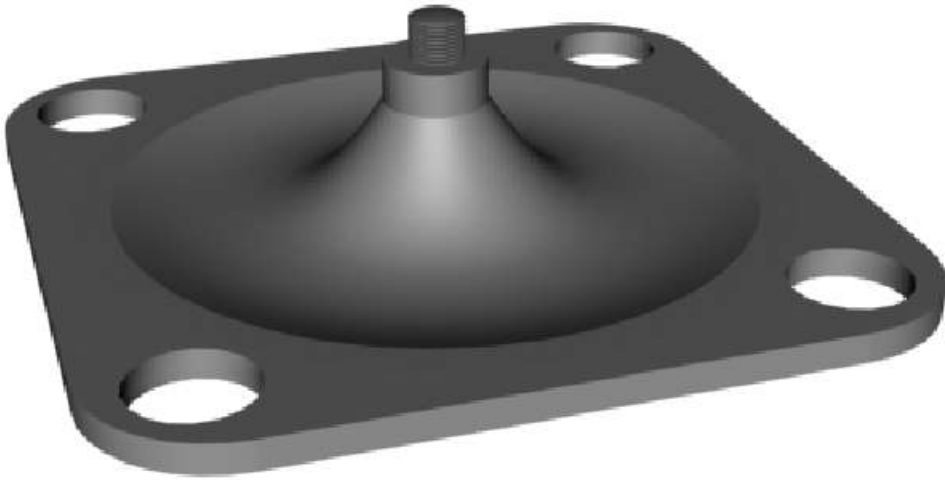
An enlarged view of the diaphragm, in the closed position of the valve, is shown.

The maximum pressure the valve can be subjected to is a function of the diaphragm material and service temperature. Also the system hydrostatic test pressure must not exceed the maximum pressure rating of the diaphragm.

VALVE TYPES

DIAPHRAGM VALVES





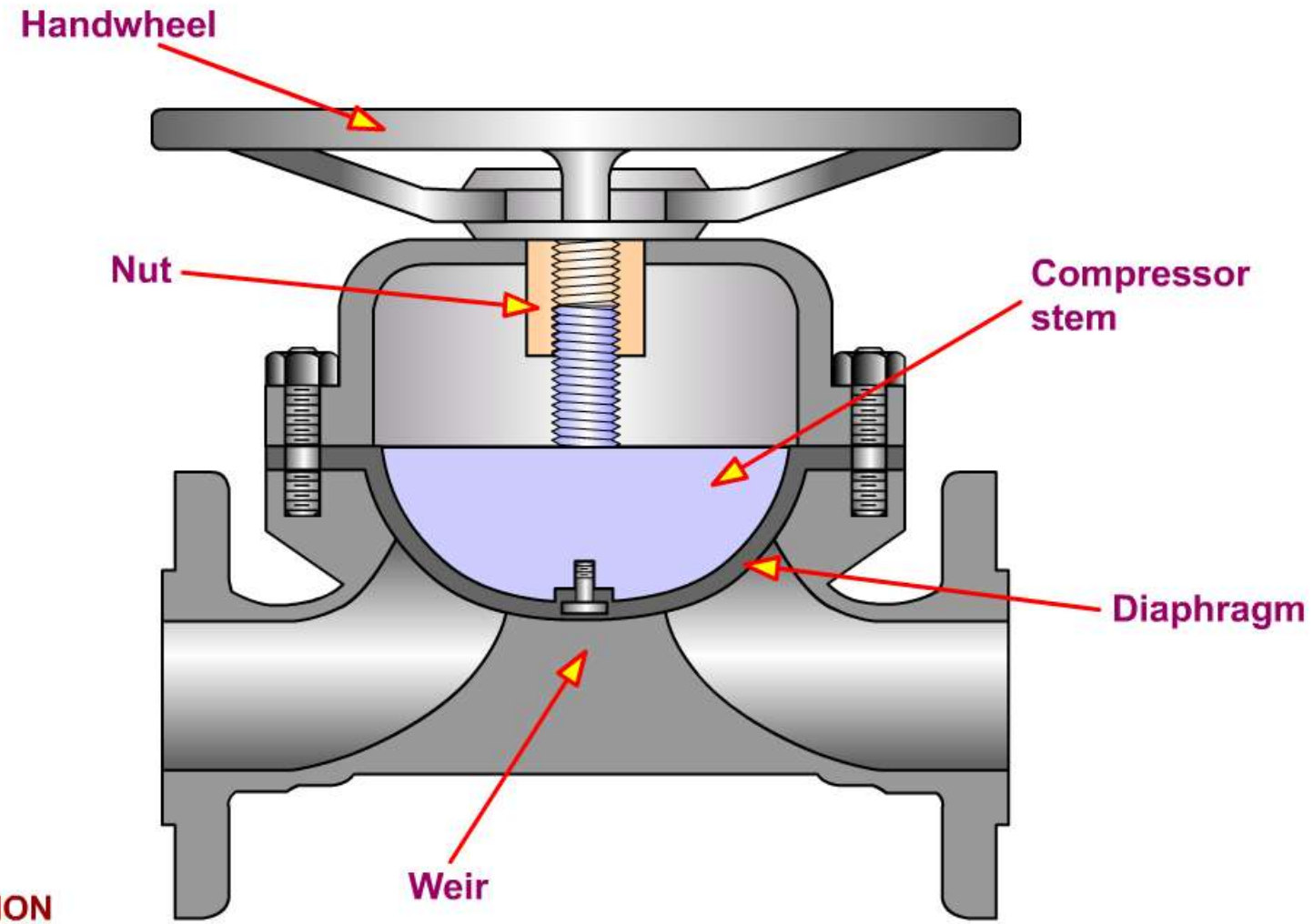
Diaphragm - open position

The working of the diaphragm is depicted.

As shown, the diaphragm is pulled upwards by the compressor-stem, towards opening the valve.

VALVE TYPES

DIAPHRAGM VALVES



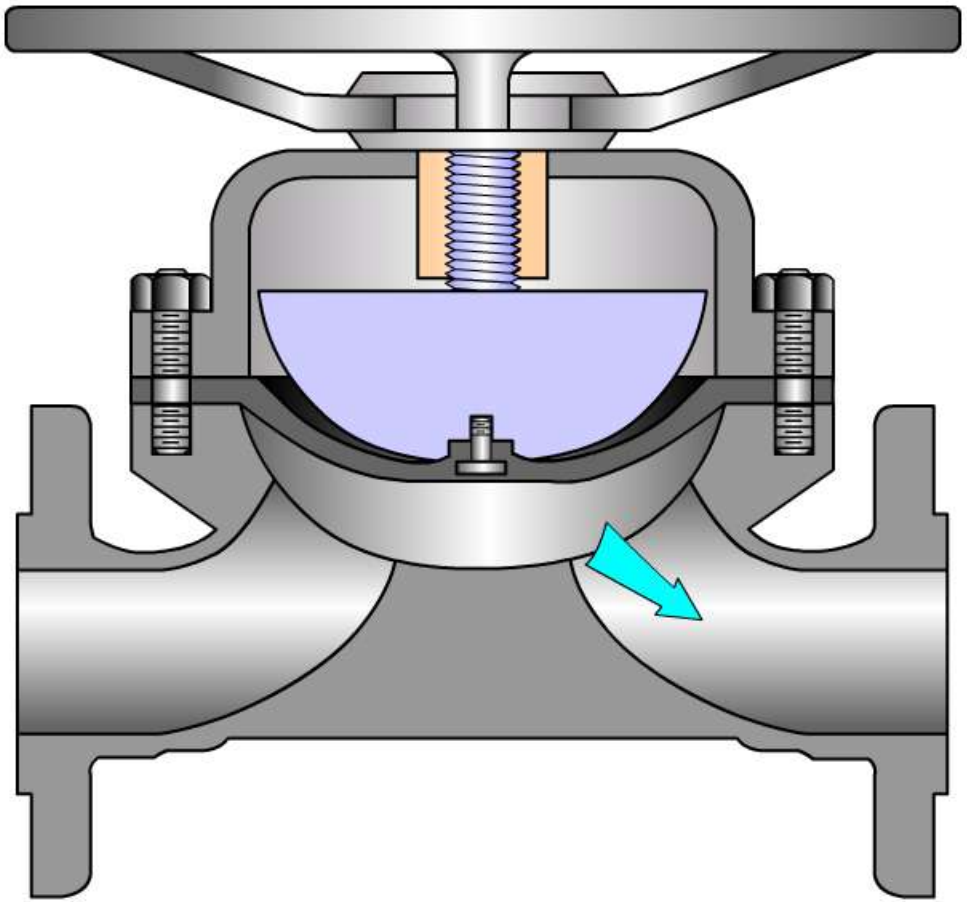
VALVE OPERATION

Let us observe the operation of the valve in its 2D cross-sectional view.

Depiction shows the closed position of the valve.

VALVE TYPES

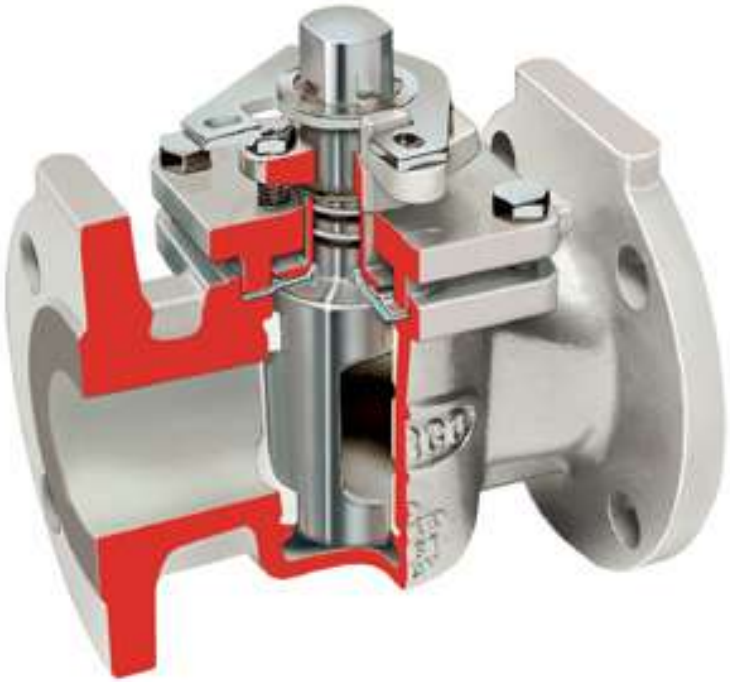
DIAPHRAGM VALVES



VALVE OPERATION

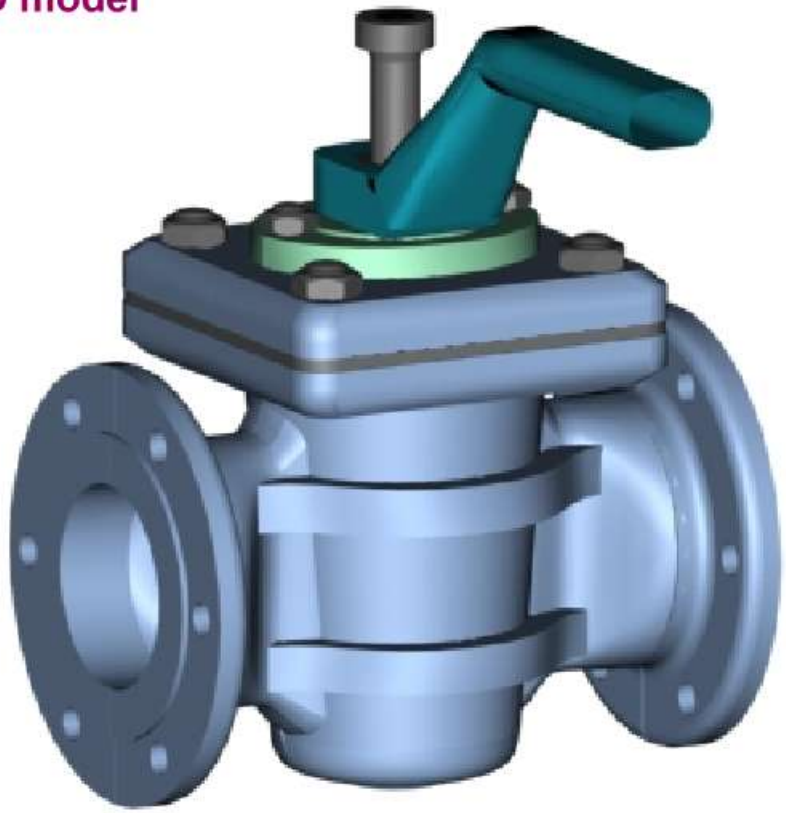
When the handwheel is rotated in the anti-clockwise direction, the nut screws onto the compressor stem, which moves upwards. The compressor stem pulls the diaphragm upwards, along with it, thus opening the valve.

Plug Valve

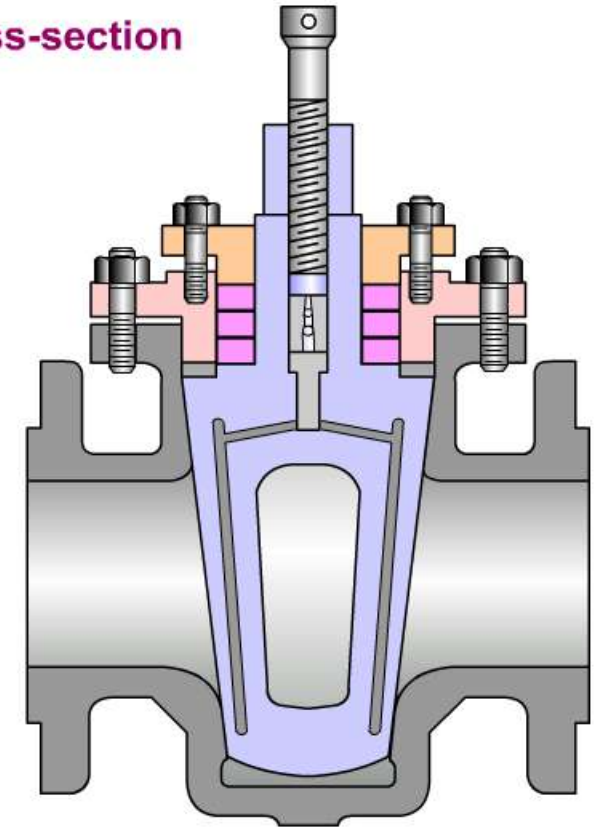


VALVE TYPES
PLUG VALVES

Valve -
3D model



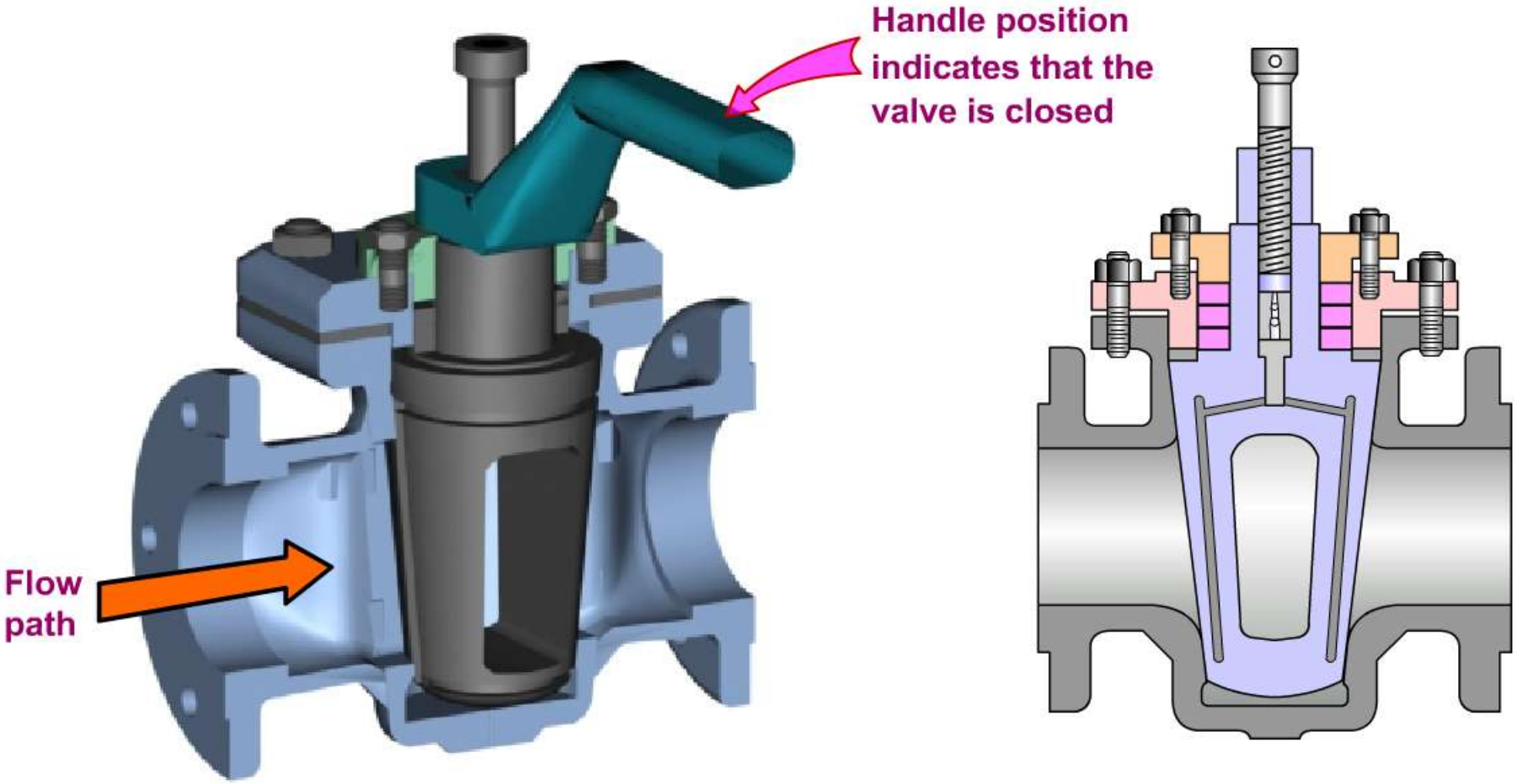
Valve -
2D cross-section



A typical model and the 2D cross-section of a plug valve is illustrated.

Plug valves, also called cocks, are generally used for the same full flow service as gate valves where quick shutoff is required. They are used for steam, water, oil, gas, and chemical liquic service. Plug valves are not generally designed for the regulation of flow. However, in some applications, like gas-flow throttling, specially designed plugs are used.

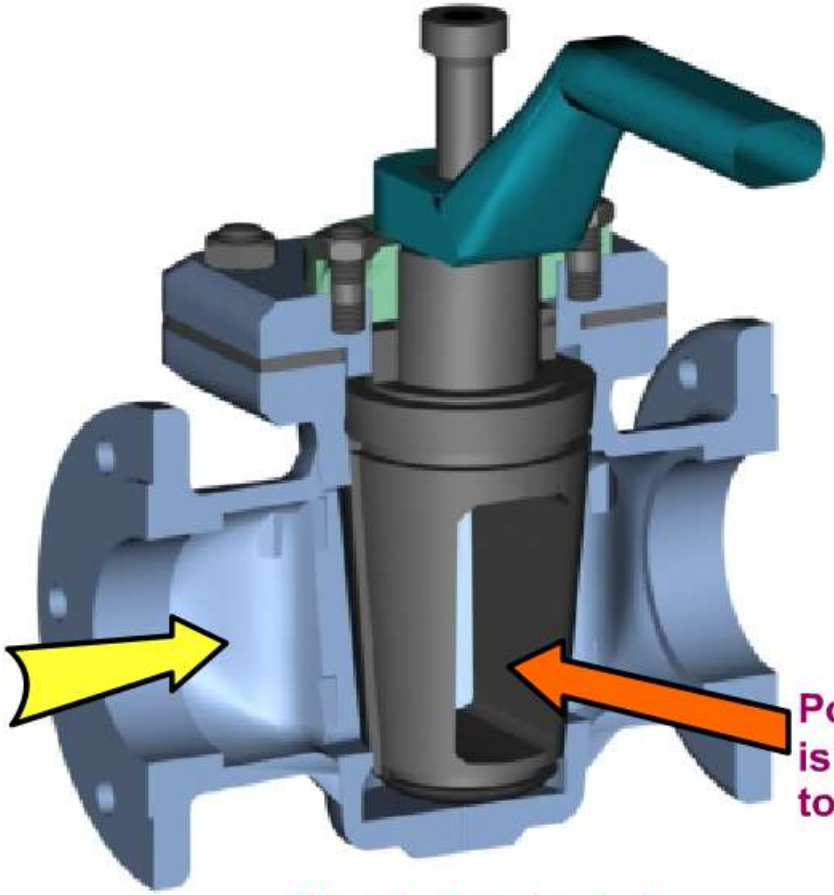
VALVE TYPES
PLUG VALVES



Depiction shows the closed position of the valve.

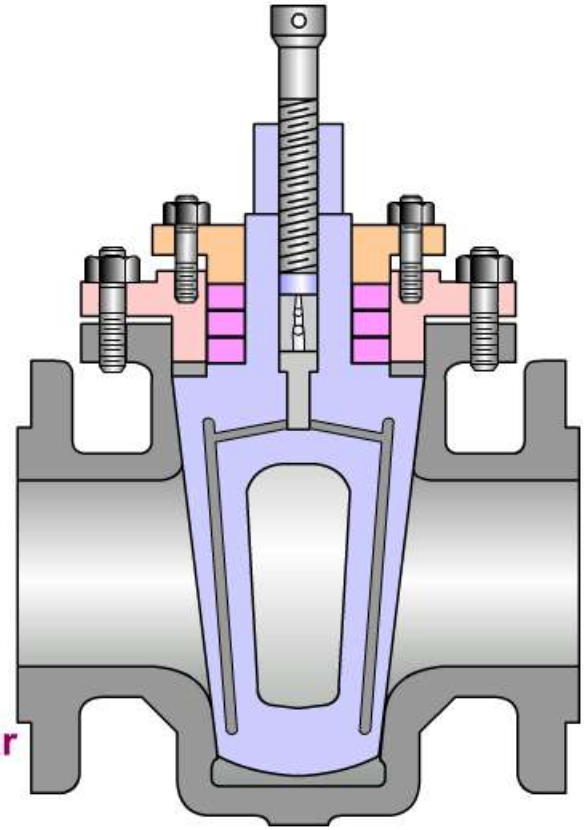
If the position of the handle is across (perpendicular) the direction of flow, it generally indicates that the valve is closed.

VALVE TYPES
PLUG VALVES



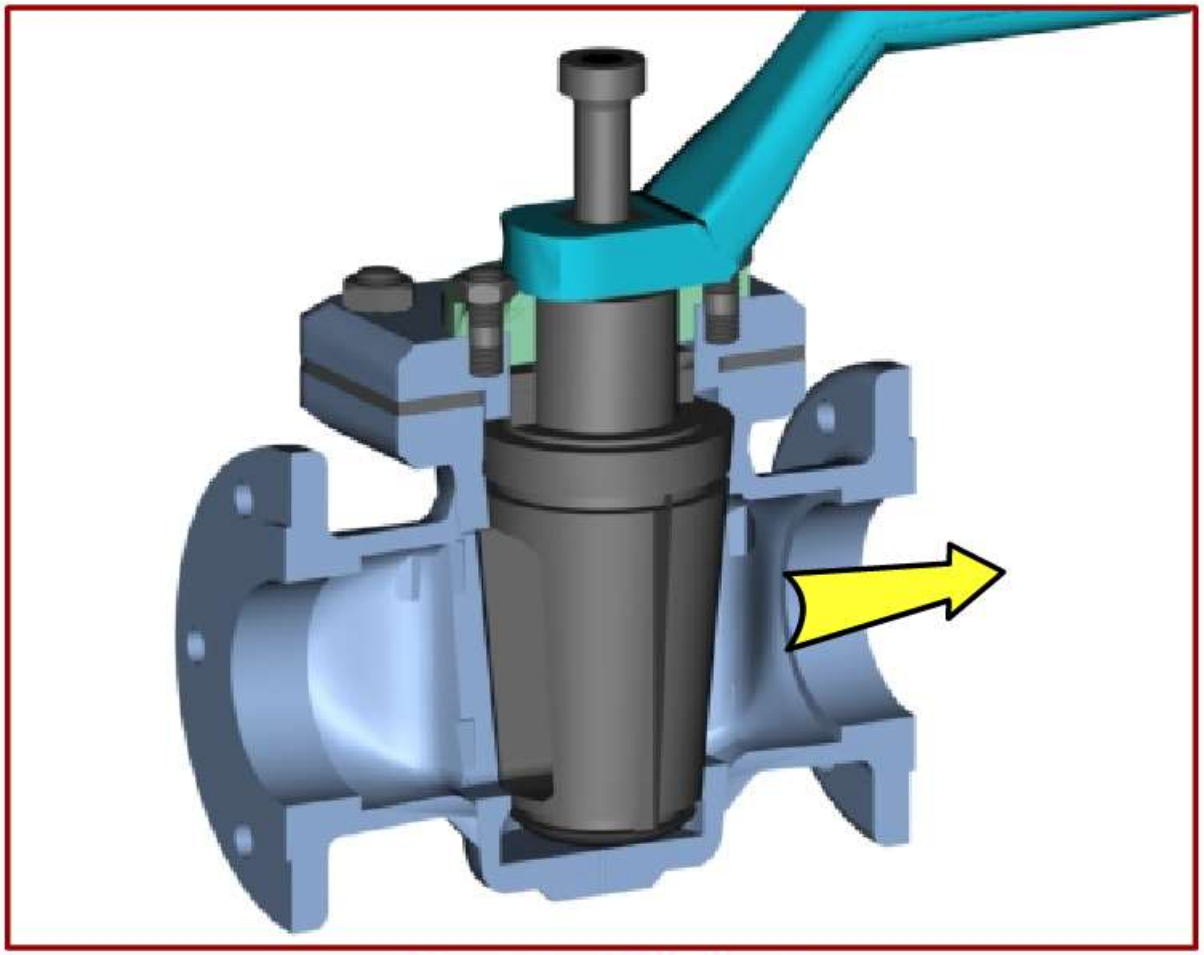
Flow is terminated

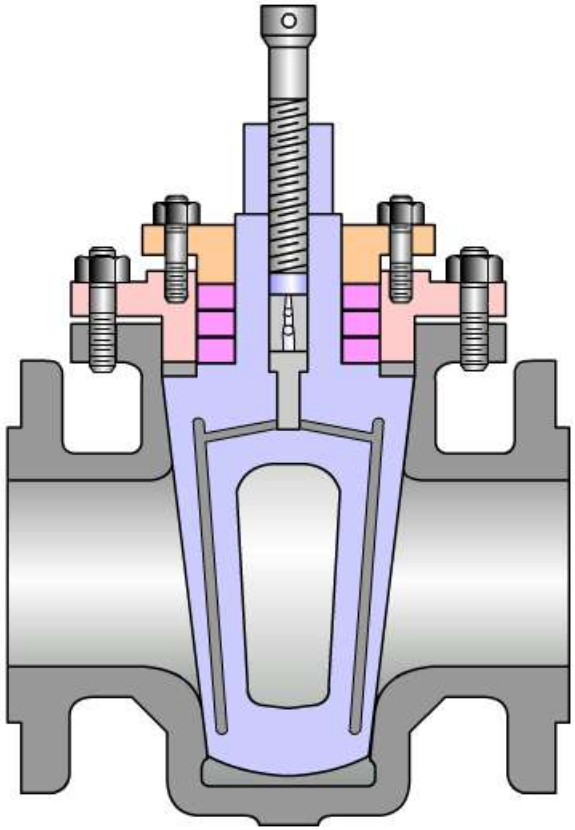
Port opening
is perpendicular
to flow path



As shown, the flow is terminated when the port opening is positioned perpendicular to the flow path.

VALVE TYPES
PLUG VALVES

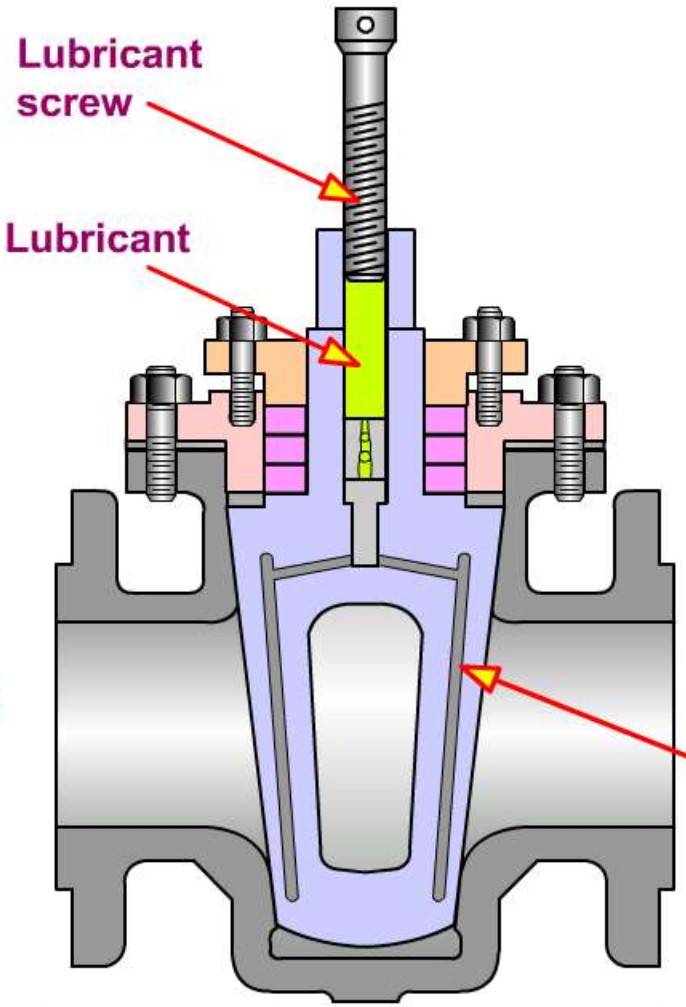




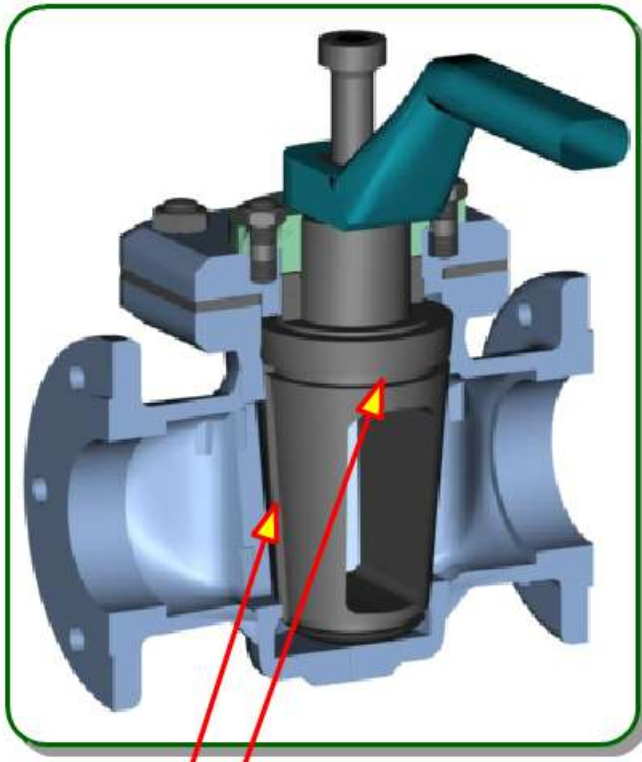
Flow is established

The valve is opened by rotating the plug a quarter turn in the anti-clockwise direction, and the flow is established. Full flow is obtained when the opening of the port is aligned parallel to the direction of the flow.

VALVE TYPES
PLUG VALVES



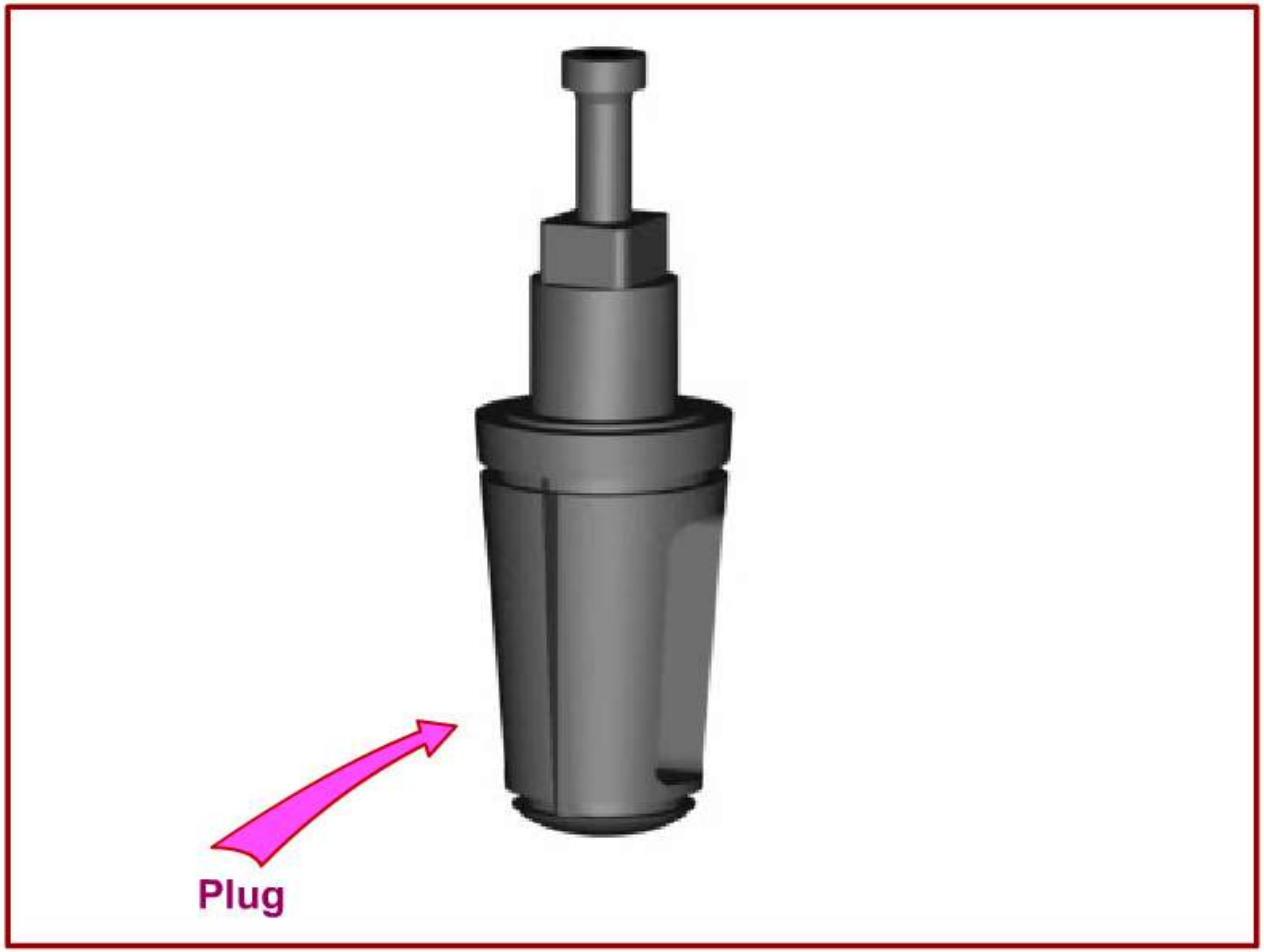
Cross-section of a typical lubricant seal valve



Channels for lubricant

Major types of plug valves involve lubricated and non-lubricated designs.
In lubricant-seal valves, ports are surrounded by channels for the admission of the lubricant, which ensure positive sealing against internal or external leakage. A momentary jacking action provided by lubricant pressure developed by turning the lubricant screw or with a pressure gun, makes it easy to turn the plug.

VALVE TYPES
PLUG VALVES

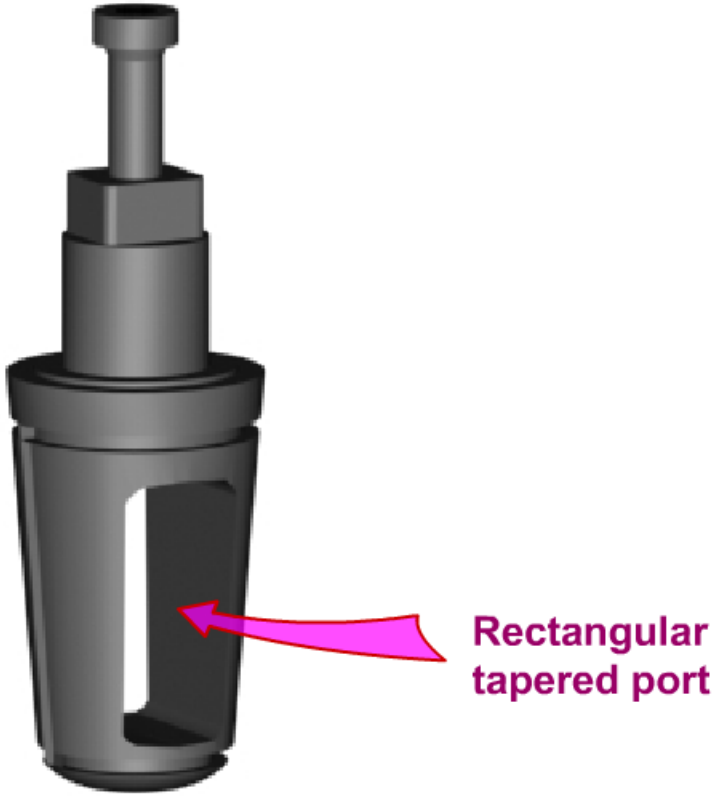


The plug is seen on a walk around.

The body and tapered plug represent the essential features in plug valves. Careful design of the internal contours of the valve produces maximum flow efficiency. The port in the tapered plug is generally rectangular. However, valves with round ports are also available.

VALVE TYPES
PLUG VALVES

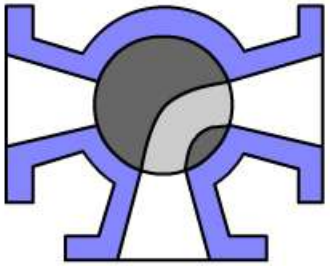
The major valve patterns or types are identified as:
a) regular
b) venturi
c) short
d) round-port
e) multiport



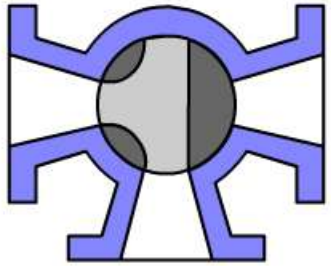
- The regular pattern employs the tapered form of port openings, the area of which is from 70 to 100 percent of the internal pipe area.
- The venturi pattern provides stream-lined flow and thus permits reduction in the port size. The port opening area is approximately 35 percent of the internal pipe area.
- The round-port full-bore pattern has a circular port through the plug and body equal to or greater than the inside diameter of the pipe or fitting.
- In several applications multiport valves provide simplification of piping and ease in operation. One three-way or four-way multiport valve can be used in place of two, three or four straightway valves.

VALVE TYPES

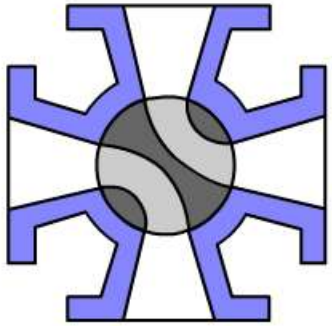
PLUG VALVES



THREE - WAY, TWO - PORT



THREE - WAY, THREE - PORT



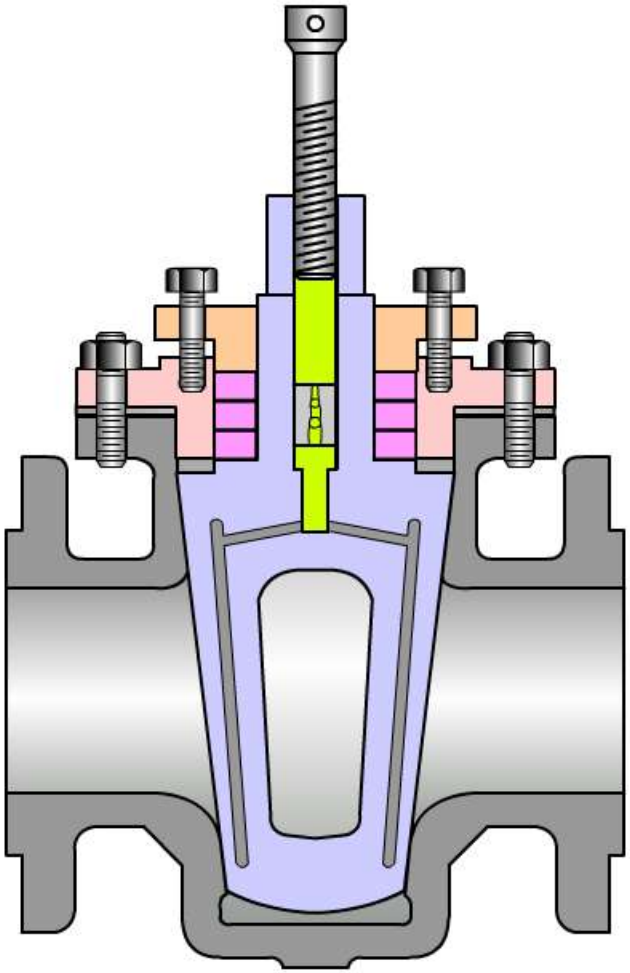
FOUR - WAY, FOUR - PORT

Schematics of three-way and four-way multiport valves have been illustrated.

Move 'MOUSE OVER' mouse icons for related flow depiction!

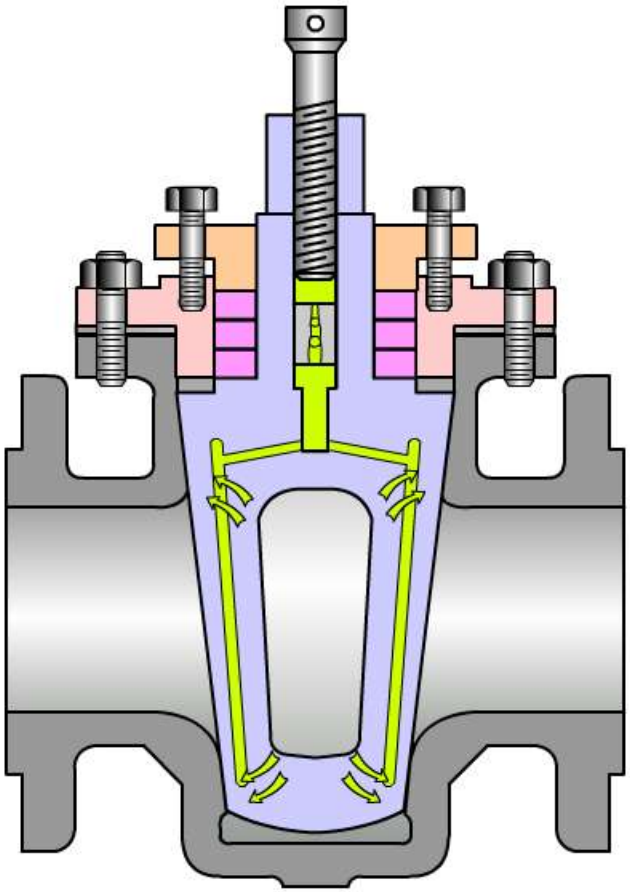
VALVE TYPES

PLUG VALVES



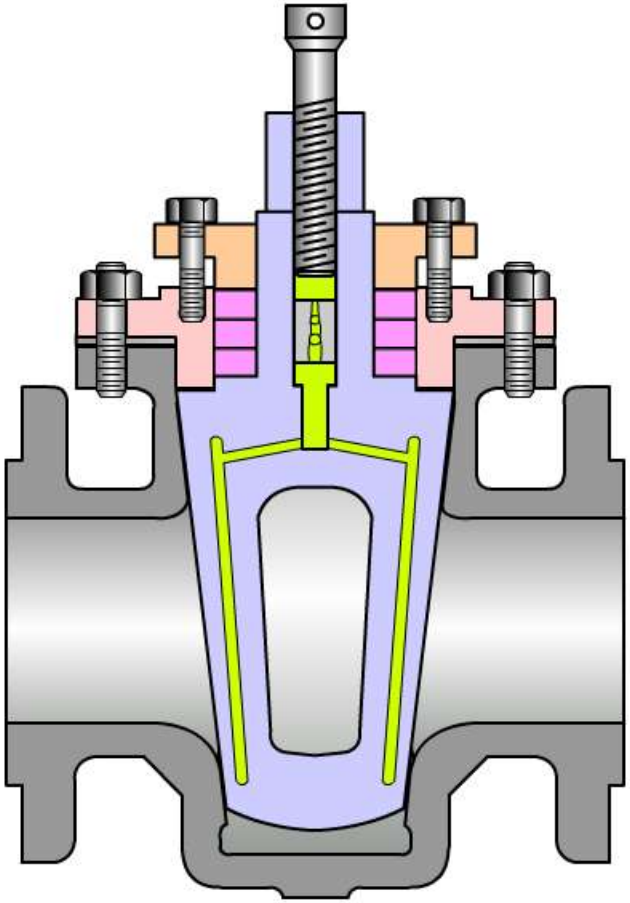
The lubricant screw is tightened and the lubricant is forced into the channel.

VALVE TYPES
PLUG VALVES



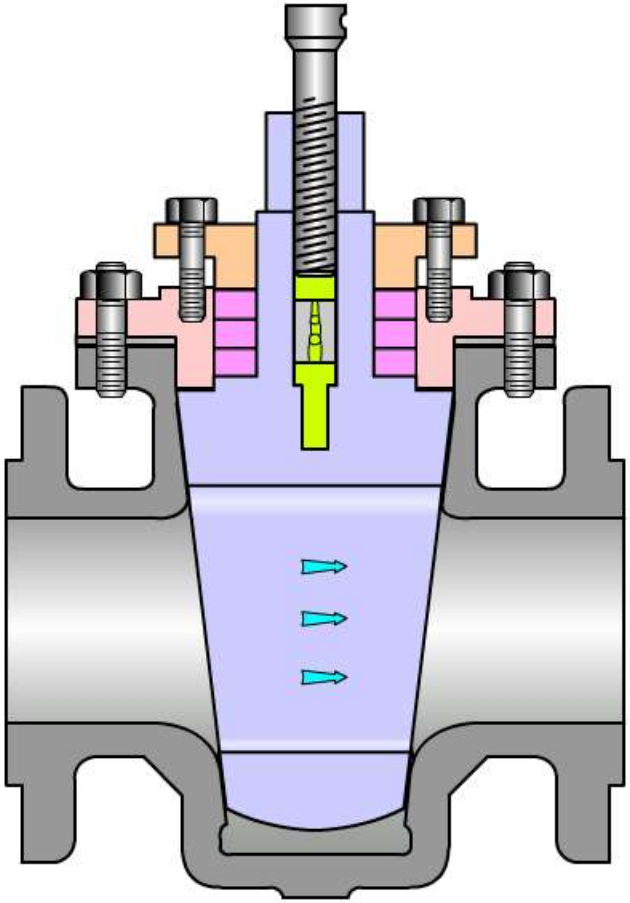
As the lubricant screw is further tightened, the lubricant is forced into the channels surrounding the port and it exerts pressure against the body of the valve.

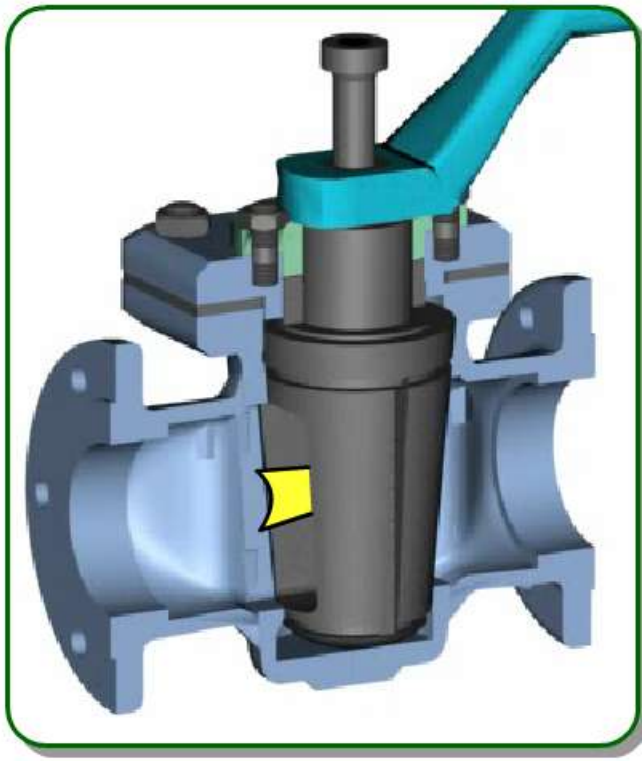
VALVE TYPES
PLUG VALVES



As a result the lubricant pressure developed exerts a powerful hydraulic jacking action on the plug, momentarily lifting it from the seat.

VALVE TYPES
PLUG VALVES





This jacking action makes it easy to turn the plug and as seen in depiction the flow across the valve is established in the open position of the plug.

VALVE TYPES
PLUG VALVES

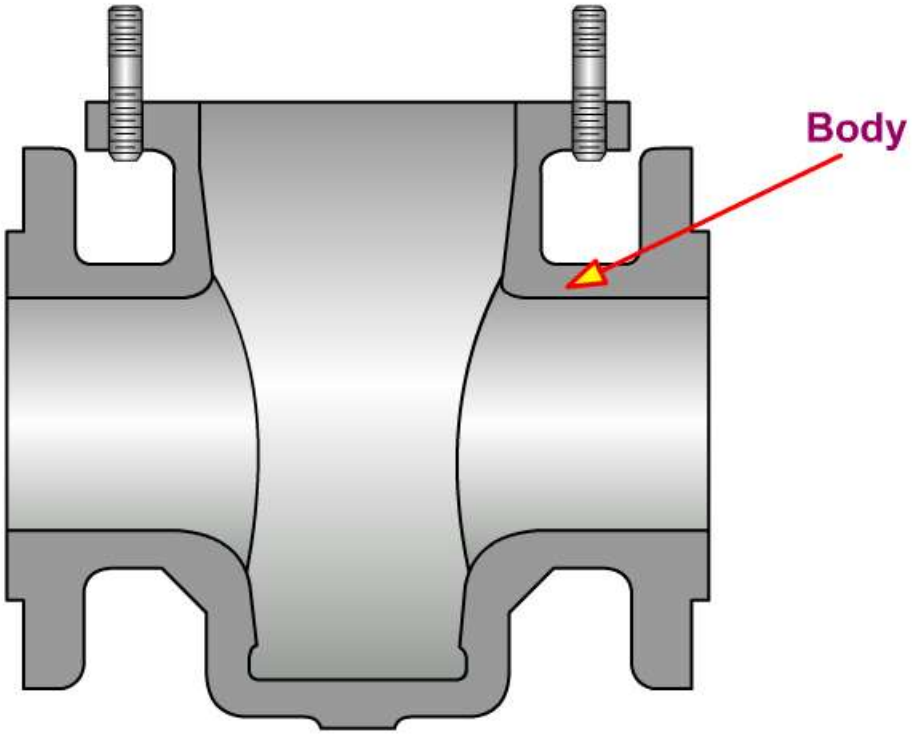
Pressure lubrication in plug valves facilitate:

- Free hydraulic action of plug by means of hydraulic action
- Maintenance of positive seal against internal and external leakage
- Free turning even of large sizes and against heavy differential pressure
- Protection of working surfaces from wear and corrosion

The lubricant plays a more important role in the efficient functioning of the valve than what the meaning generally conveys. In this sense it would be more appropriate to call the lubricant as a plastic sealant and the valve as a plastic sealed valve.

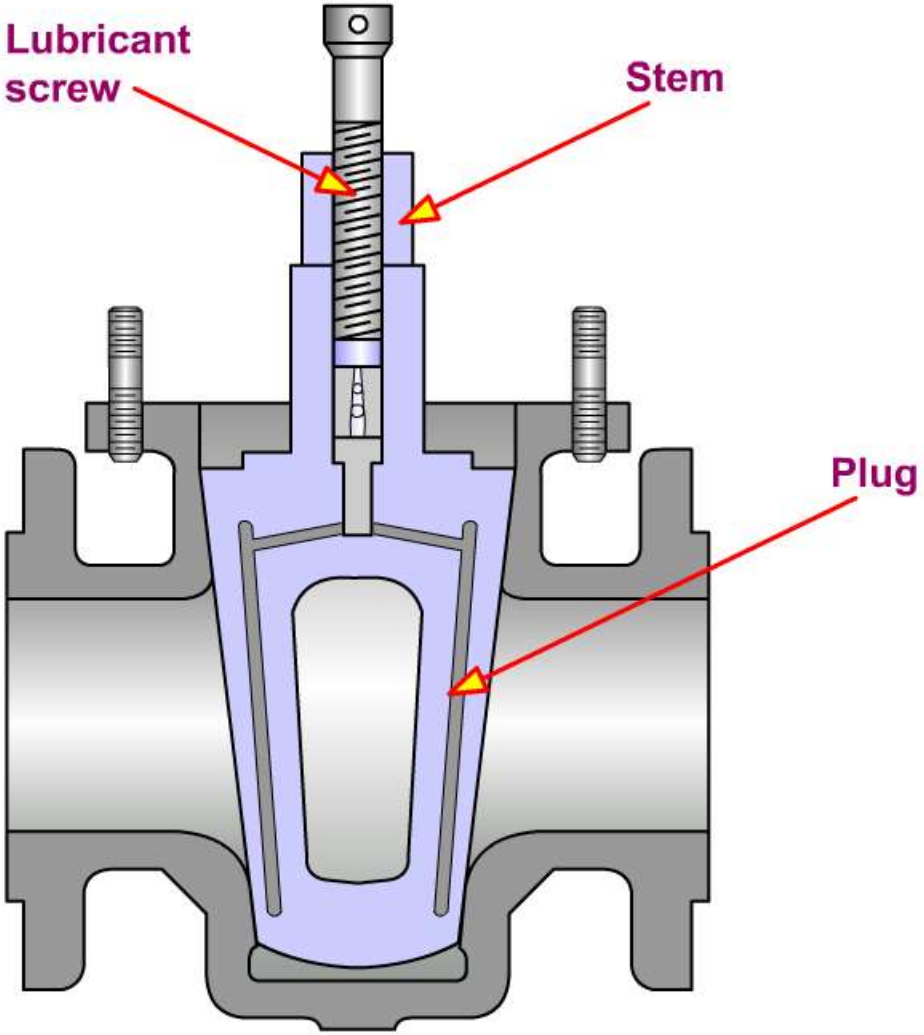
The lubricant in effect becomes a structural part of the valve, since it provides a flexible and renewable seat. This eliminates the necessity of "force fits" and metal-to-metal "distortable seat" contacts to effect a seal. The proper elasticity and resistance to chemical action of the lubricant assumes importance due to such factors. The lubricant is to be appropriately selected so as to meet the various functions it has to perform.

VALVE TYPES
PLUG VALVES



Proceed to assemble the valve.

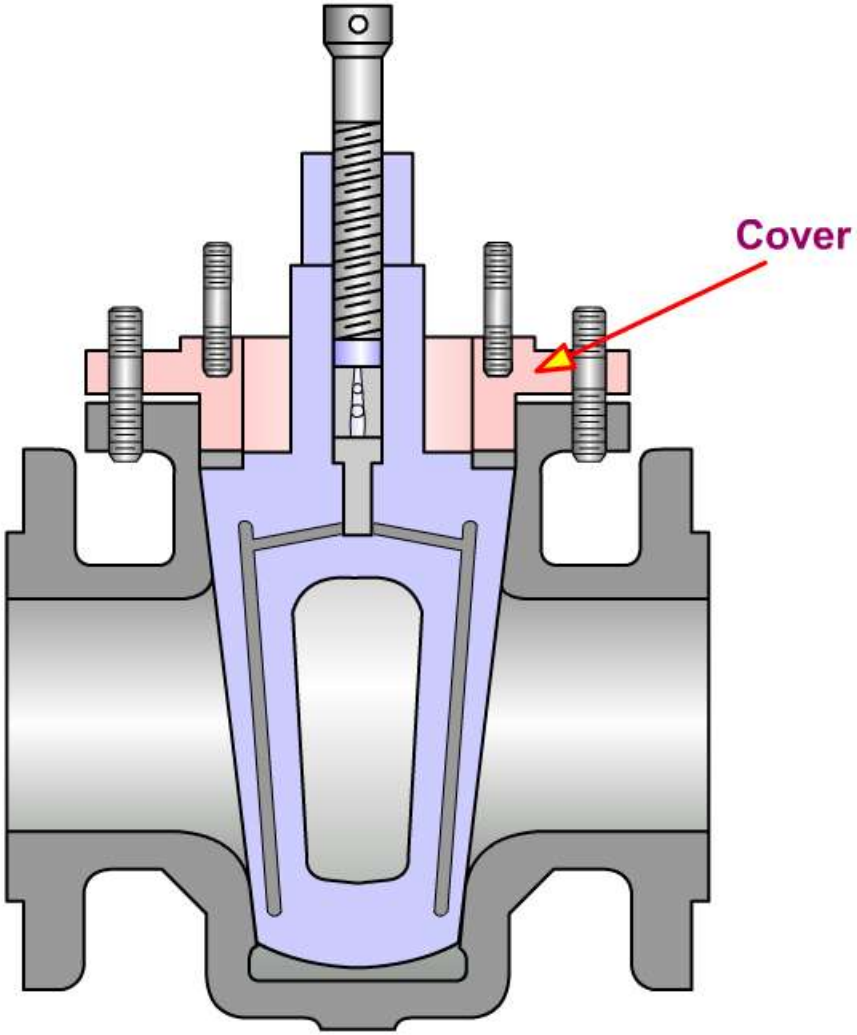
VALVE TYPES
PLUG VALVES



ASSEMBLY

- Plug, Stem and Lubricant screw arrangement

VALVE TYPES
PLUG VALVES

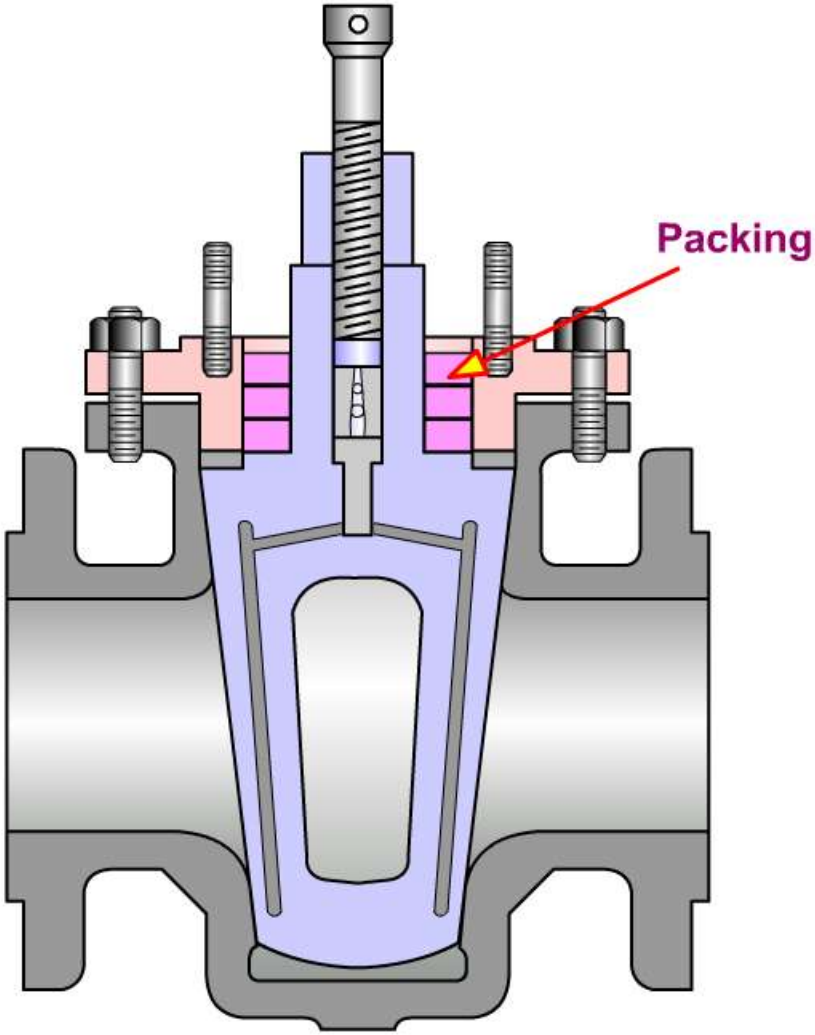


ASSEMBLY

- Cover

VALVE TYPES

PLUG VALVES

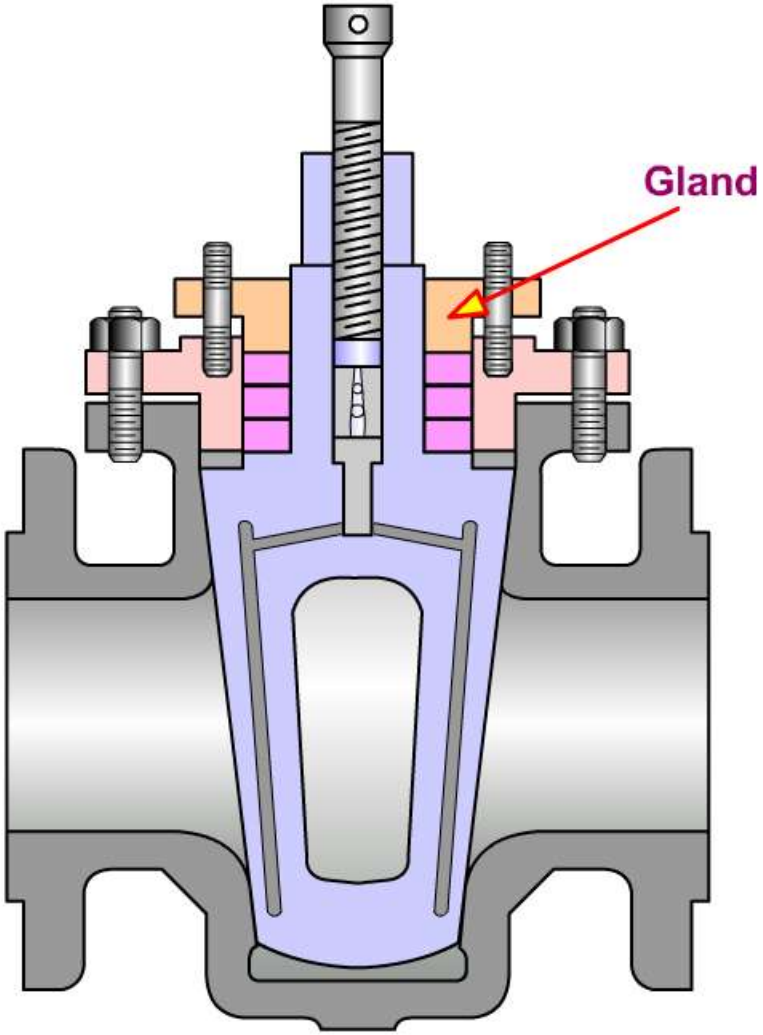


ASSEMBLY

- Packing

VALVE TYPES

PLUG VALVES



ASSEMBLY

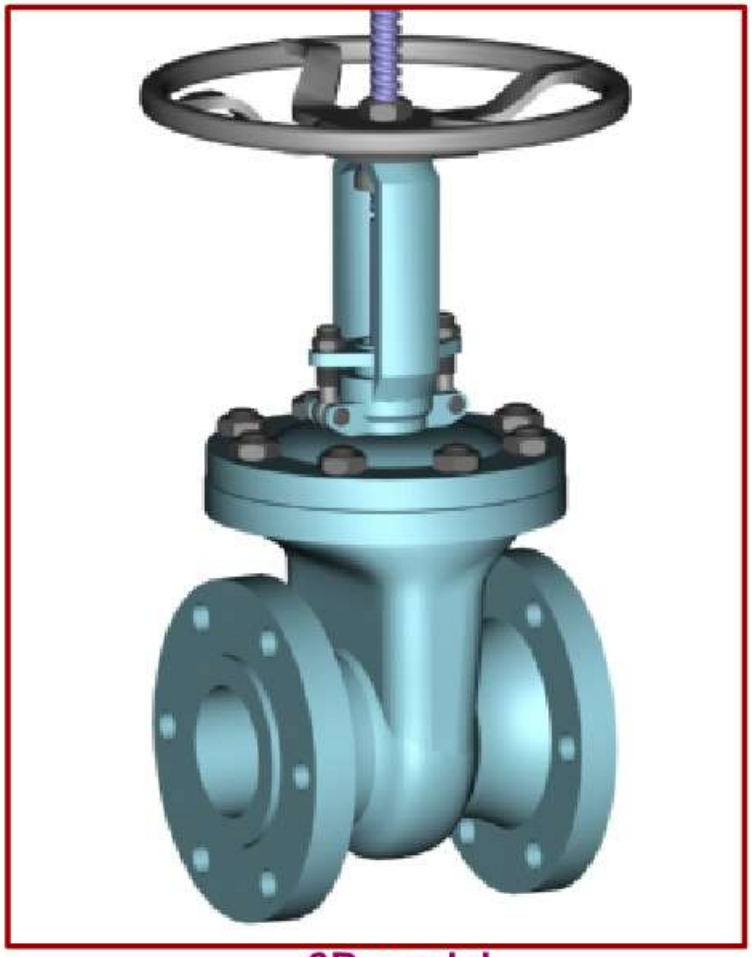
- Gland

Slide/Gate Valve

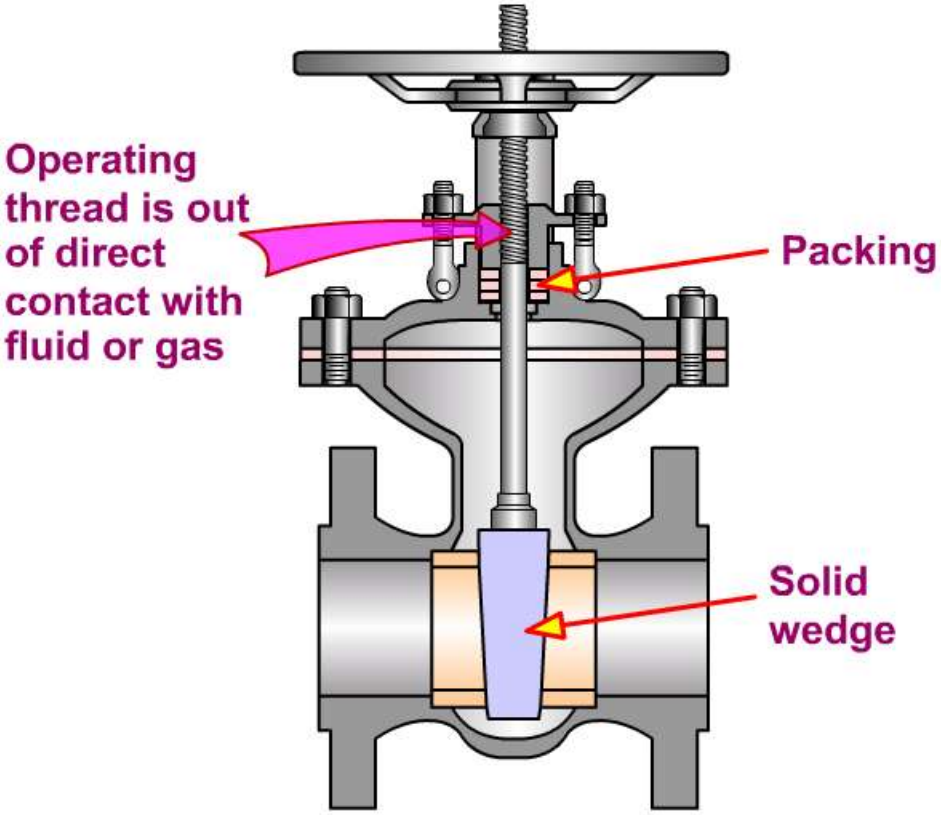
GATE VALVES

Solid Wedge Rising Stem

RISING STEM GATE VALVES



3D model



2D cross-section

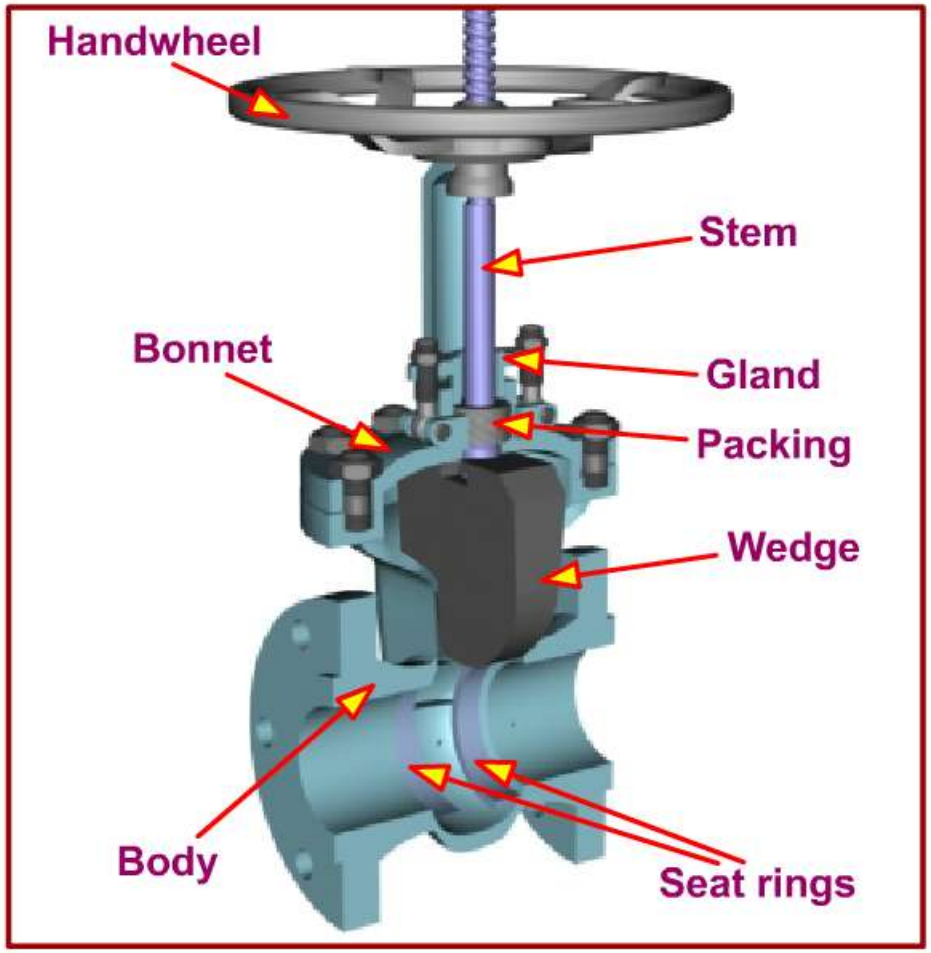
A typical model and the 2D cross-section of a solid wedge type, rising stem valve is illustrated.

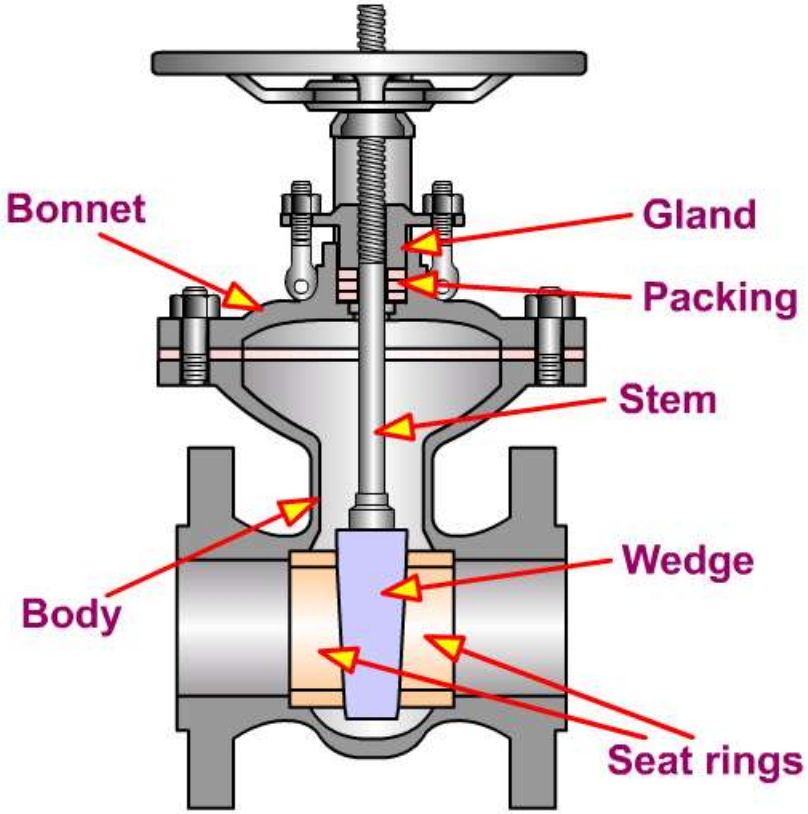
In these valves a tapered solid wedge is used to establish a firm contact against the valve seat in the closed condition. In the rising stem type the operating threads are out of direct contact with the fluid or gas.

GATE VALVES

Solid Wedge Rising Stem

RISING STEM GATE VALVES





The gate valve primarily consists of three major components namely the Body, Bonnet and Trim.

Body : The body is generally connected to piping by means of flanged, screwed, or welded joints.

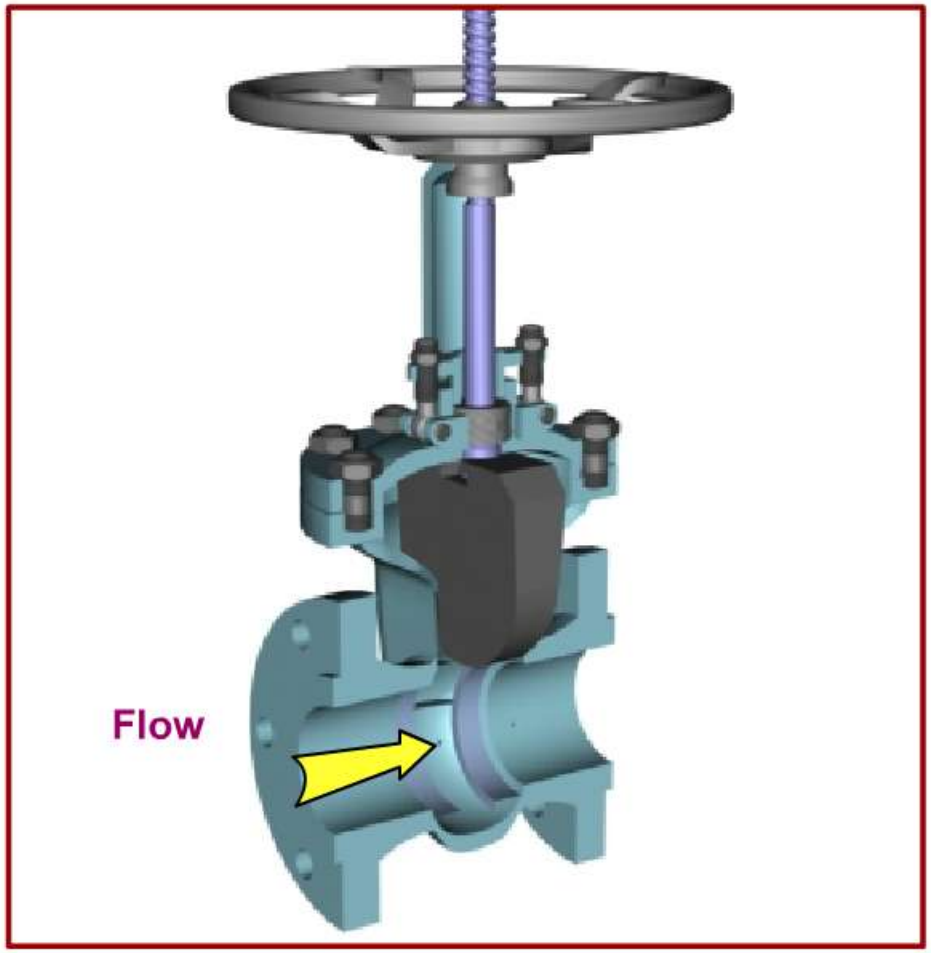
Bonnet : The bonnet contains the moving parts and is generally joined to the body with bolts, which facilitates cleaning and maintenance.

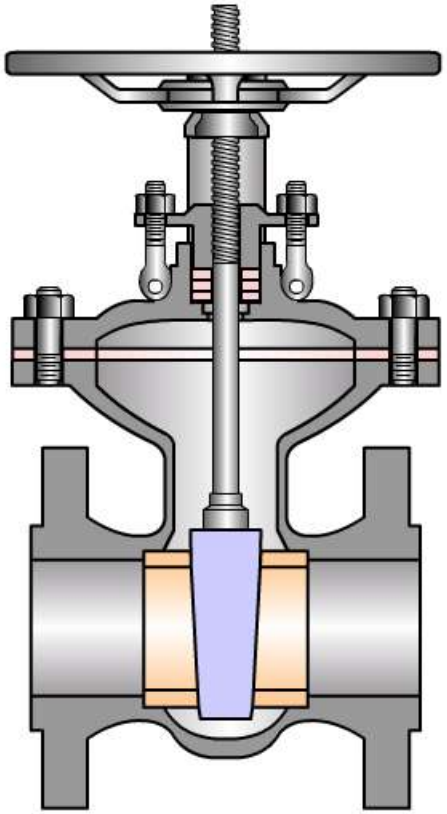
Trim : The trim comprises of the stem, gate, wedge or disk and seat rings.

GATE VALVES

RISING STEM GATE VALVES

Solid Wedge Rising Stem



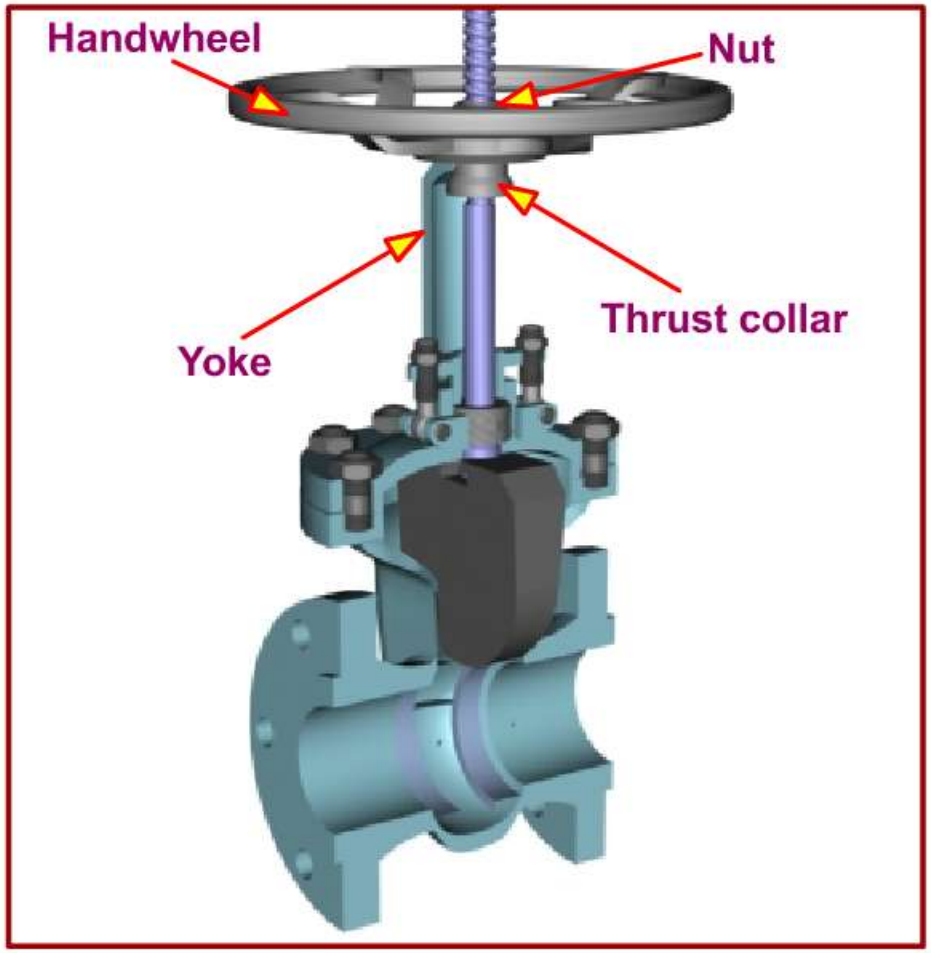


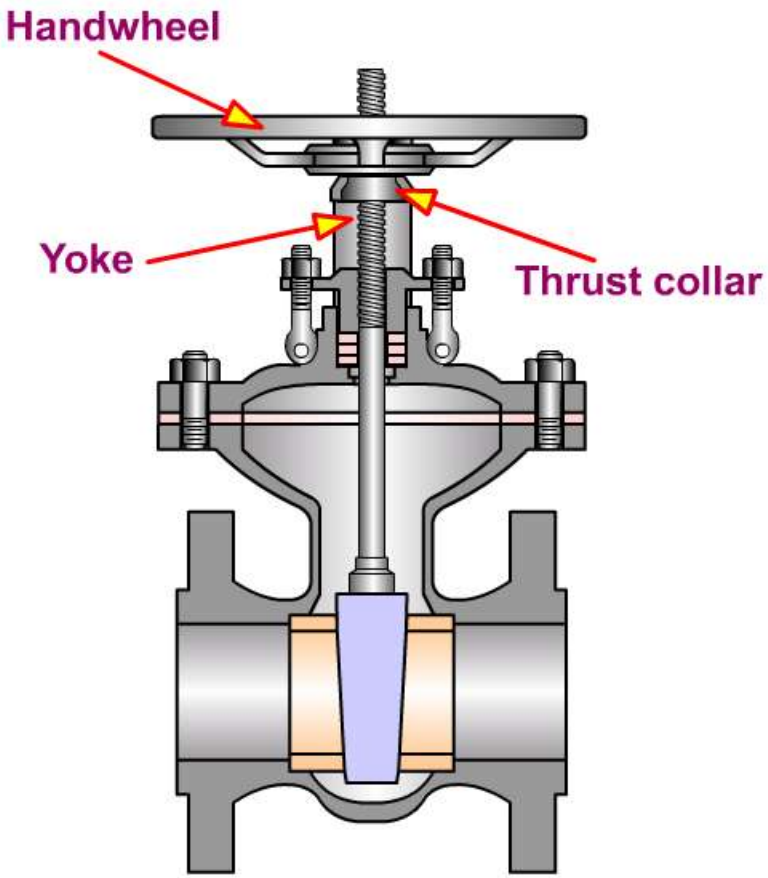
3D depiction shows the open position of the valve. It is observed that in the fully open position the flow path is in a straight line and is subjected to very less resistance.

GATE VALVES

RISING STEM GATE VALVES

Solid Wedge Rising Stem



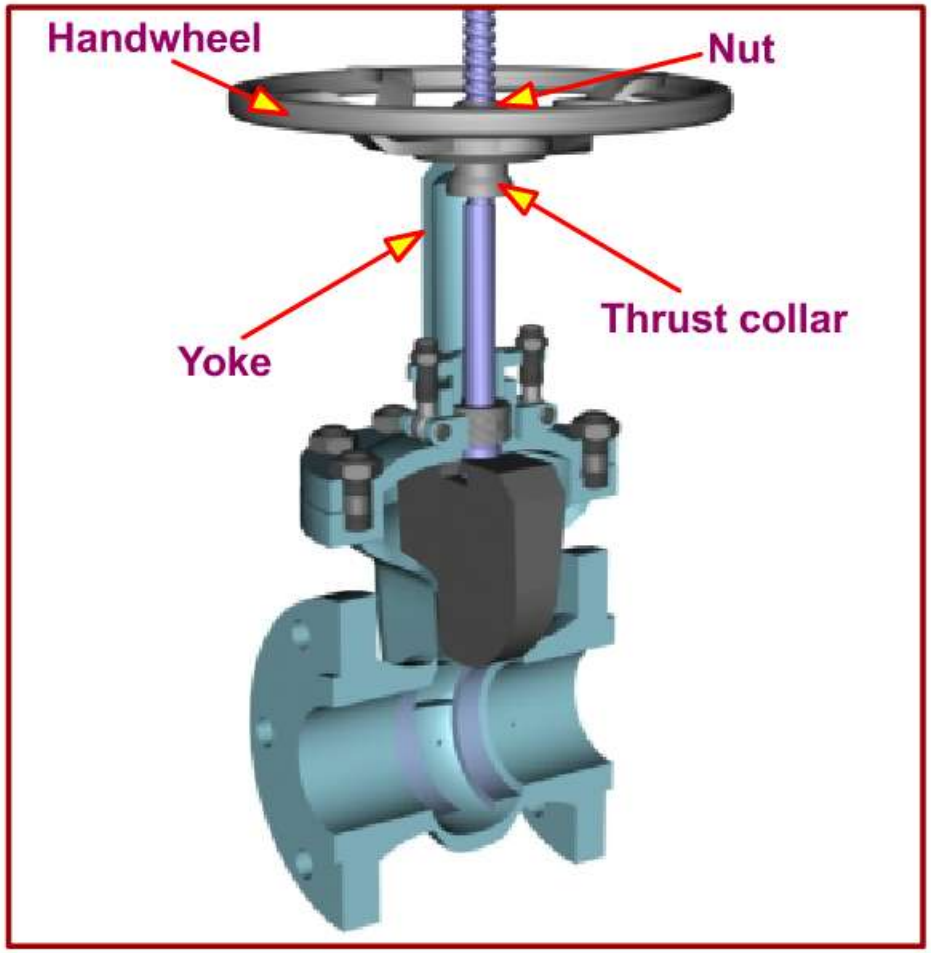


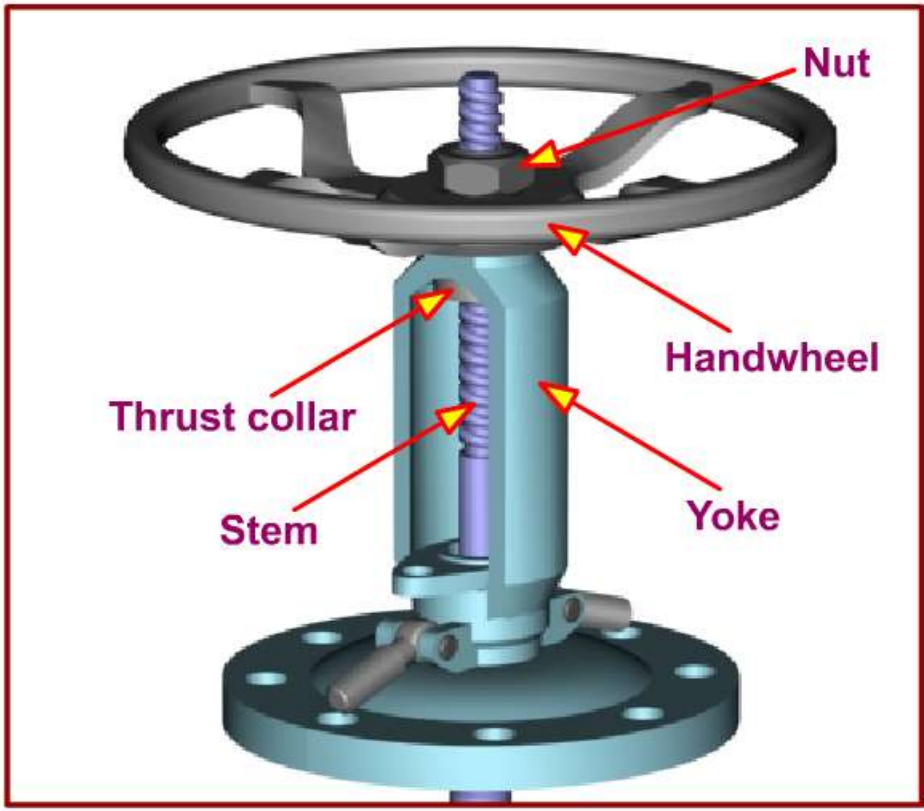
In the rising stem gate valve, a nut is fastened solidly to the handwheel and held in the yoke by thrust collars.

GATE VALVES

Solid Wedge Rising Stem

RISING STEM GATE VALVES





Shown is an enlarged view of the handwheel and related components.

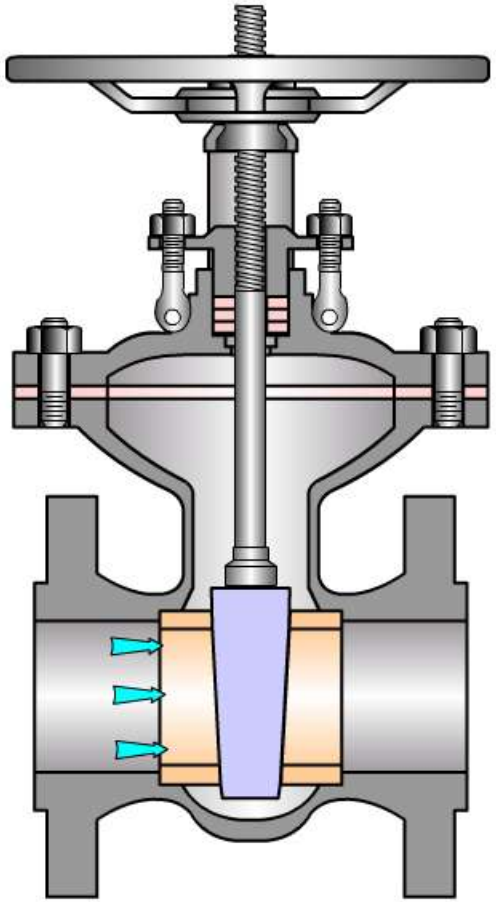
The handwheel is locked positively with the thrust collar and is held in position by the nut. The vertical motion of the thrust collar is restricted by the yoke. The stem screws into the thrust collar.

- Let us dismantle and observe the individual components towards understanding the functioning.

GATE VALVES

RISING STEM GATE VALVES

Solid Wedge Rising Stem



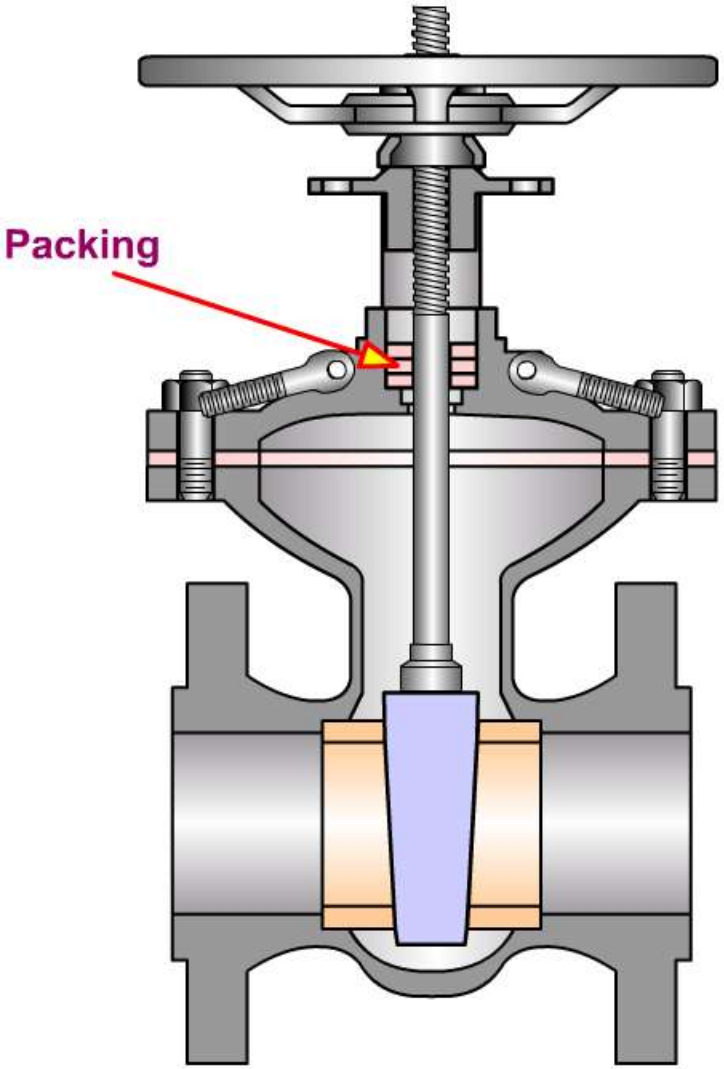
VALVE OPERATION

On rotating the handwheel in the clock-wise direction, the stem and the gate moves vertically downwards thus closing the valve.

GATE VALVES

RISING STEM GATE VALVES

Solid Wedge Rising Stem



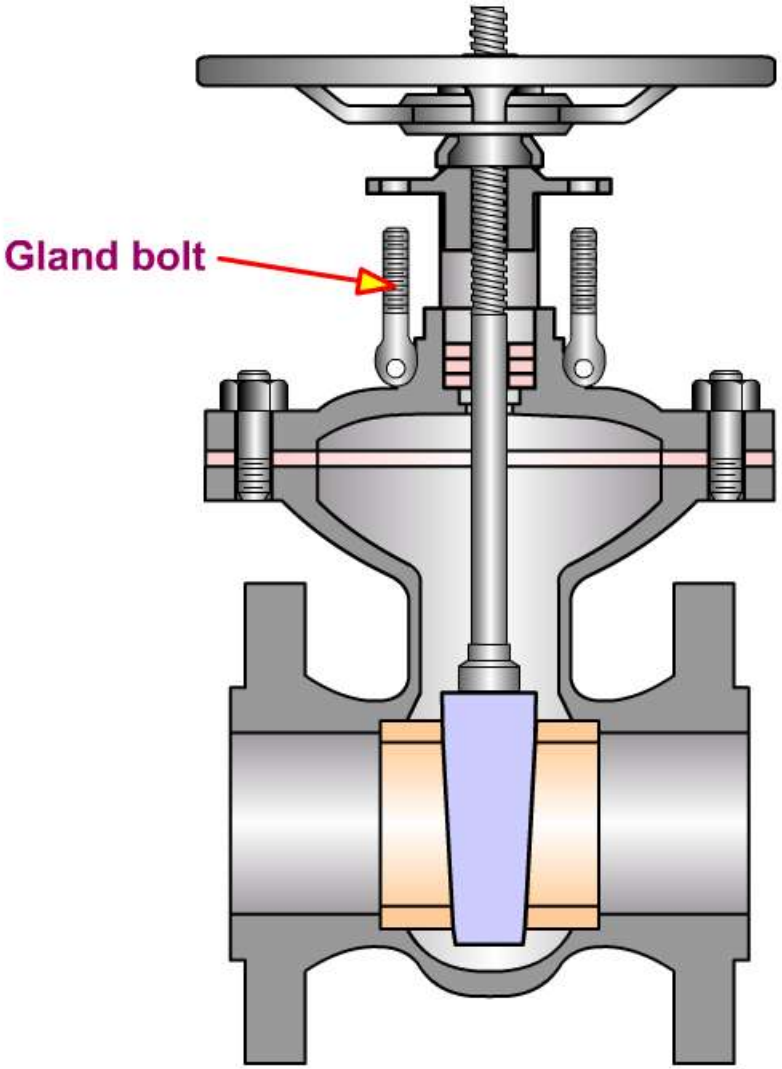
ASSEMBLY

- Packing

GATE VALVES

RISING STEM GATE VALVES

Solid Wedge Rising Stem



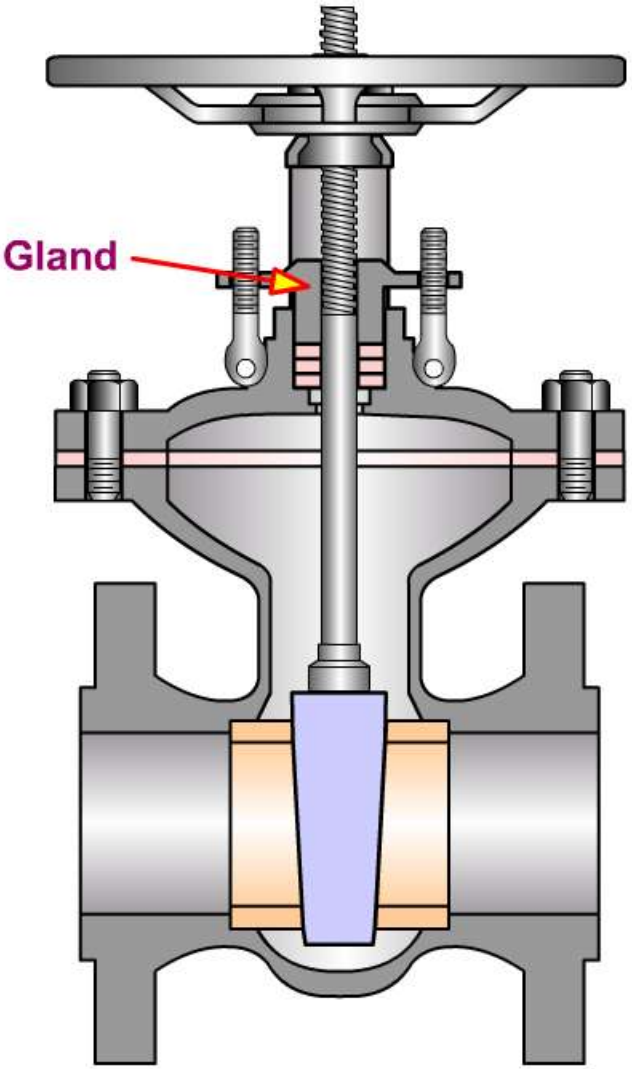
ASSEMBLY

- Gland bolts

GATE VALVES

RISING STEM GATE VALVES

Solid Wedge Rising Stem



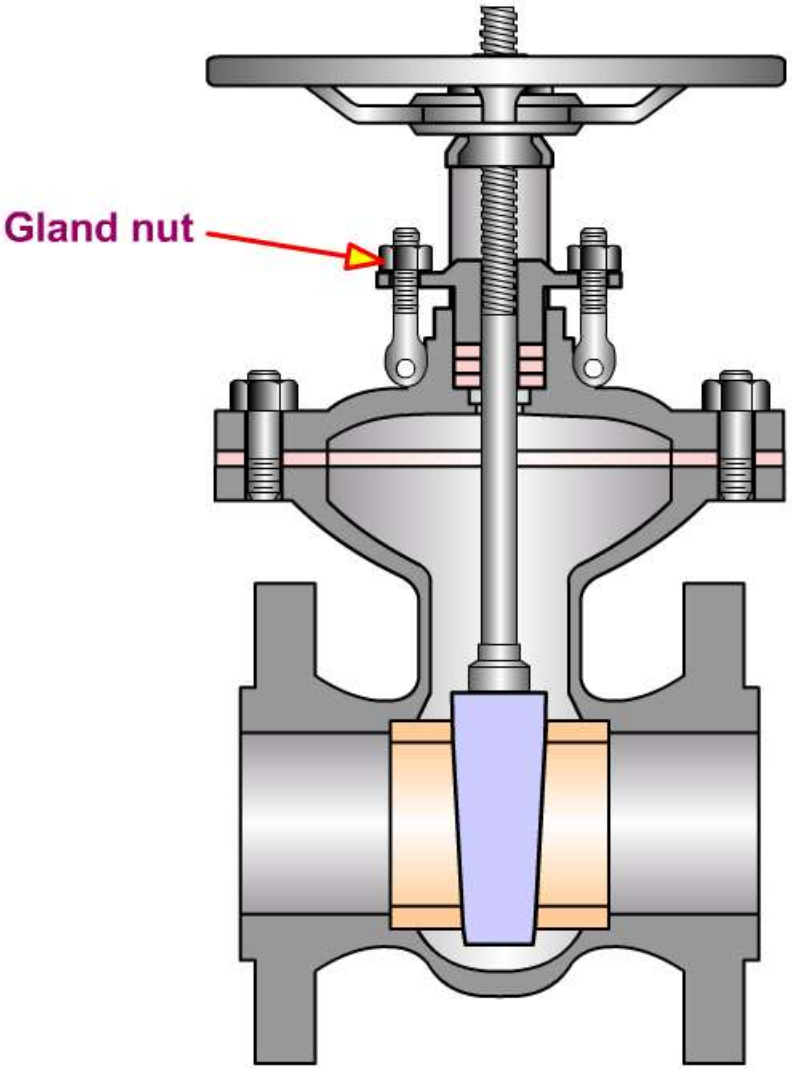
ASSEMBLY

- Gland

GATE VALVES

RISING STEM GATE VALVES

Solid Wedge Rising Stem



ASSEMBLY

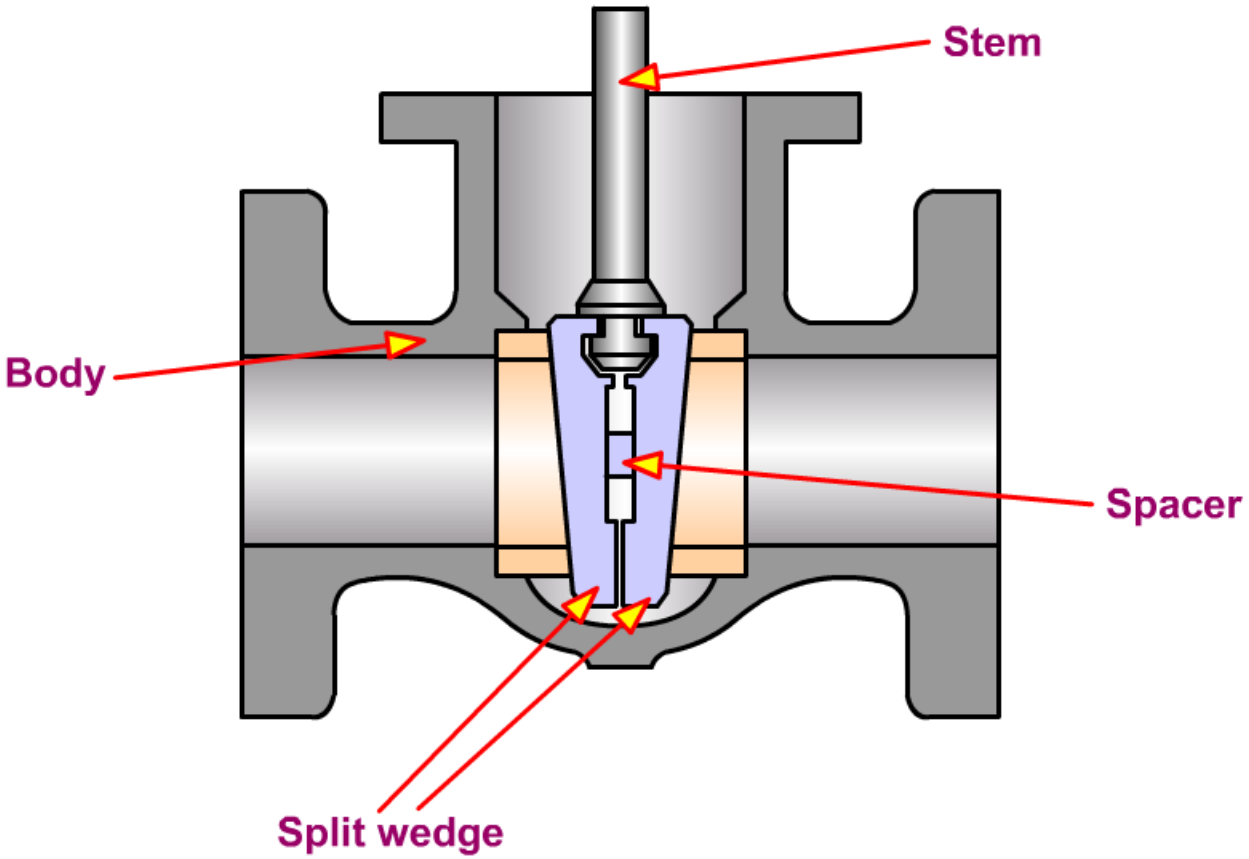
- Gland nuts

Thus the valve is assembled.

GATE VALVES

RISING STEM GATE VALVES

Split Wedge Rising Stem



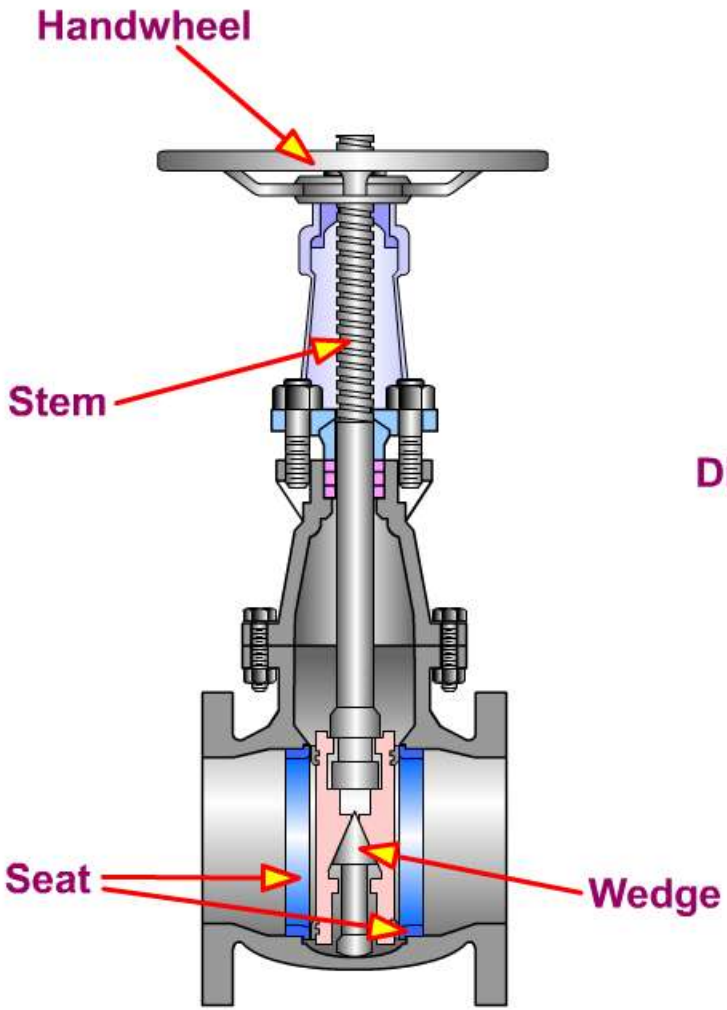
The 2D cross-section of a typical split wedge arrangement is shown.

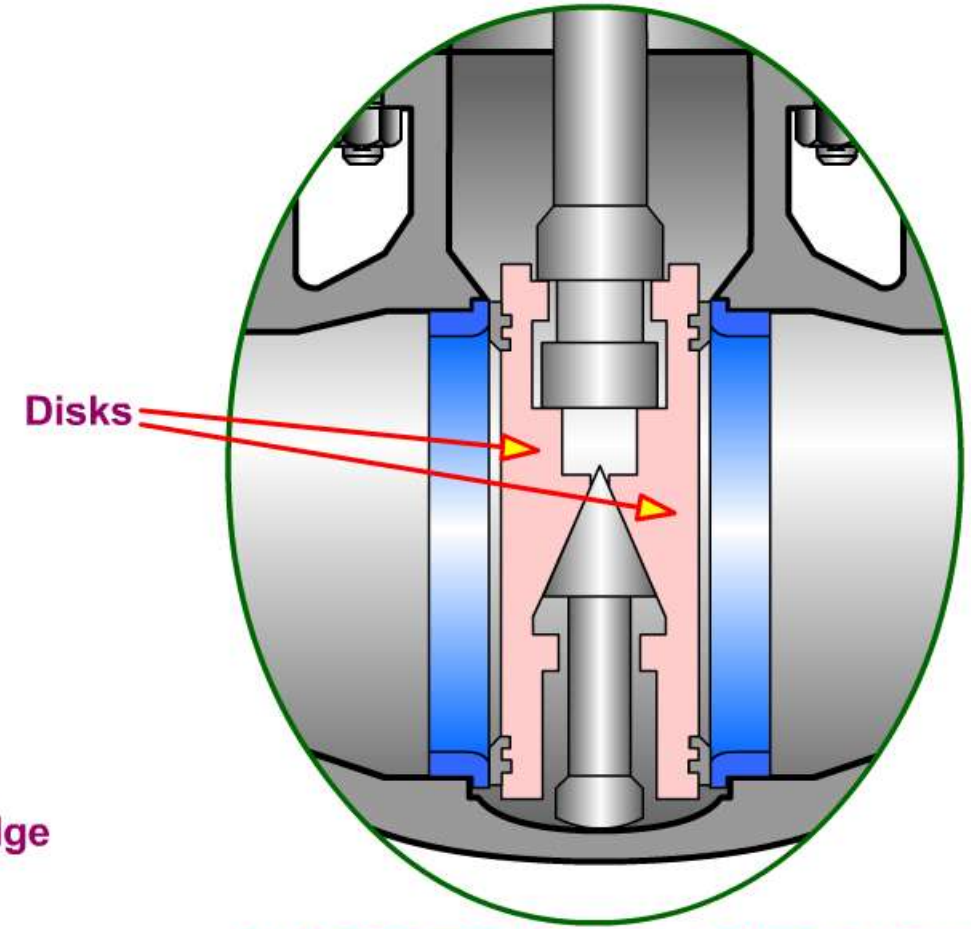
The two-piece wedge disk is seated between matching tapered seat rings in the body. This arrangement is preferred when pipe-line strain might distort the body seats. The relative flexibility between the split wedges ensures firm seating even in such cases.

GATE VALVES

RISING STEM GATE VALVES

Double-Disk Rising Stem





Wedging mechanism - enlarged view

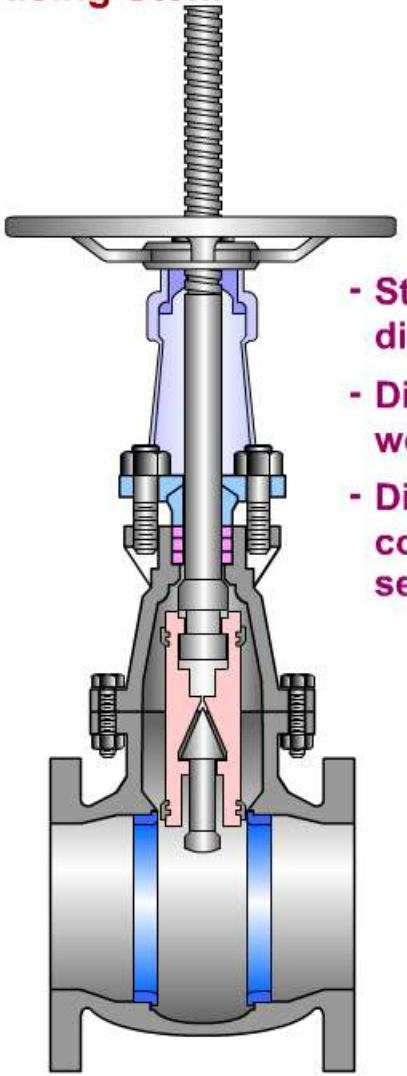
Depiction shows a typical double-disk, parallel seat, rising stem, gate valve.

An enlarged view of the wedging mechanism, which forces the disk against the valve seat is shown.

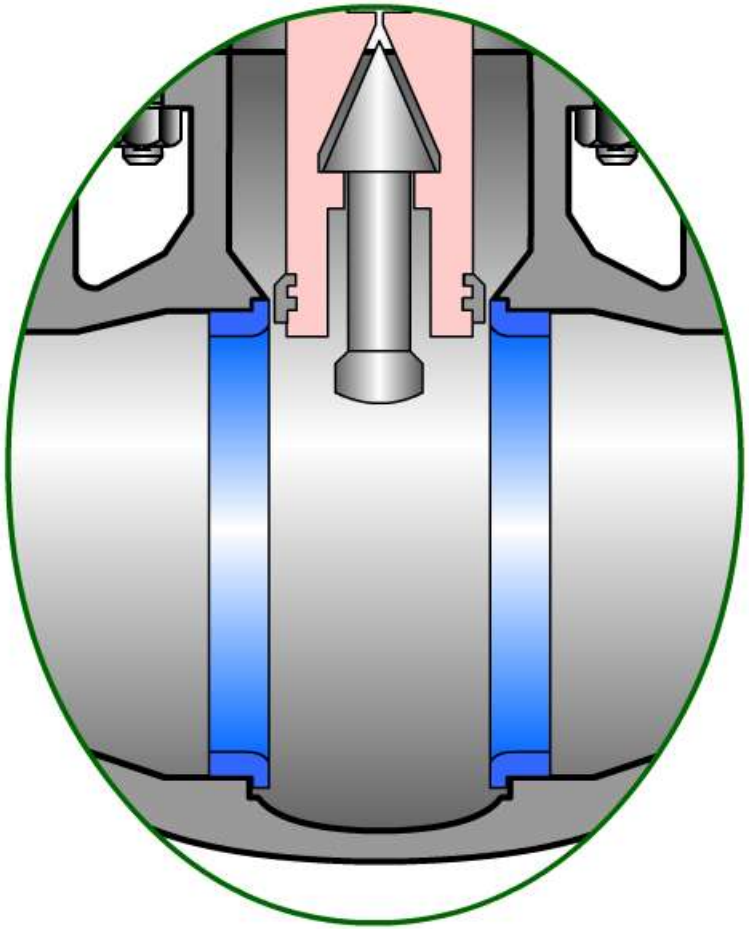
GATE VALVES

RISING STEM GATE VALVES

Double-Disk Rising Stem



- Stem pulls the disks upward
- Disks loosen from wedge
- Disks lose firm contact with the seat

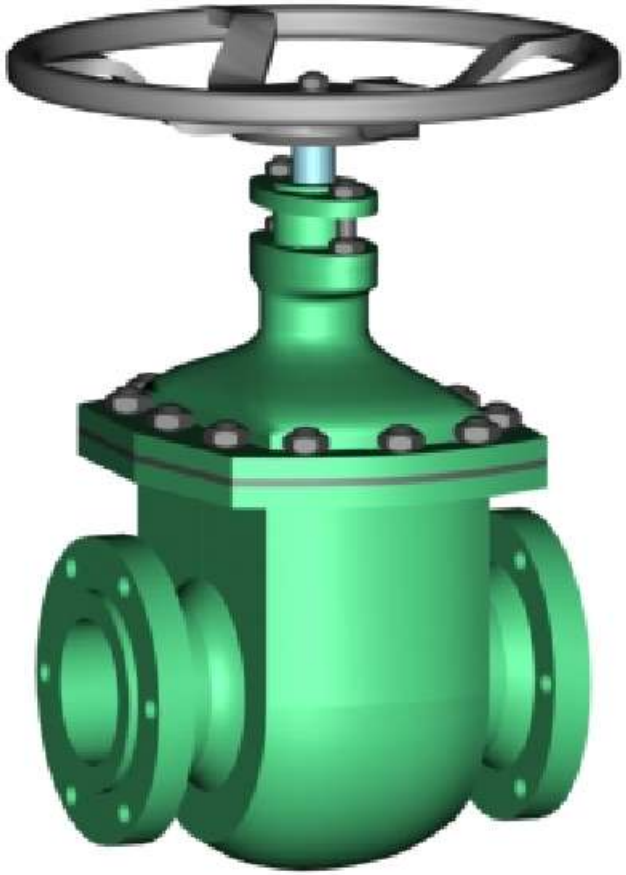


When the handwheel is rotated in the anti-clockwise direction the stem starts moving up. Further on, the stem starts pulling the disks upwards thus loosening it from the wedge. As a result the disks lose firm contact with the seat and the stem/disk is raised thus opening the valve.

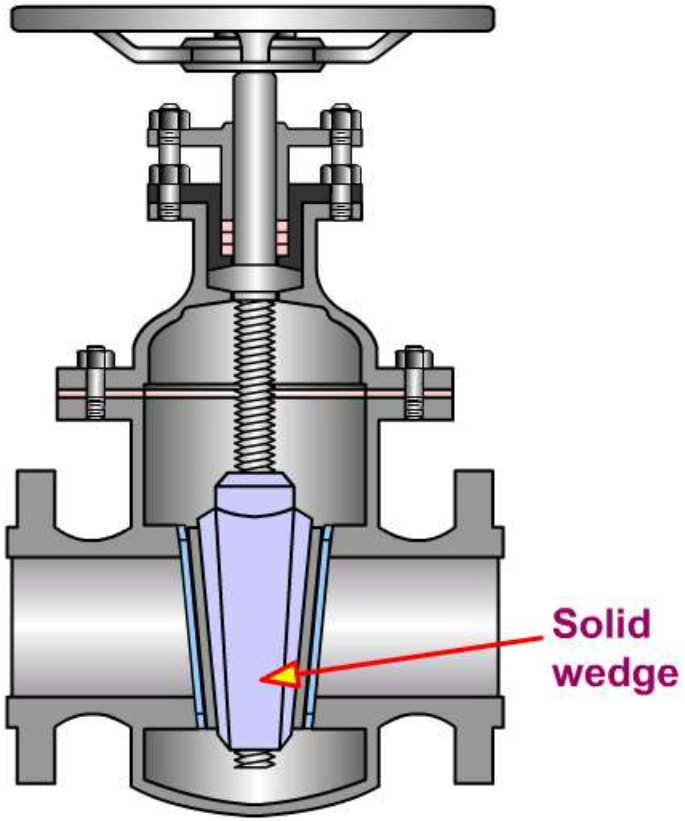
GATE VALVES

Solid Wedge Non Rising Stem

NON RISING STEM GATE VALVES



3D model



2D cross-section

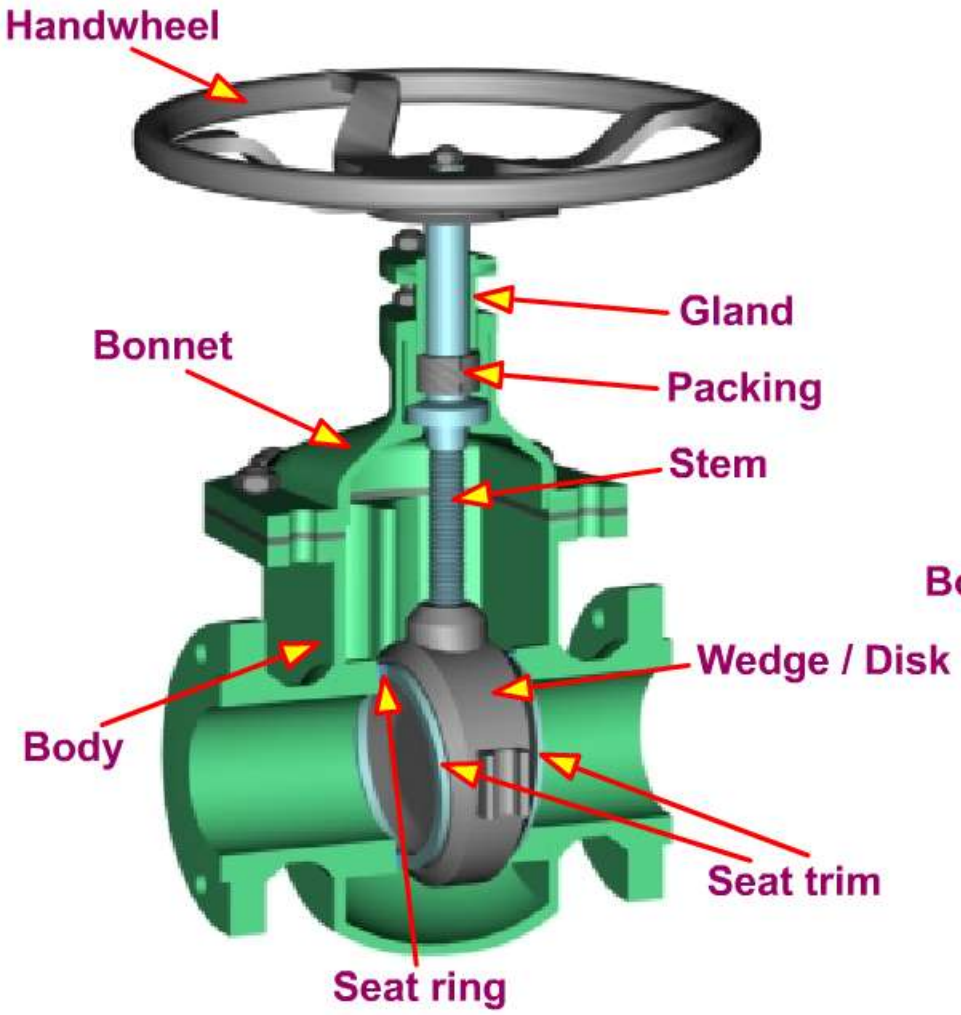
A typical model and the 2D cross-section of a solid wedge type, non rising stem valve is illustrated.

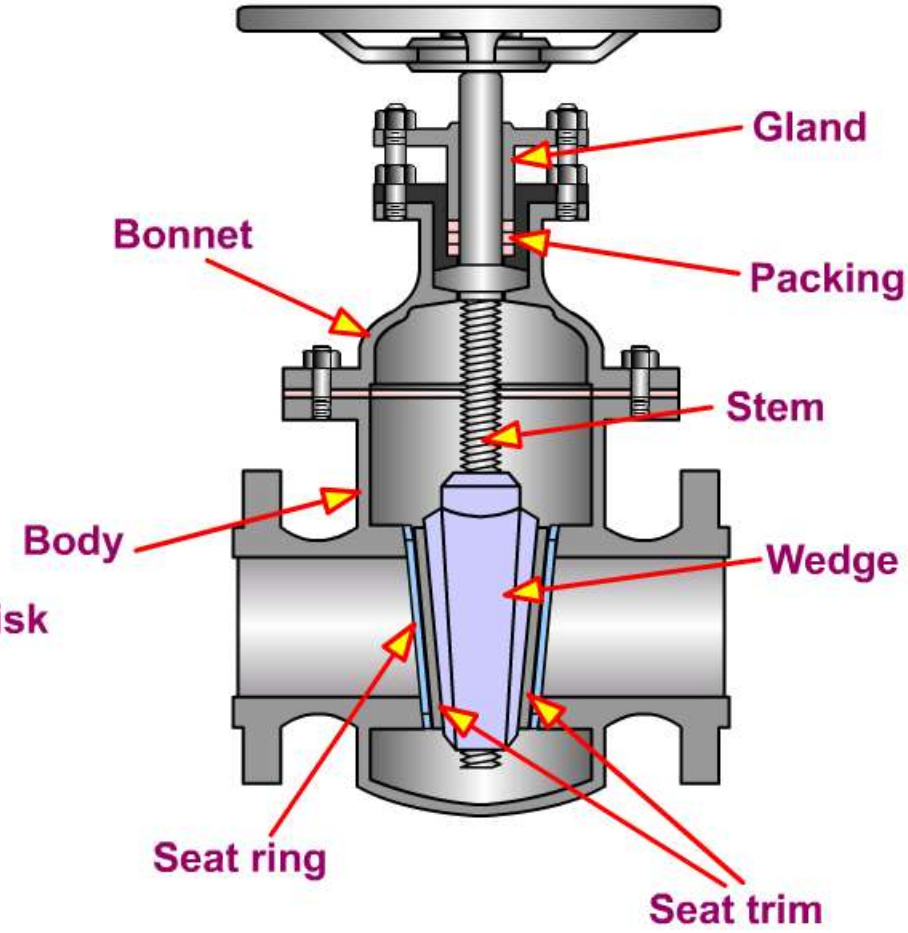
These valves are preferred where there is space limitation and if the fluid passing through the valve does not corrode, erode or leave deposits on the thread. Bigger valves are also used in buried service.

GATE VALVES

Solid Wedge Non Rising Stem

NON RISING STEM GATE VALVES



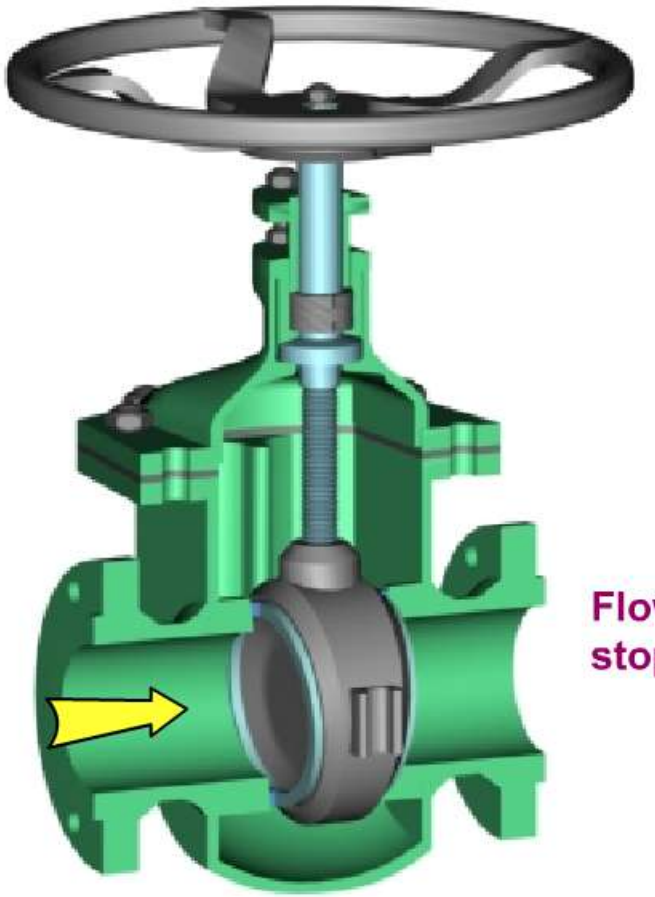


Nomenclature of the various components of the valve is shown.

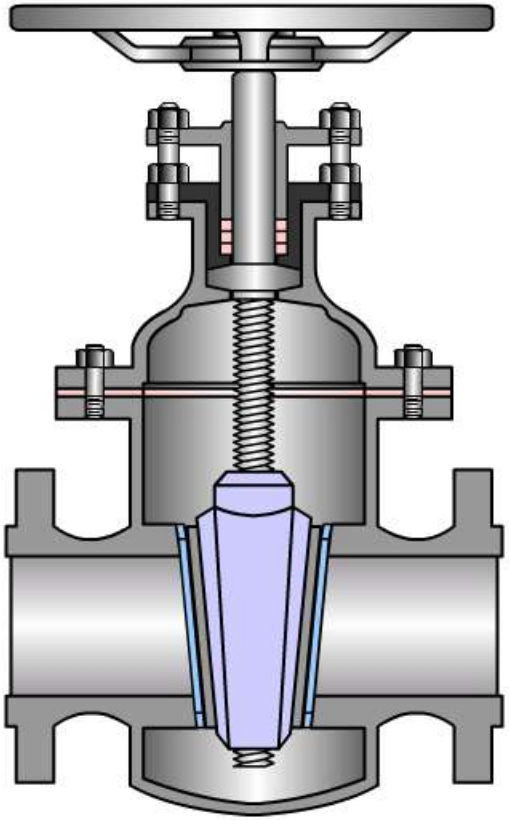
GATE VALVES

Solid Wedge Non Rising Stem

NON RISING STEM GATE VALVES



Flow is stopped

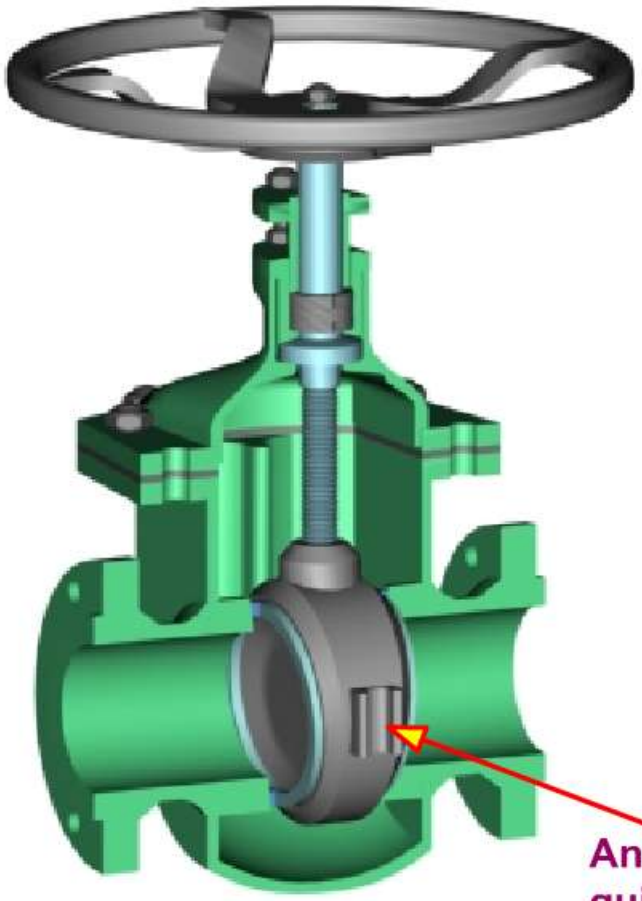


Depiction shows the closed position of the valve in which the flow is stopped.

GATE VALVES

Solid Wedge Non Rising Stem

NON RISING STEM GATE VALVES



Anti-rotation guide

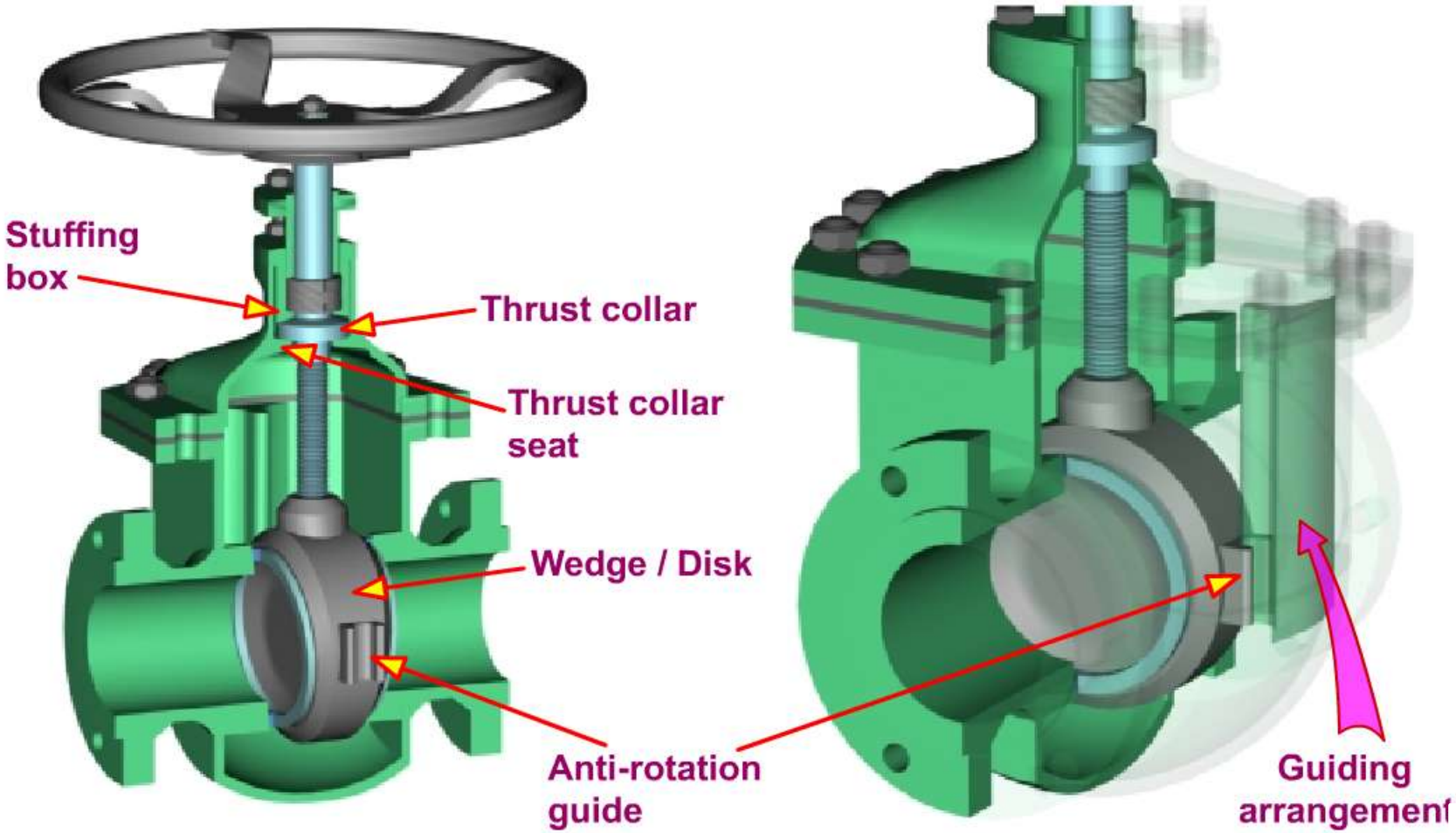
An anti-rotation guide arrangement is provided in the valve to enable its functioning.

Proceed to view the valve internals from a different view for a better understanding.

GATE VALVES

Solid Wedge Non Rising Stem

NON RISING STEM GATE VALVES

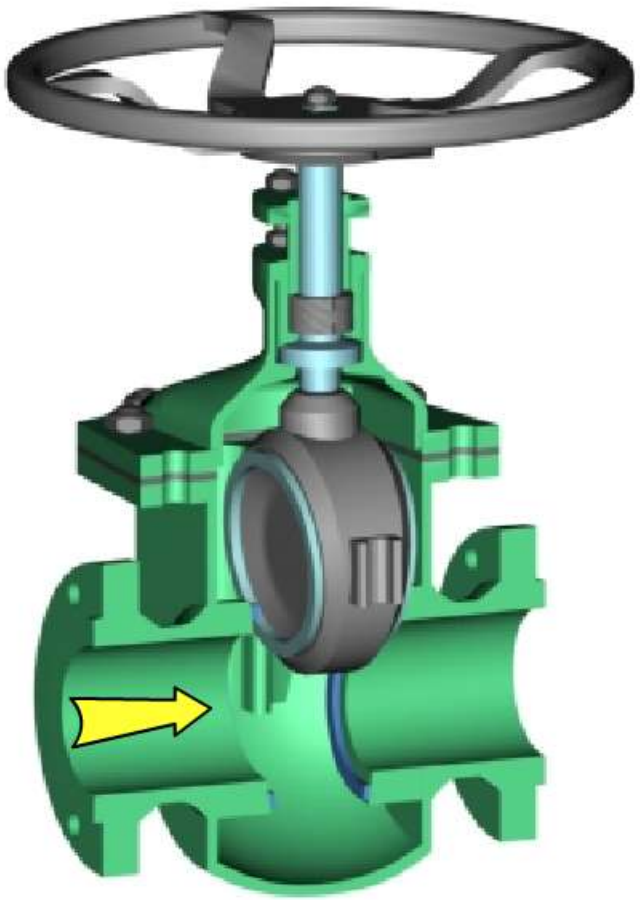


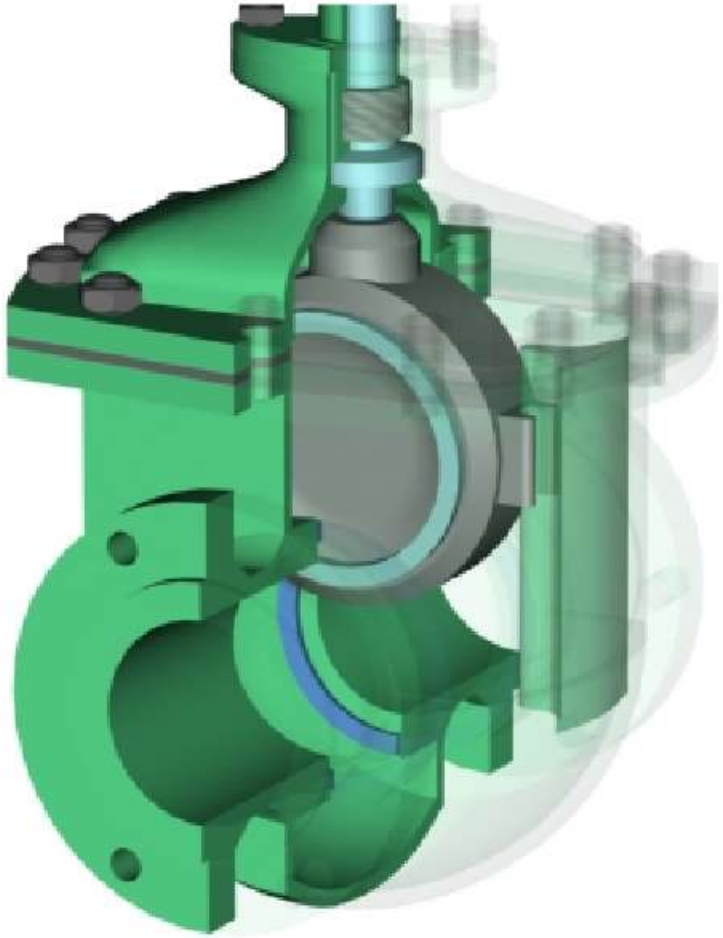
The lower threaded portion of the stem screws into the disk. The vertical motion of the stem is restricted by a thrust collar. The thrust collar rests on a seat in the bonnet and is restricted by the stuffing box on its upper side. The anti-rotation guide traverses along a suitable arrangement in the valve body.

GATE VALVES

Solid Wedge Non Rising Stem

NON RISING STEM GATE VALVES



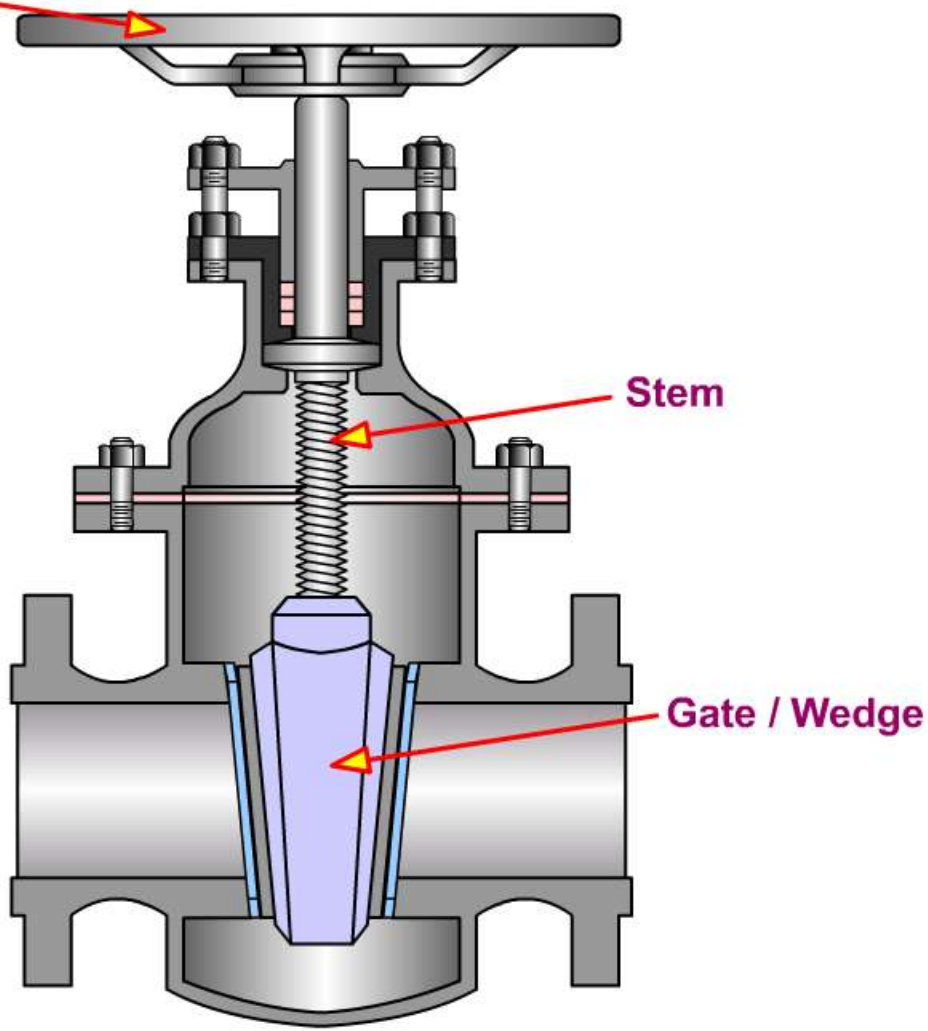


As shown when the handwheel is rotated in the anti-clockwise direction the stem screws into the disk. As a result the disk moves upwards thus opening the valve and the flow through the valve is established.

GATE VALVES

Solid Wedge Non Rising Stem

NON RISING STEM GATE VALVES



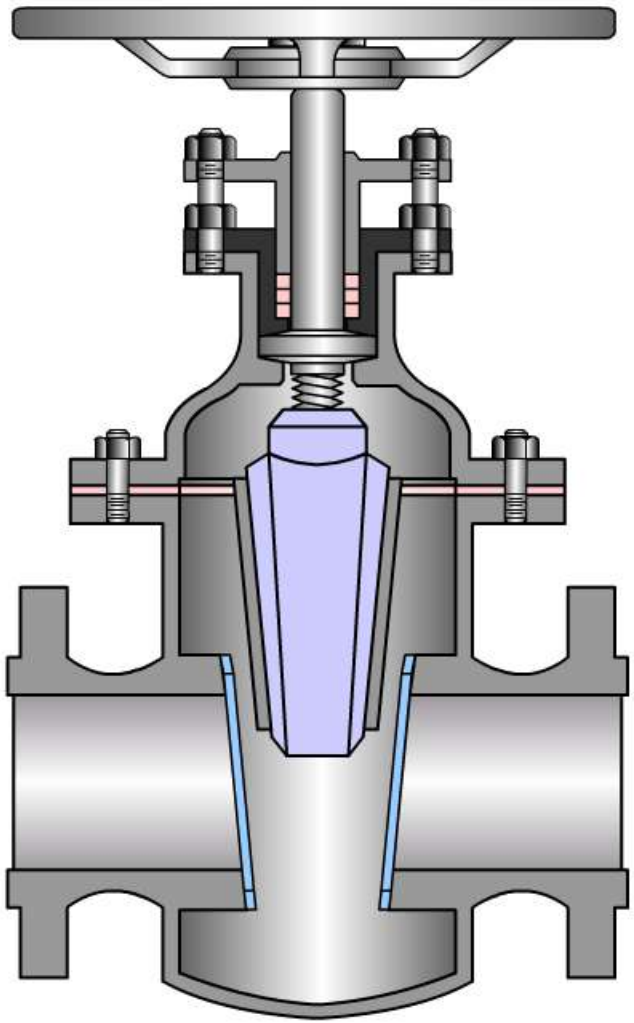
VALVE OPERATION

Let us observe the operation of the valve in its 2D cross-sectional view.

GATE VALVES

Solid Wedge Non Rising Stem

NON RISING STEM GATE VALVES



VALVE OPERATION

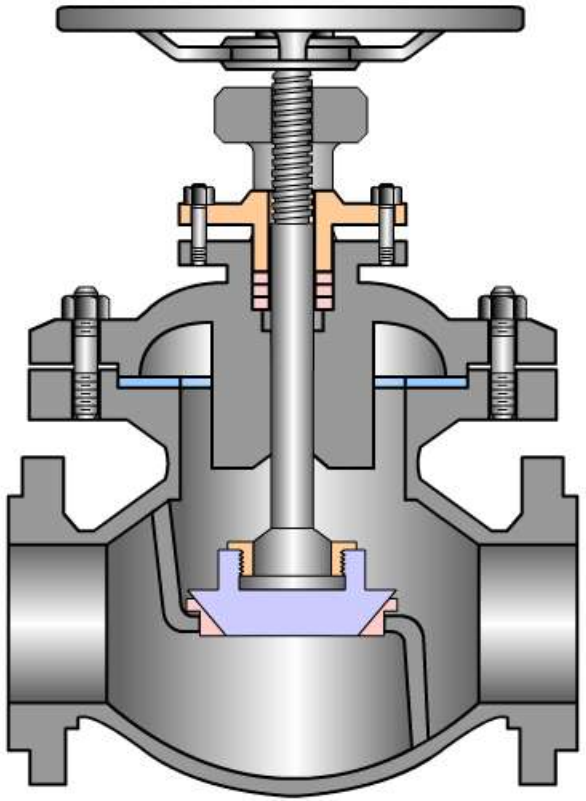
As seen, when the handwheel is rotated in the anti-clockwise direction, the stem screws into the disk / wedge, thus opening the valve.

Globe Valve

GLOBE VALVES

TEE PATTERN GLOBE VALVES

3D model



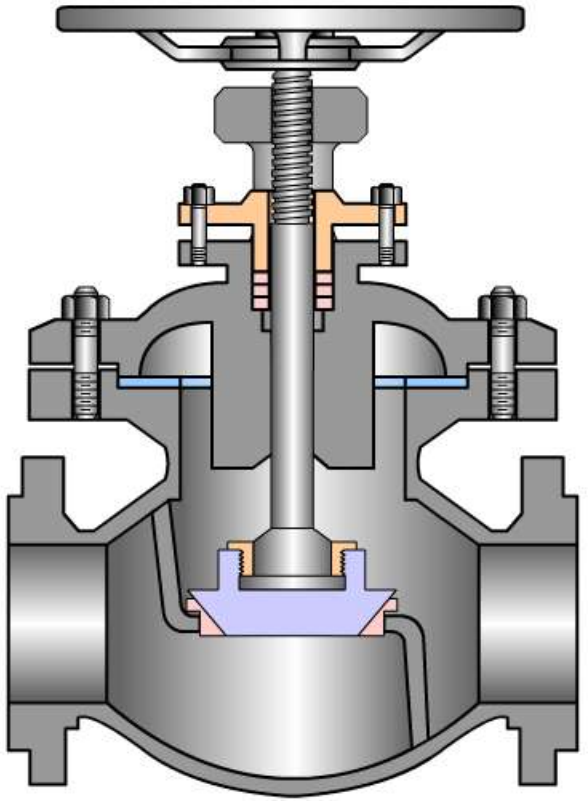
2D cross-section

A typical model and the 2D cross-section of a tee-pattern globe valve is illustrated.

The valve shown is a typical large sized valve and has flanged ends and a rising stem. Large valves have the outside screw-and-yoke construction.

GLOBE VALVES

TEE PATTERN GLOBE VALVES

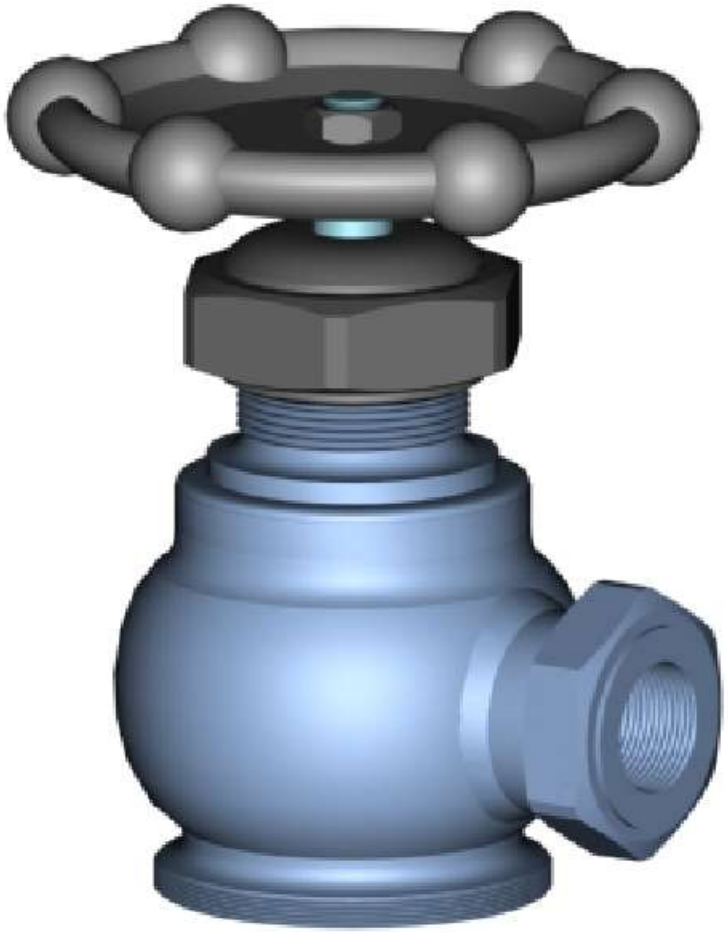


Valve spin

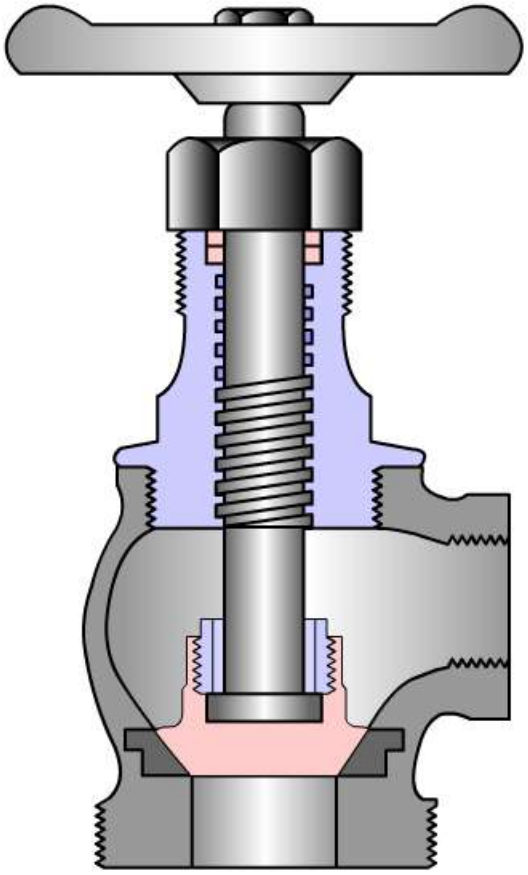
The valve is viewed on a walk around.

GLOBE VALVES

ANGLE PATTERN GLOBE VALVES



3D model



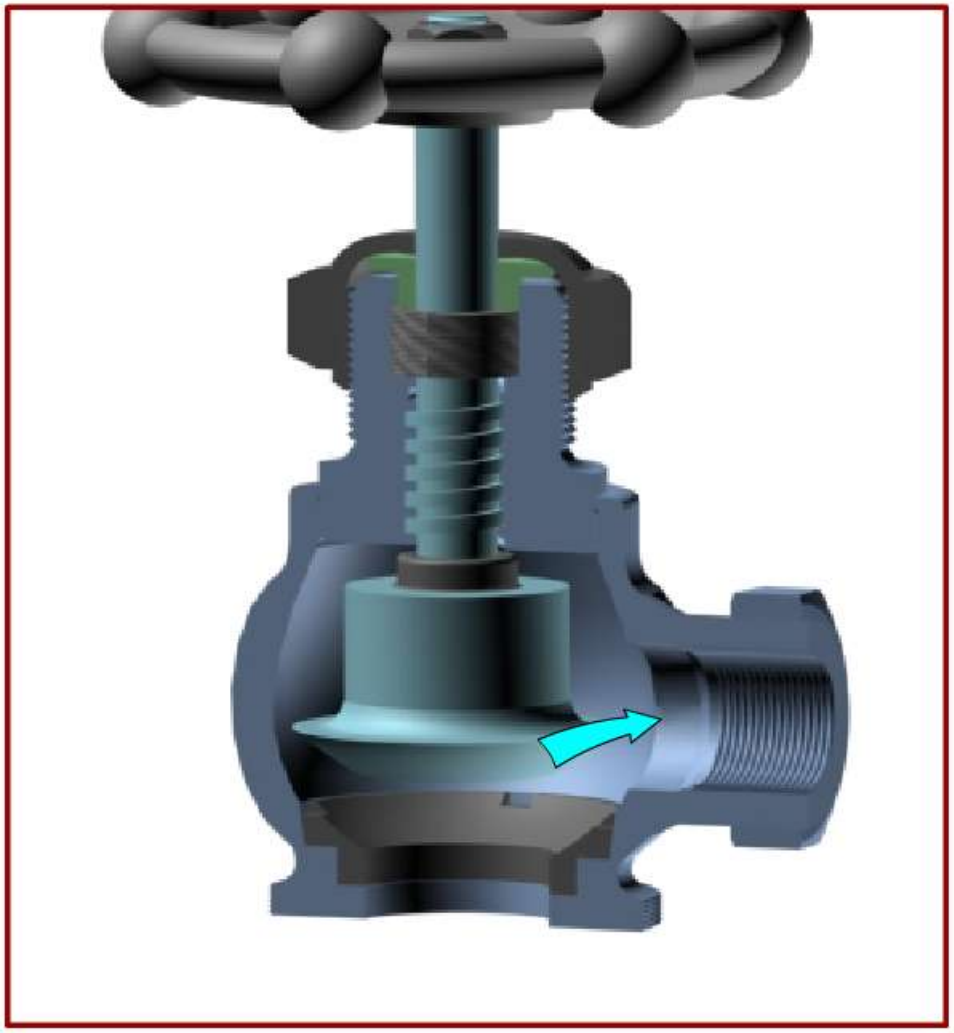
2D cross-section

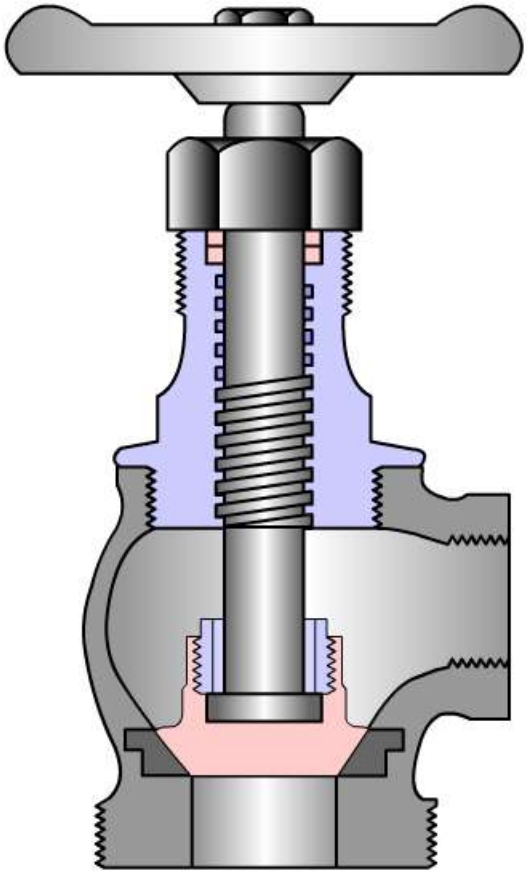
A typical model and the 2D cross-section of an angle globe valve is illustrated.

Angle-pattern globe valves exhibit improved flow characteristics over the tee-pattern globe valves.

GLOBE VALVES

ANGLE PATTERN GLOBE VALVES

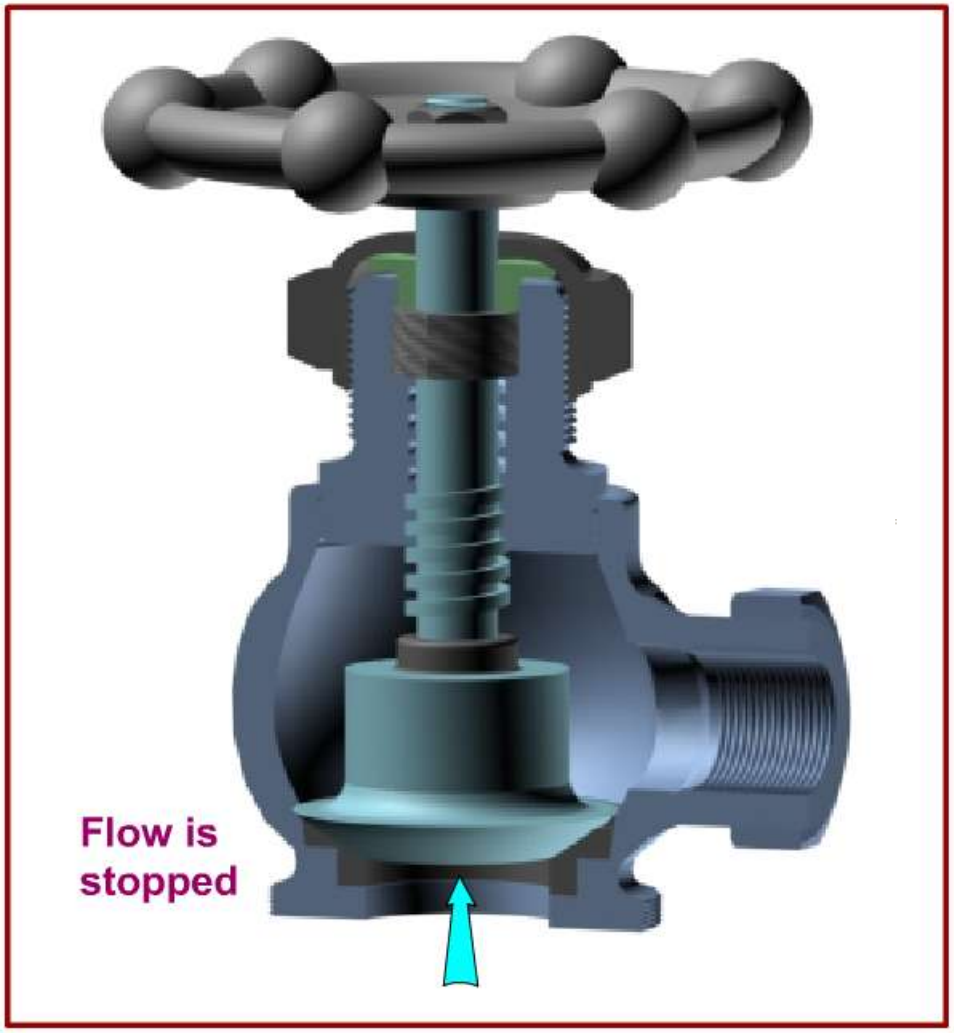


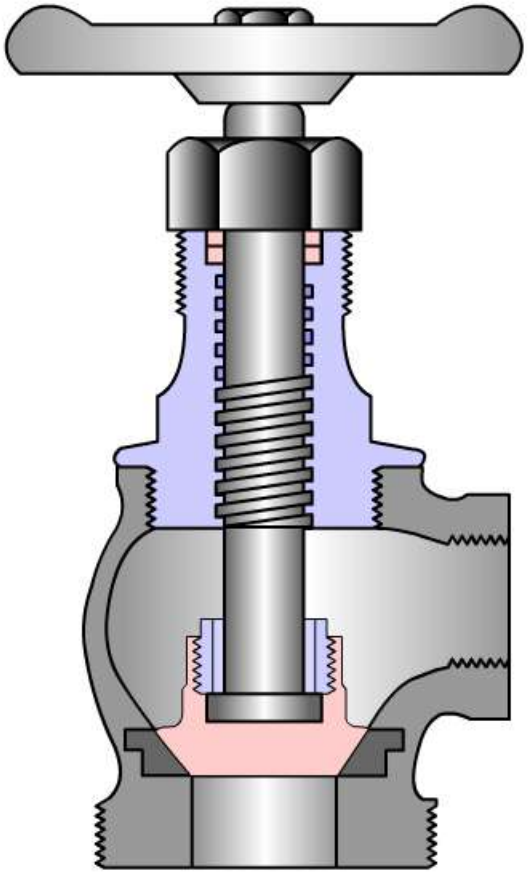


As shown, when the handwheel is rotated in the anti-clockwise direction the stem and disk also rotates and moves upwards thus opening the valve.

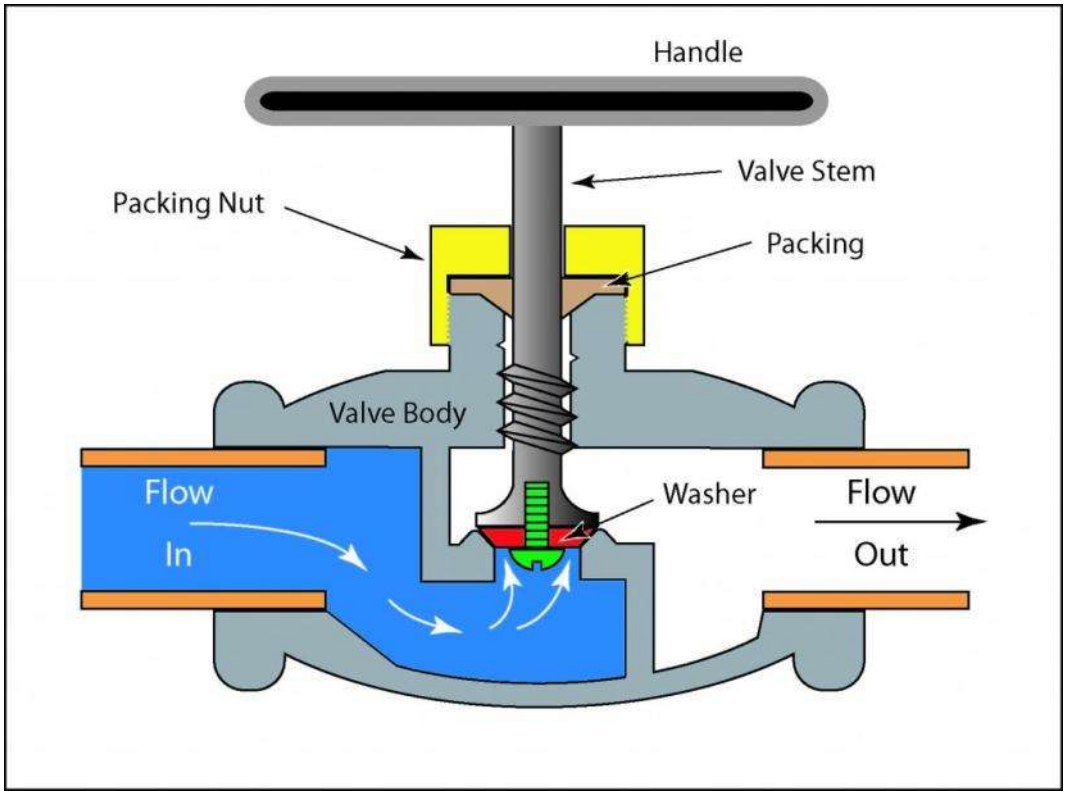
GLOBE VALVES

ANGLE PATTERN GLOBE VALVES





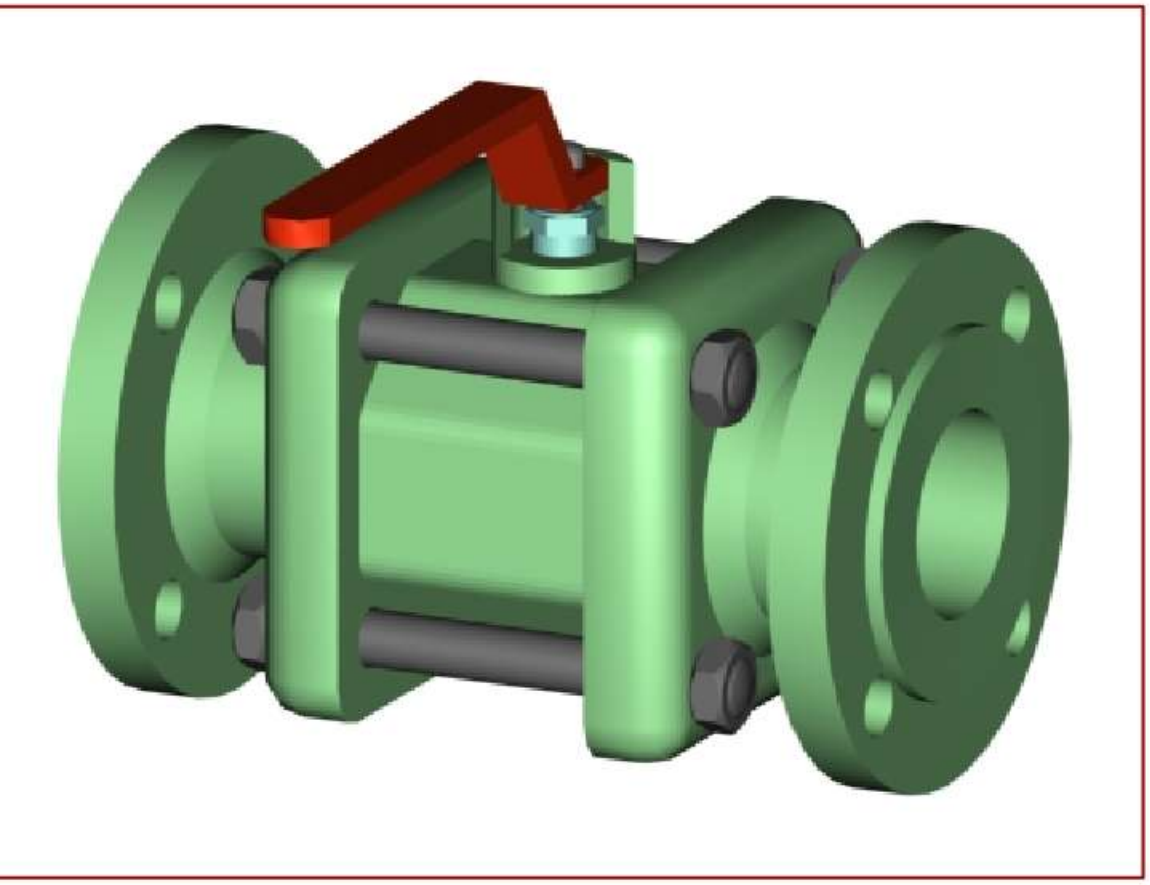
On rotating the handwheel in the clockwise direction the stem and disk also rotates and moves downwards thus shutting-off the valve.


Handle
Valve Stem
Packing Nut
Packing
Valve Body
Flow
In
Washer
Flow
Out

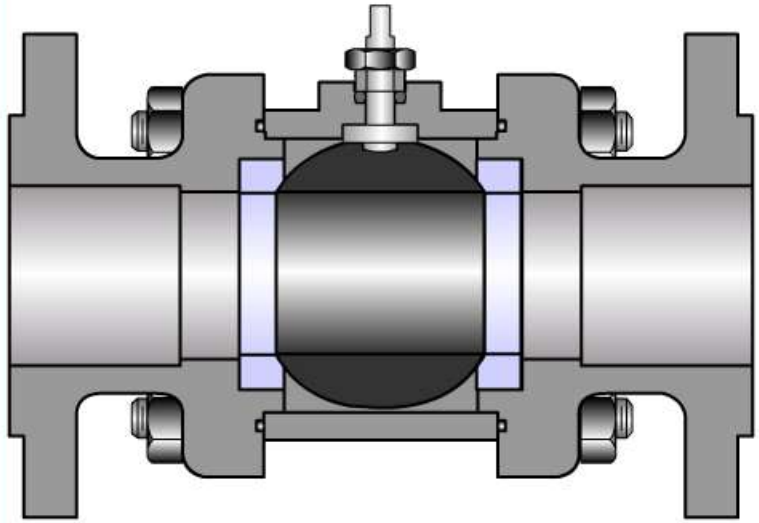
Ball Valve

BALL VALVES

FLANGED END BALL VALVES



3D model

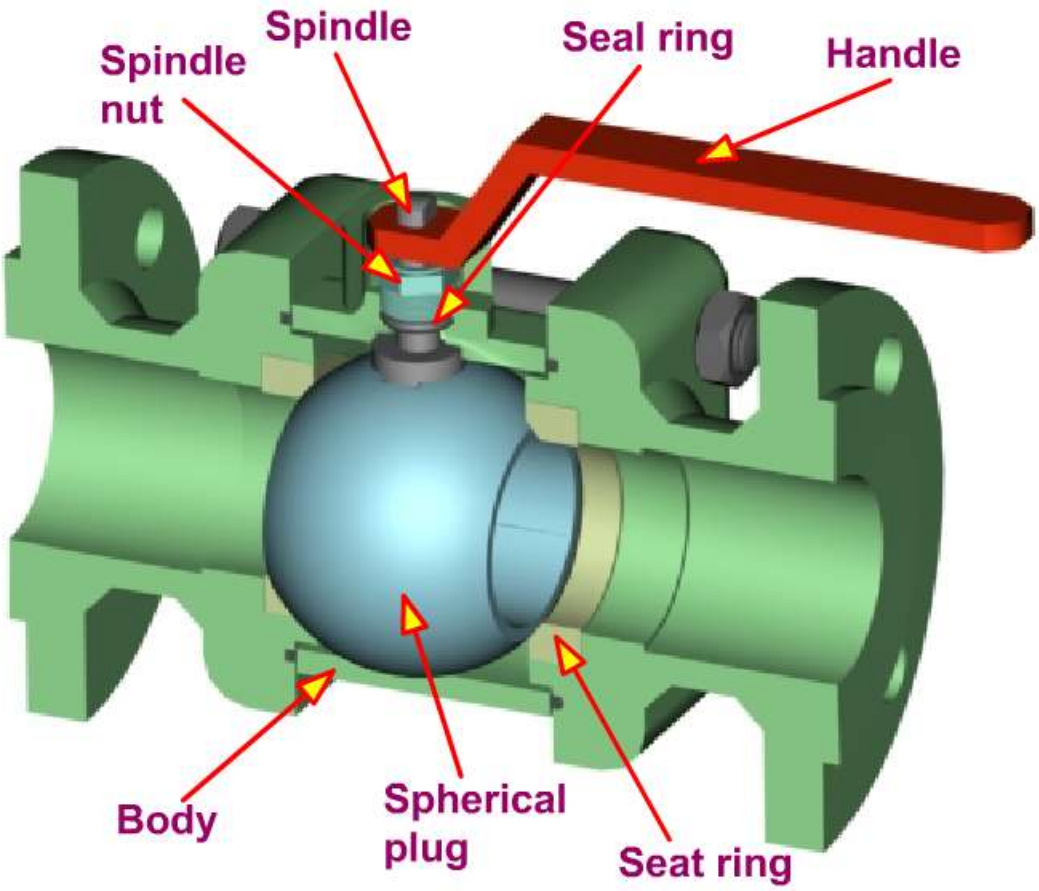


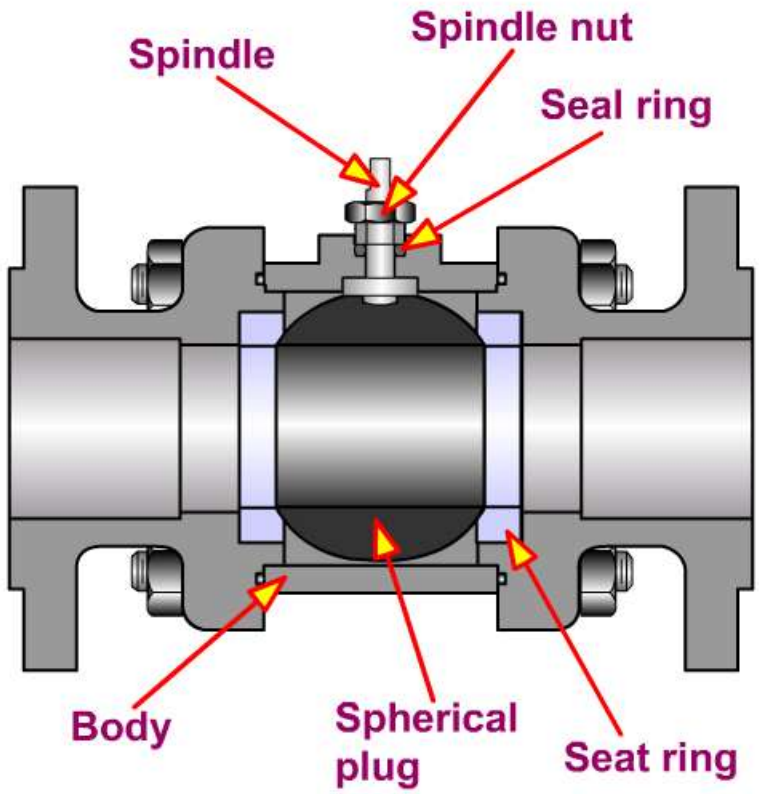
2D cross-section

A typical model and the 2D cross-section of a flanged end ball valve is illustrated.

BALL VALVES

FLANGED END BALL VALVES



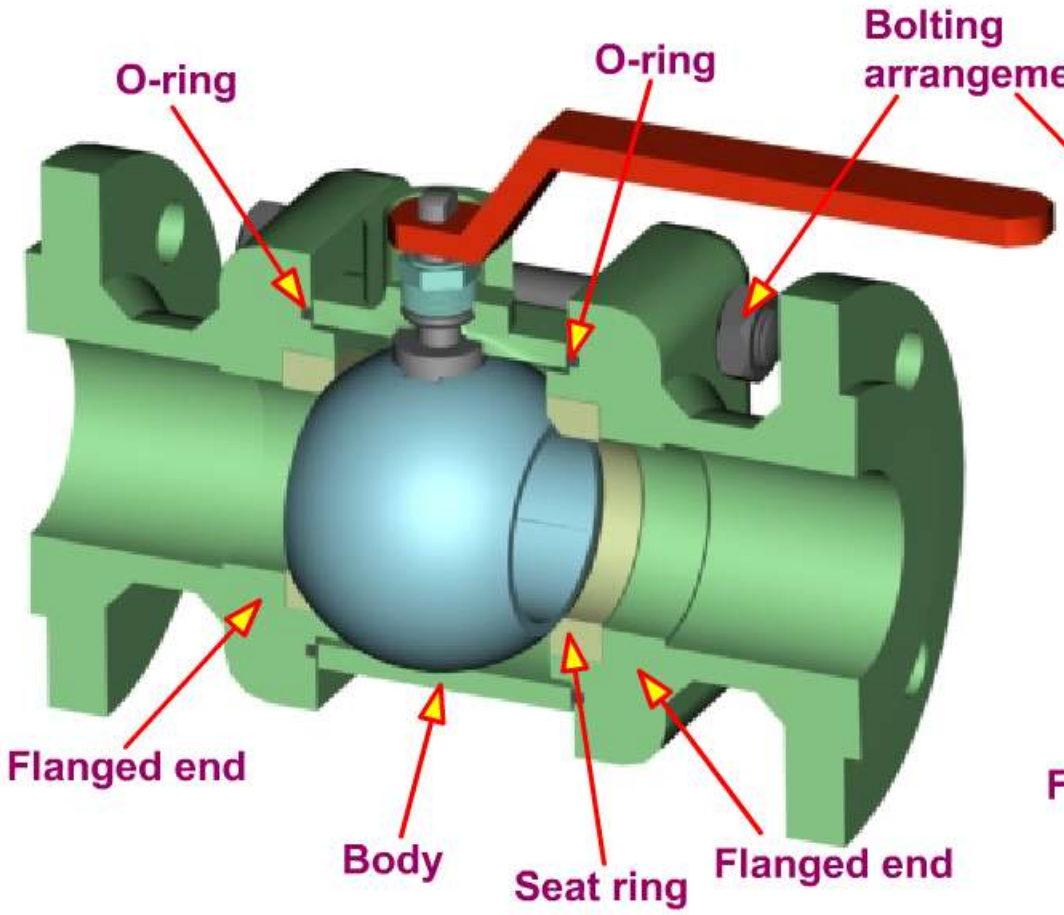


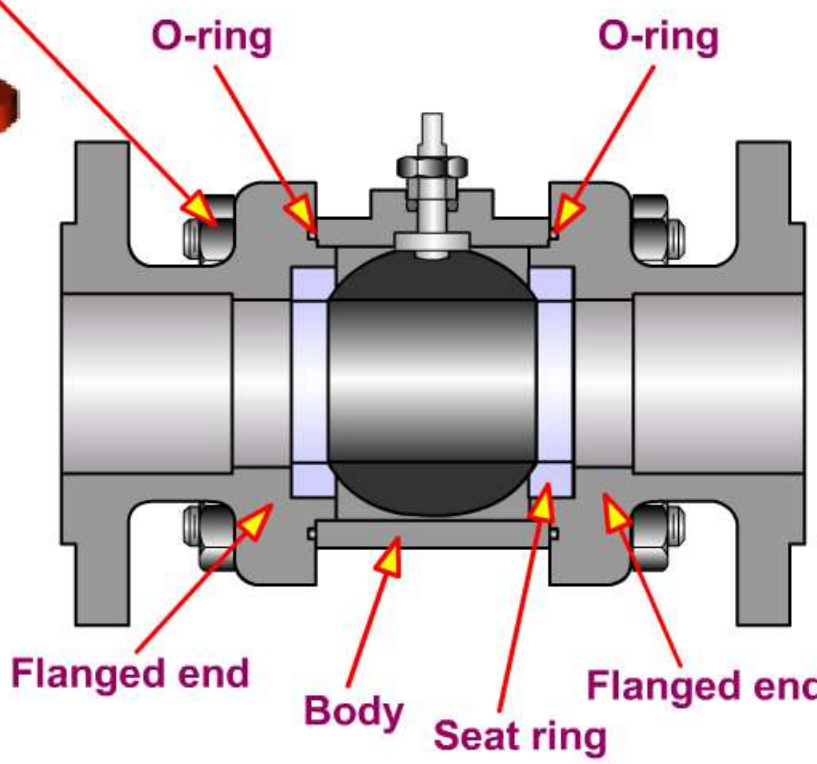
Major components of the ball valve are the body, spherical plug (ball), and seats. The spindle is positively locked with the spherical plug and handle.

Ball valves are made in three general patterns - venturi port, full port, and reduced port. The full port has an inside diameter equal to the inside diameter of the pipe. In the venturi and reduced port styles, the port is generally one pipe size smaller than the line size.

BALL VALVES

FLANGED END BALL VALVES

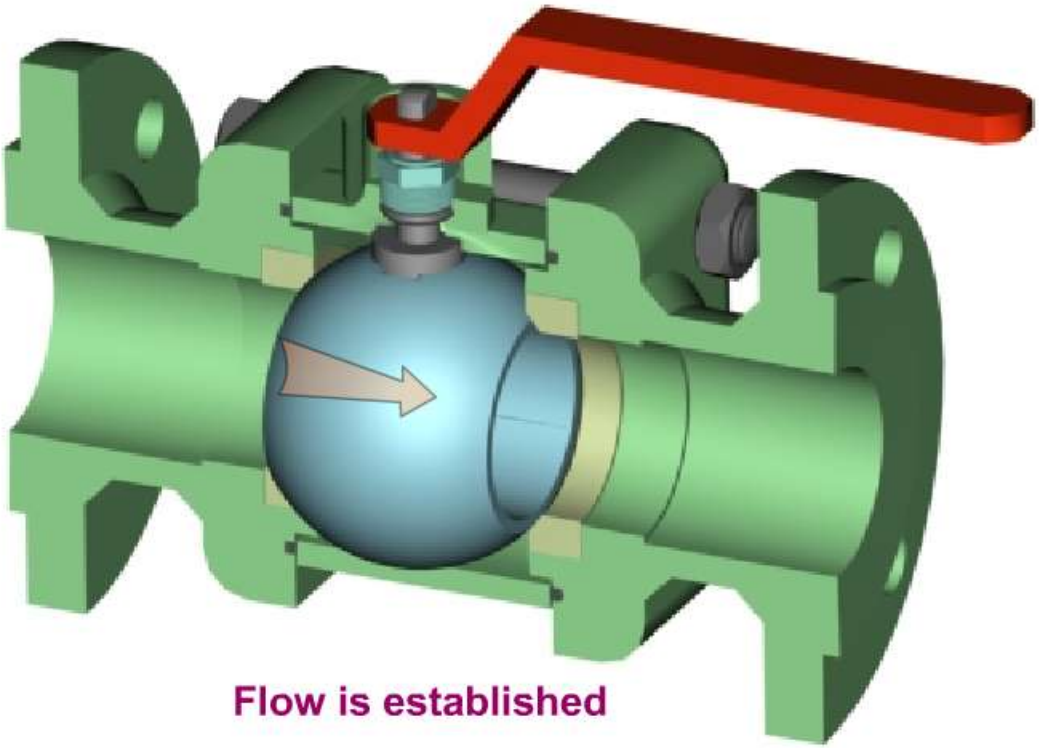




The flanged end parts, which connect to the piping are held to the main body by bolting arrangement. The body end parts keep the seat rings pressed against the spherical plug.

BALL VALVES

FLANGED END BALL VALVES



Flow is established

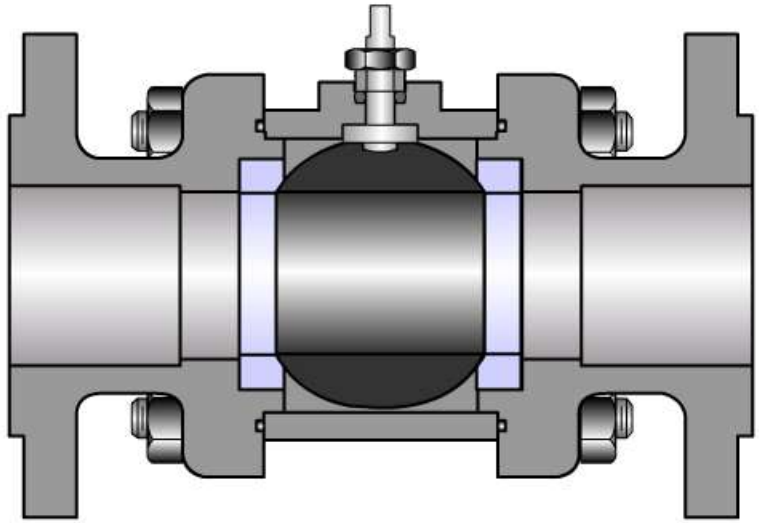
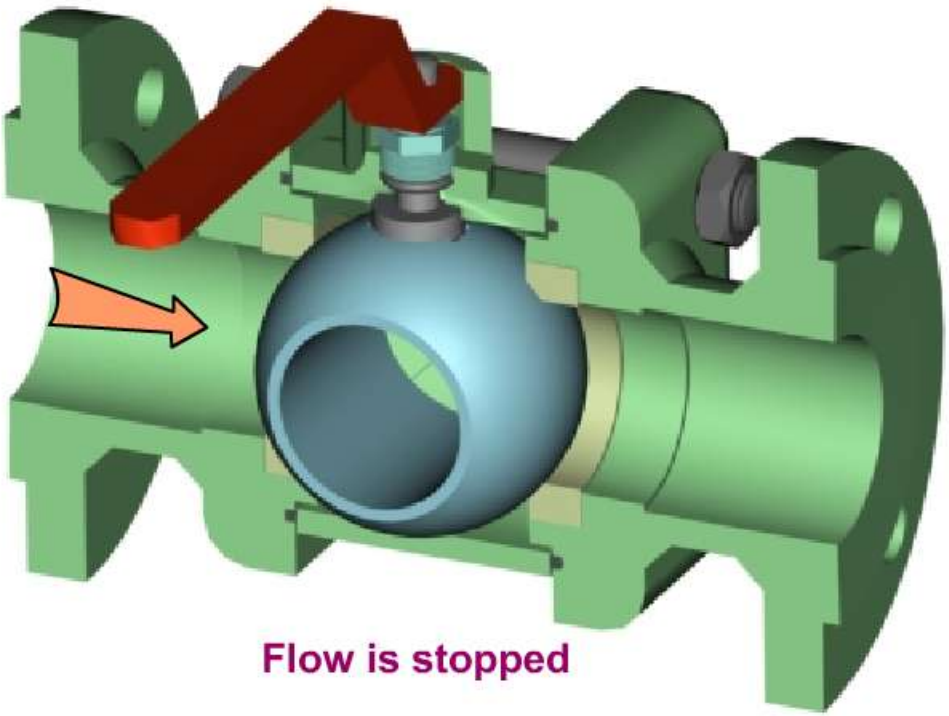


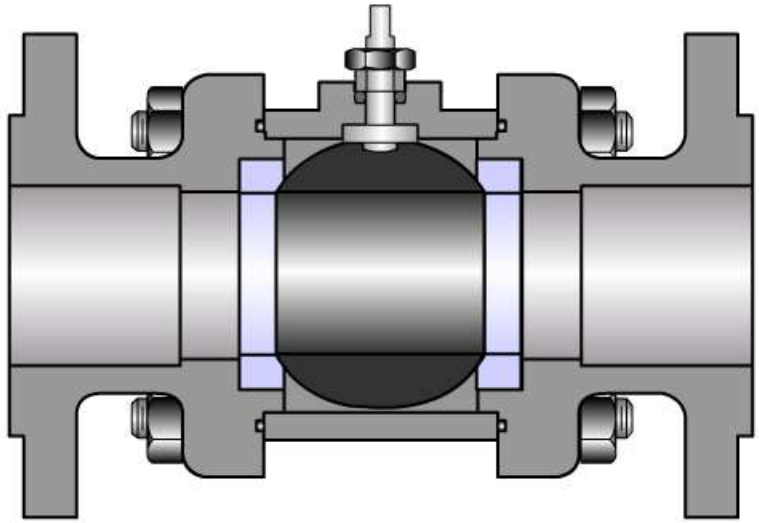
Illustration shows the open position of the valve. Flow path across the valve is depicted.

BALL VALVES

FLANGED END BALL VALVES



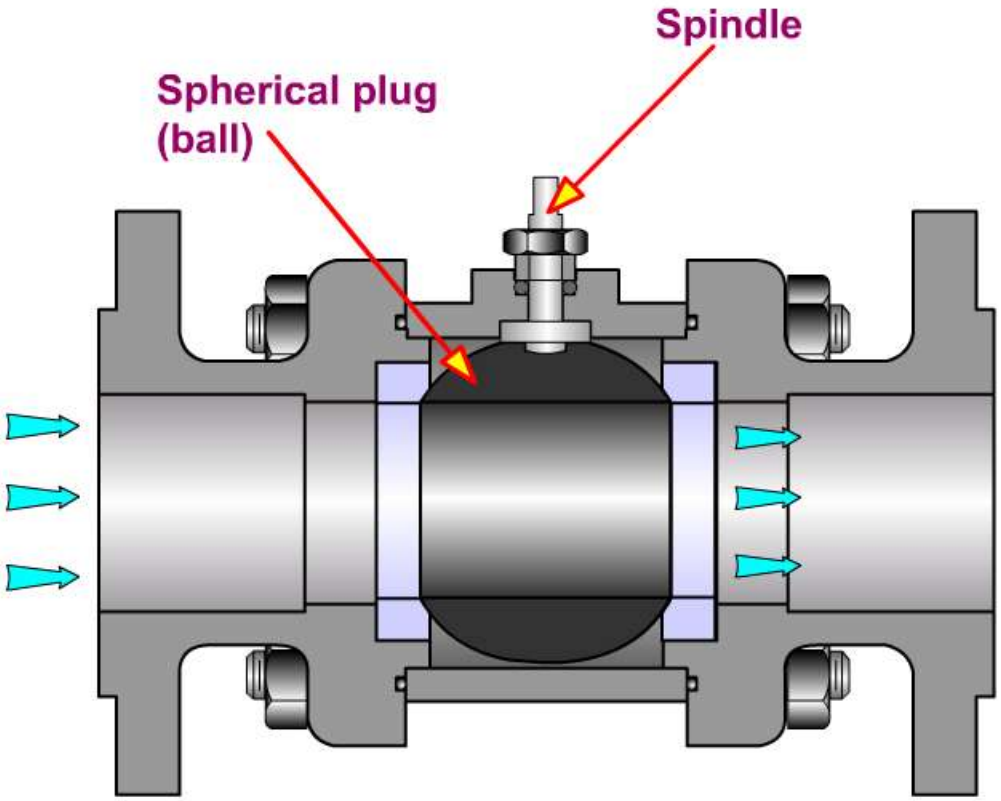
Flow is stopped



As depicted, the valve is closed by rotating the spindle/spherical plug a quarter turn in the clock-wise direction, thus stopping the flow.

BALL VALVES

FLANGED END BALL VALVES



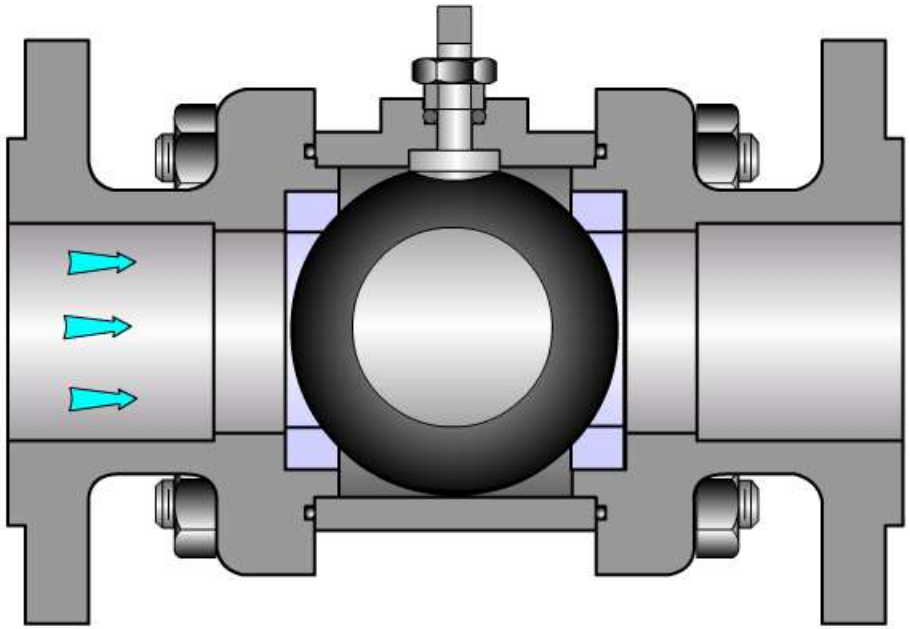
VALVE OPERATION

Let us observe the operation of the valve in its 2D cross-sectional view.

Depiction shows the open position of the valve and the flow path.

BALL VALVES

FLANGED END BALL VALVES

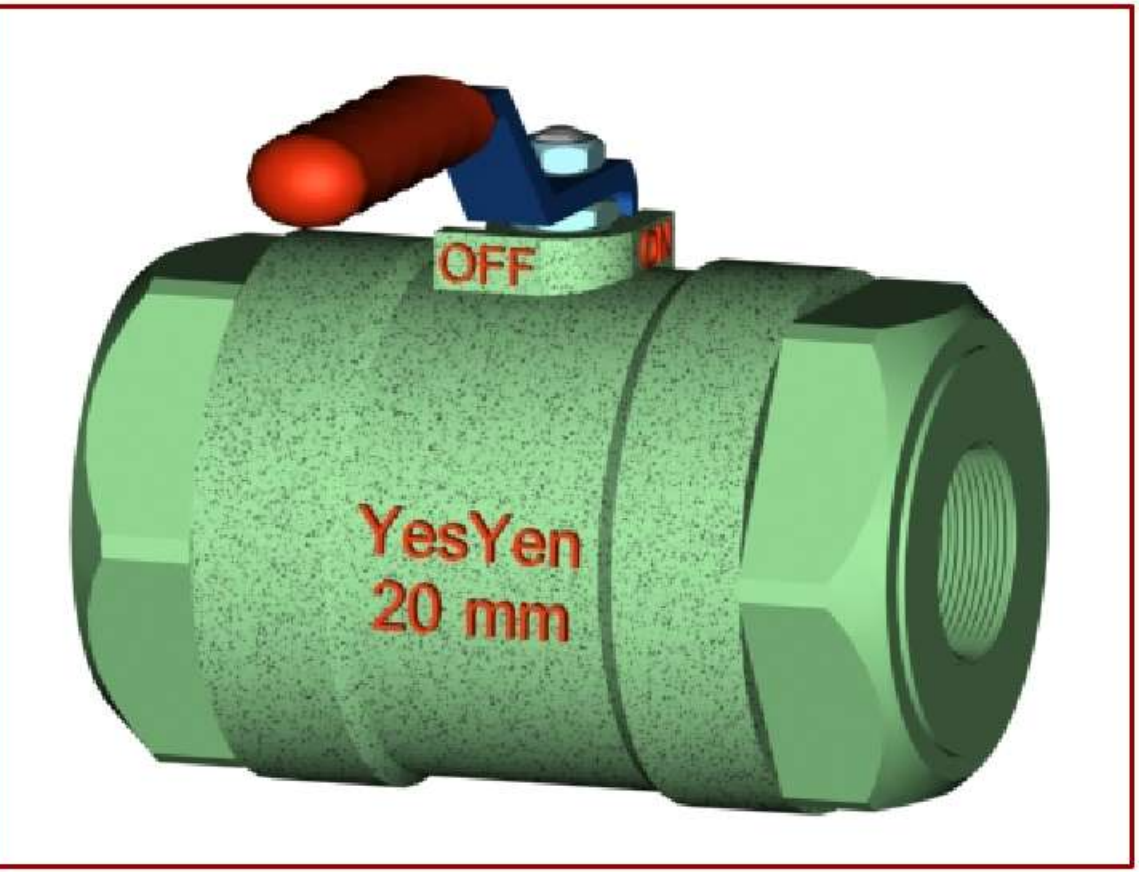


VALVE OPERATION

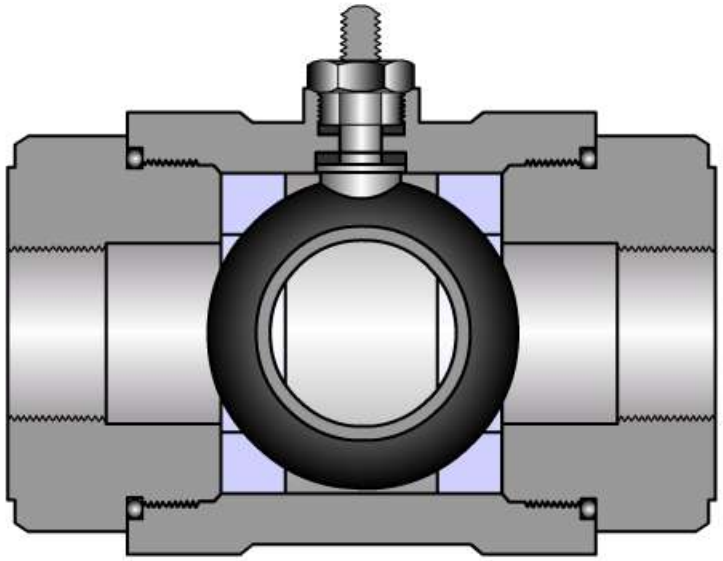
As shown, when the spindle and ball arrangement is rotated through a quarter (90^0) turn in the clockwise direction, the valve closes and the flow stops.

BALL VALVES

SCREWED END BALL VALVES



3D model

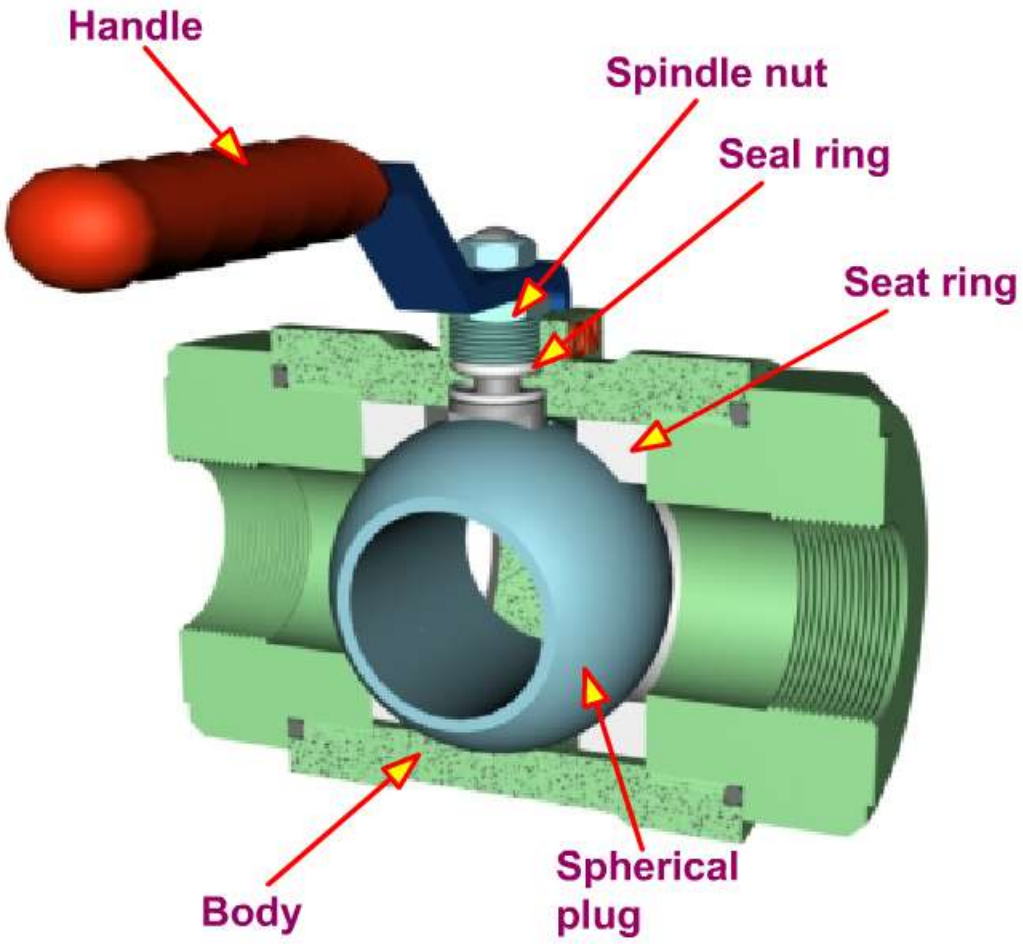


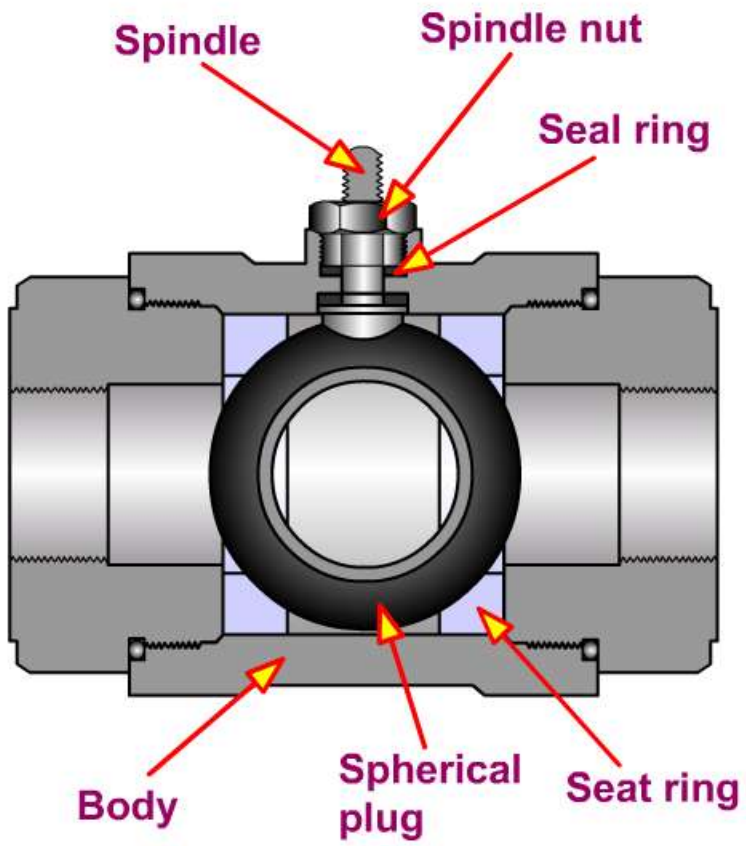
2D cross-section

A typical model and the 2D cross-section of a screwed end ball valve is illustrated.

BALL VALVES

SCREWED END BALL VALVES





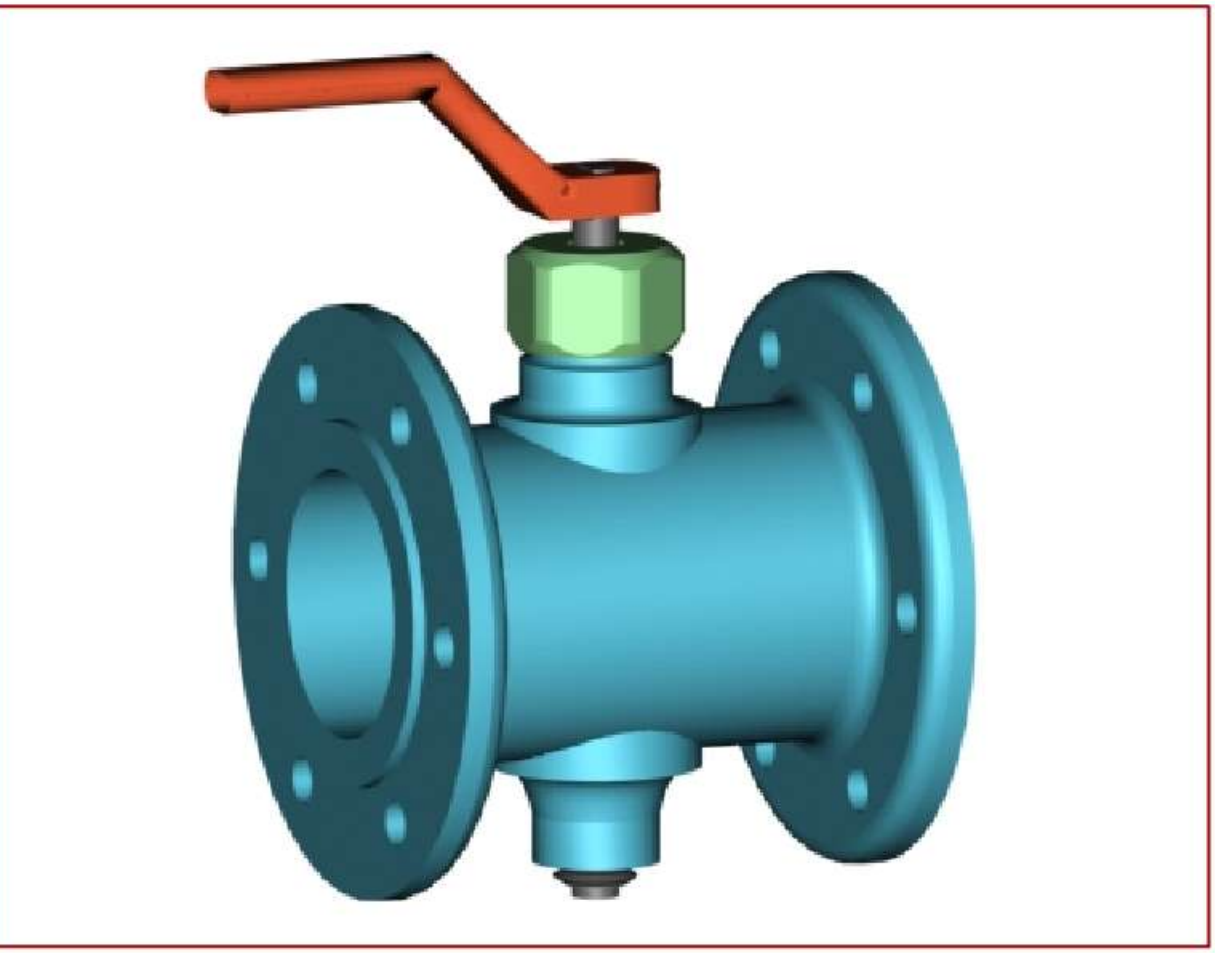
Major components of the ball valve are the body, spherical plug (ball), and seats. The spindle is positively locked with the spherical plug and handle.

Ball valves are made in three general patterns - venturi port, full port, and reduced port. The full port has an inside diameter equal to the inside diameter of the pipe. In the venturi and reduced port styles, the port is generally one pipe size smaller than the line size.

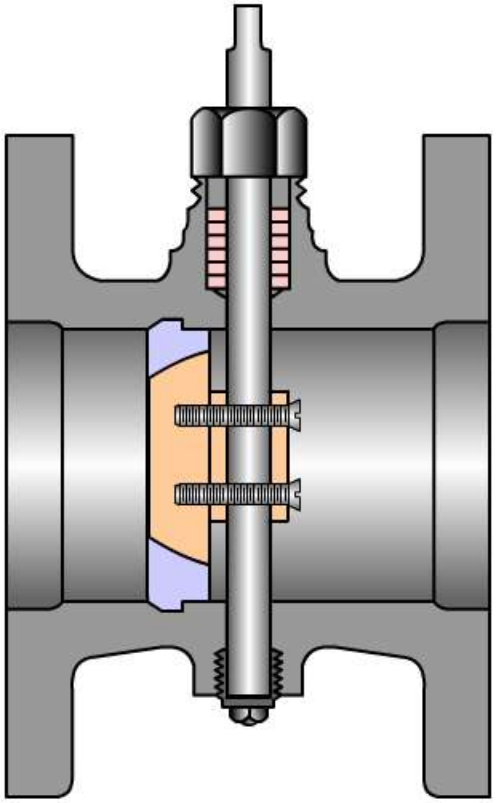
Butterfly Valve

VALVE TYPES
BUTTERFLY VALVES

Flanged-end Butterfly Valve



3D model



2D cross-section

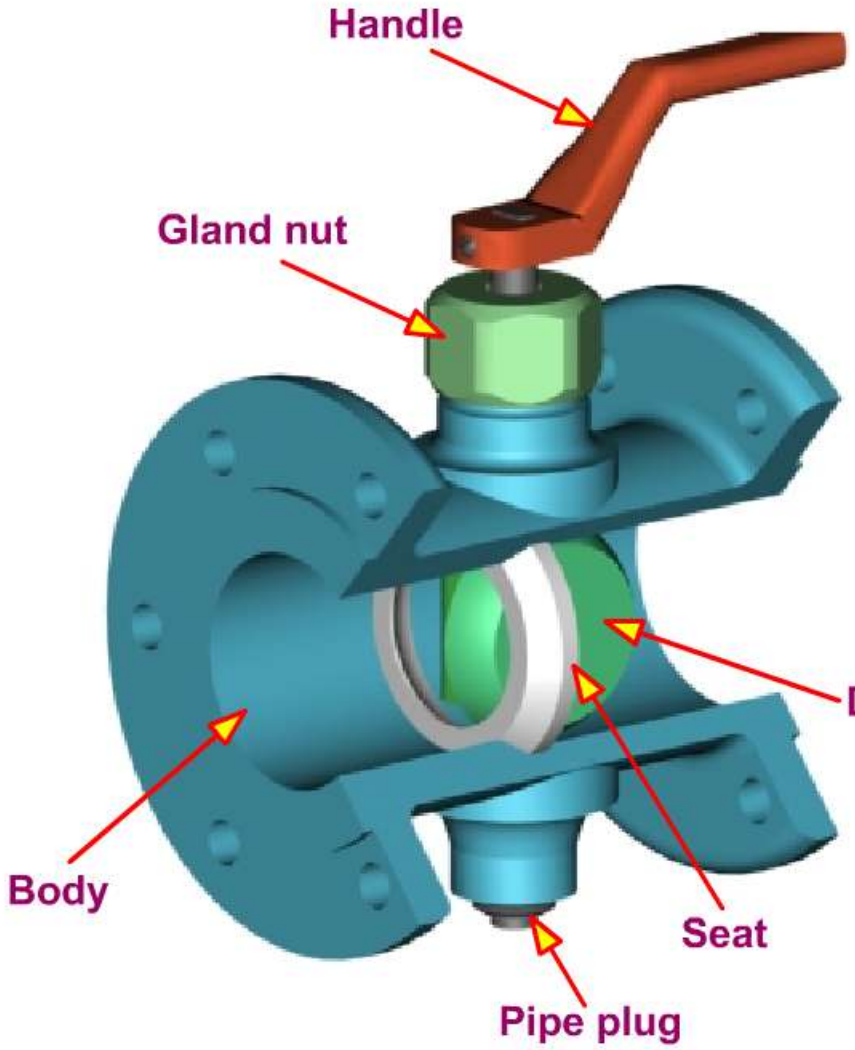
Butterfly valves are low pressure valves of efficient design, used to control and regulate flow.

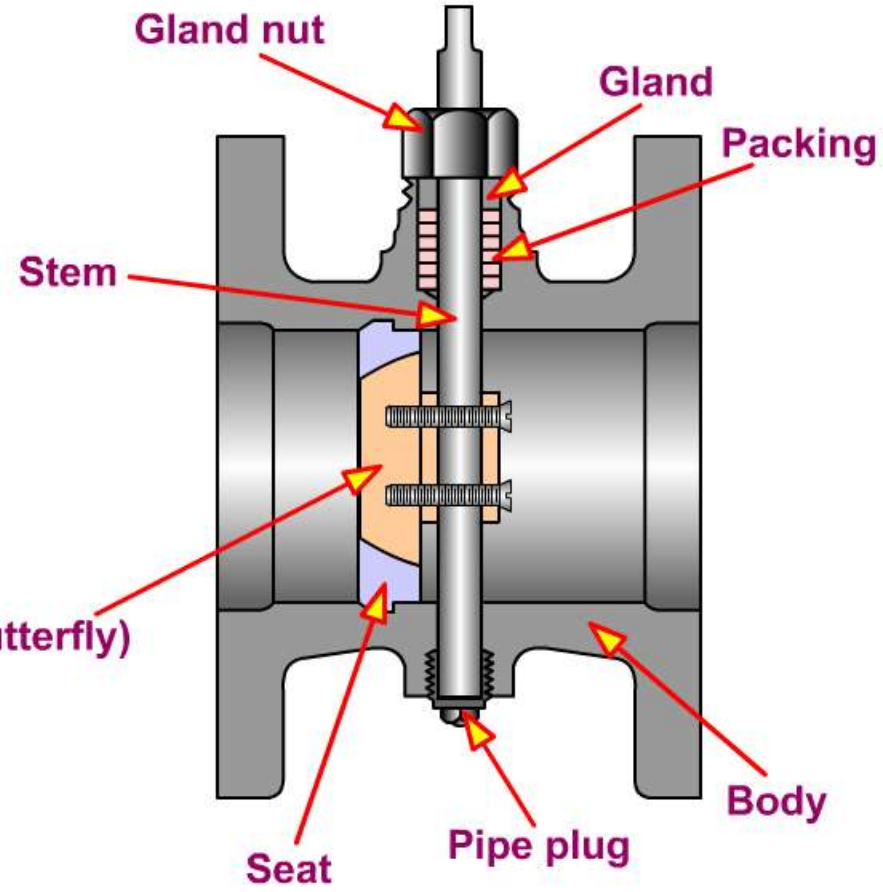
A typical model and the 2D cross-section of a flanged-end butterfly valve is shown.

VALVE TYPES

BUTTERFLY VALVES

Flanged-end Butterfly Valve





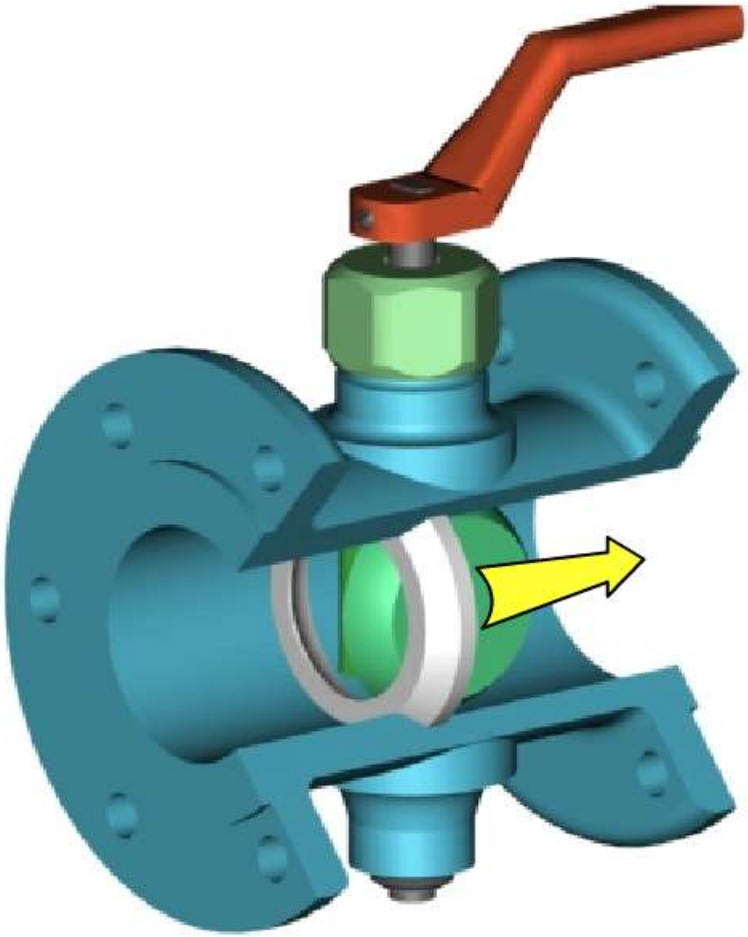
The valve primarily consists of the body, disc, stem and seat. The stem is positively locked with the disk and handle.

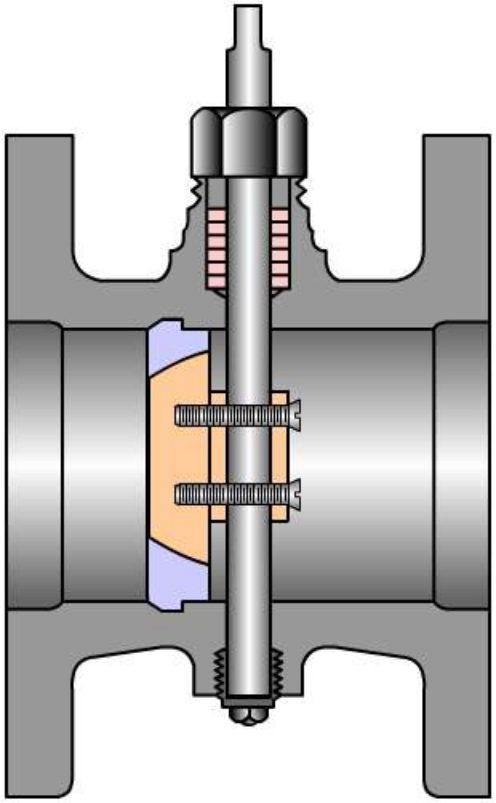
3D depiction shows the open position of the valve.

VALVE TYPES

BUTTERFLY VALVES

Flanged-end Butterfly Valve





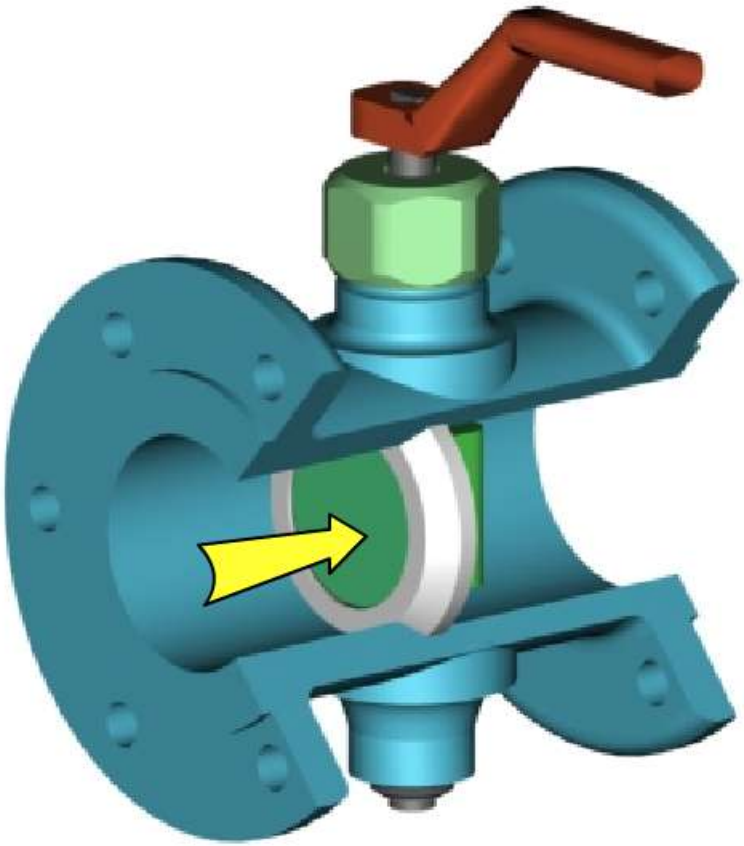
As shown, in the open position the liquid or gas flows through the valve.

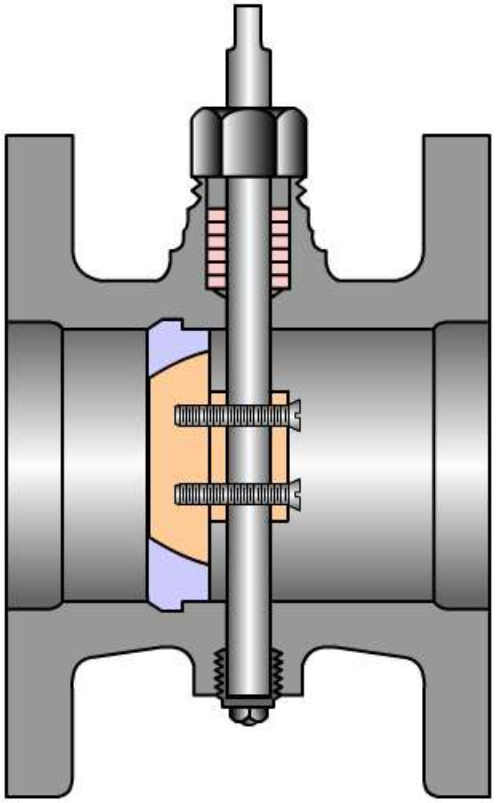
Now let us close the valve.

VALVE TYPES

BUTTERFLY VALVES

Flanged-end Butterfly Valve



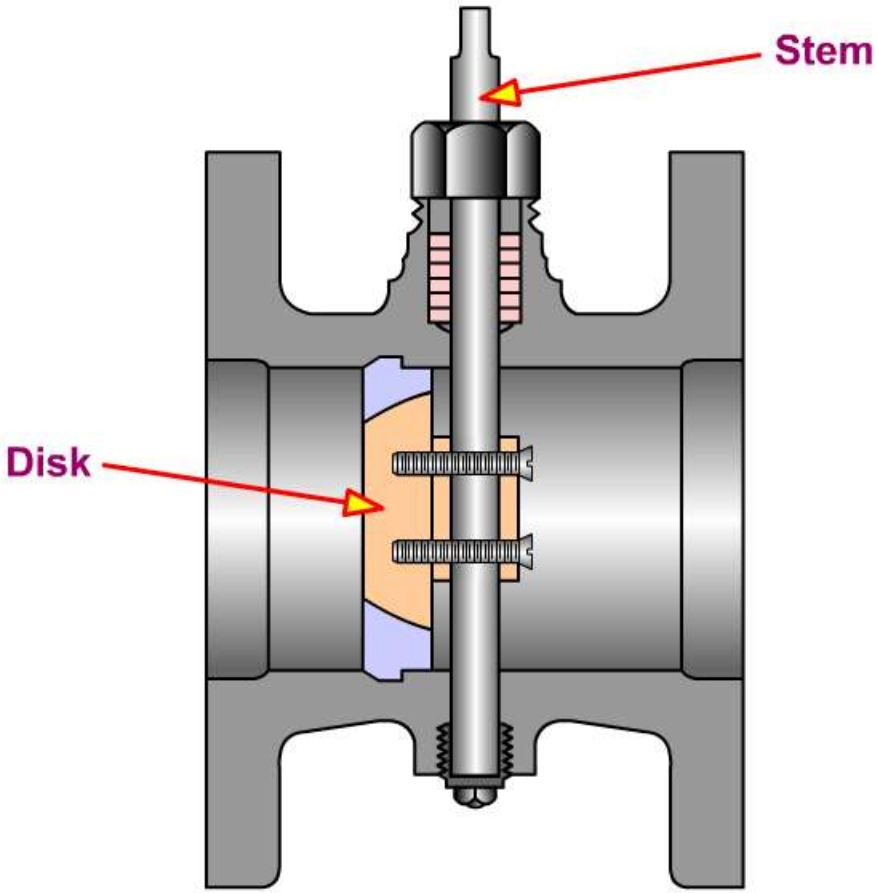


As depicted the valve is closed by rotating the stem/disk a quarter turn in the clock-wise direction, thus stopping the flow.

VALVE TYPES

BUTTERFLY VALVES

Flanged-end Butterfly Valve



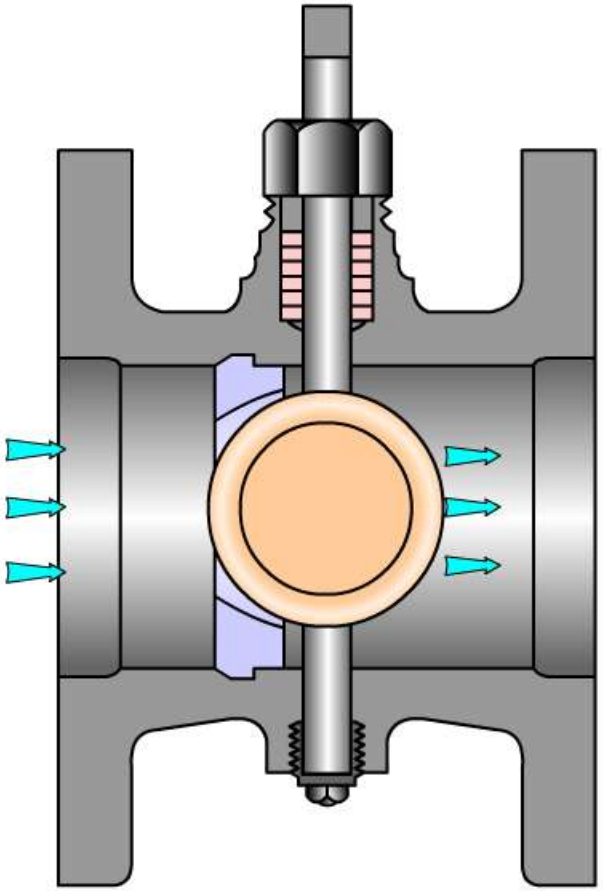
VALVE OPERATION

Let us observe the operation of the valve in its 2D cross-sectional view.

VALVE TYPES

BUTTERFLY VALVES

Flanged-end Butterfly Valve



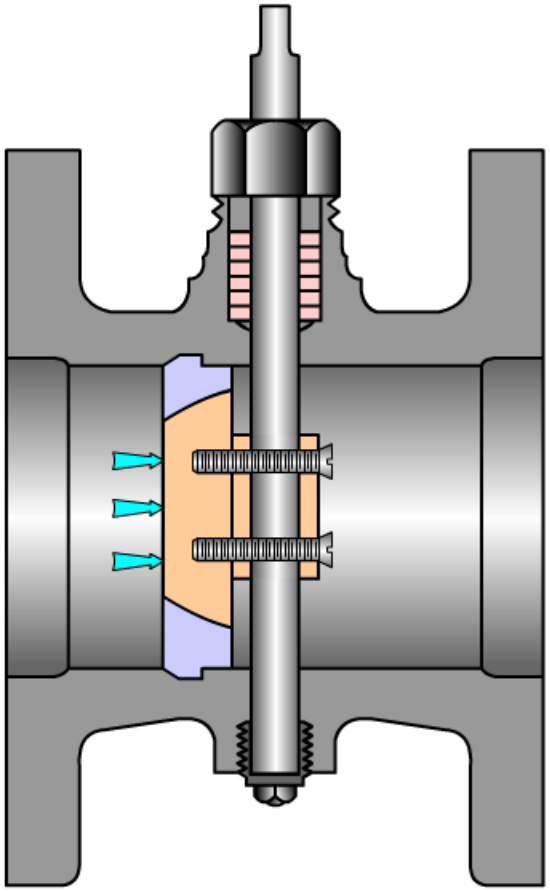
VALVE OPERATION

As shown, when the stem and disk arrangement is rotated through a quarter (90^0) turn in the anti-clockwise direction, the valve opens and the flow is established.

VALVE TYPES

BUTTERFLY VALVES

Flanged-end Butterfly Valve

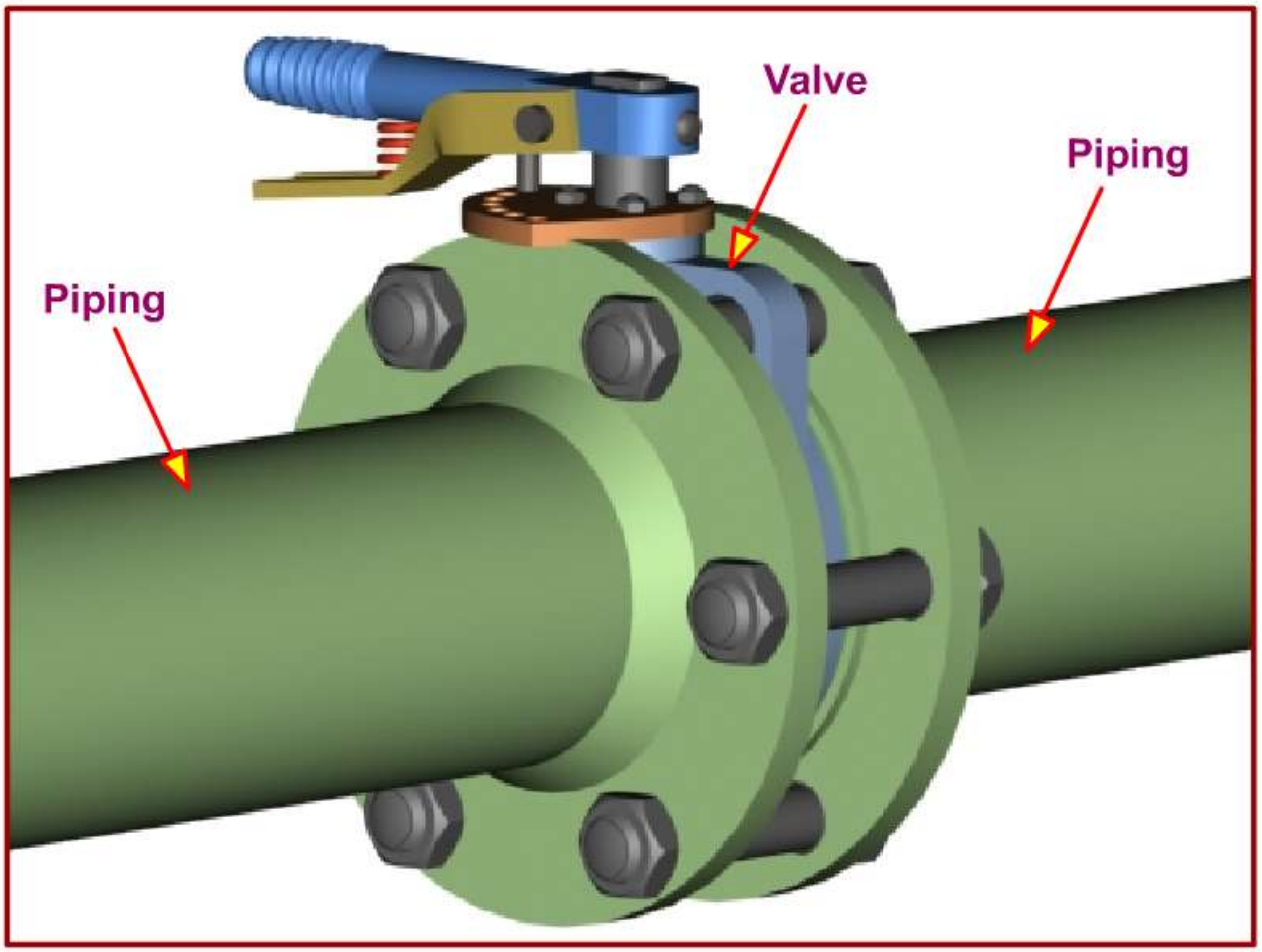


VALVE OPERATION

On rotating the stem and disk arrangement through a quarter (90^0) turn in the clockwise direction, the valve closes and the flow is stopped.

VALVE TYPES
BUTTERFLY VALVES

Wafer Butterfly Valve



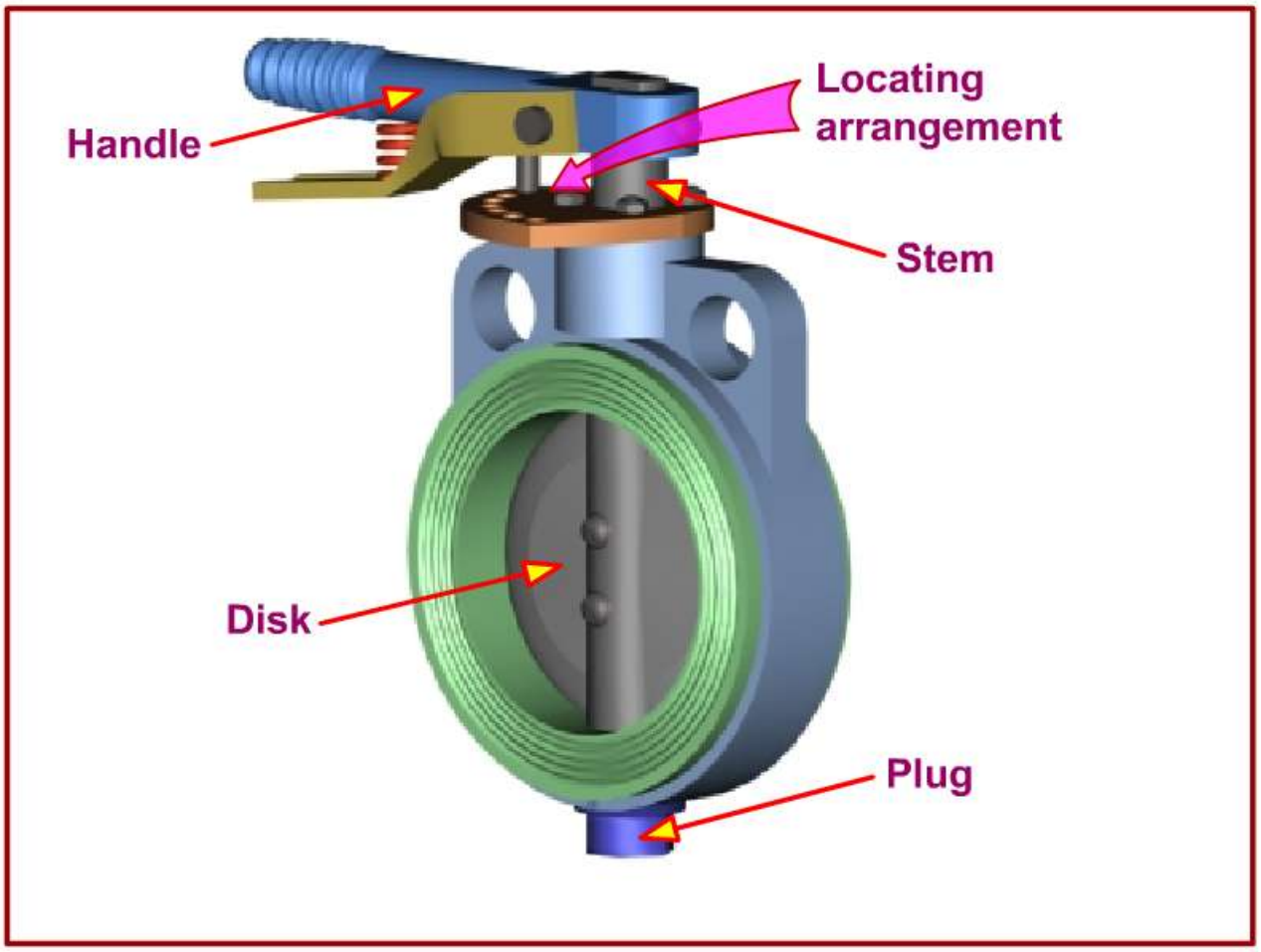
Wafer butterfly arrangement

Depiction shows a typical wafer butterfly valve arrangement. Wafer butterfly arrangements are available in a range of designs. The valve does not have flanges and is held in place by bolting arrangement between the pipe flanges.

VALVE TYPES

BUTTERFLY VALVES

Wafer Butterfly Valve



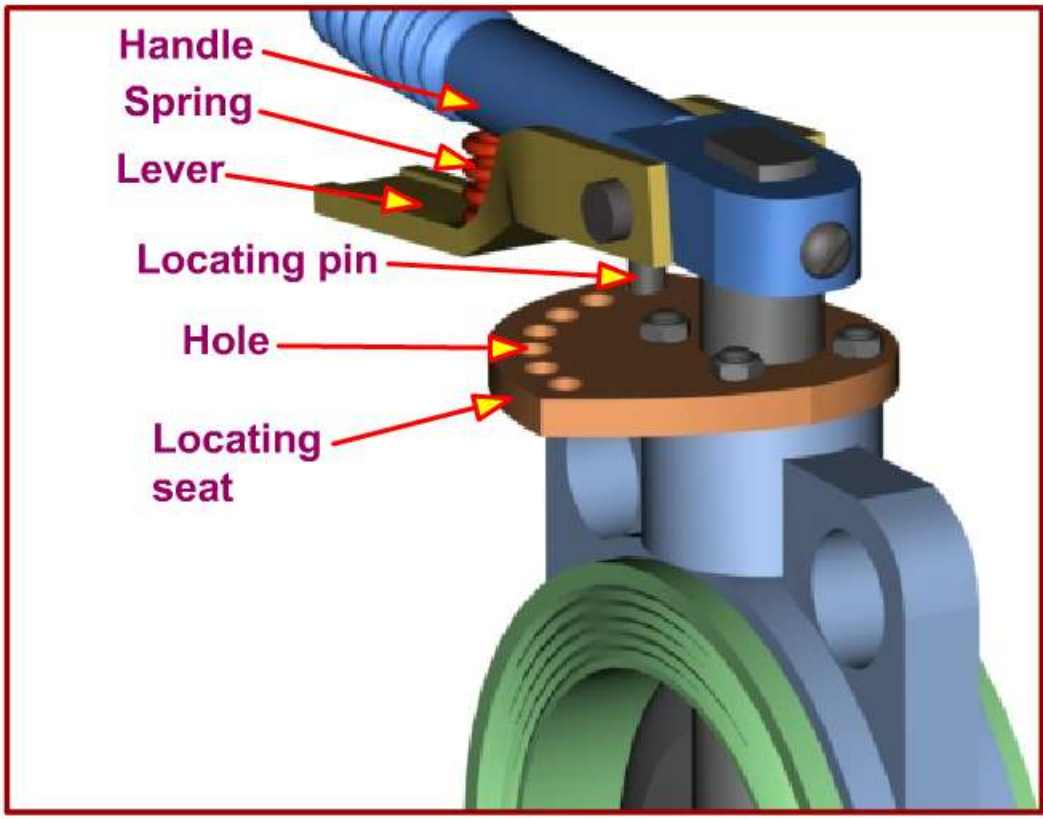
Shown is the valve without the piping arrangement.

The nomenclature of various components of the valve is depicted. The stem is positively locked with the disk and handle.

VALVE TYPES

BUTTERFLY VALVES

Wafer Butterfly Valve



Locating arrangement - enlarged view

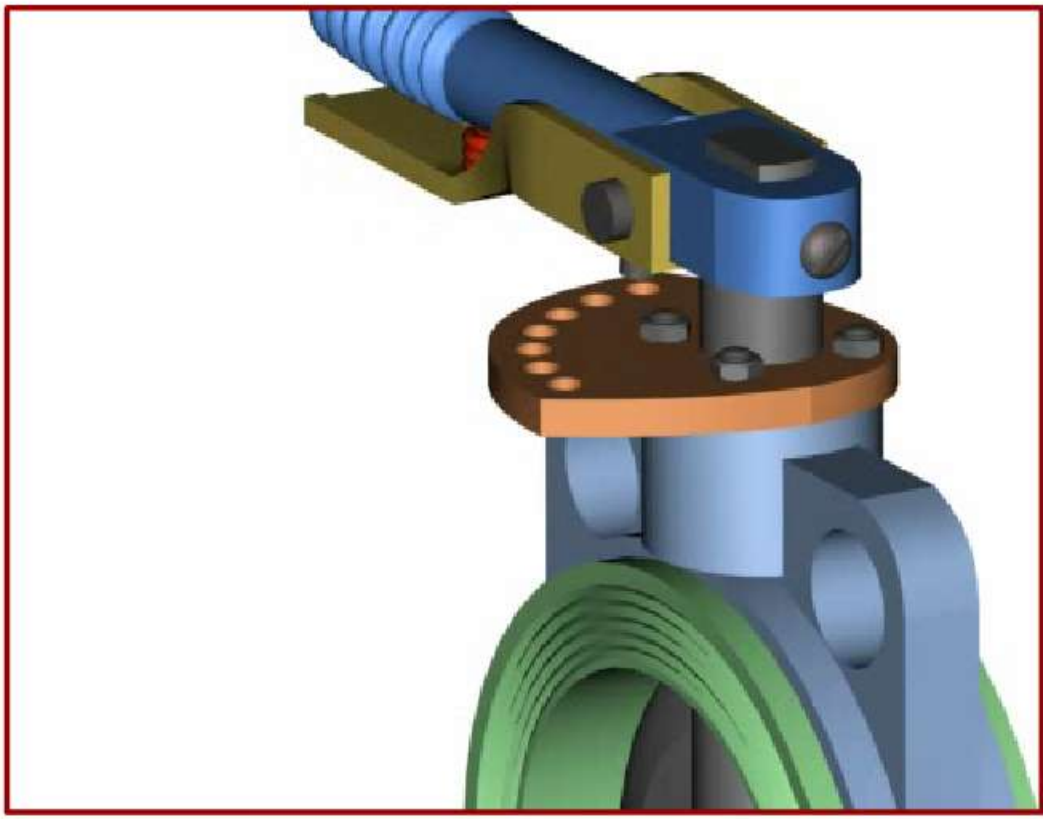
We shall look into the operation of the valve. The disk is held in position by a locating pin, which mates with corresponding holes in the locating seat. The pin is connected to a lever, which is kept pressed by a spring connected to the handle. Depiction shows the closed position of the valve.

- Let us partially open the valve.

VALVE TYPES

BUTTERFLY VALVES

Wafer Butterfly Valve

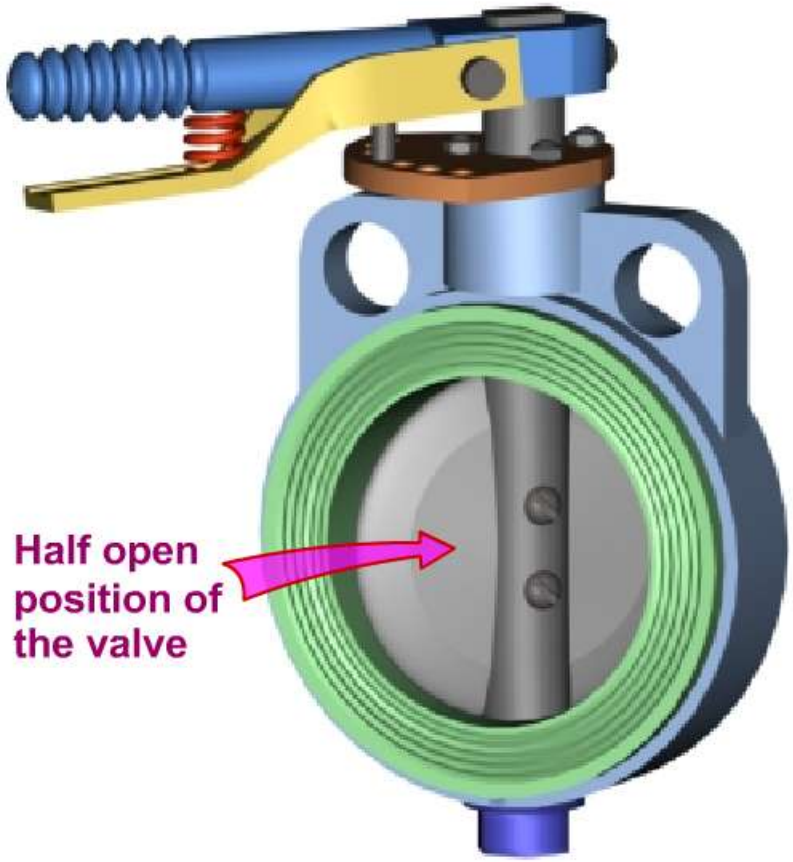


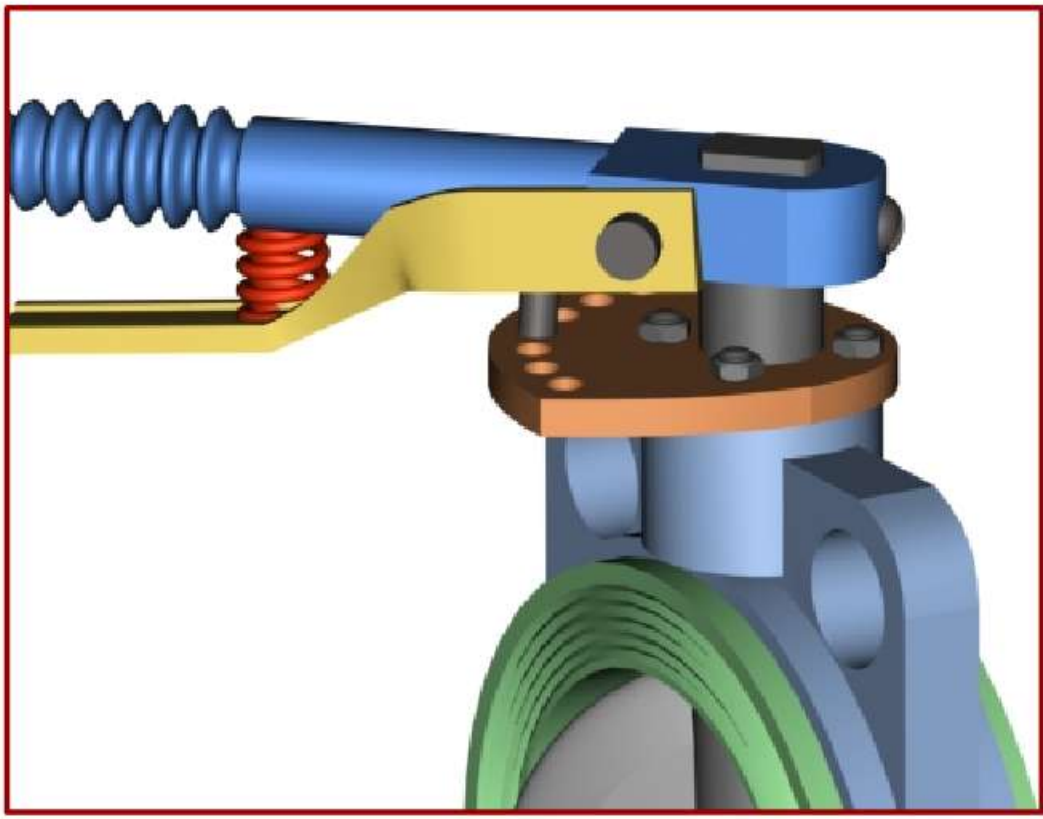
As shown the lever is forced against the spring pressure, to release the pin from its mating hole.

VALVE TYPES

BUTTERFLY VALVES

Wafer Butterfly Valve





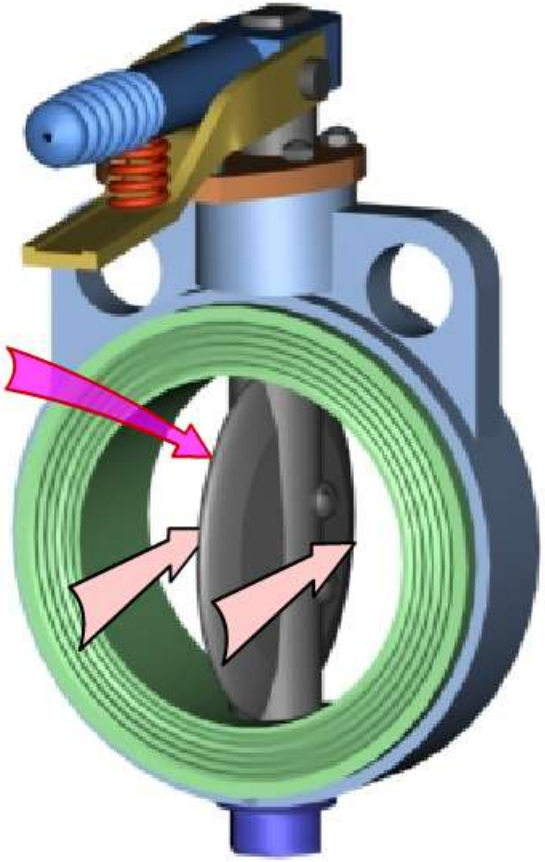
The handle is then rotated in the anti-clockwise direction to the desired position and the lever is released thus locking the pin and disk.

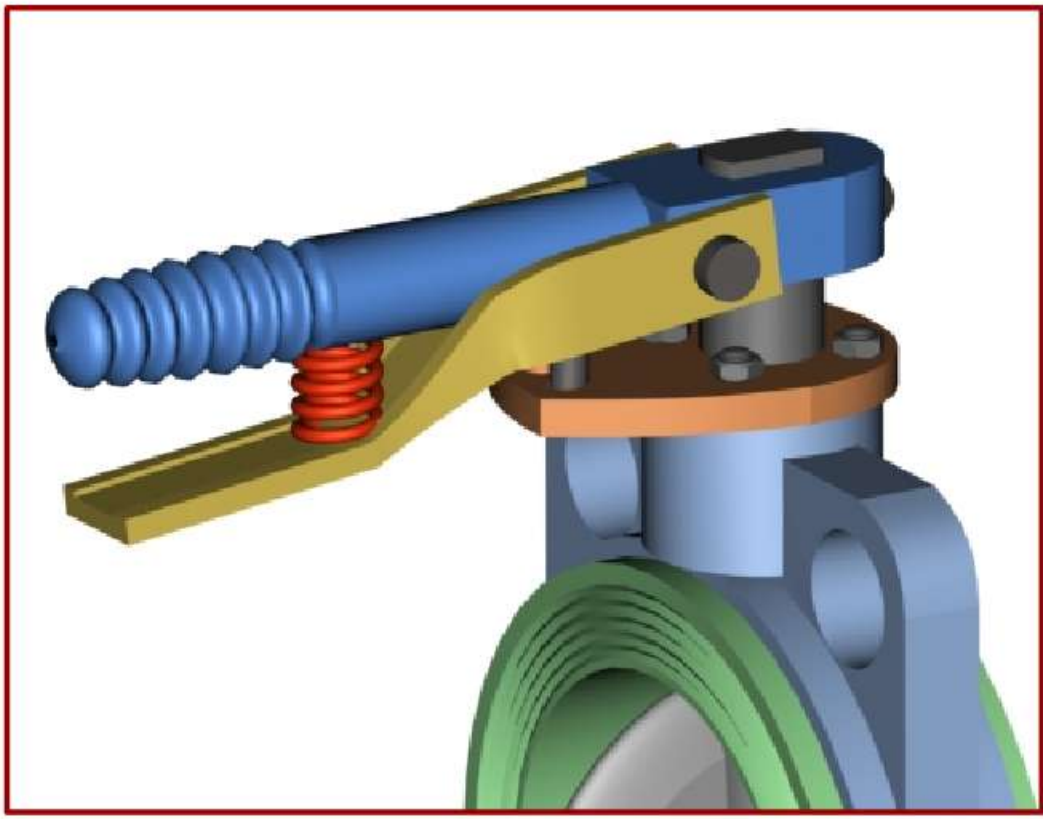
- Illustration shows the handle and disk rotated across 45^0 to the half open position of the valve.

VALVE TYPES

BUTTERFLY VALVES

Wafer Butterfly Valve





In a similar manner, the handle and disk is further rotated across 45^0, to the fully open position of the valve.

- Depiction shows the flow path through the fully open valve.

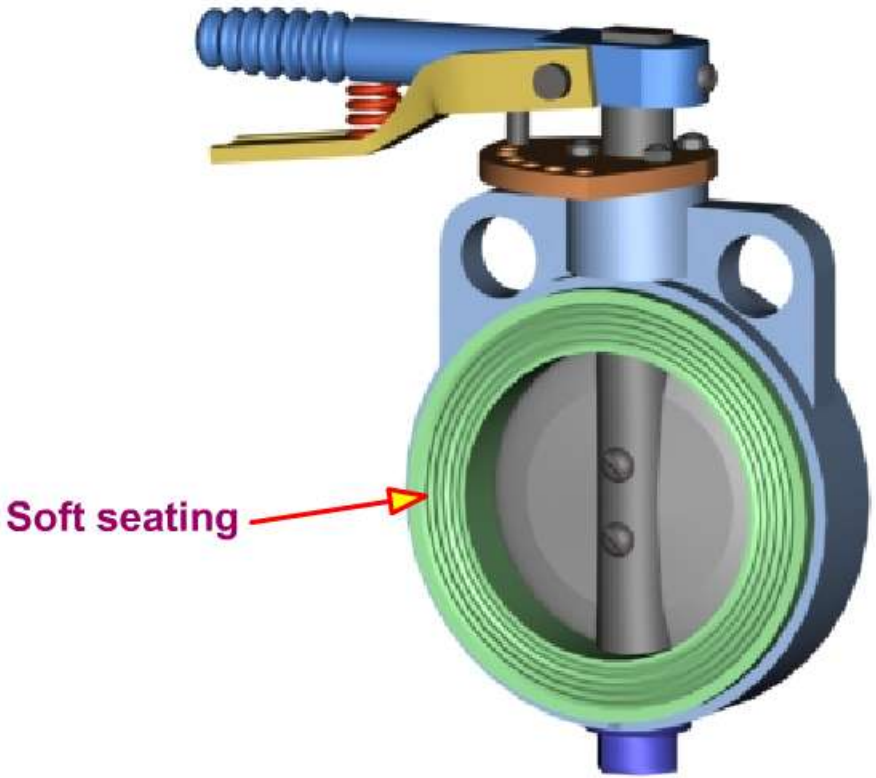
VALVE TYPES

BUTTERFLY VALVES

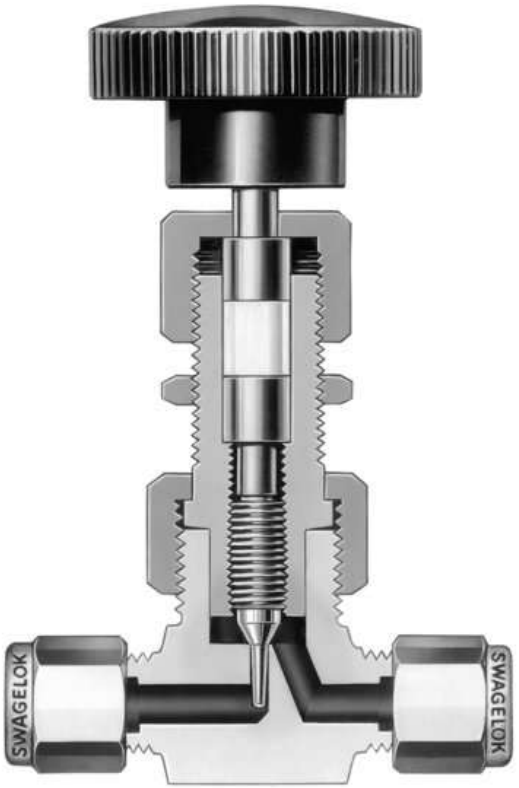
Wafer Butterfly Valve

Butterfly valves are fast operation low-pressure drop valves, requiring only a quarter turn from closed to fully-open position.

These valves are available with metal to metal seats, soft seats and with fully lined body and disk. The soft seats permit very tight shutoff. Full lining increases the resistance to erosion and corrosion. Seating materials like Buna N, Neoprene, Fluorel, Hypalon and EPDM are available.



Needle Valve



Needle valves have a slender, tapered point at the end of the valve stem that is lowered through the seat to restrict or block flow.

Fluid flowing through the valve turns 90 degrees and passes through an orifice that is the seat for a rod with a cone shaped tip.

These small valves are widely used to accurately regulate the flow of liquids and gases at low flow rates.

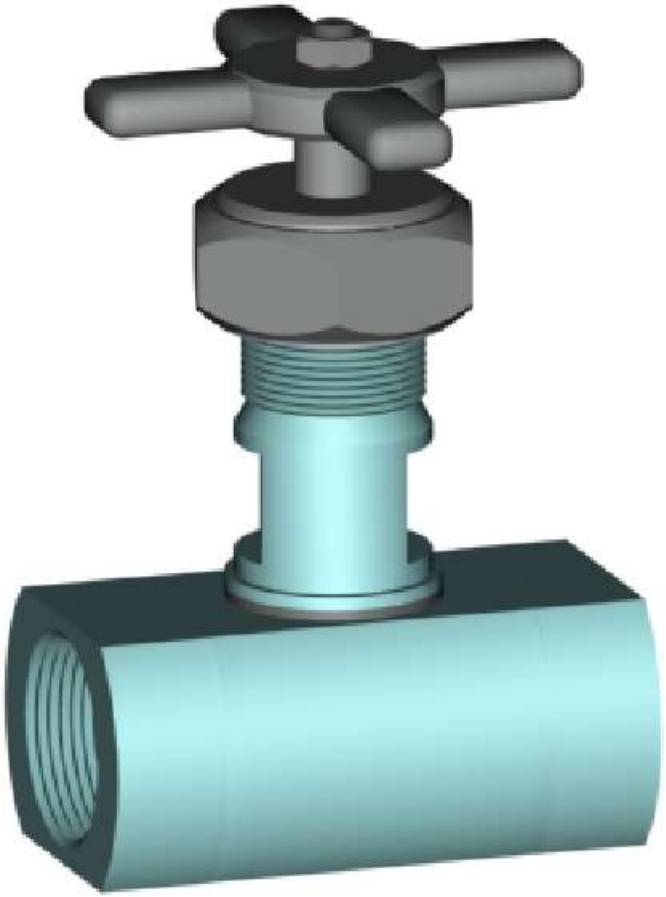
The fine threading of the stem and the large seat area allow for precise resistance to flow.

Needle valves are used to control flow into delicate gauges, which might be damaged by sudden surges of fluid under pressure.

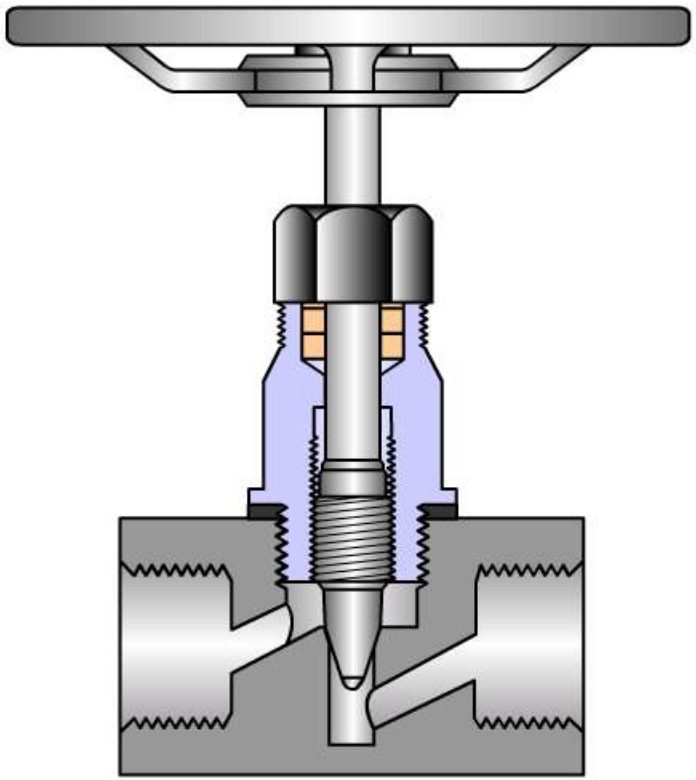
Needle valves are also used in situations where the flow must be gradually brought to a halt and at other points where precise adjustments of flow are necessary or where a small flow rate is desired.

They can be used as both on/off valves and for throttling service.

VALVE TYPES
NEEDLE VALVES



3D model



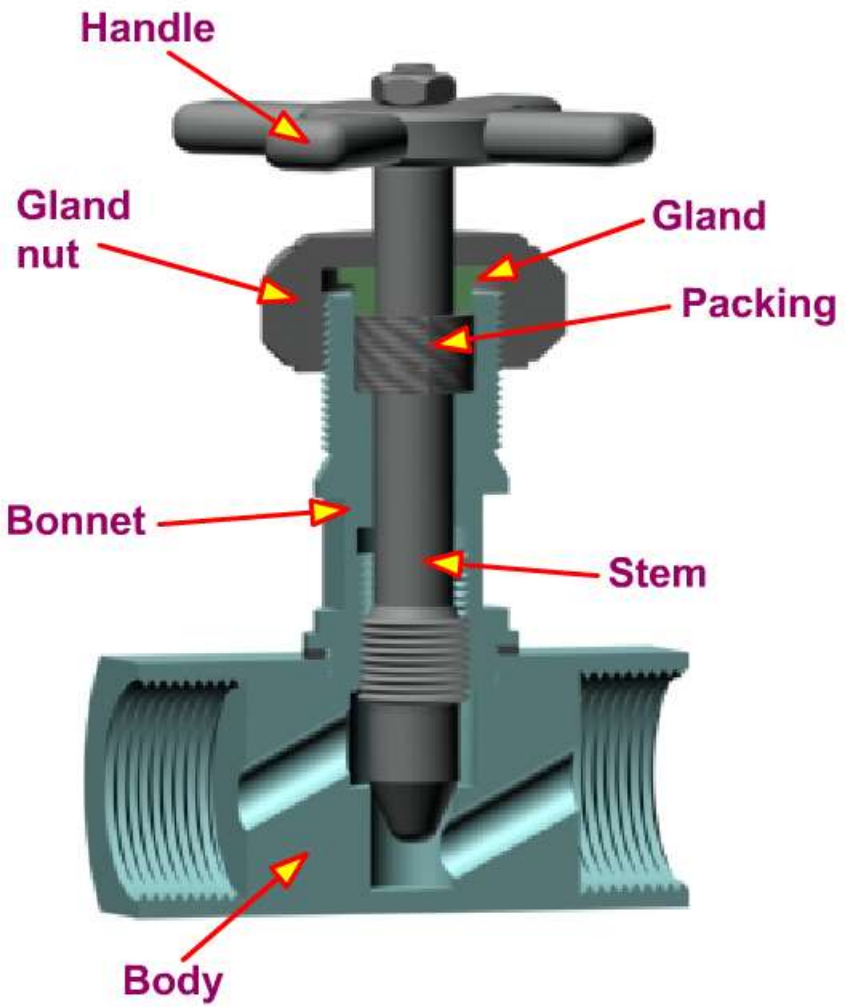
2D cross-section

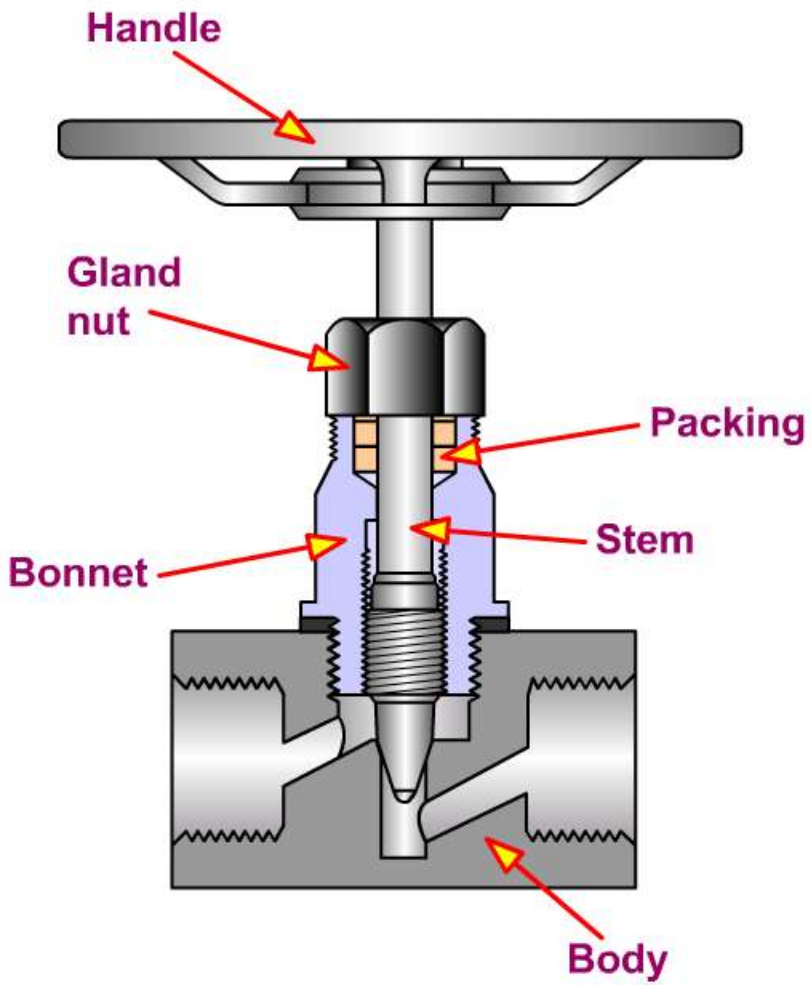
A typical model and the 2D cross-section of a needle valve is illustrated.

Needle valves are generally used for instrument, gauge and meter line service.

VALVE TYPES

NEEDLE VALVES



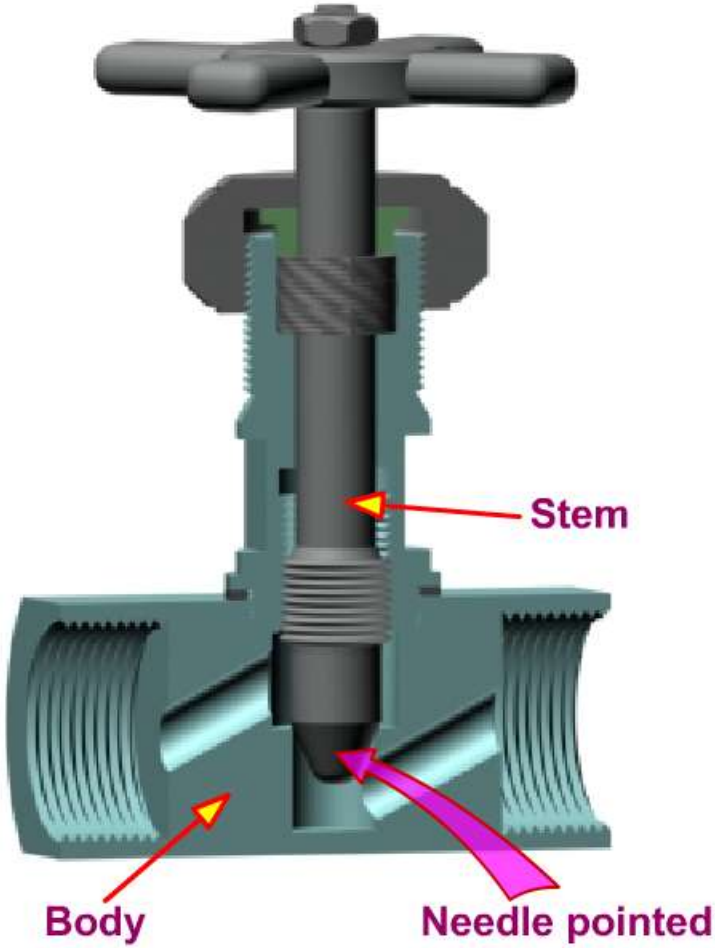


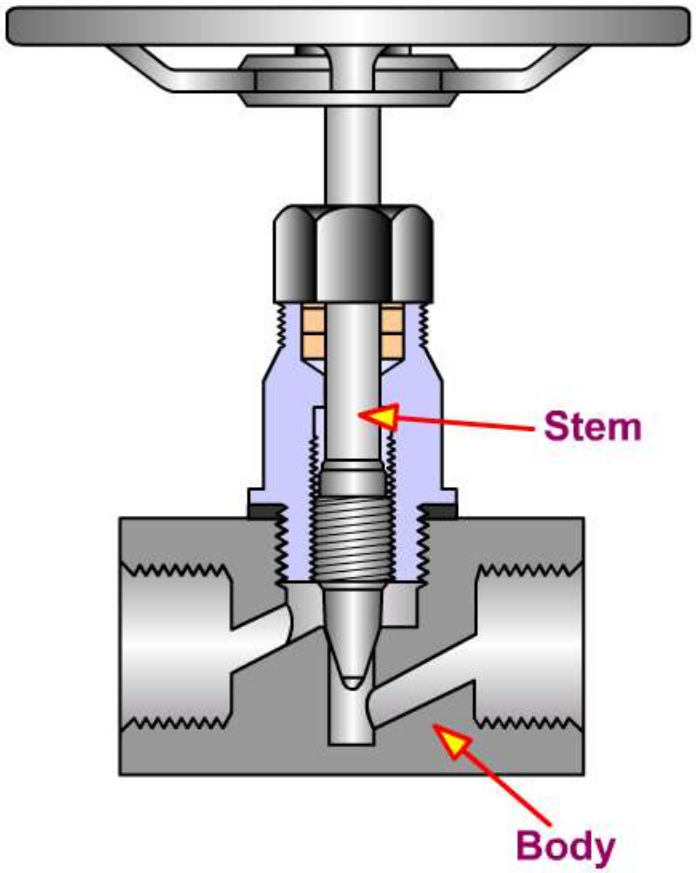
The nomenclature of the various components of the valve are shown.

The stem is positively locked with the handle and screws into corresponding mating arrangement in the bonnet.

VALVE TYPES

NEEDLE VALVES



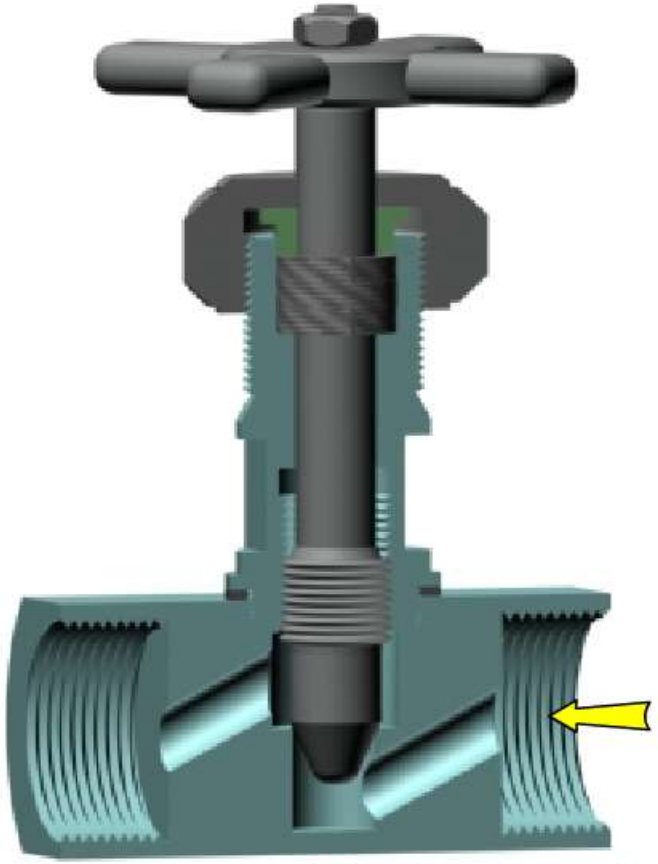


Depiction shows the closed position of the valve.

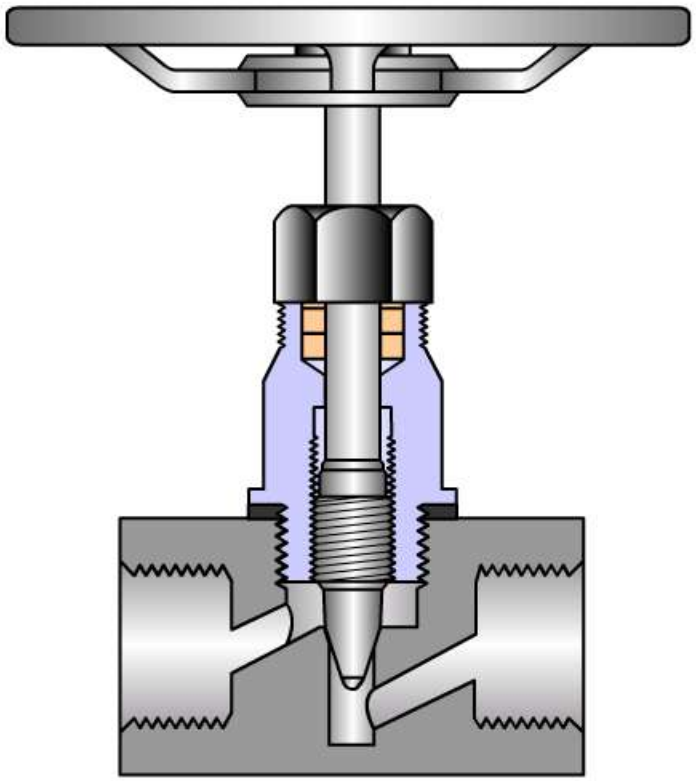
The end of the stem is needle pointed. The needle fits accurately into the seat thus providing tight closure with minimum effort.

VALVE TYPES

NEEDLE VALVES



Flow is stopped

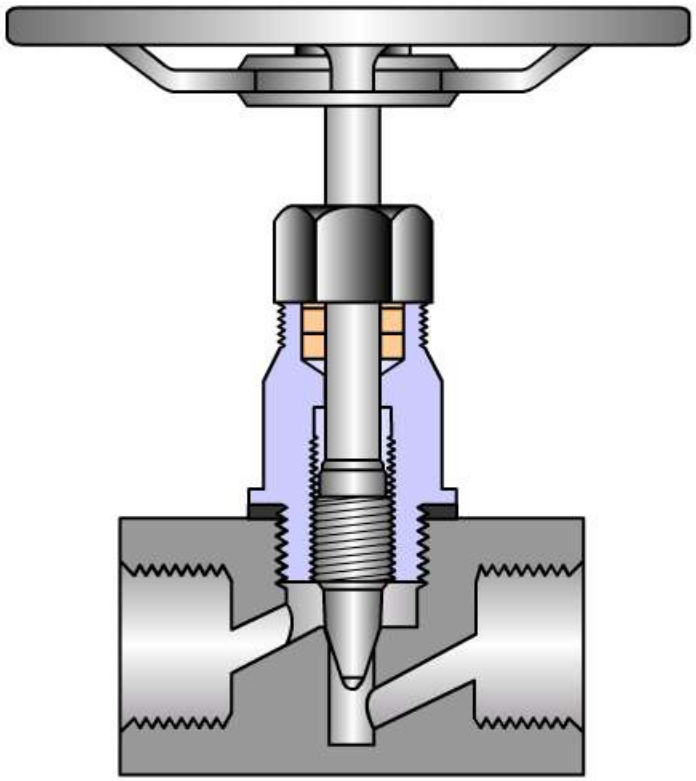


As seen in the closed position of the valve the flow path is restricted.

VALVE TYPES

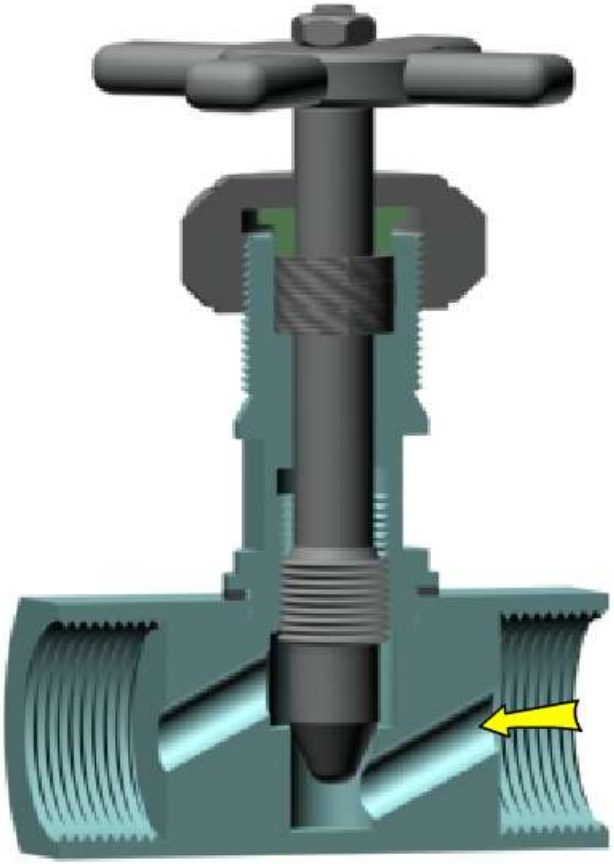
NEEDLE VALVES

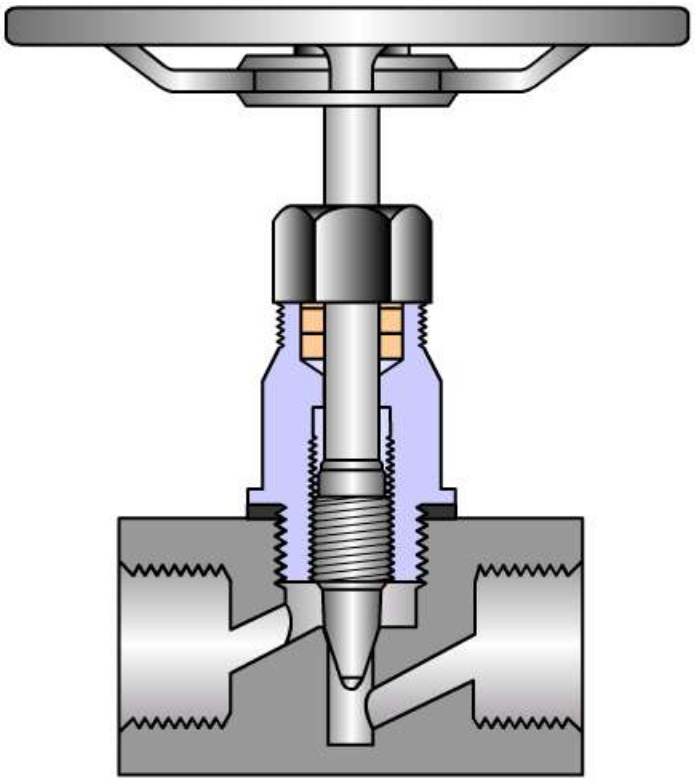
Flow is established



As the handle is rotated in the anti-clockwise direction the stem rotates upwards thus opening the valve.

VALVE TYPES
NEEDLE VALVES





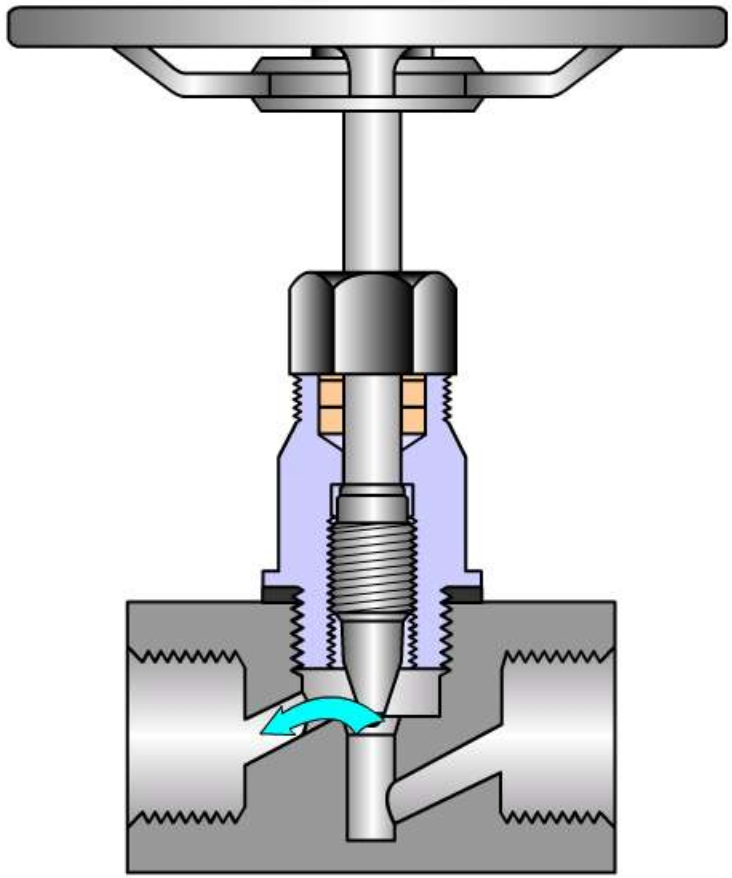
Flow is stopped

When the handle is rotated in the clockwise direction the stem rotates downwards thus closing the valve.

The stem has fine threads to enable fine adjustments. Because of the needle point of the stem very accurate throttling is possible. These valves are therefore used extensively in applications involving high pressures and temperatures.

VALVE TYPES

NEEDLE VALVES

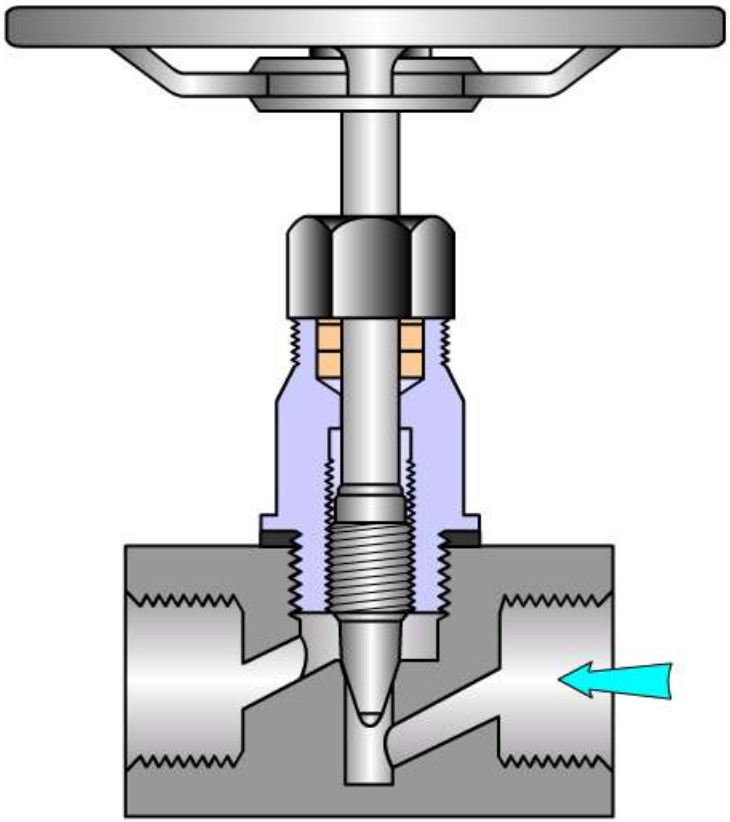


VALVE OPERATION

When the handwheel is rotated in the anti-clockwise direction, the stem rotates upwards thus opening the valve.

VALVE TYPES

NEEDLE VALVES



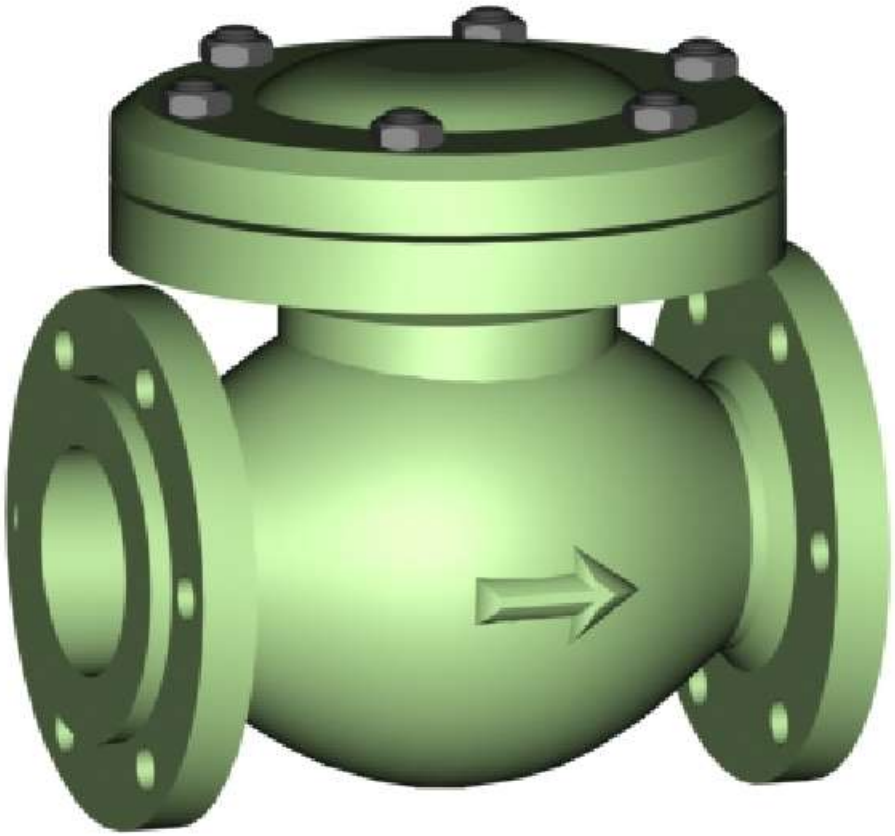
VALVE OPERATION

On rotating the handwheel in the clockwise direction, the stem rotates downwards thus closing the valve.

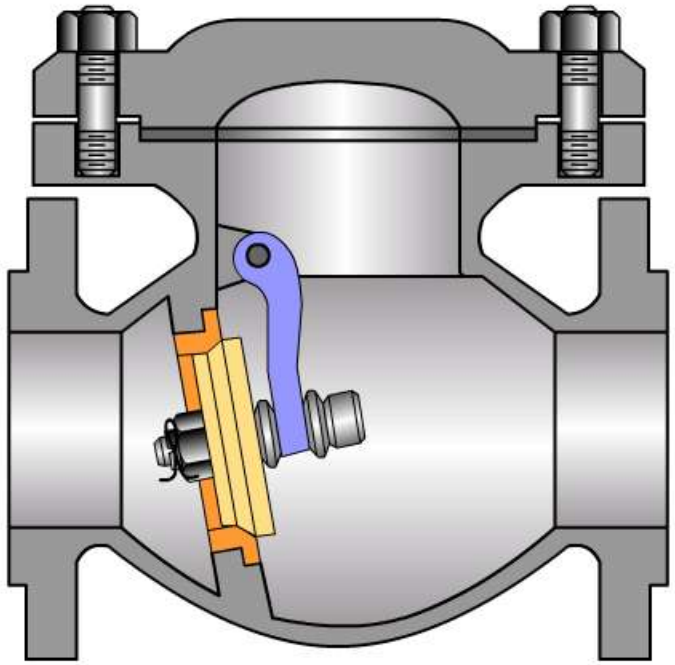
Check/Non-return Valve

CHECK VALVES

SWING CHECK VALVES



3D model



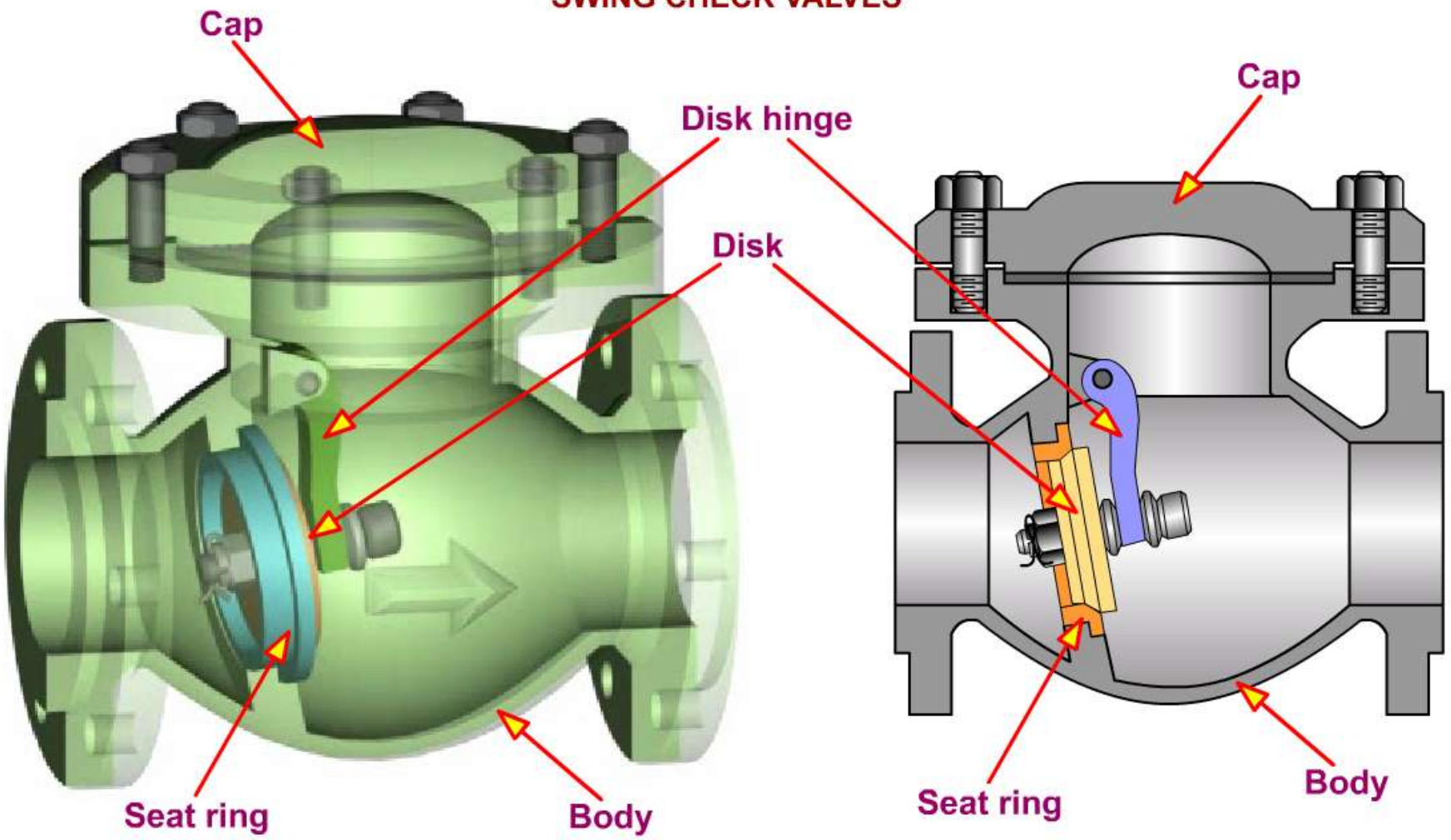
2D cross-section

A typical model and the 2D cross-section of a swing check valve is illustrated.

Of the various types of check valves, the swing check valve is more commonly used.

CHECK VALVES

SWING CHECK VALVES

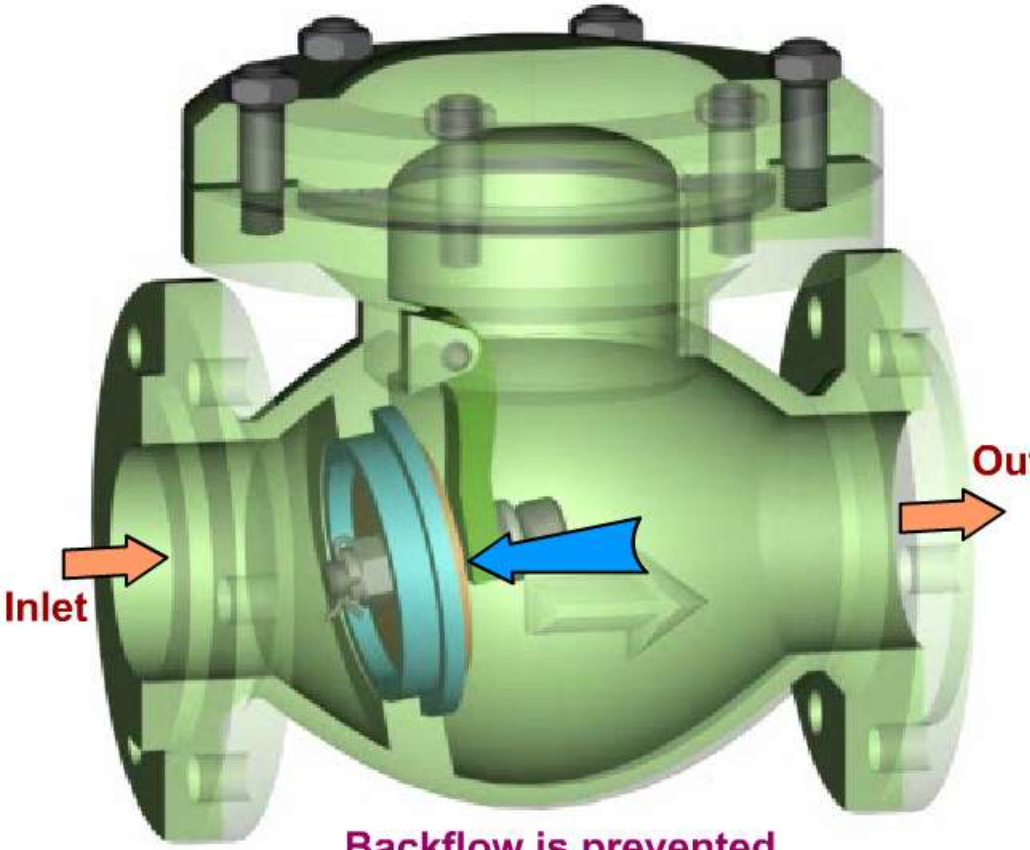


The nomenclature of the various components of the valve are shown.

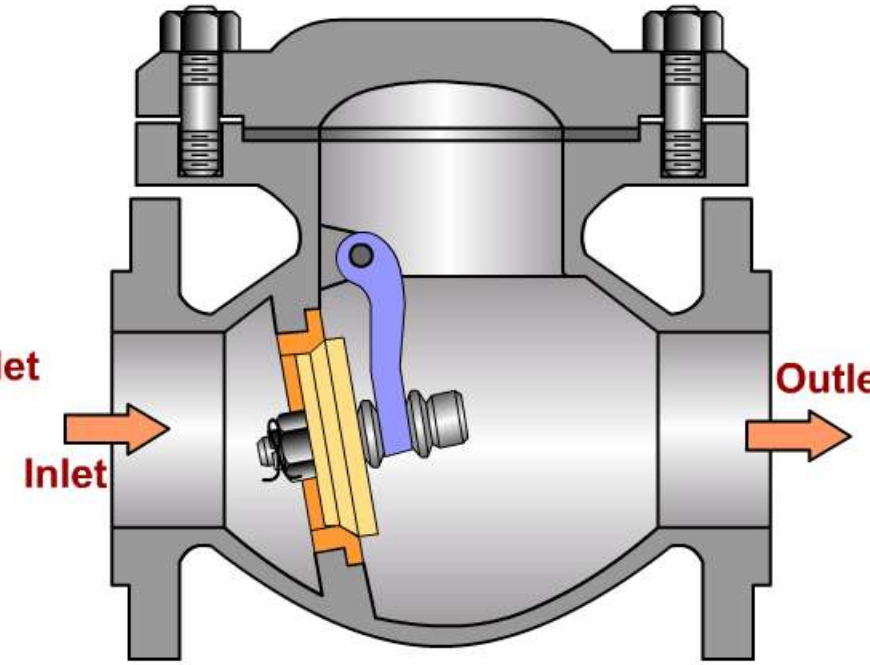
The disk is pivoted by means of the disk hinge from lugs cast integrally with the body.

CHECK VALVES

SWING CHECK VALVES



Backflow is prevented

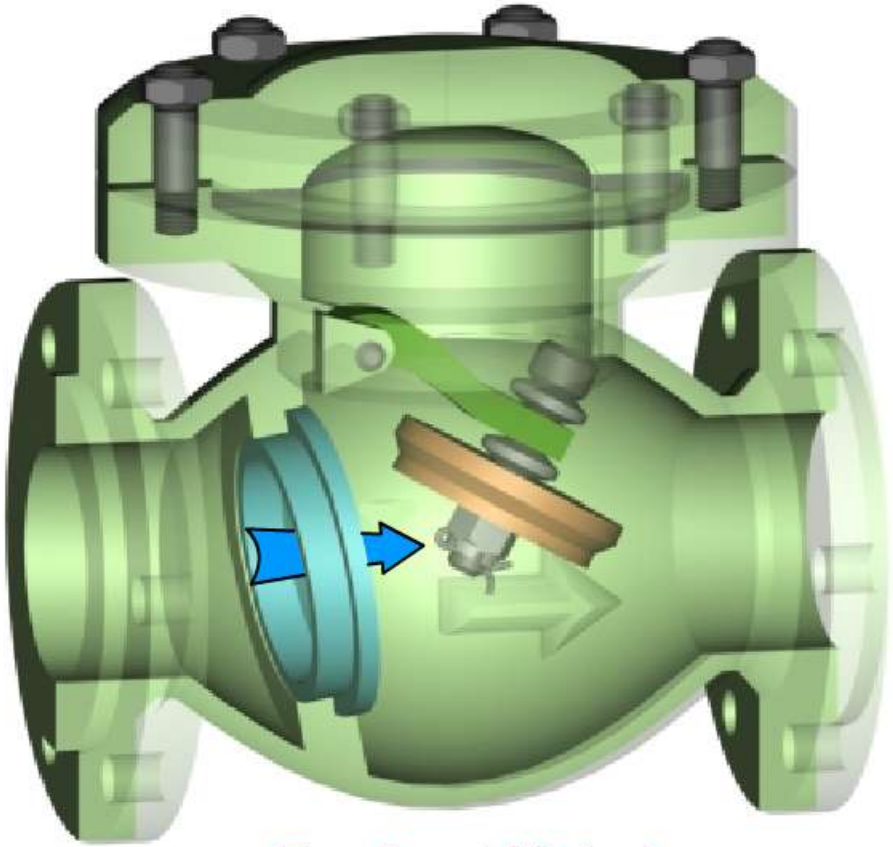


Depiction shows the closed position of the valve.

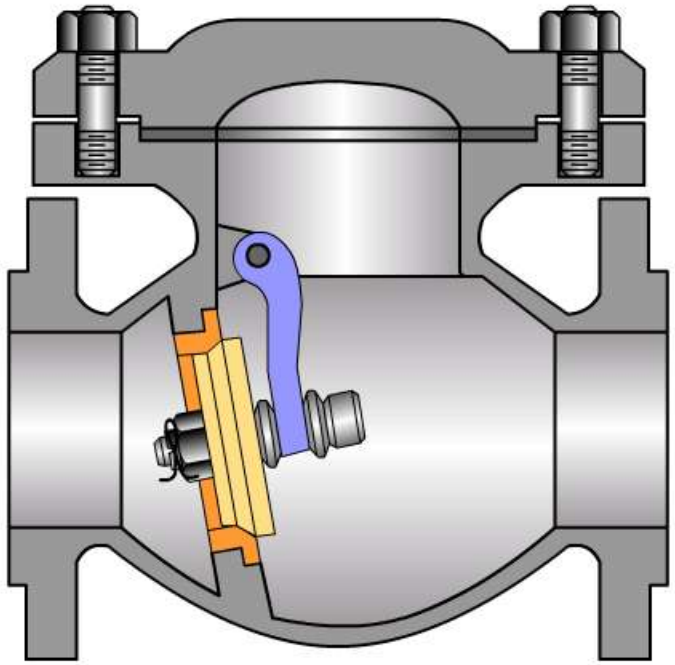
As seen in the closed position of the valve, back flow of the fluid is prevented.

CHECK VALVES

SWING CHECK VALVES



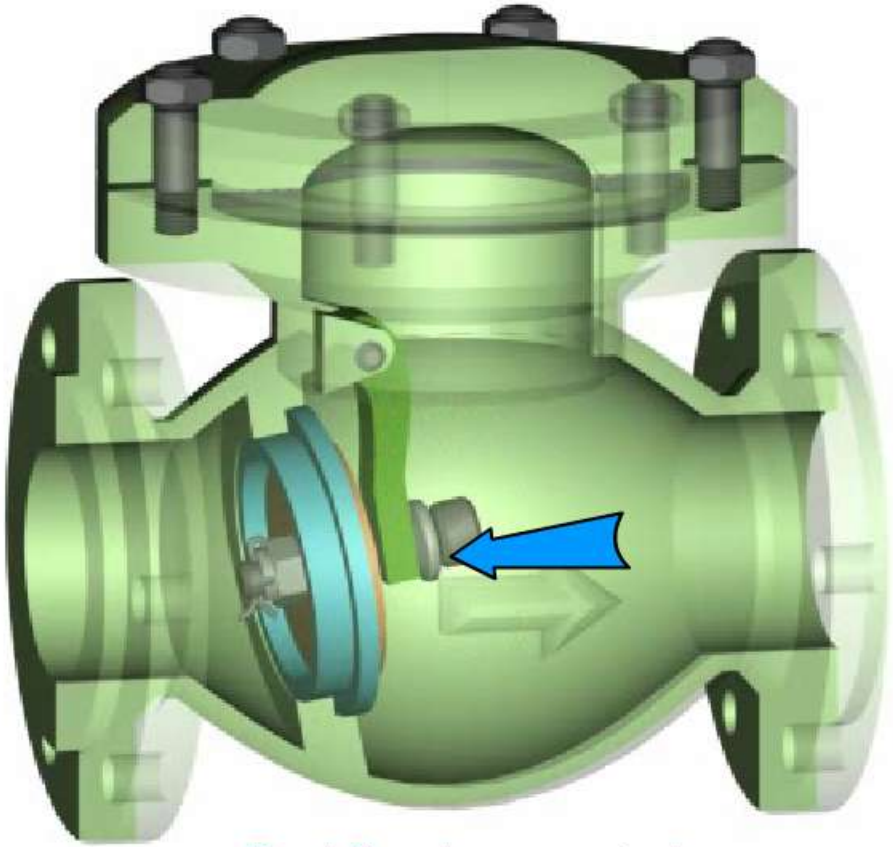
Flow is established

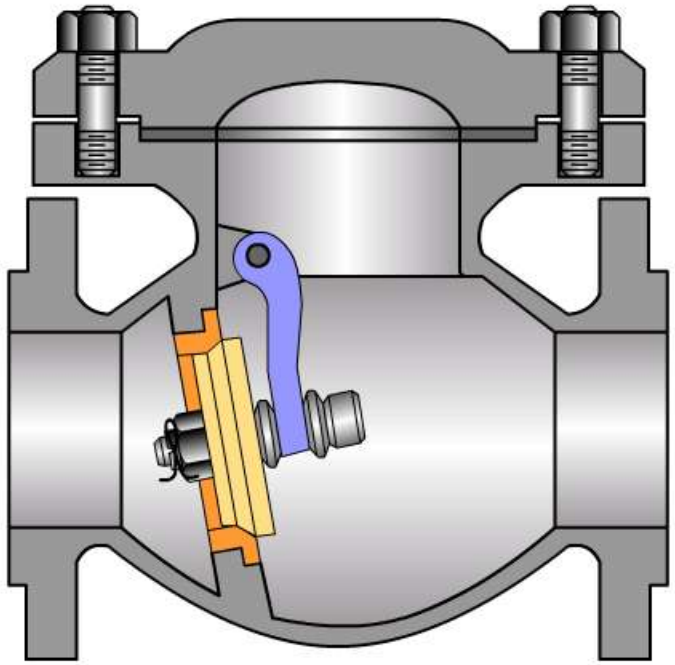


When the flow velocity increases, it exerts a pressure on the disk and makes it to swing open, thus establishing the flow.

CHECK VALVES

SWING CHECK VALVES



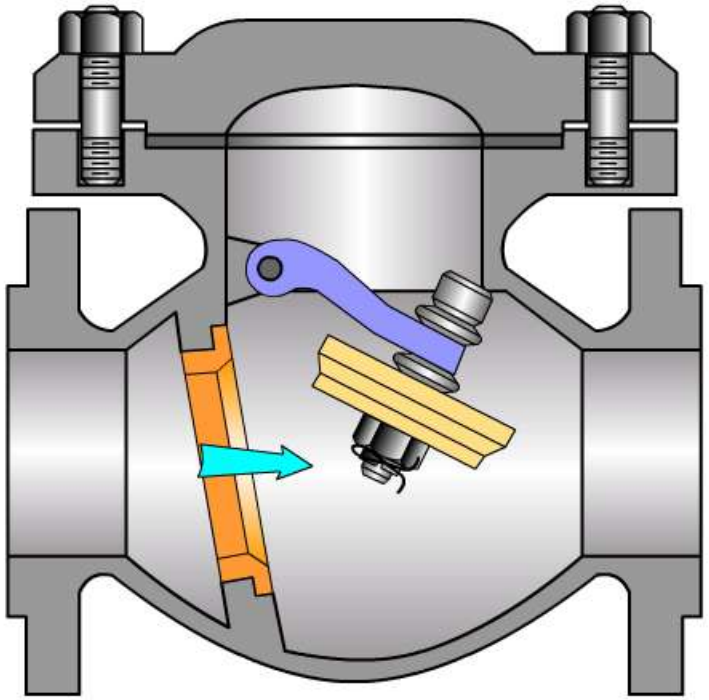


Backflow is prevented

When the flow stops, fluid which flows back into the valve from the outlet forces the disk to swing shut thus preventing backflow of fluid.

CHECK VALVES

SWING CHECK VALVES

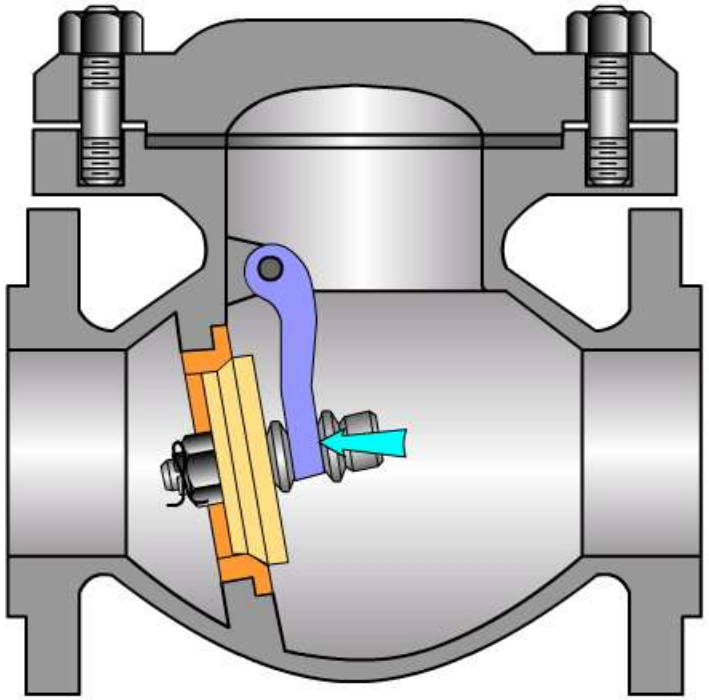


VALVE OPERATION

When the flow velocity increases, it exerts a pressure on the disk and makes it to swing open, thus establishing the flow.

CHECK VALVES

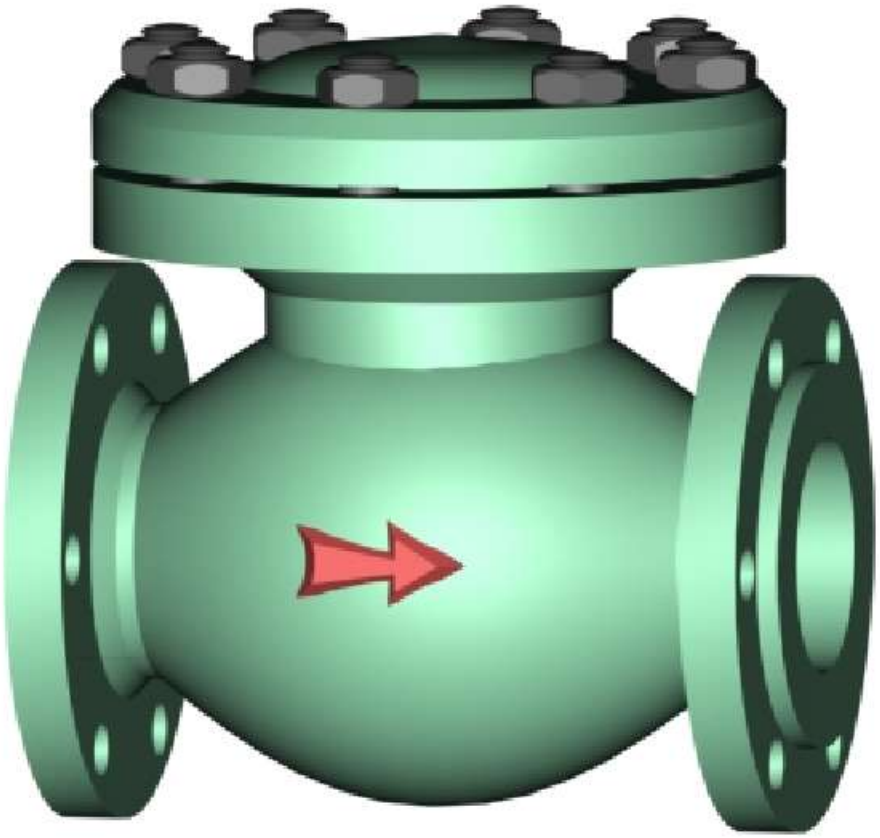
SWING CHECK VALVES



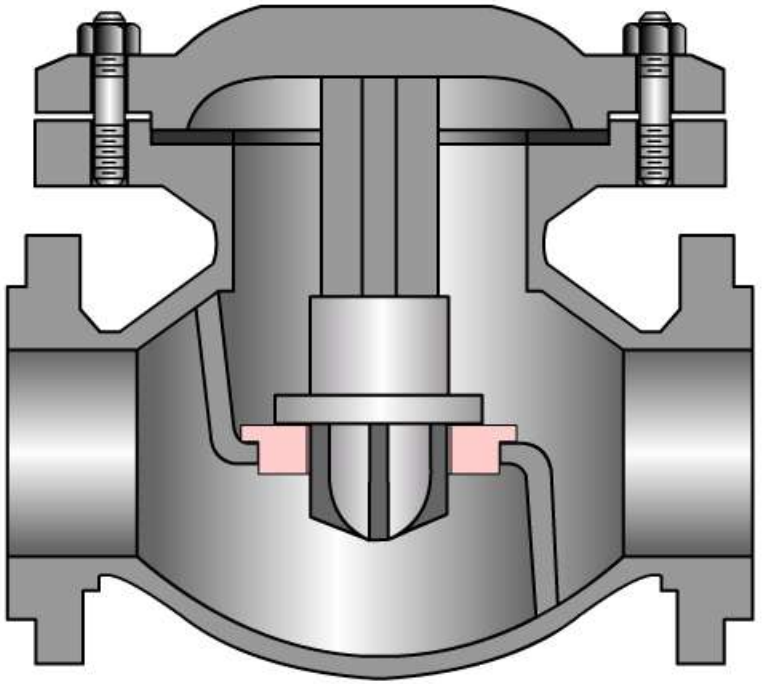
VALVE OPERATION

When the flow stops, fluid which flows back into the valve from the outlet forces the disk to swing shut thus preventing backflow of fluid.

CHECK VALVES
LIFT CHECK VALVES



3D model



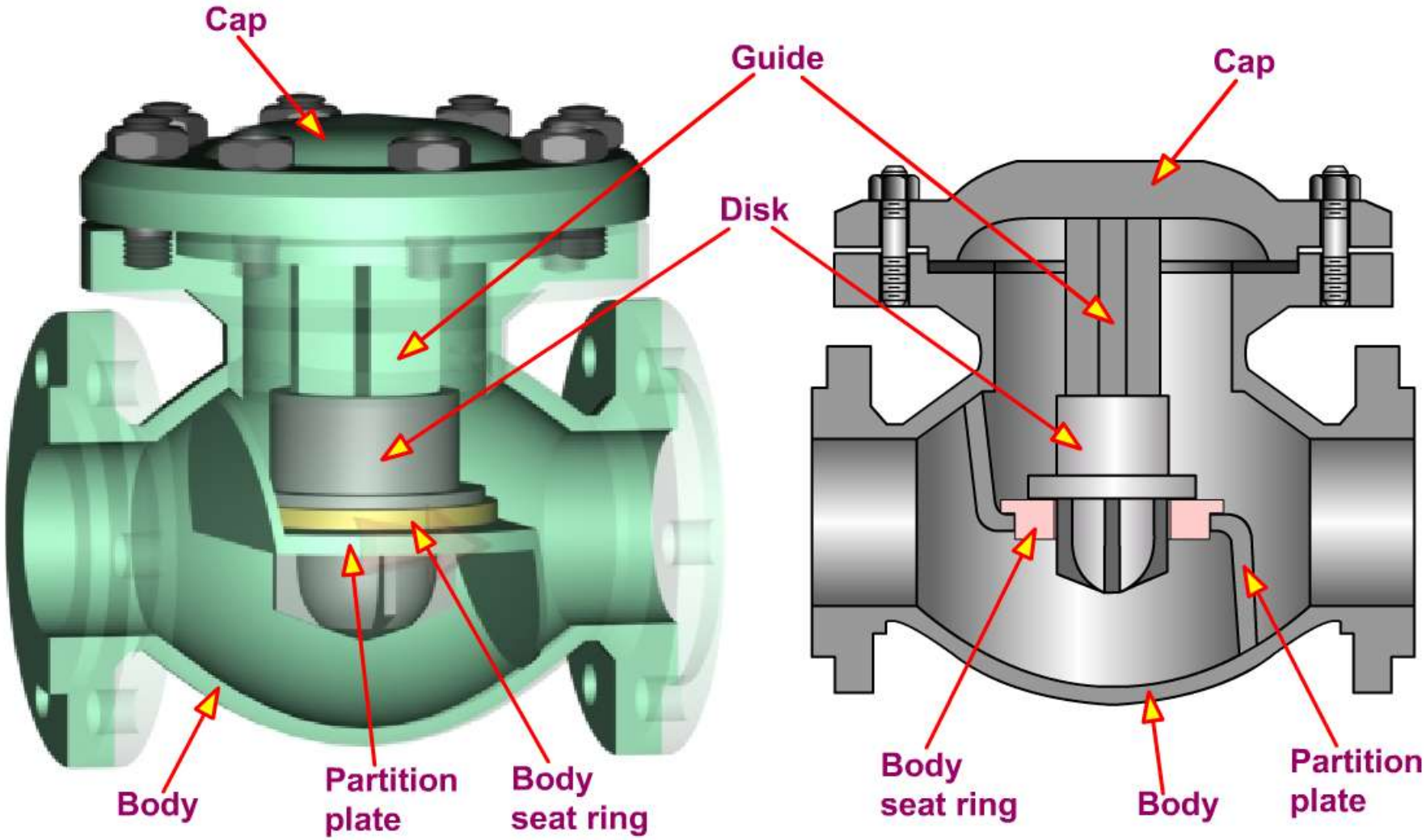
2D cross-section

A typical model and the 2D cross-section of a lift check valve is illustrated.

Lift check valves offer more pressure drop than swing check valves. They are particularly adapted for high-pressure services where velocity of flow is very high.

CHECK VALVES

LIFT CHECK VALVES

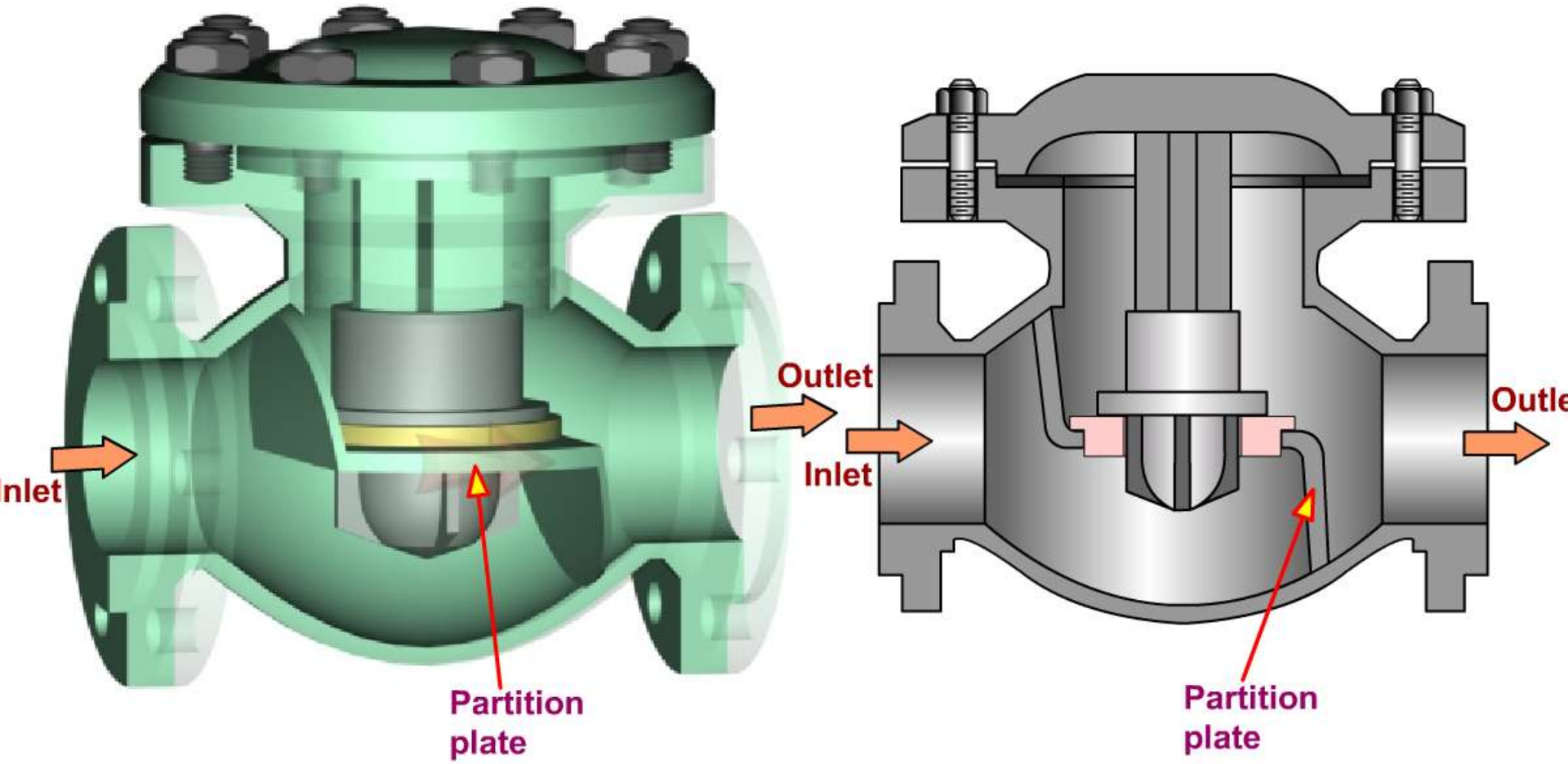


The nomenclature of the various components of the valve are shown.

The disk traverses along accurate guiding arrangement and provides a firm seating with the body seat ring. The valve must always be placed such that the direction of lift of the disk is vertical. The valves will not function if installed in vertical pipelines.

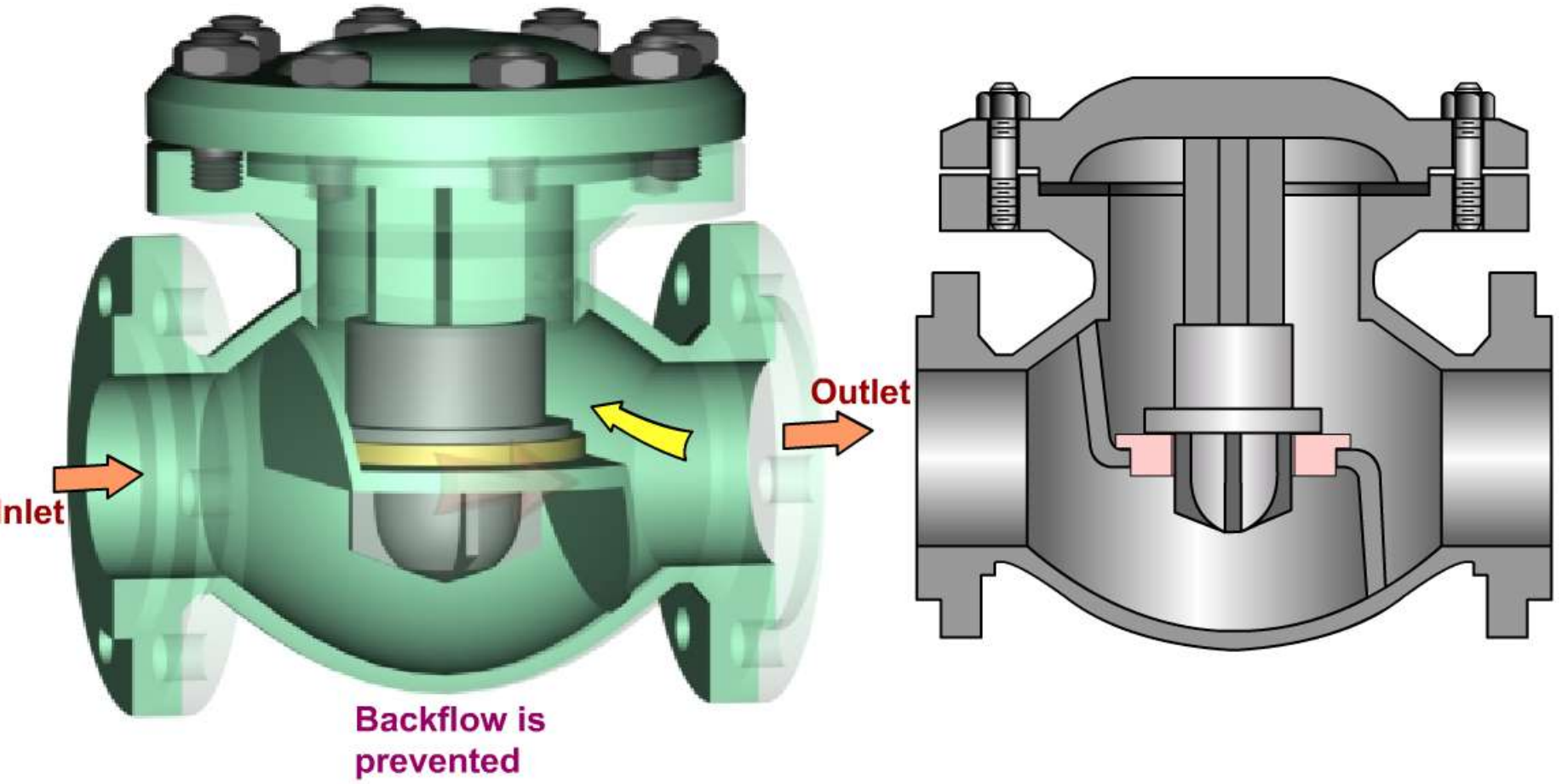
CHECK VALVES

LIFT CHECK VALVES



The inlet and outlet of the valve is separated by a partition plate integral with the body, which decides the direction of flow.

CHECK VALVES
LIFT CHECK VALVES

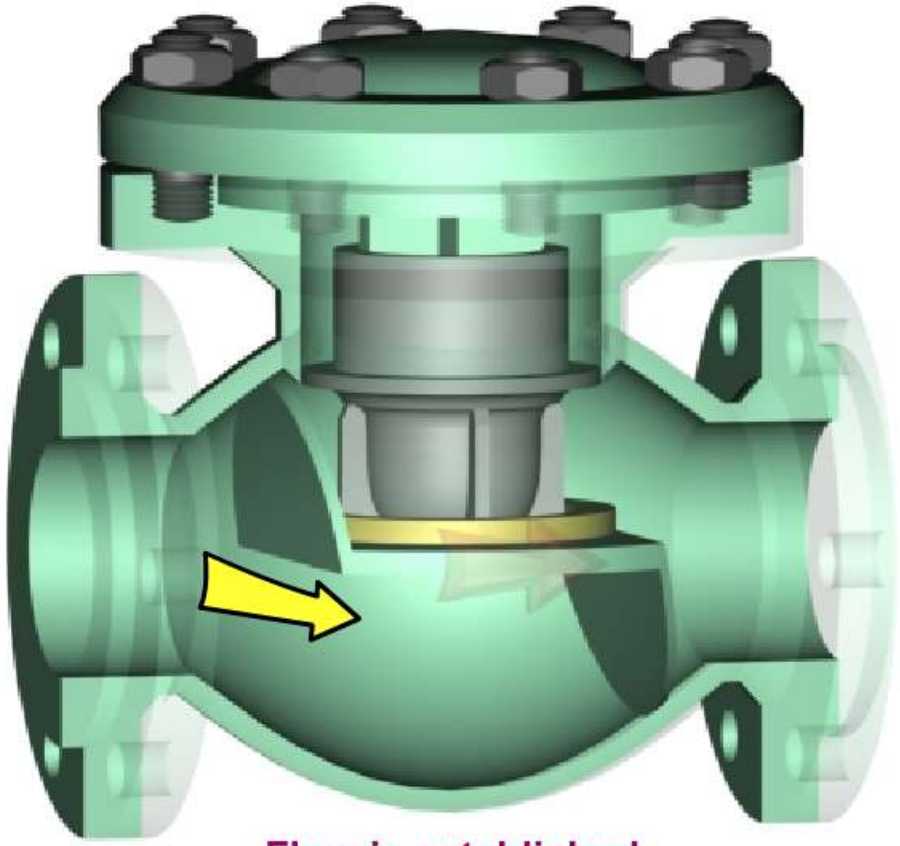


Depiction shows the closed position of the valve.

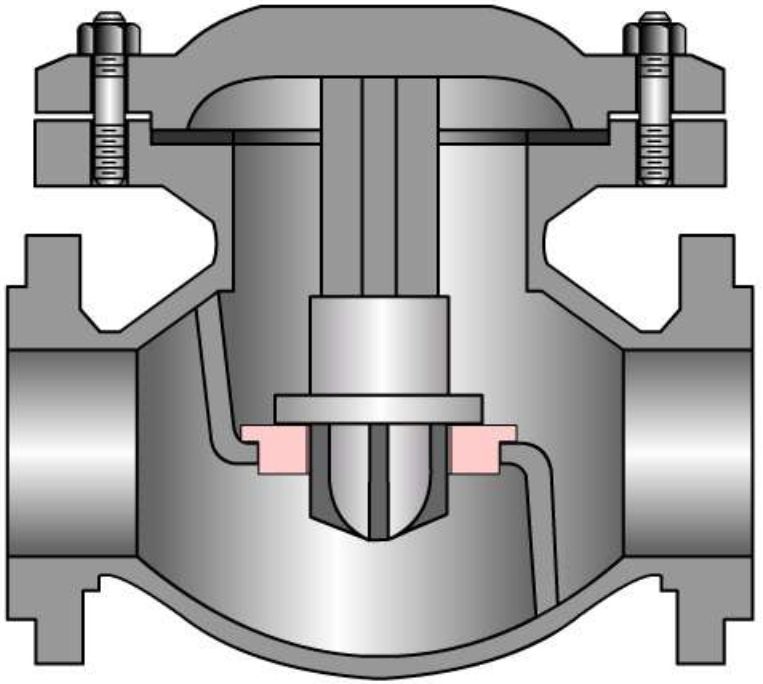
As seen in the closed position of the valve, backflow of the fluid is prevented.

CHECK VALVES

LIFT CHECK VALVES



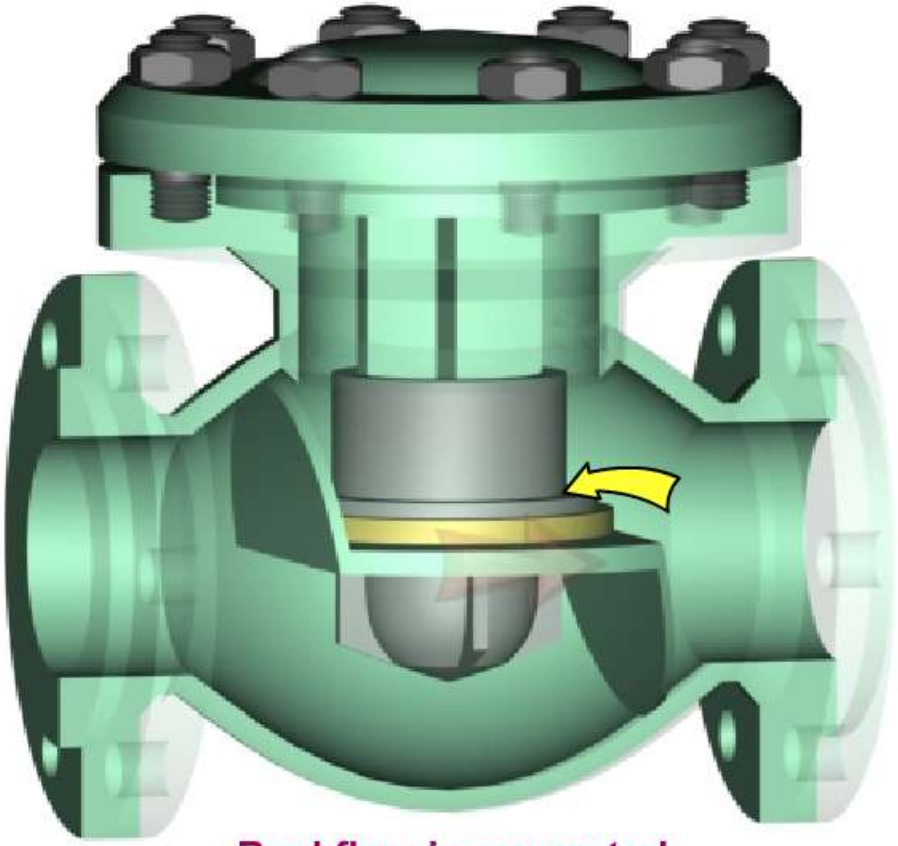
Flow is established



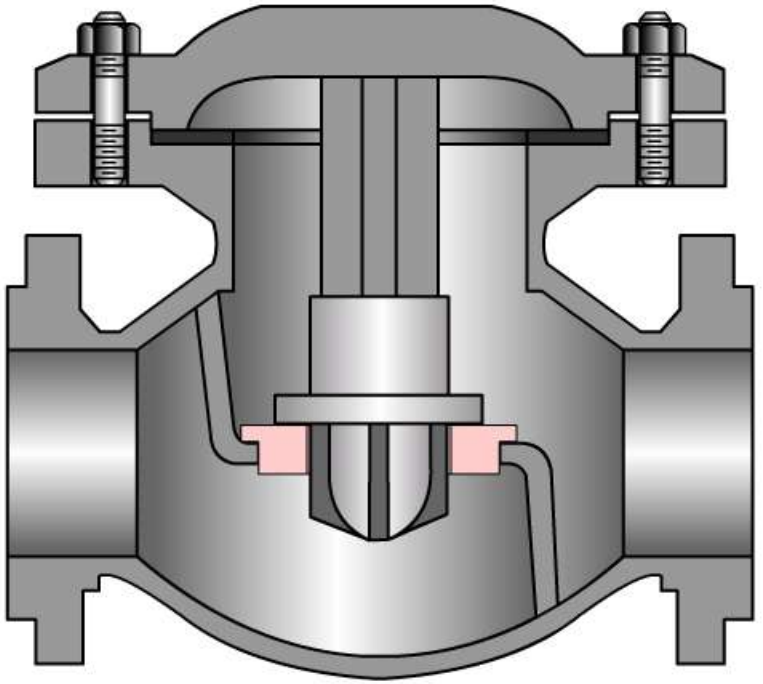
When the flow velocity increases, it exerts a pressure on the disk and pushes it upwards, thus establishing the flow.

CHECK VALVES

LIFT CHECK VALVES



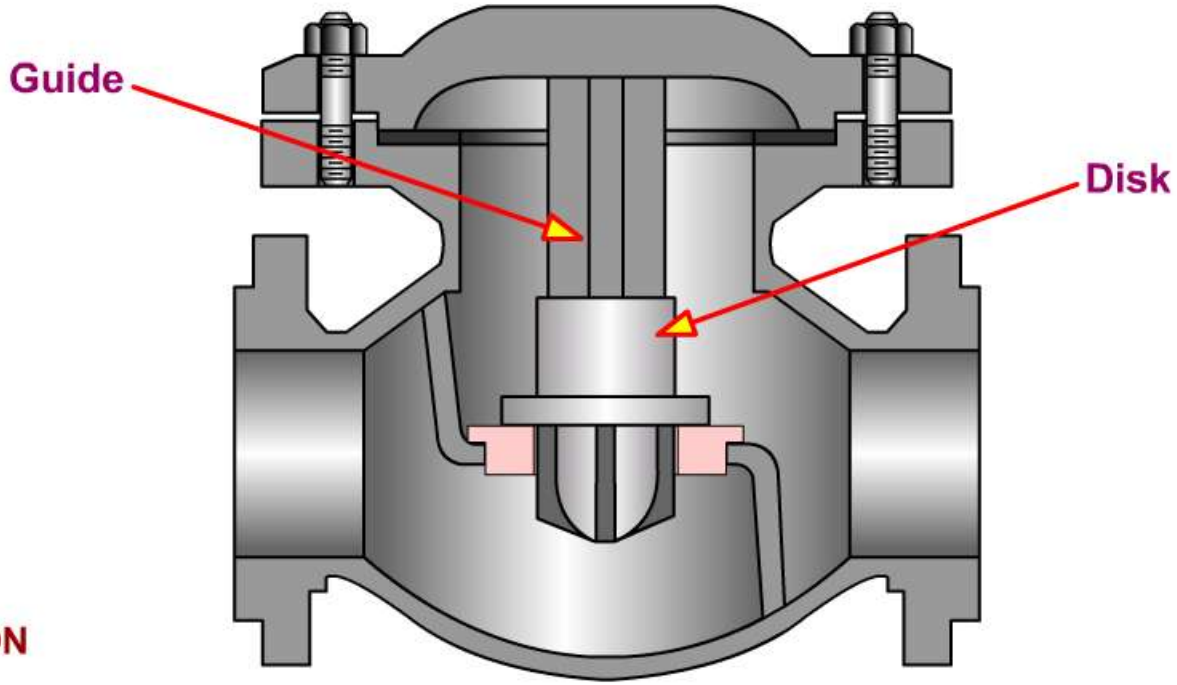
Backflow is prevented



When the flow stops, fluid which flows back into the valve from the outlet exerts a pressure on the disk and pushes it downwards, thus stopping backflow.

CHECK VALVES

LIFT CHECK VALVES



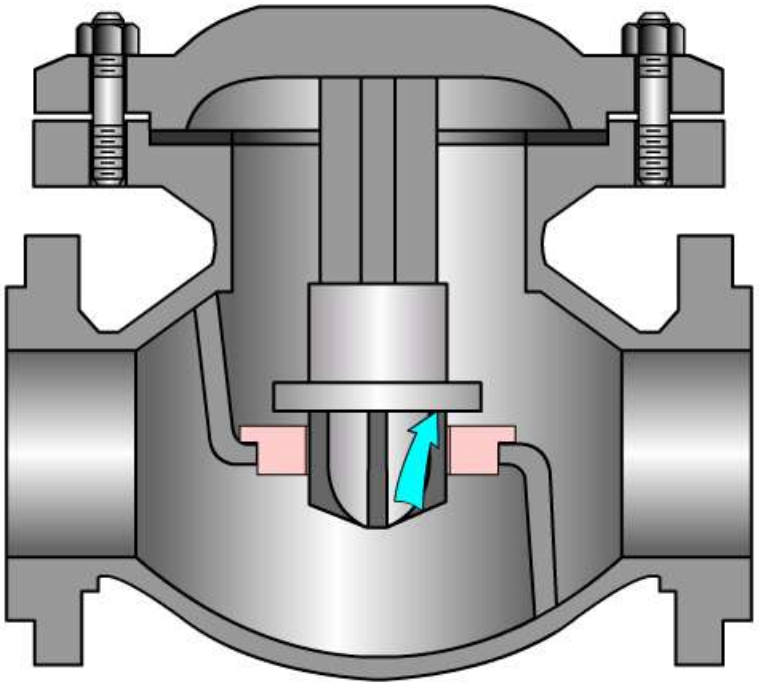
VALVE OPERATION

Let us observe the operation of the valve in its 2D cross-sectional view.

Depiction shows the closed position of the valve.

CHECK VALVES

LIFT CHECK VALVES

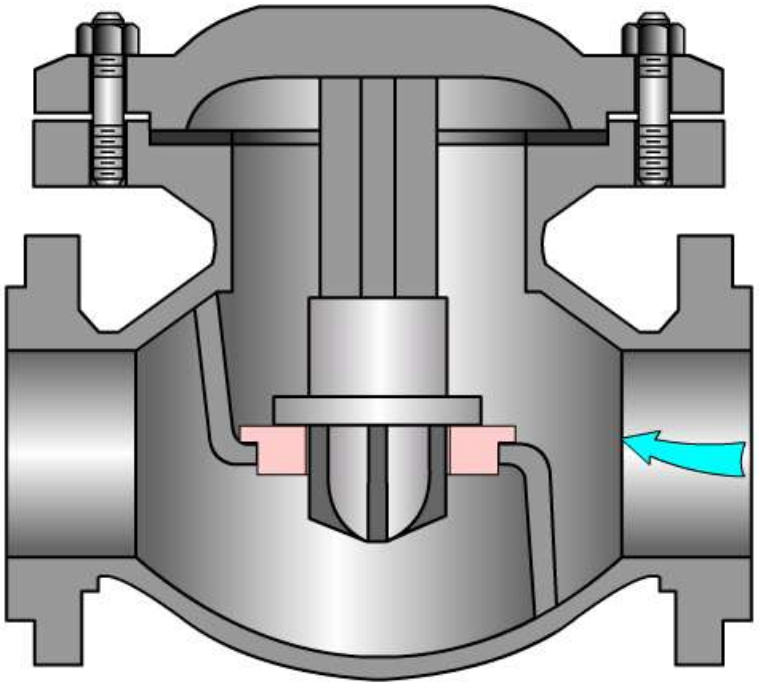


VALVE OPERATION

When the flow velocity increases, it exerts a pressure on the disk and pushes it upwards, thus establishing the flow.

CHECK VALVES

LIFT CHECK VALVES

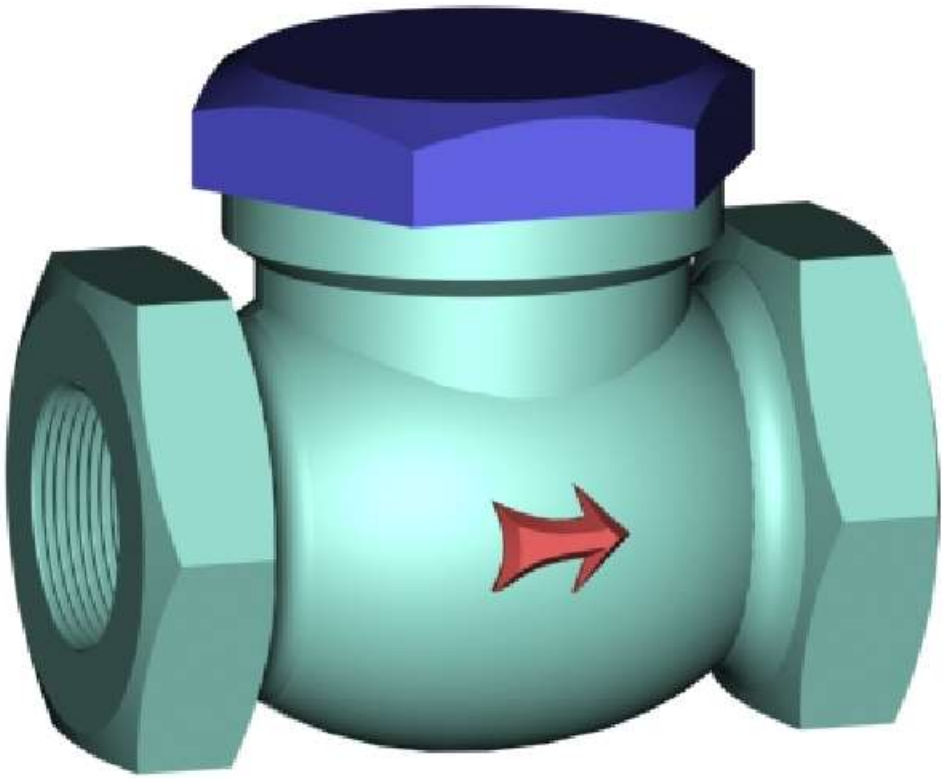


VALVE OPERATION

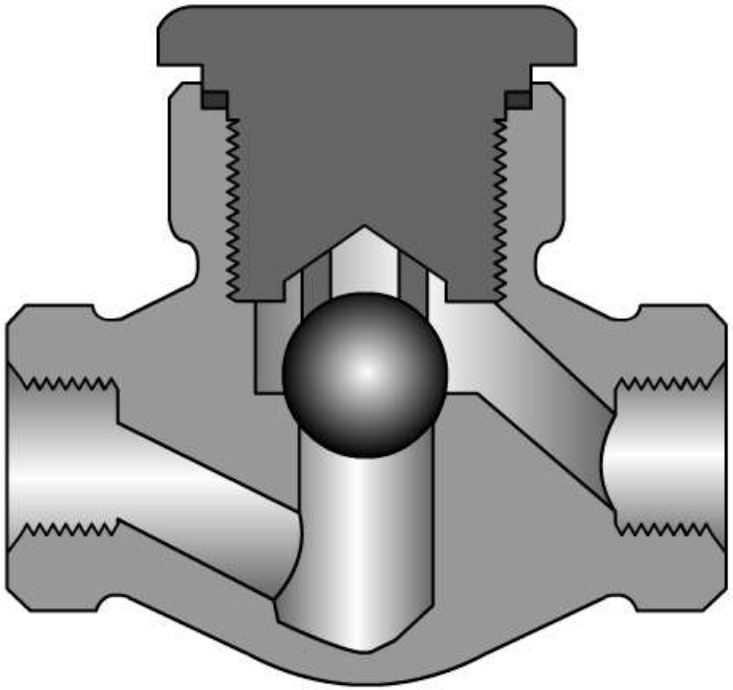
When the flow stops, fluid which flows back into the valve from the outlet exerts a pressure on the disk and pushes it downwards, thus stopping backflow.

CHECK VALVES

BALL CHECK VALVES



3D model

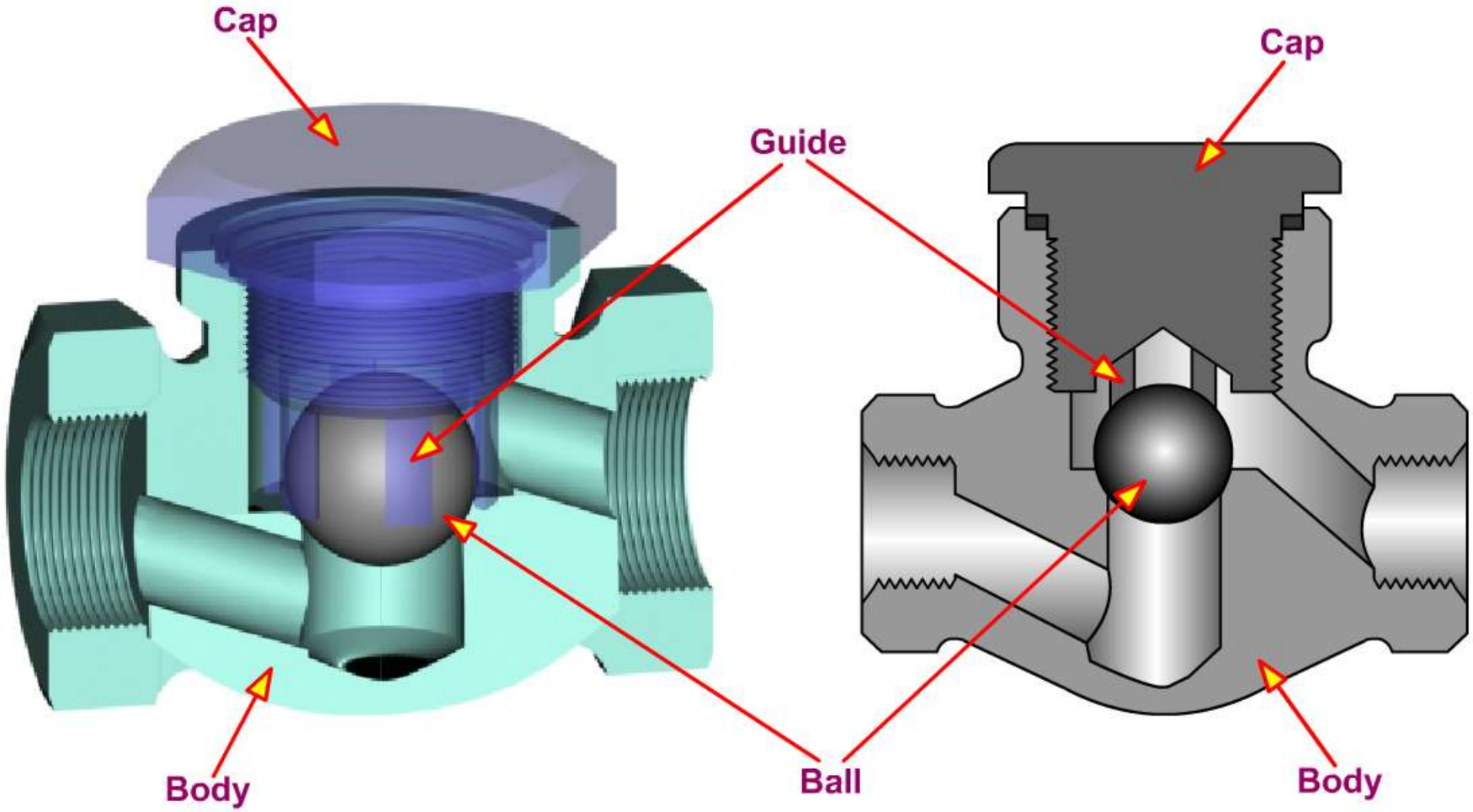


2D cross-section

A typical model and the 2D cross-section of a ball check valve is illustrated.

CHECK VALVES

BALL CHECK VALVES

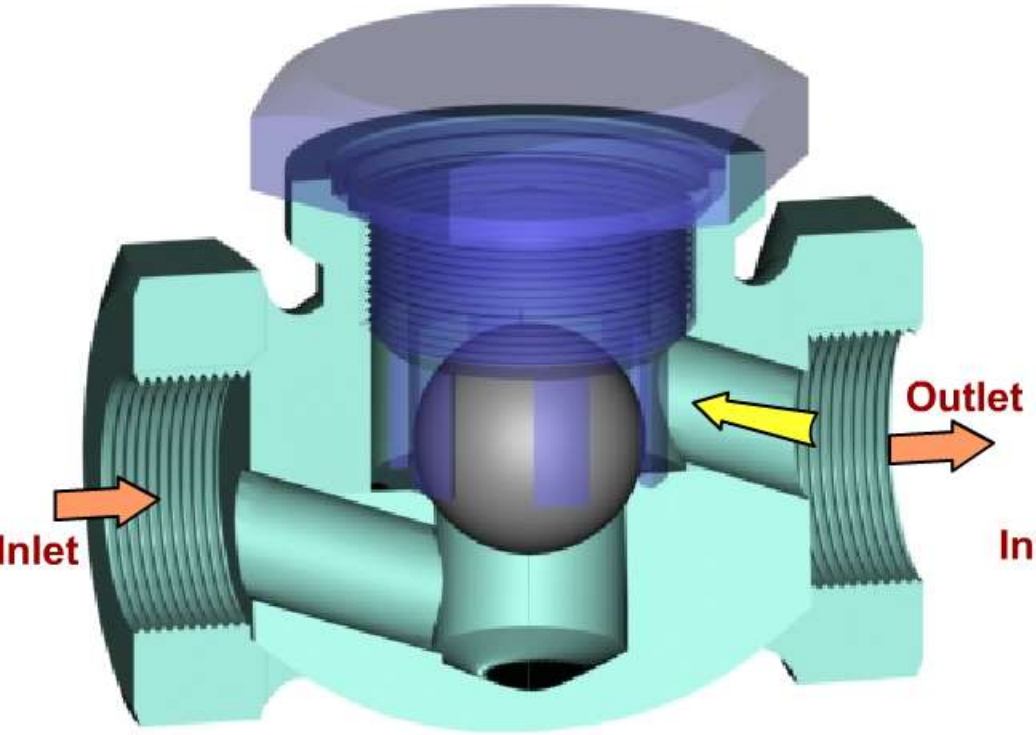


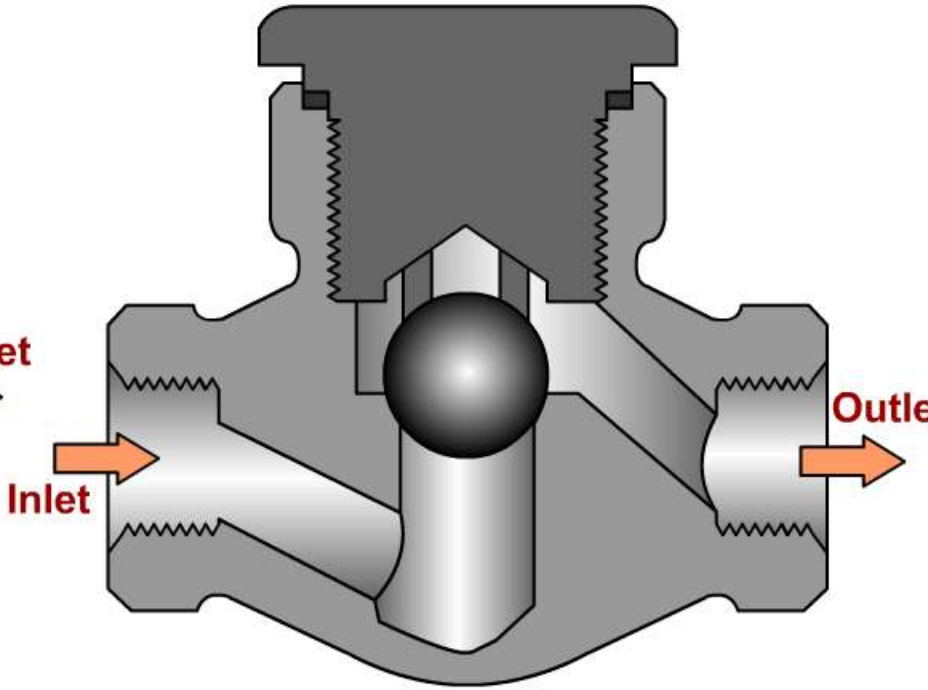
The nomenclature of the various components of the valve are shown.

The ball traverses through suitable guiding arrangement and provides seating with the body. The valve must always be placed such that the direction of lift of the ball is vertical.

CHECK VALVES

BALL CHECK VALVES





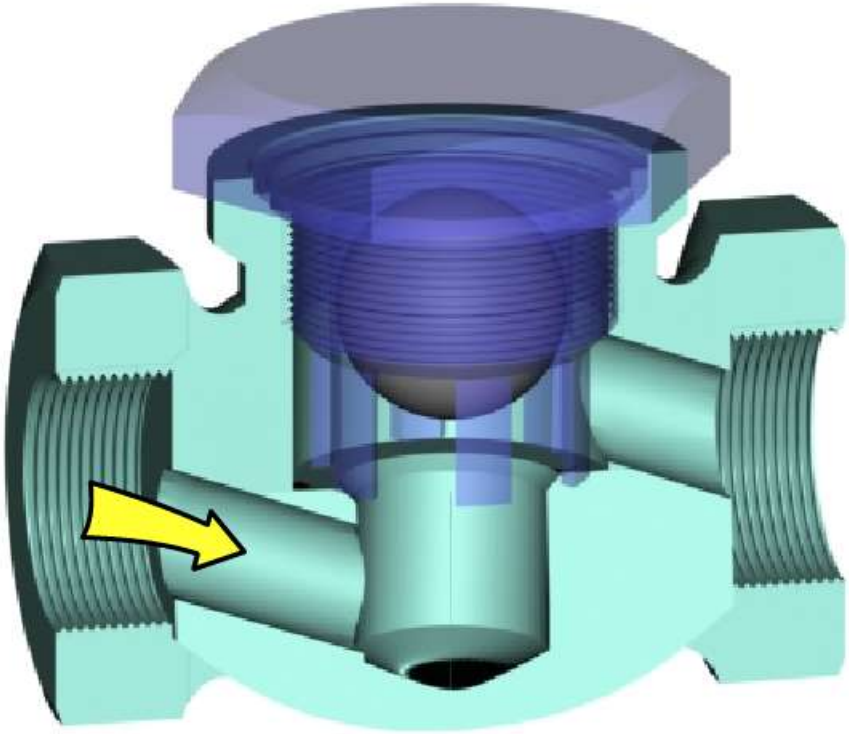
Backflow is prevented

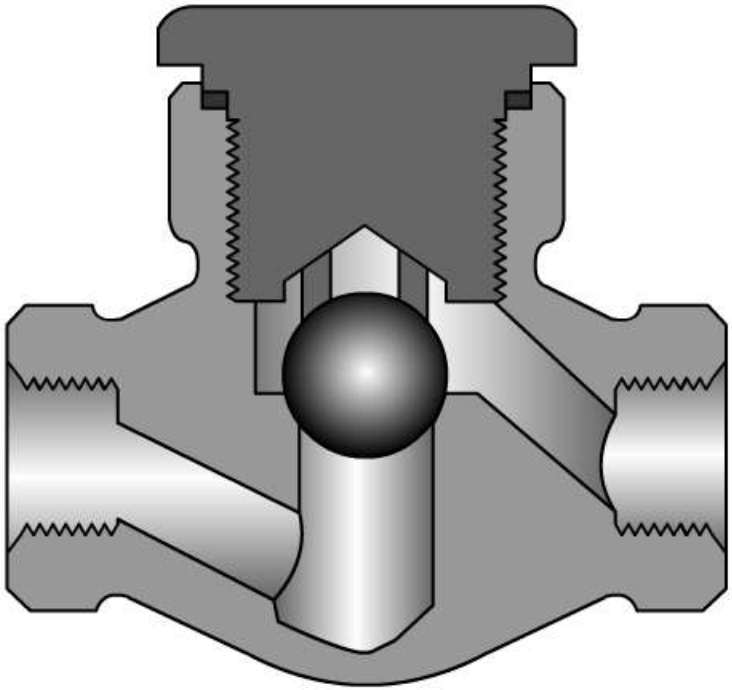
Depiction shows the closed position of the valve.

As seen in the closed position of the valve, backflow of the fluid is prevented.

CHECK VALVES

BALL CHECK VALVES



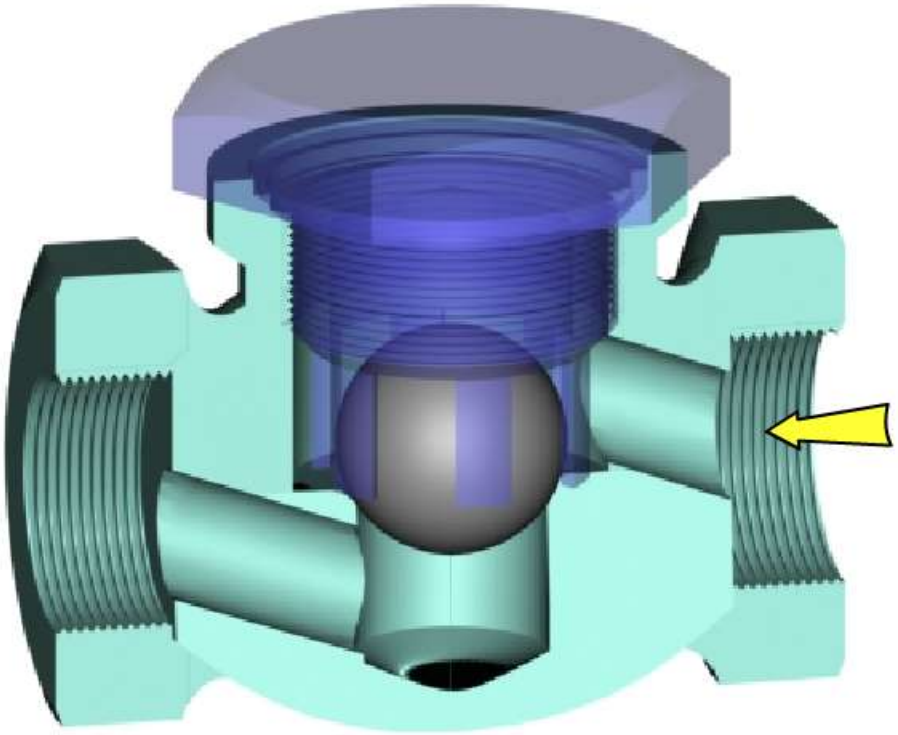


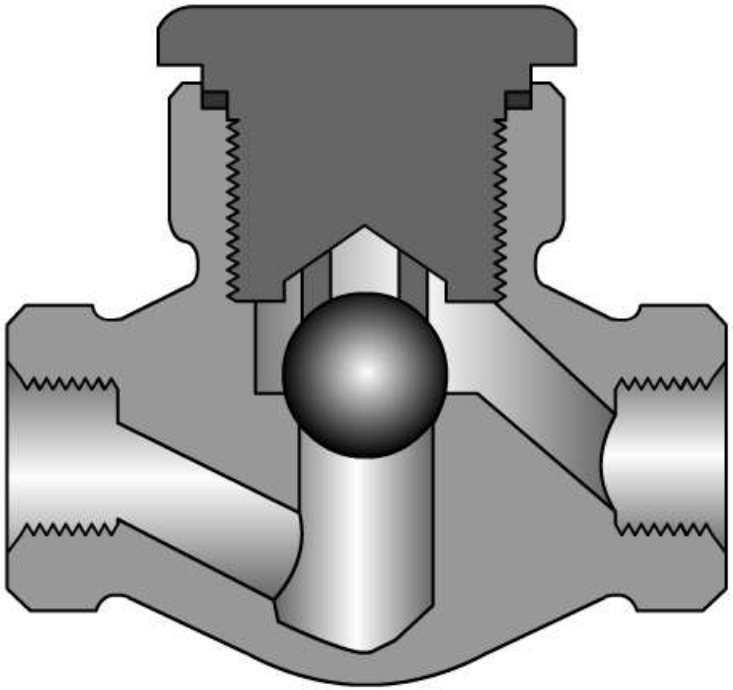
Flow is established

When the flow velocity increases, it exerts a pressure on the ball and pushes it upwards, thus establishing the flow.

CHECK VALVES

BALL CHECK VALVES



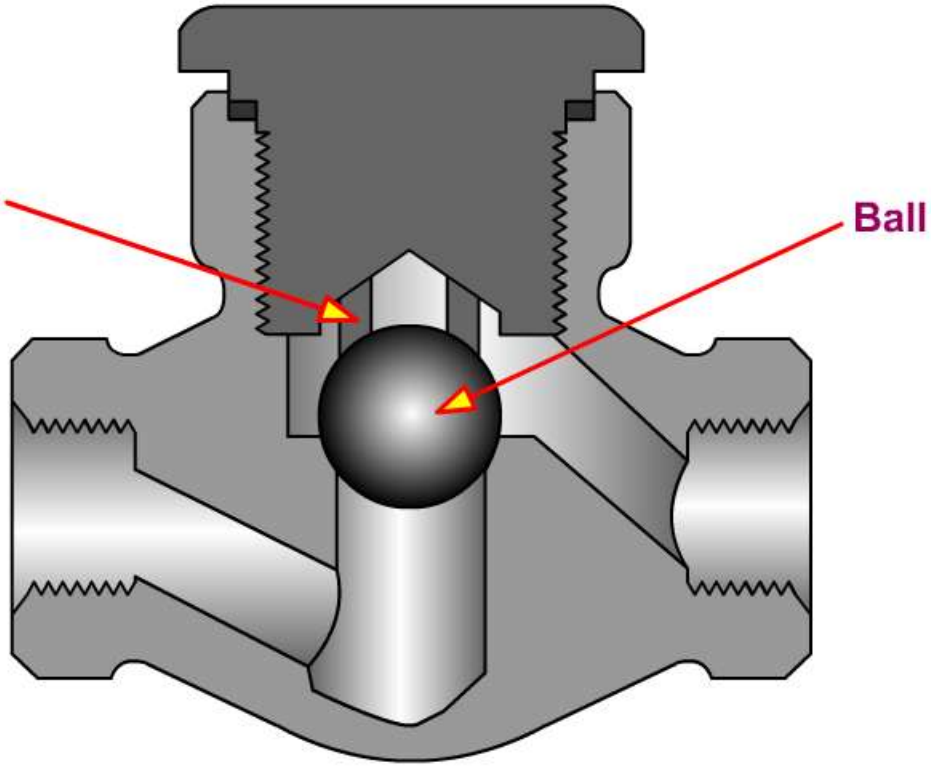


Backflow is prevented

When the flow stops, fluid which flows back into the valve from the outlet exerts a pressure on the ball and pushes it downwards, thus stopping backflow.

CHECK VALVES

BALL CHECK VALVES



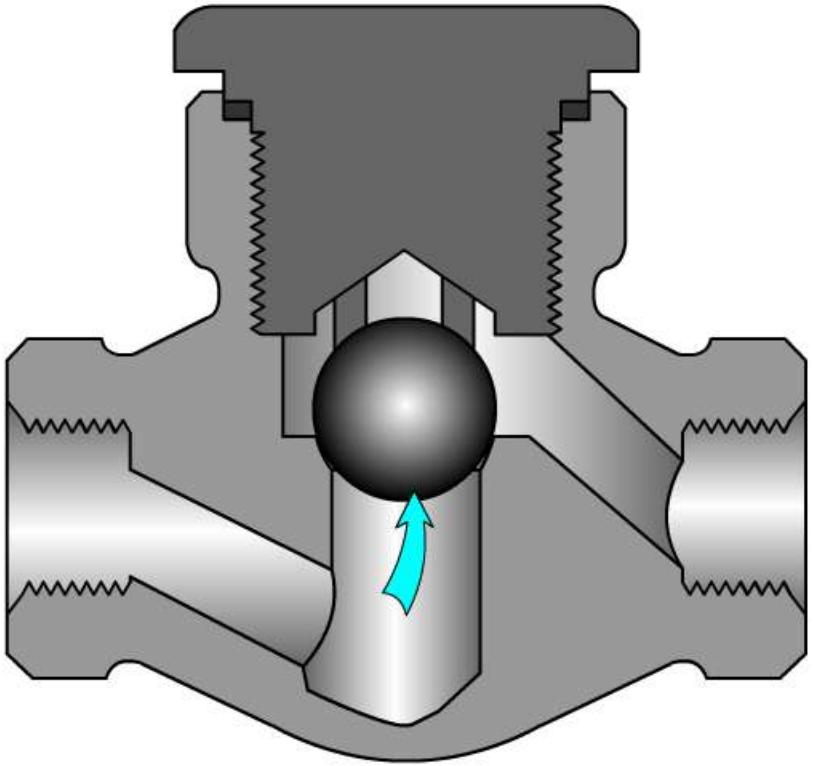
VALVE OPERATION

Let us observe the operation of the valve in its 2D cross-sectional view.

Depiction shows the closed position of the valve.

CHECK VALVES

BALL CHECK VALVES

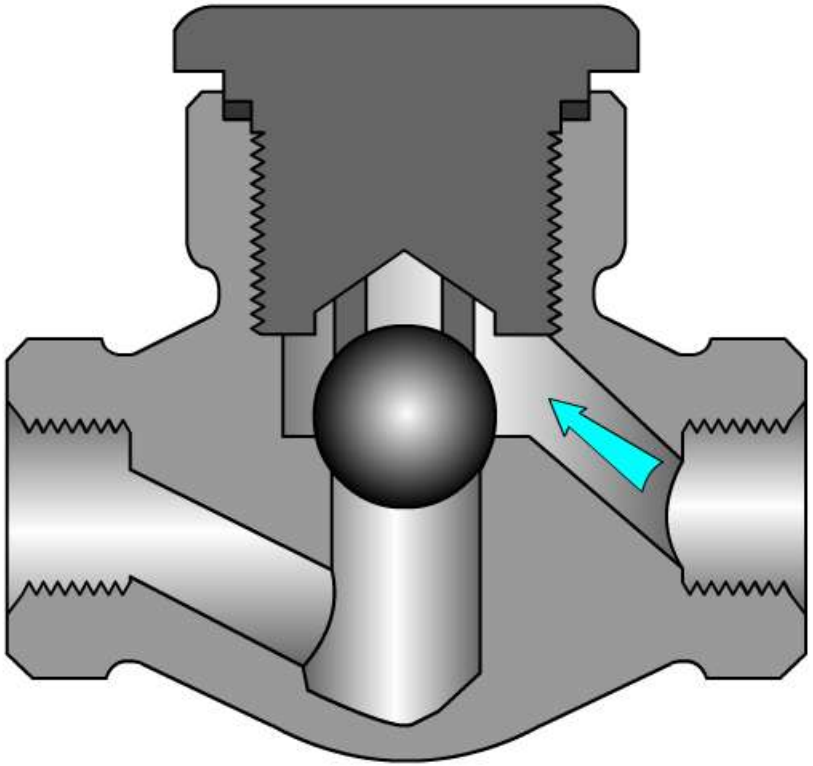


VALVE OPERATION

When the flow velocity increases, it exerts a pressure on the ball and pushes it upwards, thus establishing the flow.

CHECK VALVES

BALL CHECK VALVES



VALVE OPERATION

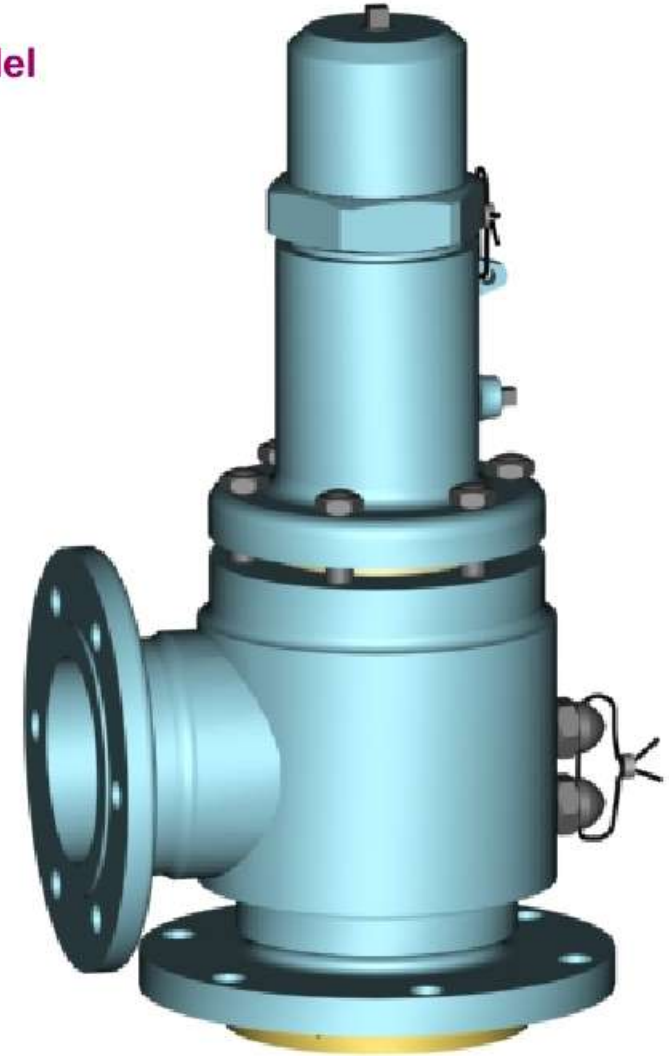
When the flow stops, fluid which flows back into the valve from the outlet exerts a pressure on the ball and pushes it downwards, thus stopping backflow.

Safety Relief Valve

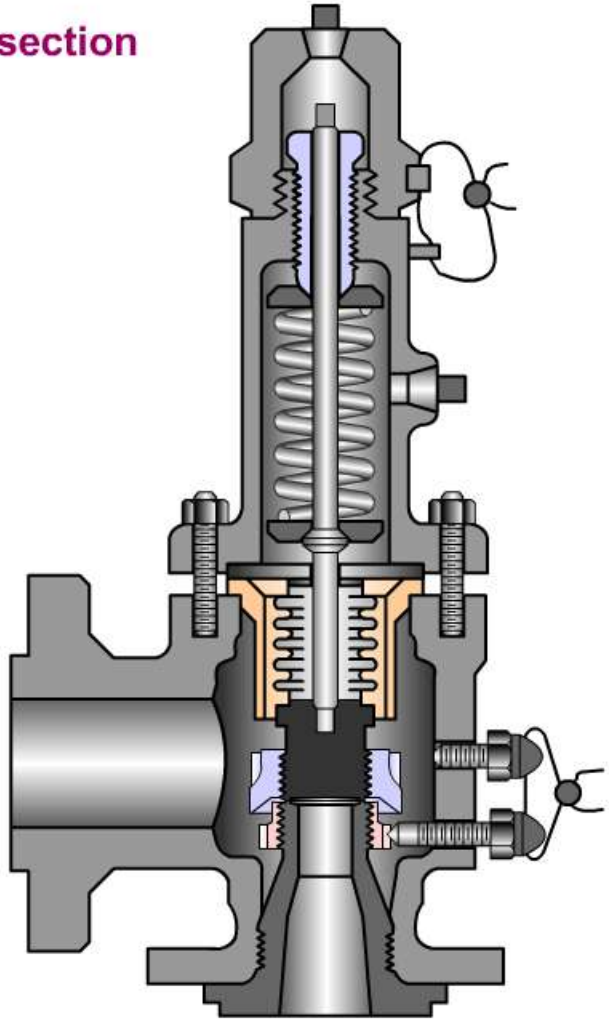
PRESSURE RELIEF VALVES

SAFETY VALVES

3D model



2D cross-section

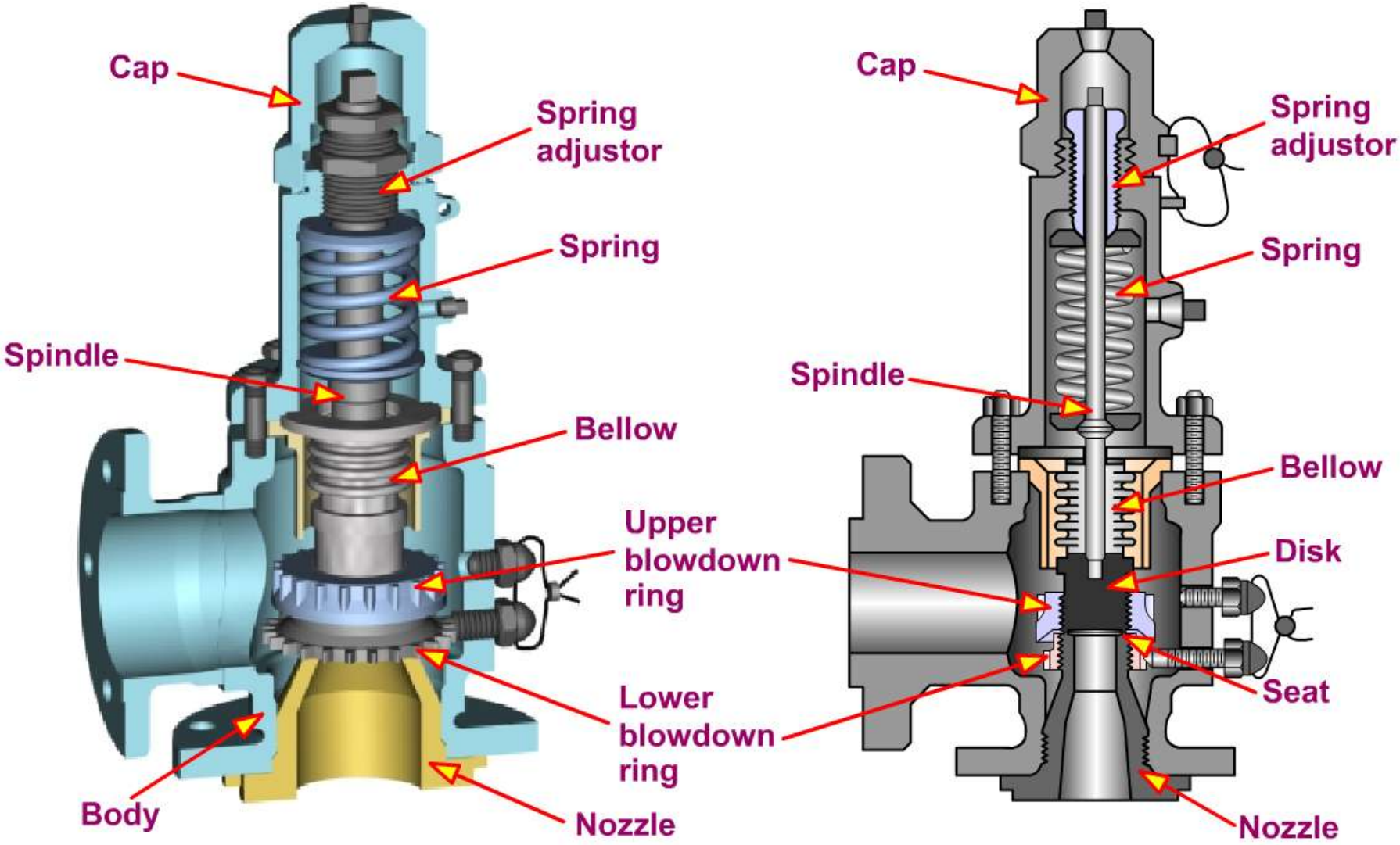


A typical model and the 2D cross-section of a safety valve is illustrated.

Safety valve is a pressure relief valve actuated by inlet static pressure and is characterized by rapid opening or pop action. Safety valves are primarily used with compressible gases especially for steam and air services.

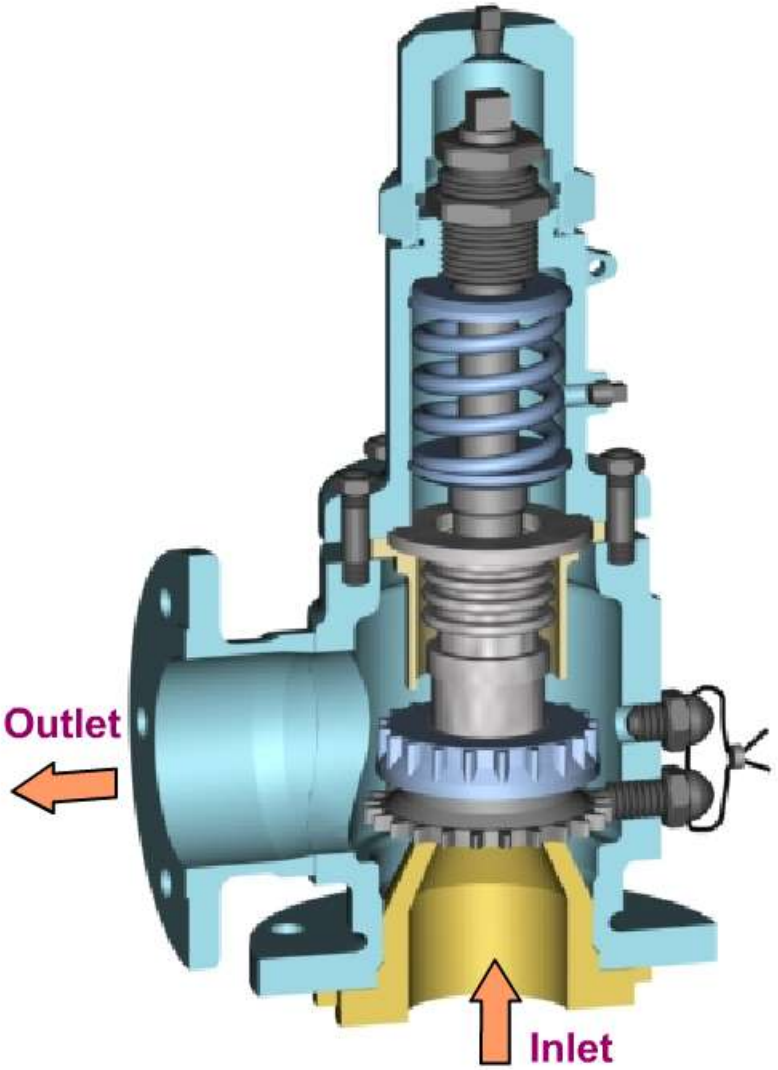
PRESSURE RELIEF VALVES

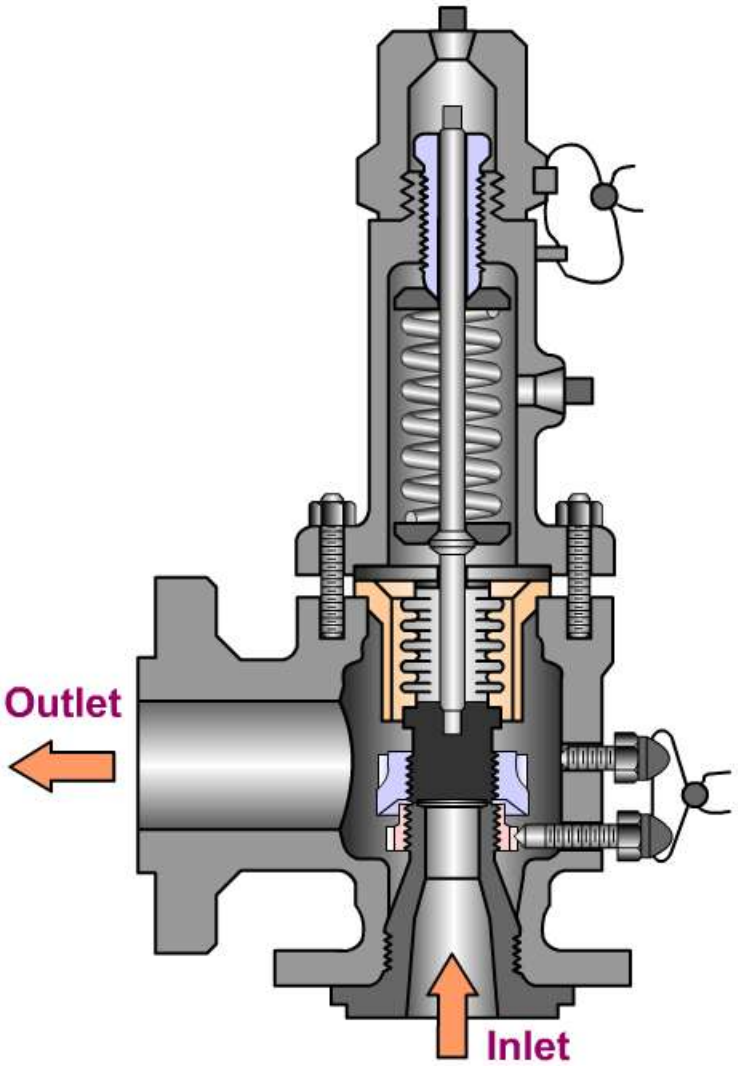
SAFETY VALVES



The nomenclature of the various components are shown.

PRESSURE RELIEF VALVES
SAFETY VALVES

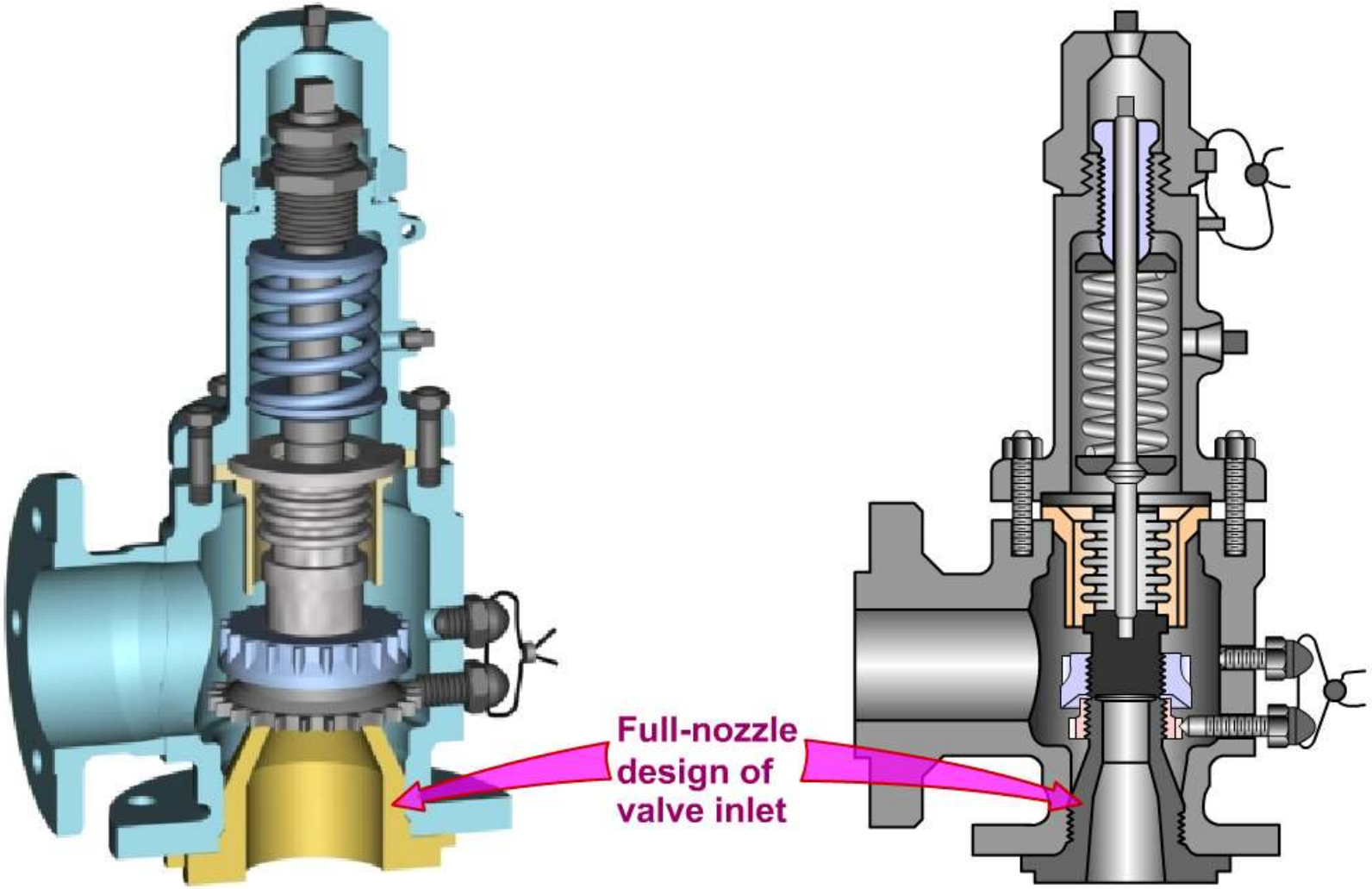




The system pressure acts on the disk through the inlet connection or nozzle. The outlet of the valve may have a screwed or flanged connection to a piped discharge system. In some cases like compressed air systems, there may not be an outlet connection and the fluid is vented directly to the atmosphere.

PRESSURE RELIEF VALVES

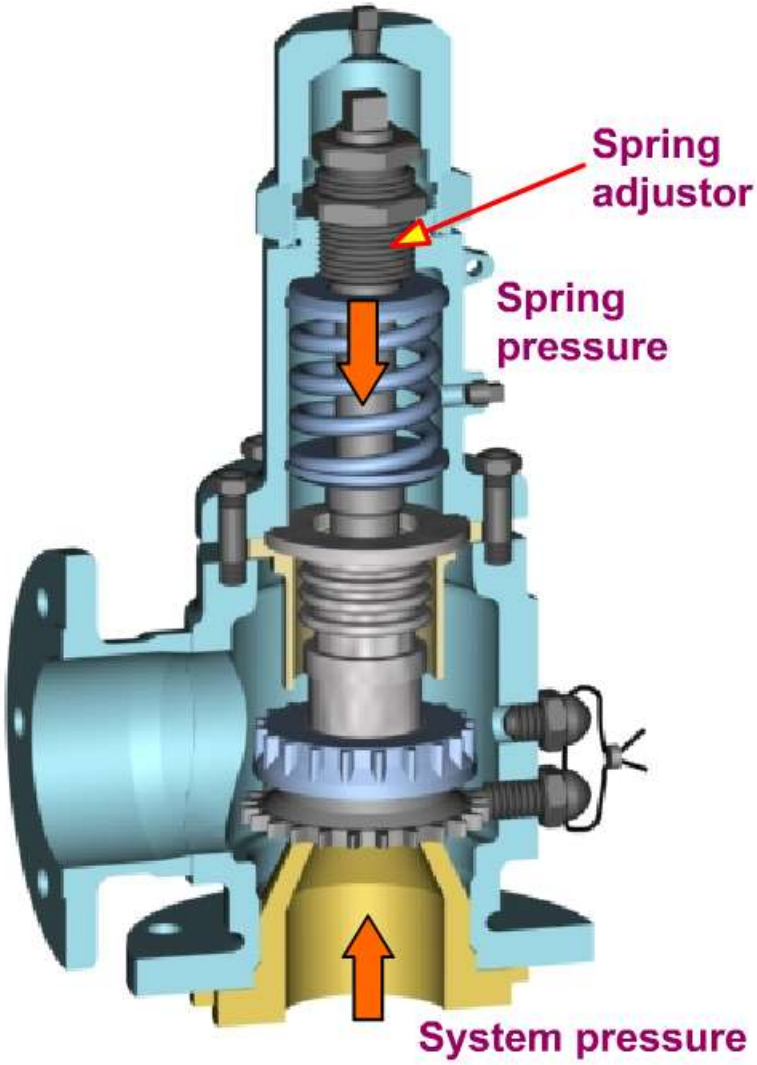
SAFETY VALVES

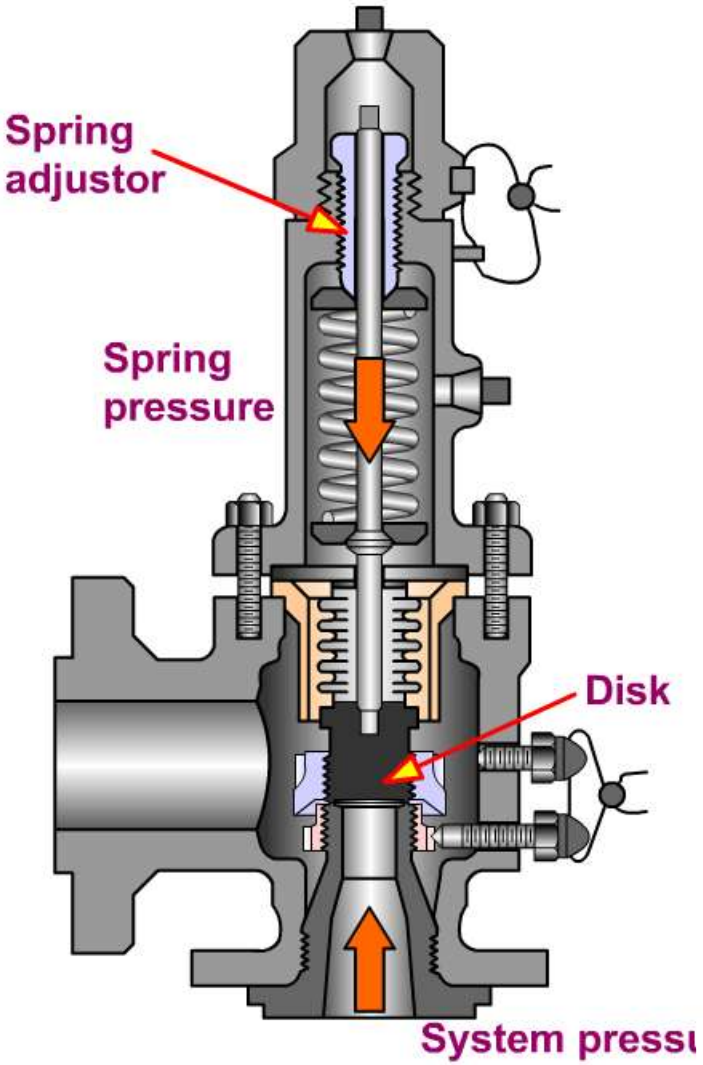


The inlet nozzle may be of the full-nozzle or semi-nozzle type. In the full-nozzle design the entire inlet tract is formed from one piece. This design is preferred for high pressure and corrosive fluid requirements. The semi-nozzle design involves the use of a seating ring, which is fit into the body. This design has the advantage of easy seat replacement.

PRESSURE RELIEF VALVES

SAFETY VALVES

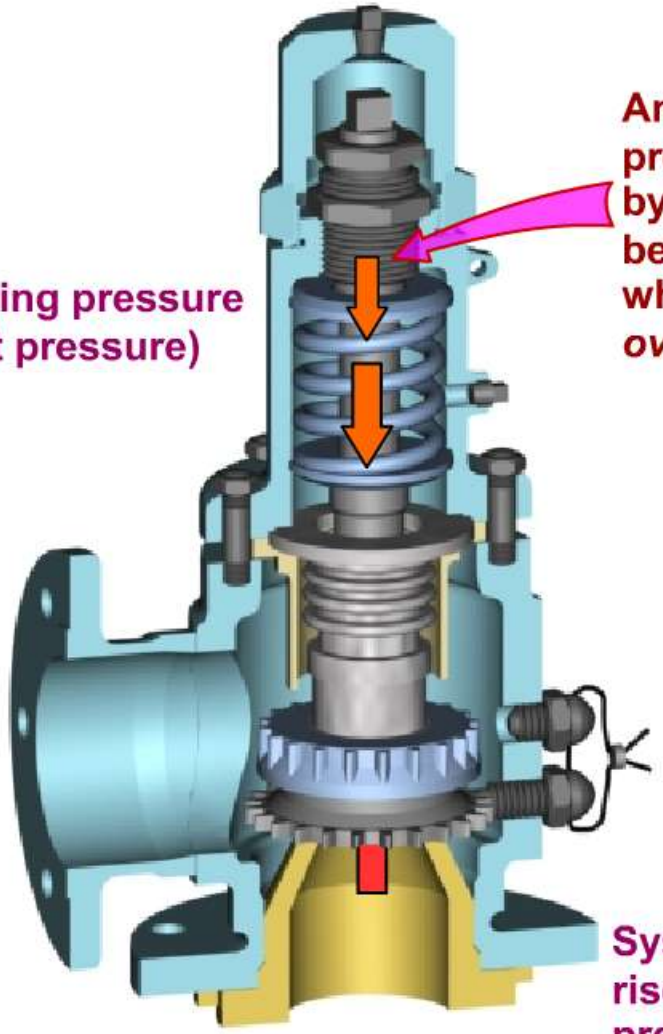




The system pressure acts below the disk. In the normal operating condition, the disk is held against the nozzle seat by spring-pressure from the top. The amount of compression on the spring is usually adjustable by means of the spring adjuster. Thus the pressure at which the disk lifts off the seat can be altered.

PRESSURE RELIEF VALVES

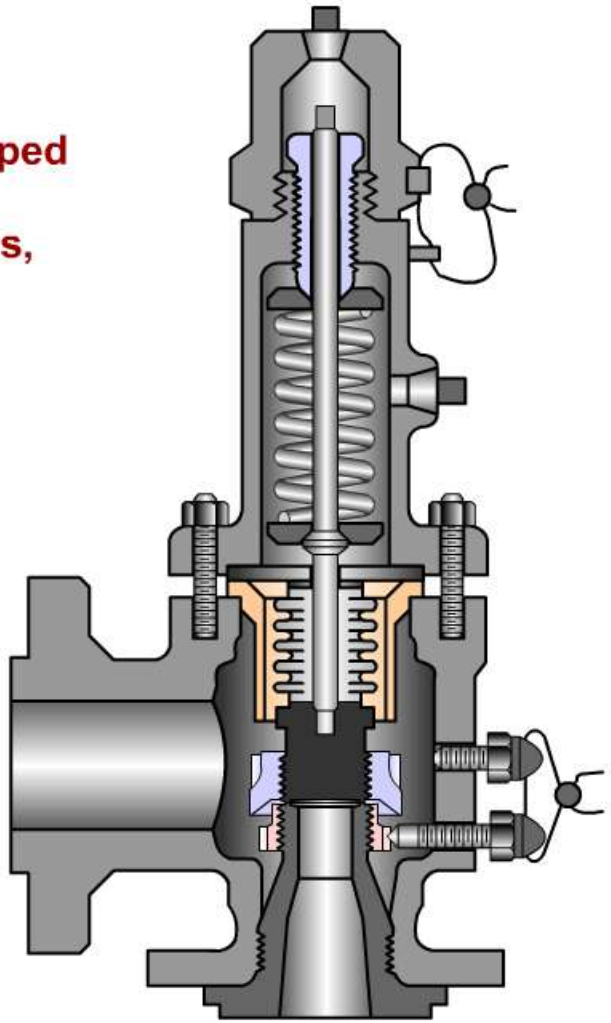
SAFETY VALVES



Spring pressure (set pressure)

An additional pressure is developed by the spring as it begins to compress, which is called *overpressure*

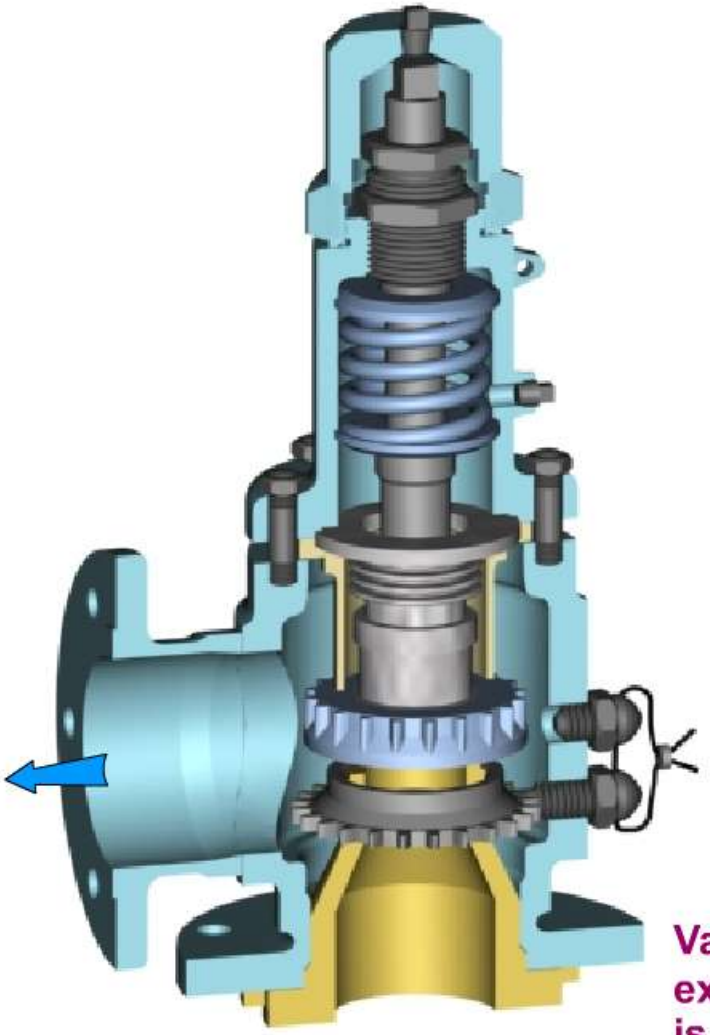
System pressure rises above set pressure



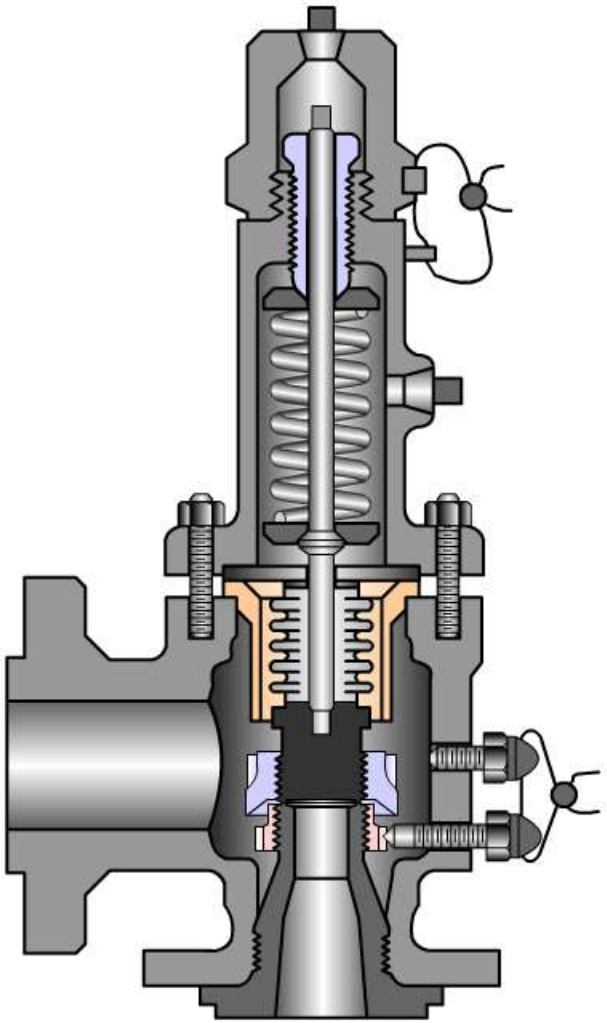
When the inlet static pressure rises above the set pressure, the disk begins to lift off its seat and fluid begins to escape. But as the spring begins to compress, it exerts a greater force. This additional pressure, which has to be overcome to achieve discharge at the valves rated capacity is called *overpressure*.

PRESSURE RELIEF VALVES

SAFETY VALVES



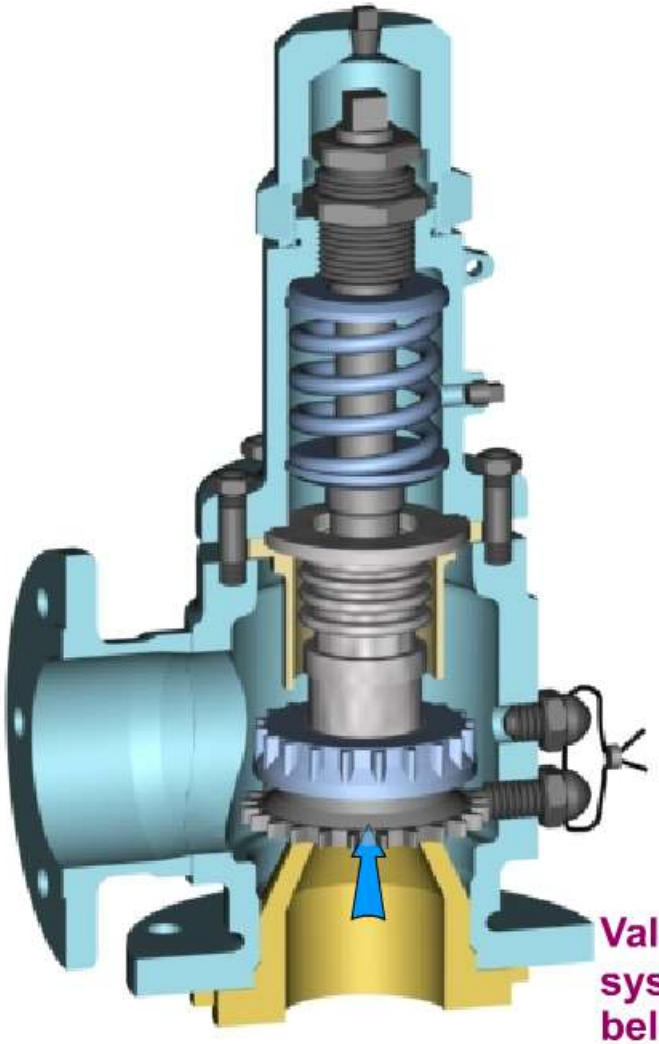
Valve opens and excess pressure is relieved

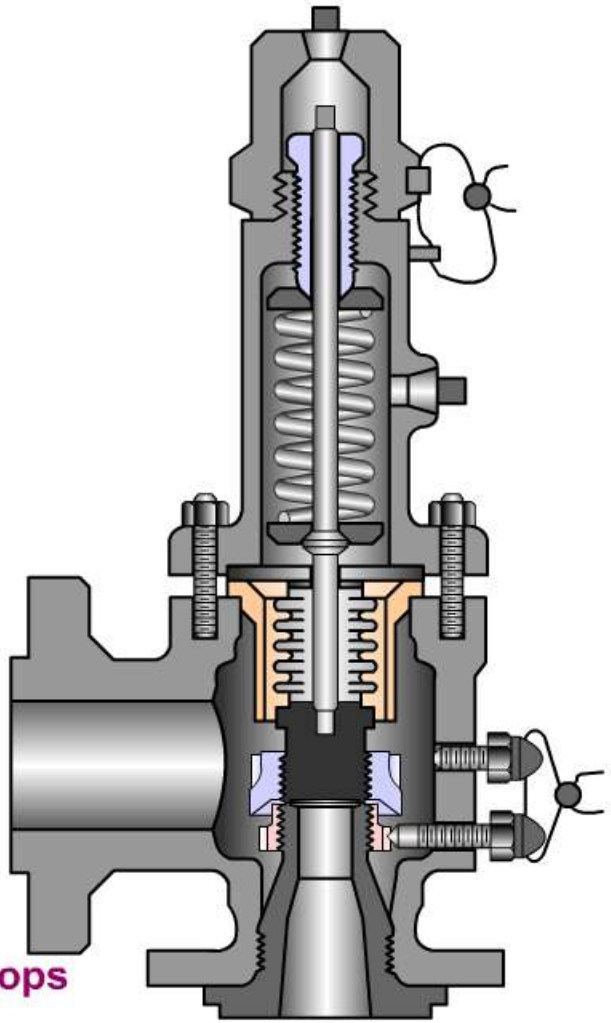


Thus when the system pressure increases over the set pressure, the disk rapidly pops open thus discharging the fluid and relieving the excess pressure.

PRESSURE RELIEF VALVES

SAFETY VALVES

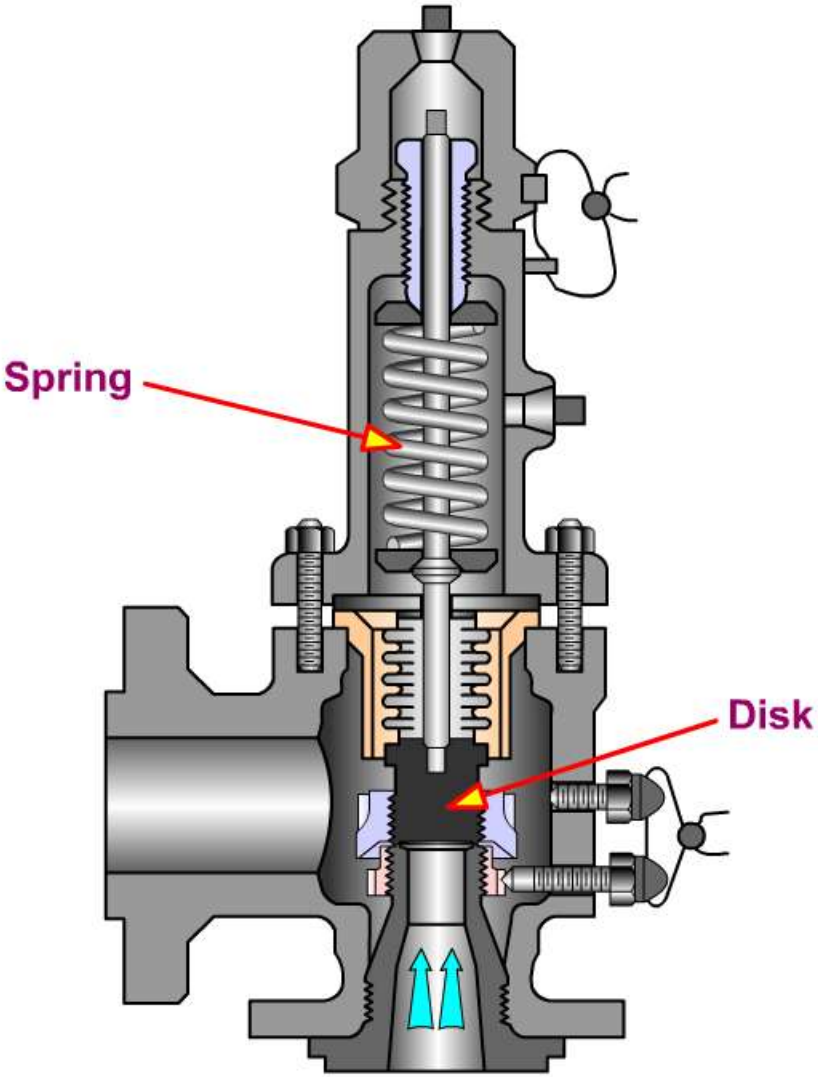




Valve closes when system pressure drops below set pressure

Once the normal operating condition is achieved the valve is expected to close again. But since a large area of the disk is exposed to the fluid, the valve closes only when the pressure drops below the set pressure. This difference between the reseating pressure and the set pressure is known as *blowdown* and is usually expressed as a percentage of the set pressure.

PRESSURE RELIEF VALVES
SAFETY VALVES

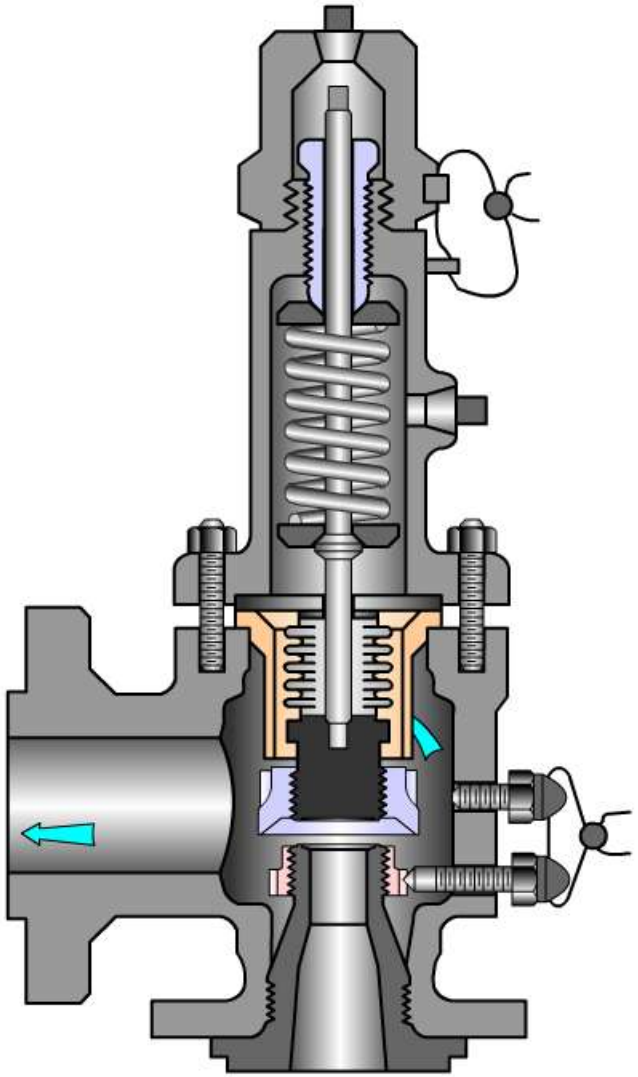


VALVE OPERATION

Let us observe the operation of the valve in its 2D cross-sectional view.

- Depiction shows the closed position of the valve.

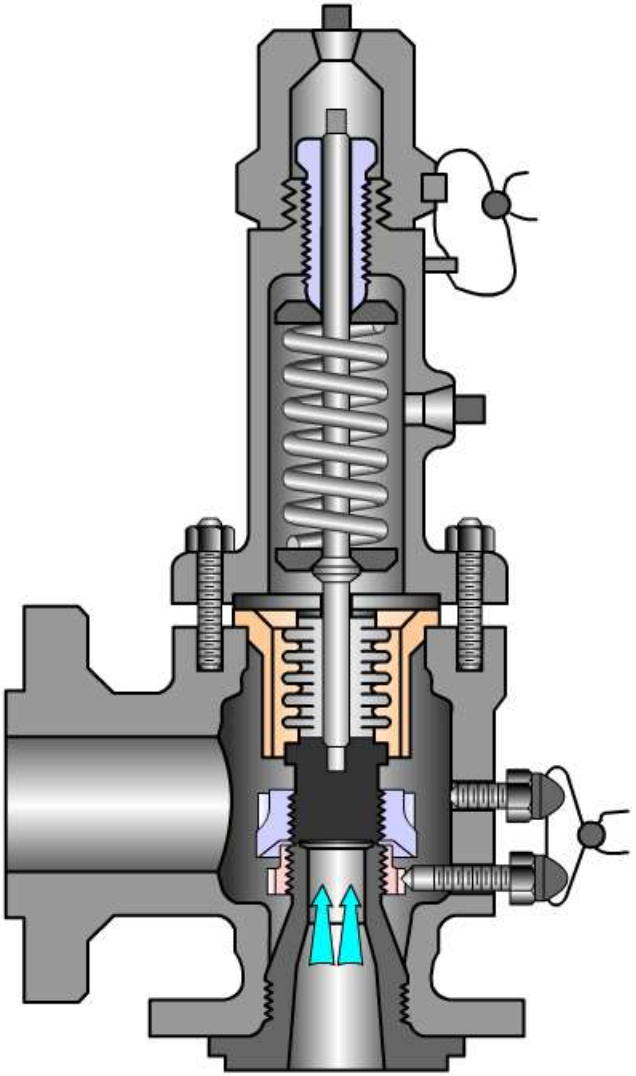
PRESSURE RELIEF VALVES
SAFETY VALVES



VALVE OPERATION

As seen, when the system pressure increases over the set pressure, the disk rapidly pops open thus discharging the fluid and the excess pressure is relieved.

PRESSURE RELIEF VALVES
SAFETY VALVES



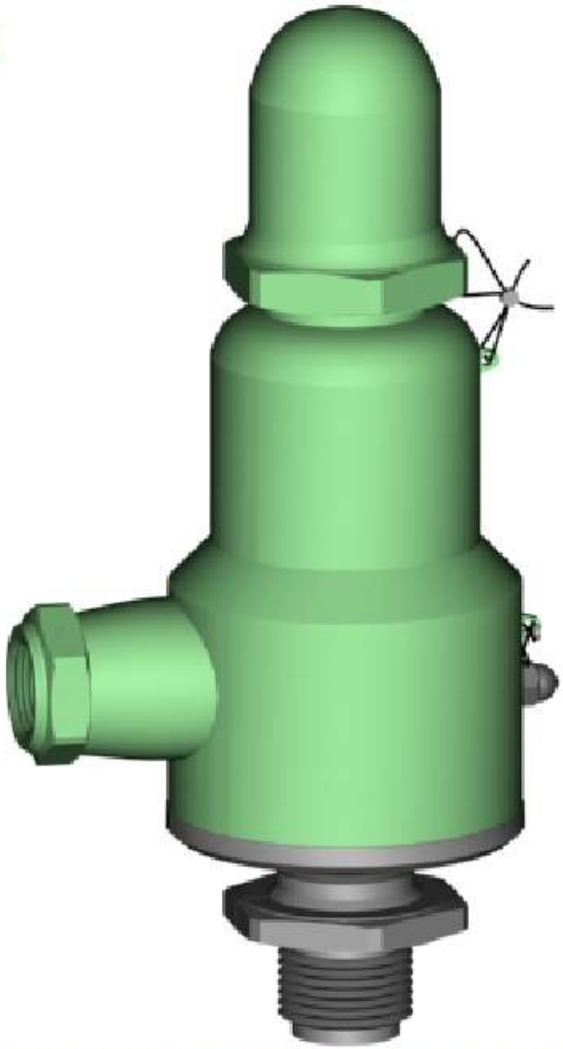
VALVE OPERATION

When the system pressure drops below the set pressure, the disk reseats thus closing the valve.

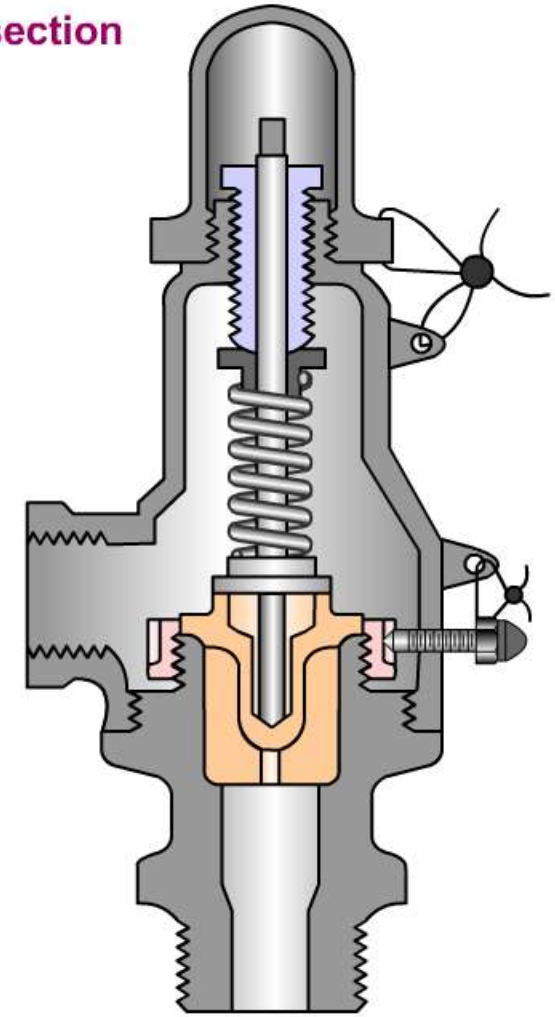
PRESSURE RELIEF VALVES

RELIEF VALVES

3D model



2D cross-section

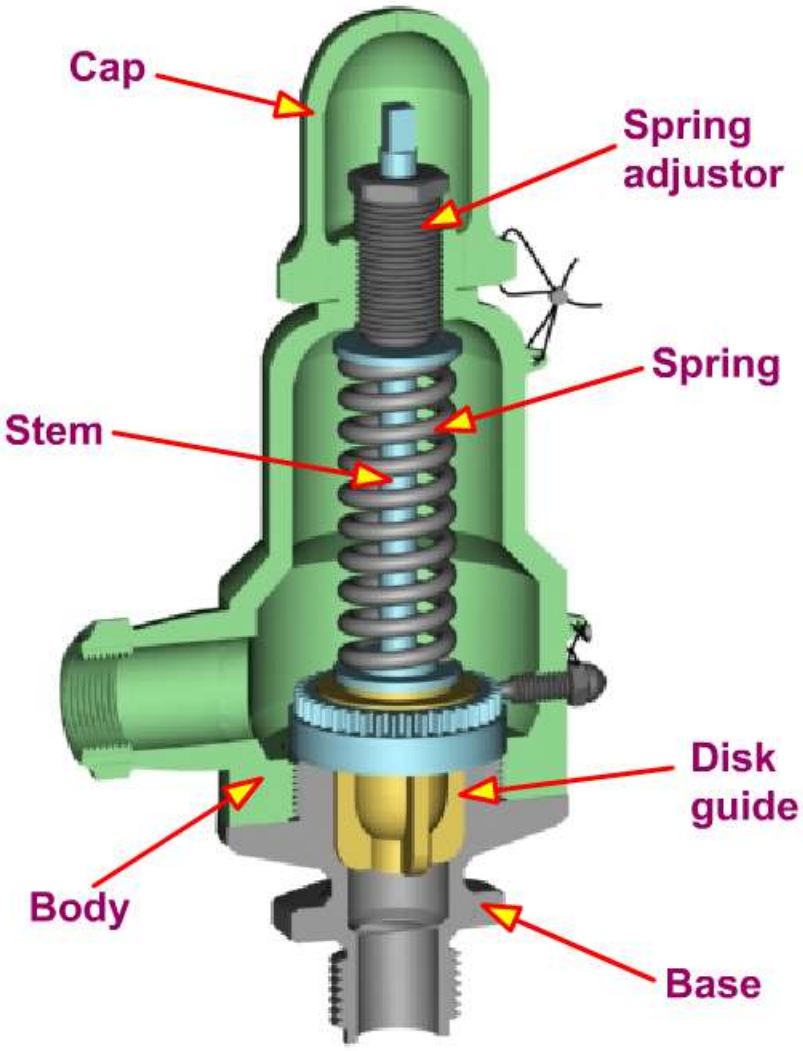


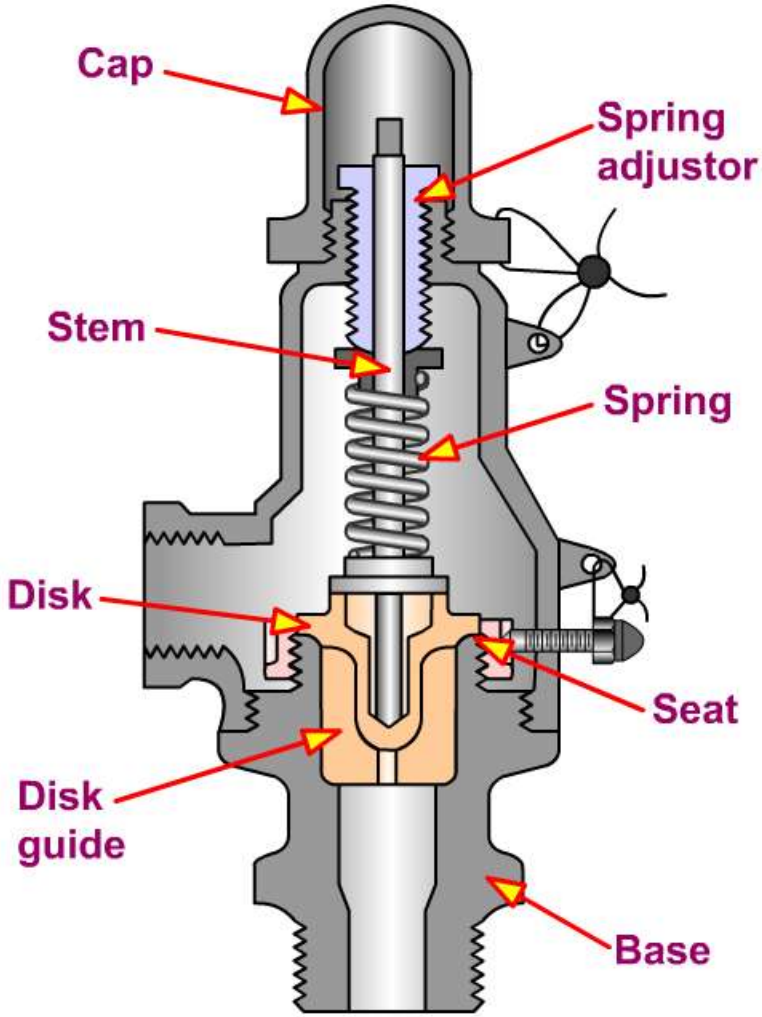
A typical model and the 2D cross-section of a relief valve is illustrated.

Relief valve is a pressure relief device actuated by inlet static pressure, having a gradual lift generally proportional to the increase in pressure over opening pressure. Relief valves are commonly used in liquid systems.

PRESSURE RELIEF VALVES

RELIEF VALVES





The nomenclature of the various components are shown.

PRESSURE RELIEF VALVES

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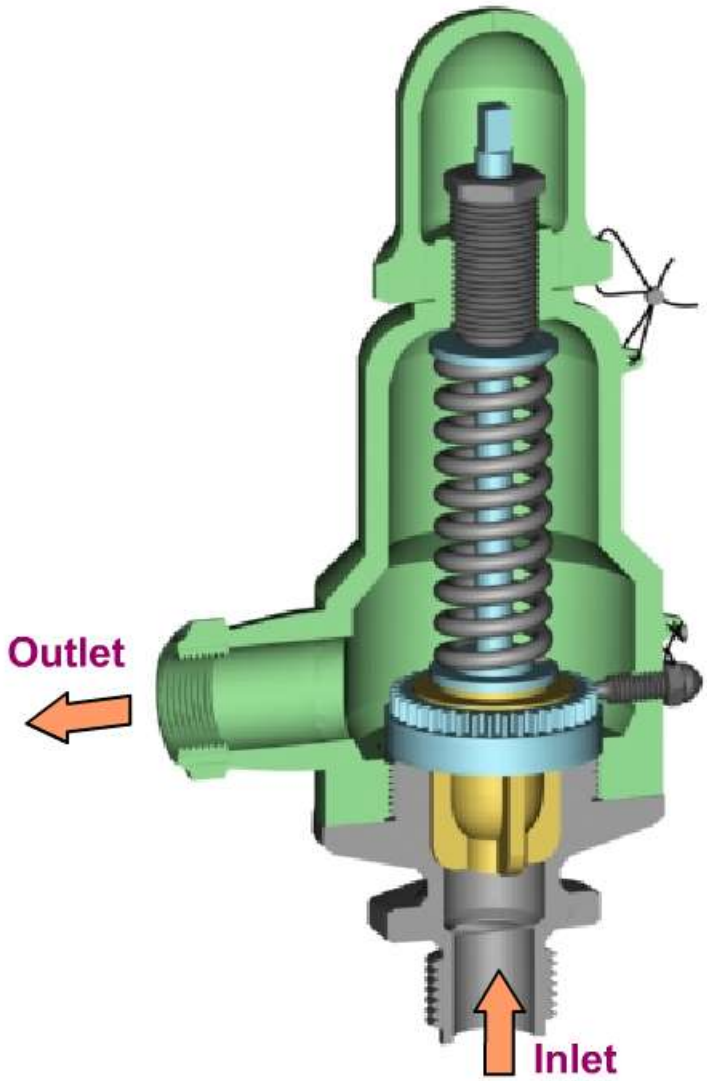

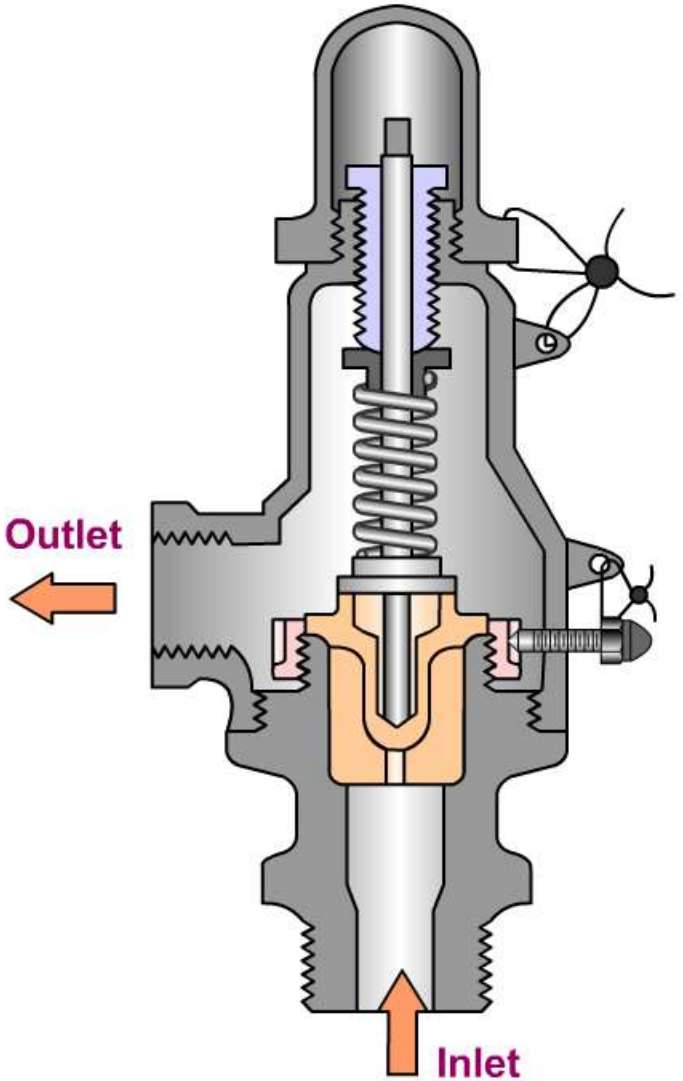

The system pressure acts on the disk through the inlet connection or nozzle. The outlet of the valve may have a screwed or flanged connection to a piped discharge system.

PRESSURE RELIEF VALVES

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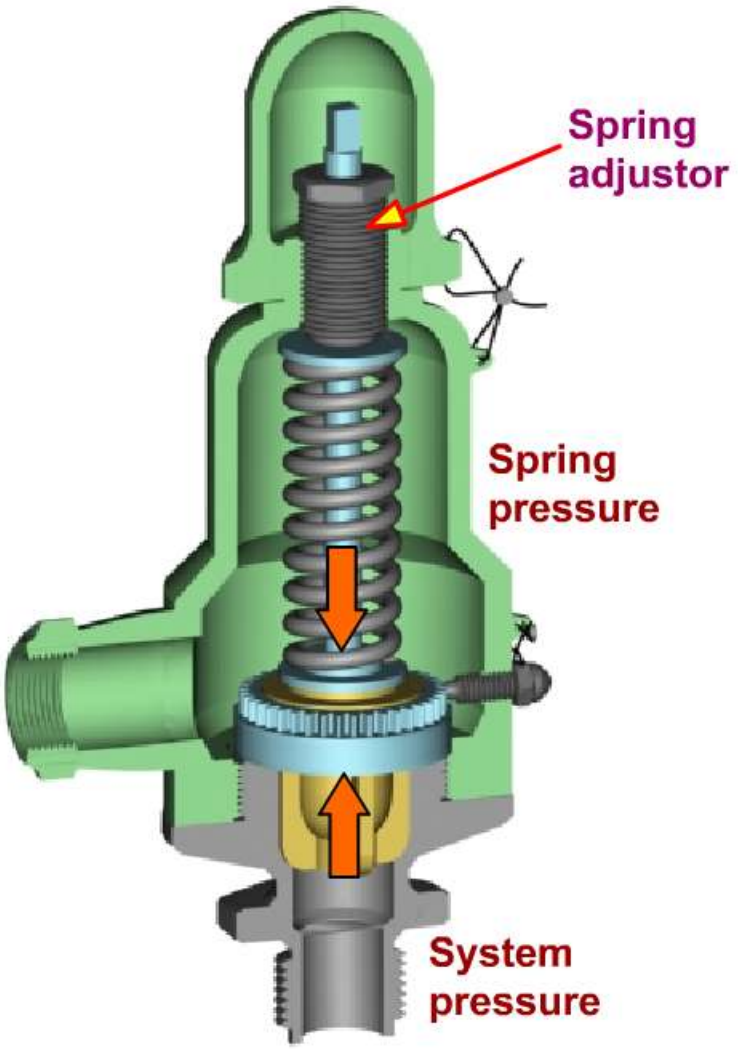
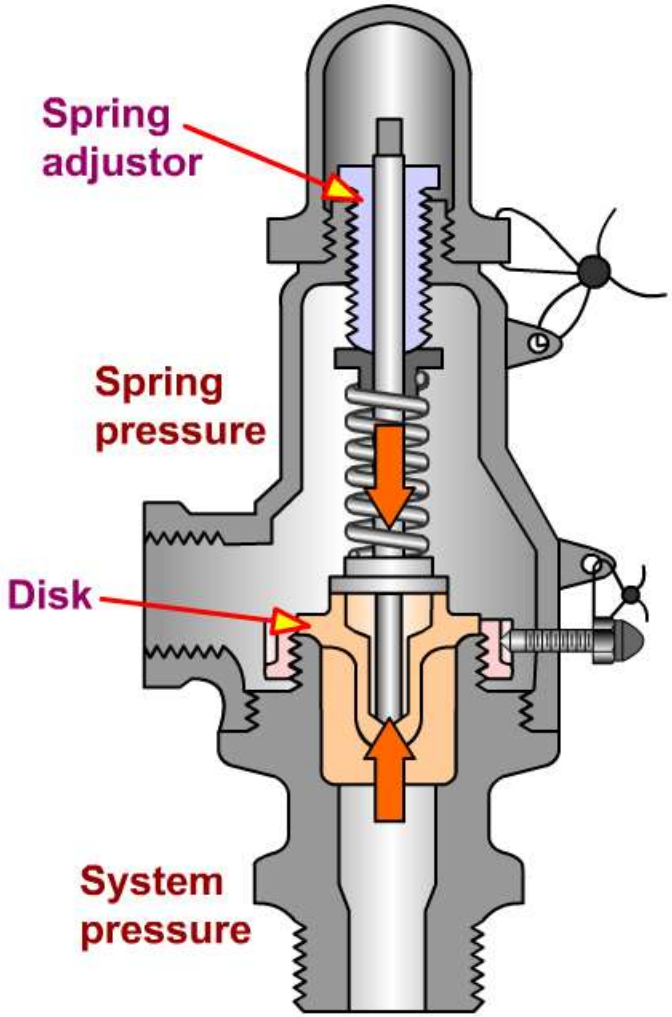
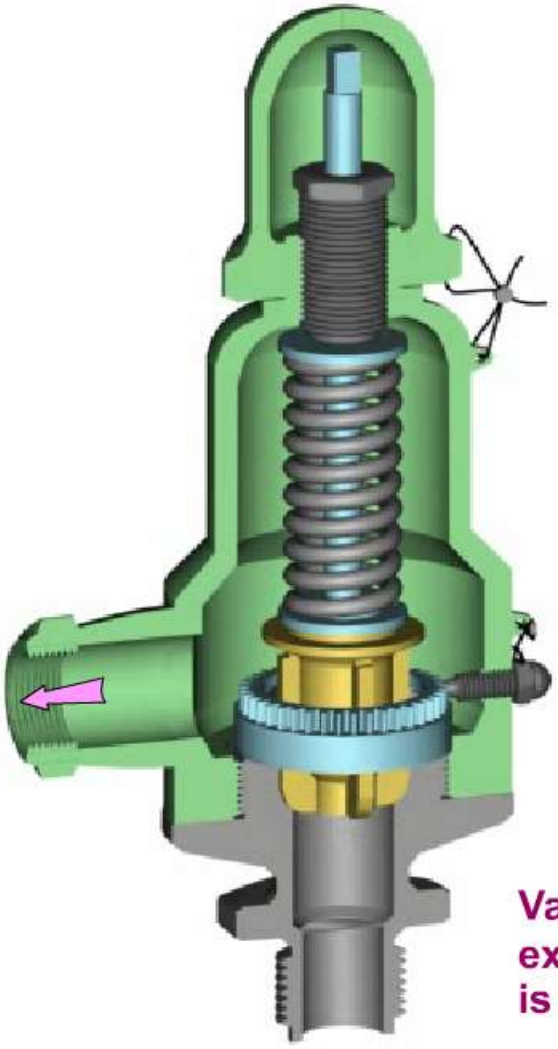




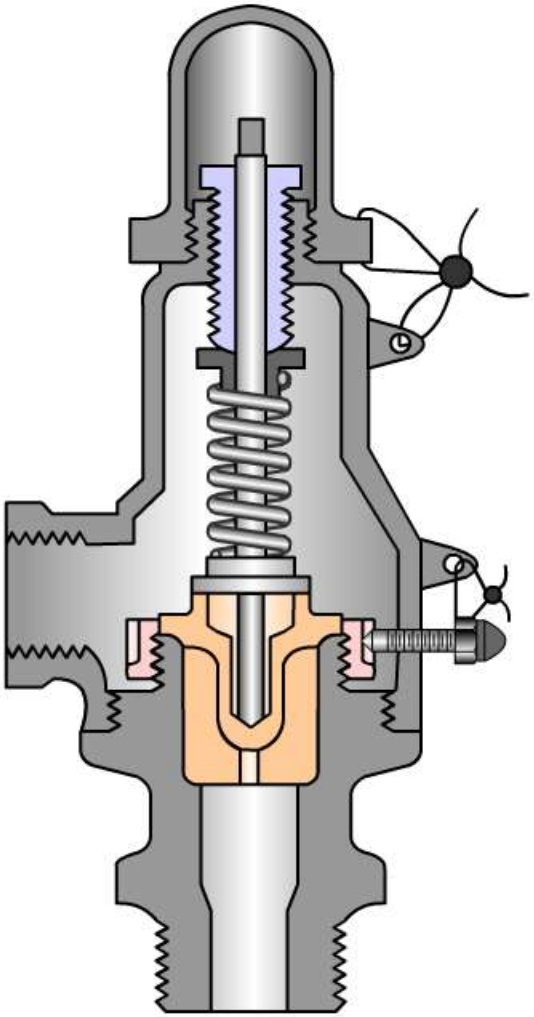
The system pressure acts below the disk. In the normal operating condition, the disk is held against the seat by spring-pressure from the top. The amount of compression on the spring is usually adjustable by means of the spring adjuster. Thus the pressure at which the disk lifts off the seat can be altered.

PRESSURE RELIEF VALVES

RELIEF VALVES



Valve opens and excess pressure is relieved

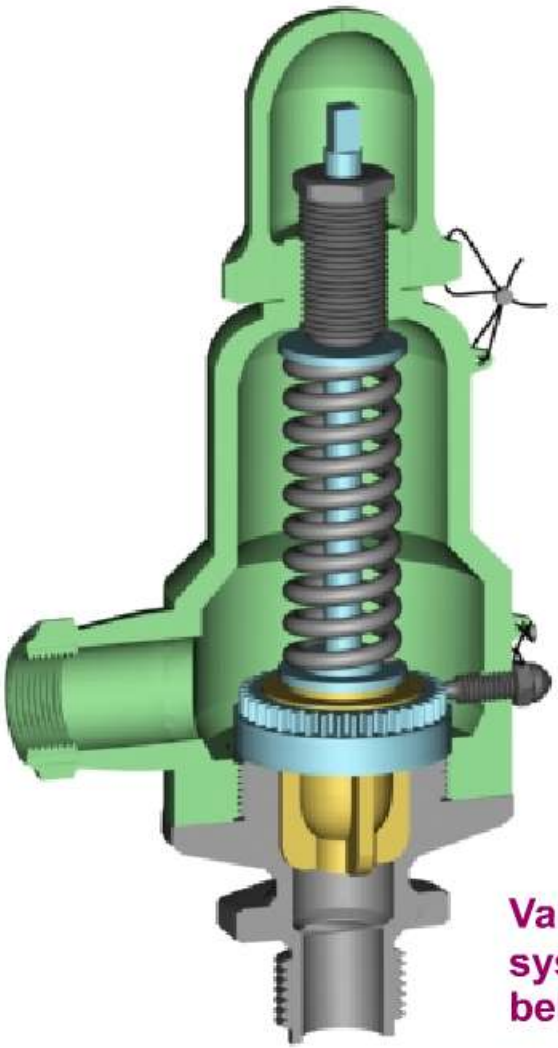


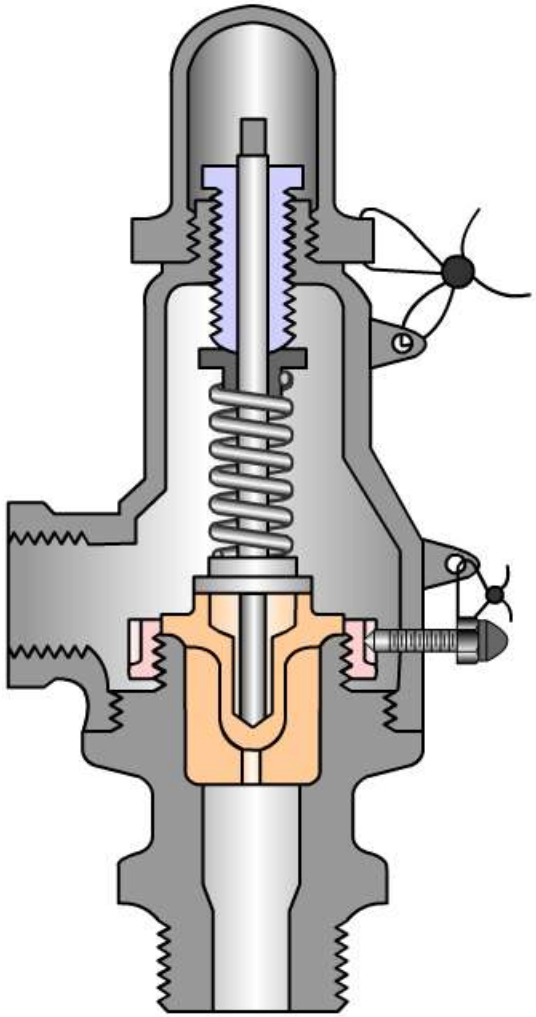
When the system pressure increases over the set pressure, the disk gradually lifts in proportion to the increase in system pressure over the set pressure. Thus the excess pressure is relieved.

- Flow path across one of the disk guides is shown.

PRESSURE RELIEF VALVES

RELIEF VALVES



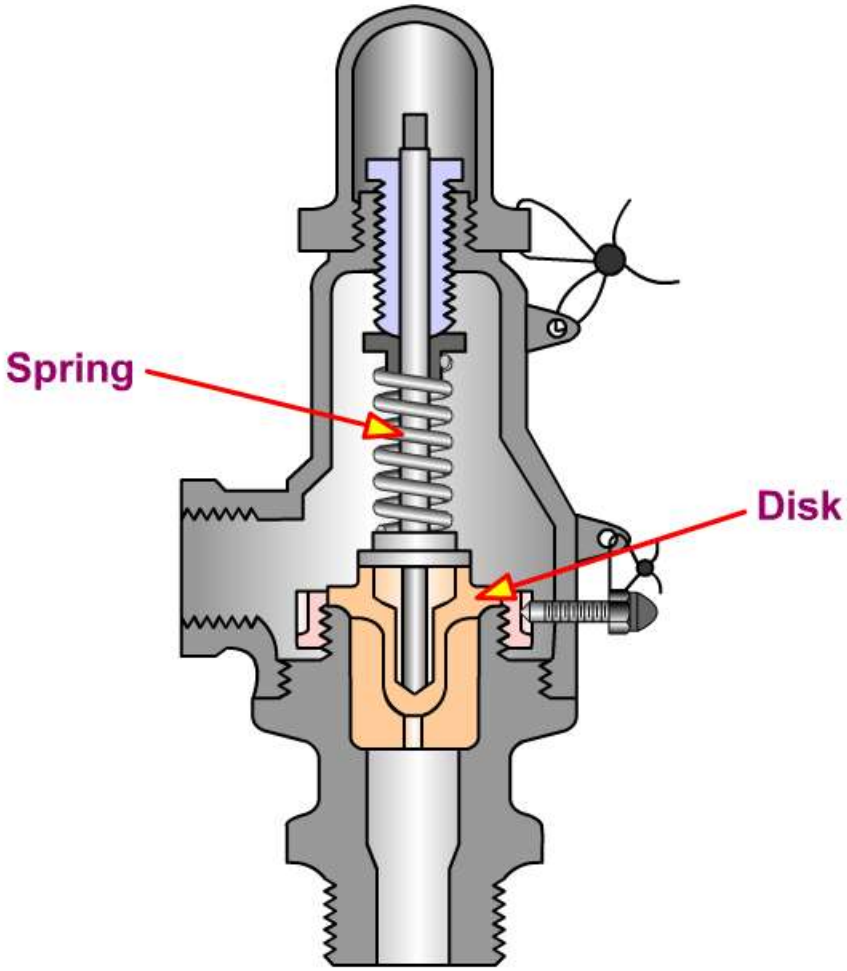


Valve closes when system pressure drops below set pressure

The disk reseats itself when the system pressure drops below the set pressure.

PRESSURE RELIEF VALVES

RELIEF VALVES



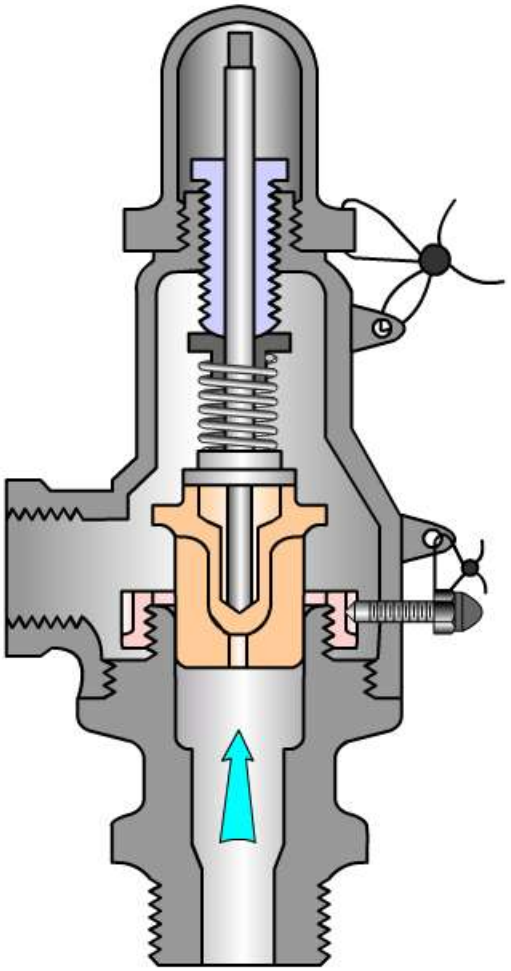
VALVE OPERATION

Let us observe the operation of the valve in its 2D cross-sectional view.

- Depiction shows the closed position of the valve.

PRESSURE RELIEF VALVES

RELIEF VALVES



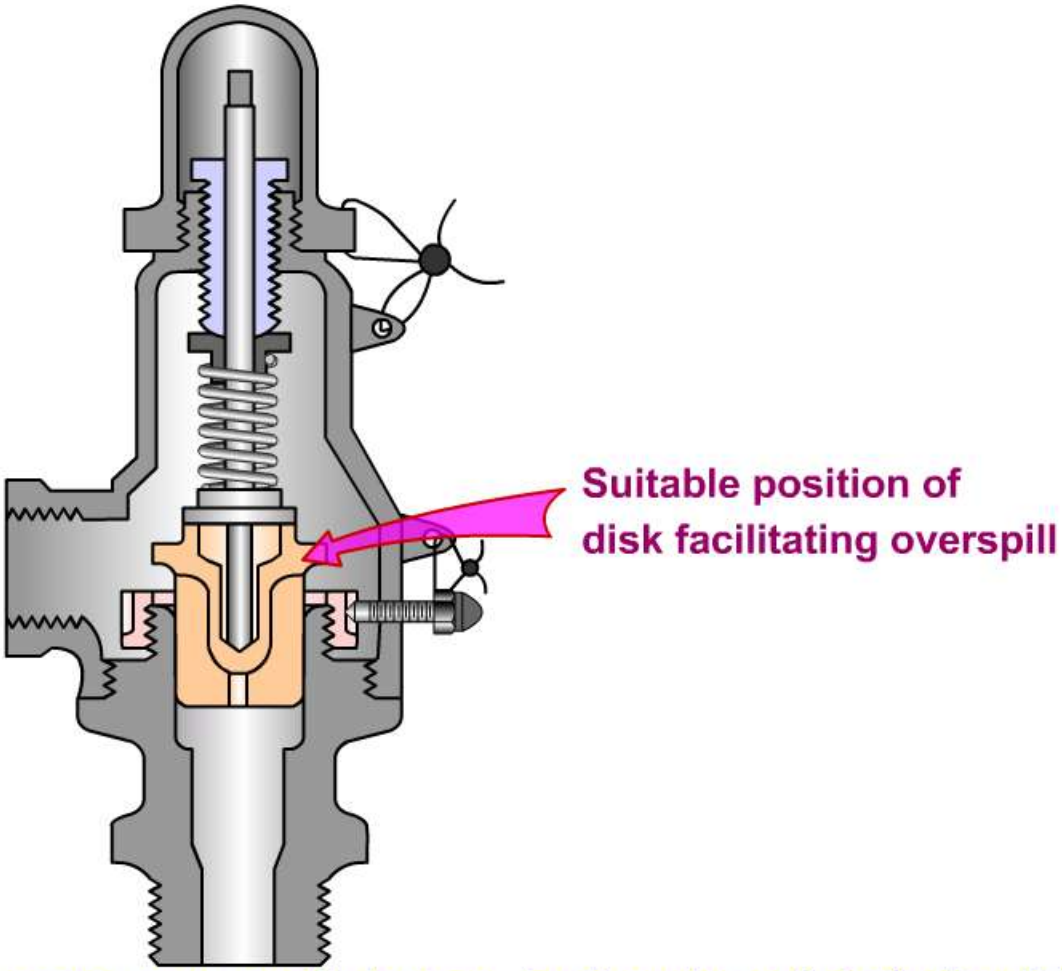
VALVE OPERATION

When the system pressure increases over the set pressure, the disk gradually lifts in proportion to the increase in system pressure over the set pressure. Thus the excess pressure is relieved.

- The flow path across one of the disk guides is shown.

PRESSURE RELIEF VALVES

RELIEF VALVES

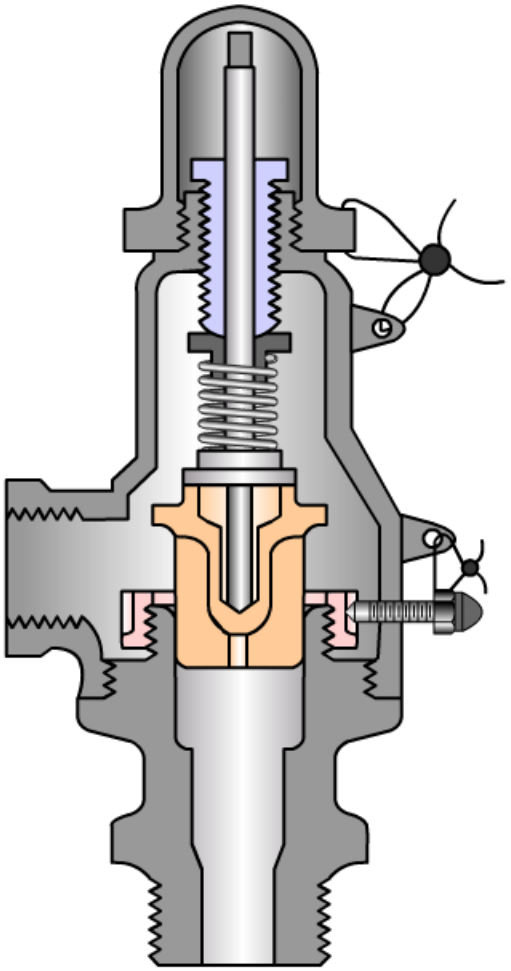


VALVE OPERATION

Relief valves can also be used as pressure overspill devices. In oil systems (lube/hydraulic) the system pressurizing pump usually will have excess capacity than the rated requirement to take care of any occasional excess demand by the system. This excess capacity is spilled back to the oil reservoir through the relief valve in the normal operating condition.

PRESSURE RELIEF VALVES

RELIEF VALVES



The disk keeps positioning itself so as to precisely relieve and maintain a constant system pressure

VALVE OPERATION

Relief valves can also be used as pressure overspill devices. In oil systems (lube/hydraulic) the system pressurizing pump usually will have excess capacity than the rated requirement to take care of any occasional excess demand by the system. This excess capacity is spilled back to the oil reservoir through the relief valve in the normal operating condition.

PRESSURE RELIEF VALVES

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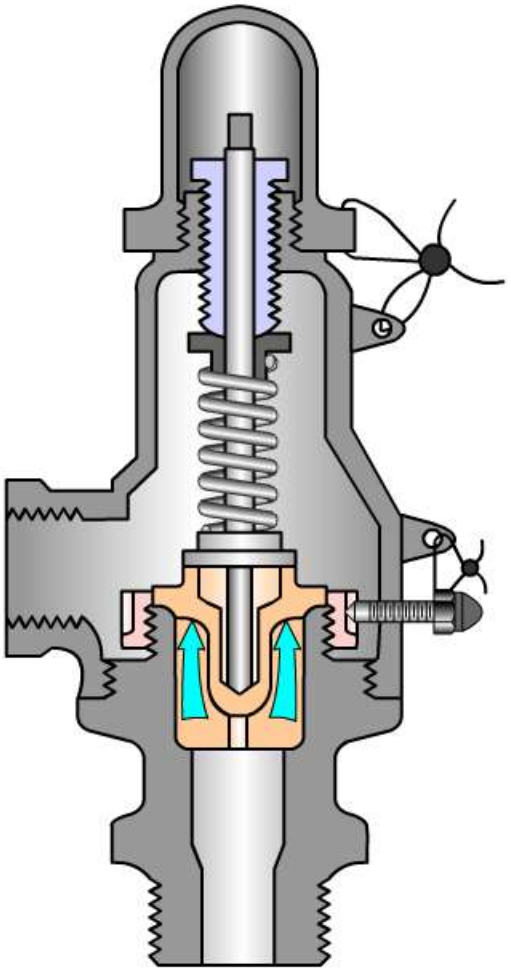
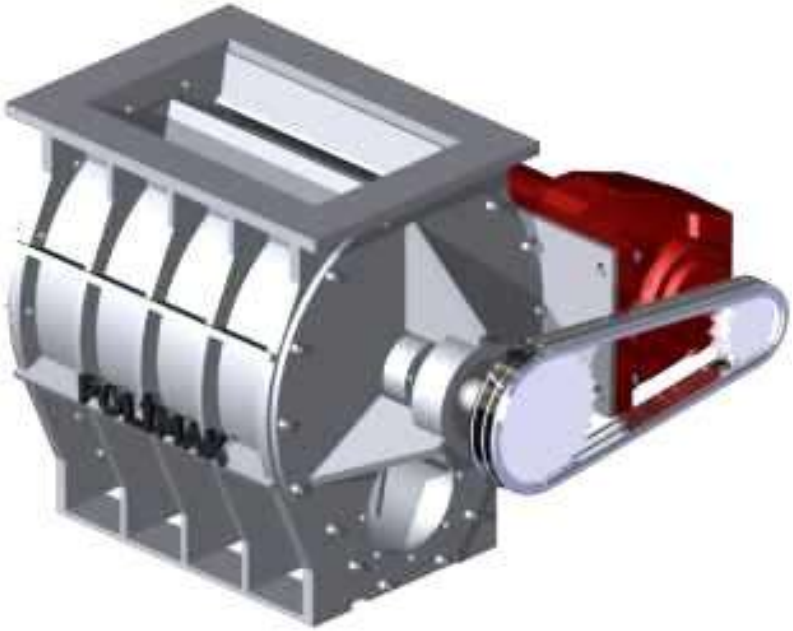


VALVE OPERATION

When the system pressure drops below the set pressure, the disk reseats itself thus closing the valve.

Rotary/Star Valve



Rotary valves are used in applications such as pneumatic conveying and dust filtration, particularly where air leakage needs to be minimised and the material requires metering at an even, quick speed.

They are ideally suited to control delivery or discharge of powder or pelletized products to and from conveying systems, bag filters and centrifugal separators.