



VALVES

TRAINING CENTRE

Thursday, August 4, 2016





**This Presentation
will only cover Water
and Gas Delivery
Valves.**



**The Hydraulic Valves
are extensively
covered in another
module on Basic
Hydraulics**





CONTENTS

- Types of valves
- Components of Valves
- Applications



At the end of this section, you should be able to...

- Describe the major types of valves, their operation and characteristics.

- Select an appropriate valve for a specific application.

- Identify the function of the major components of a valve.



TYPES OF VALVES



GATE VALVE



DIAPHRAGM VALVE

BALL VALVE

NEEDLE VALVE

FOOT VALVE

CHECK VALVE



GLOBE VALVE

BUTTERFLY VALVE

TAPER PLUG VALVE

PINCH VALVE

SOLENOID VALVE

GATE VALVE

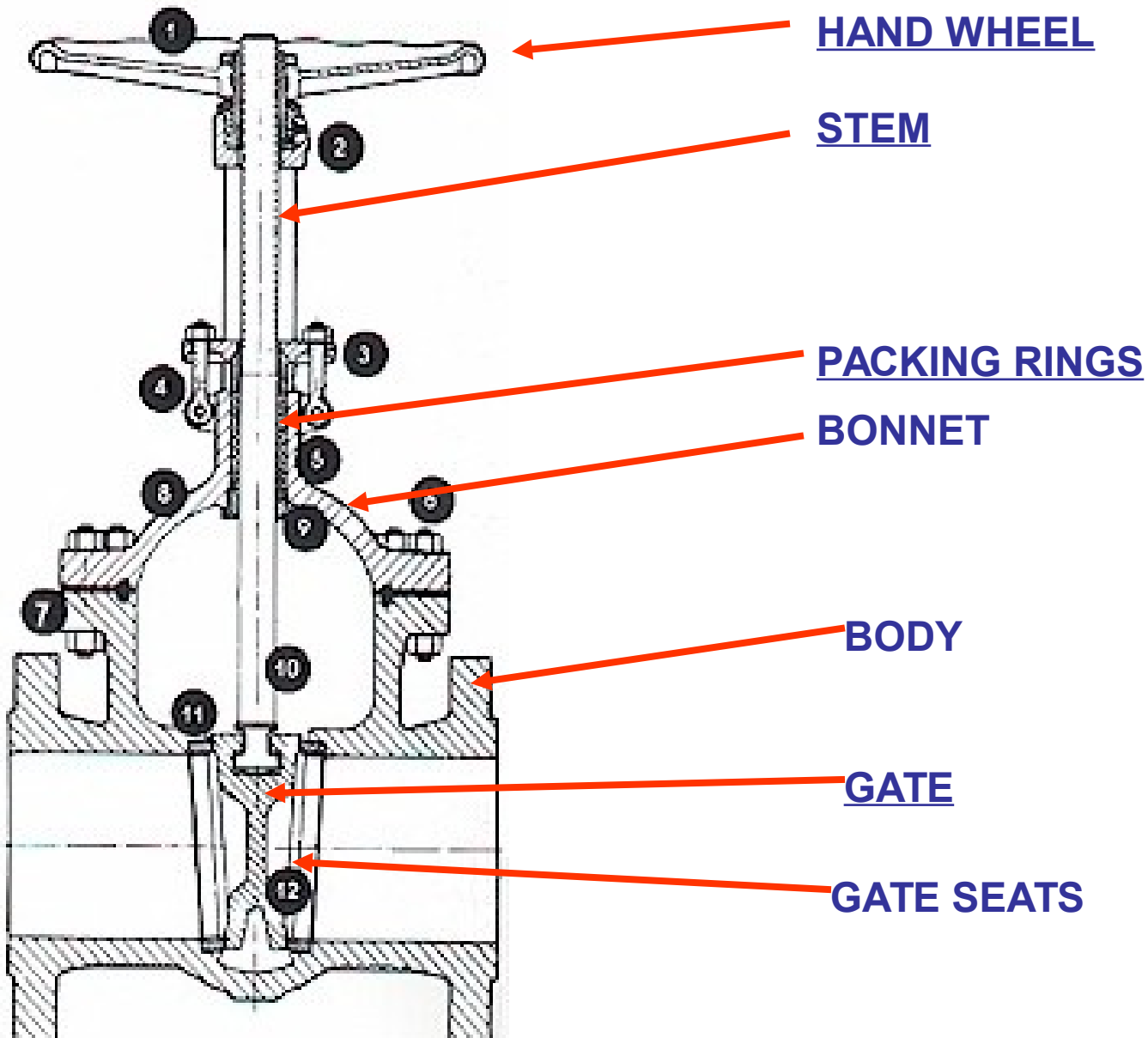
Gate valves are linear motion valves in which a flat closure element slides into the flow stream to provide shut-off. Gate valves/knife valves are designed to minimize pressure drop across the valve in the fully opened position as the direction of fluid flow does not change, and the diameter through which the process fluid passes is essentially equal to that of the pipe. Hence, they tend to have minimal pressure drop when opened fully.



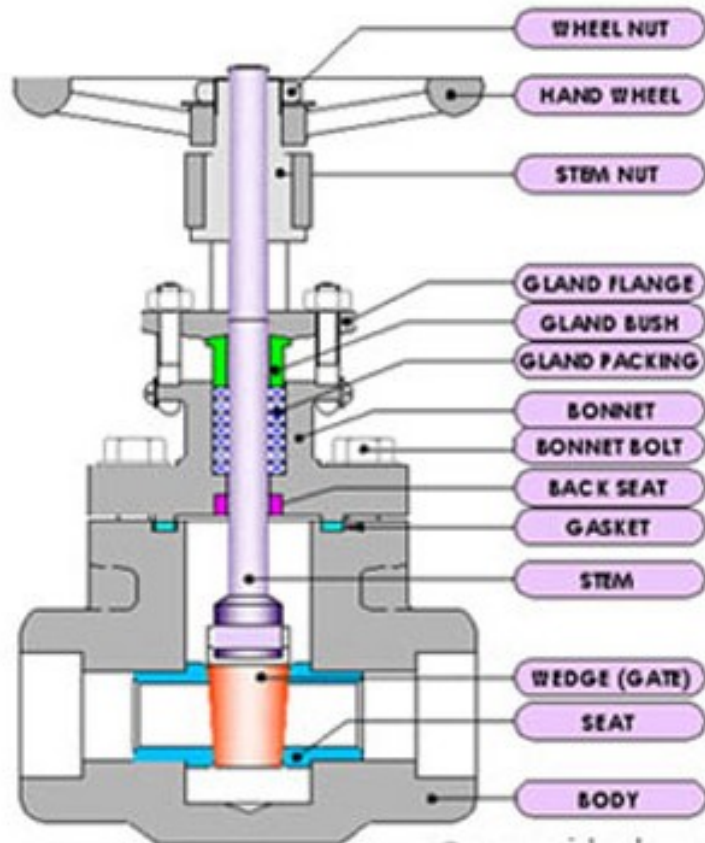
GATE VALVE



PARTS OF GATE VALVE



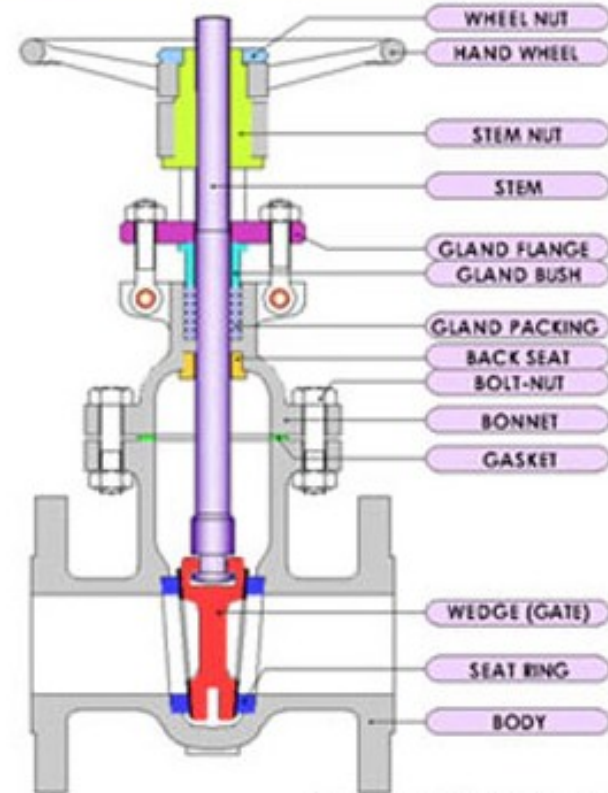
PARTS OF GATE VALVE



© www.jdvalves.com

Forged Steel Gate Valve
OS & Y Type, Rising Stem, Bolted Bonnet
Design Standard: API 602
Pressure Rating: 800# // 1500#
End Connection Screwed / Socket Weld End

PARTS OF GATE VALVE



© www.jdvalves.com

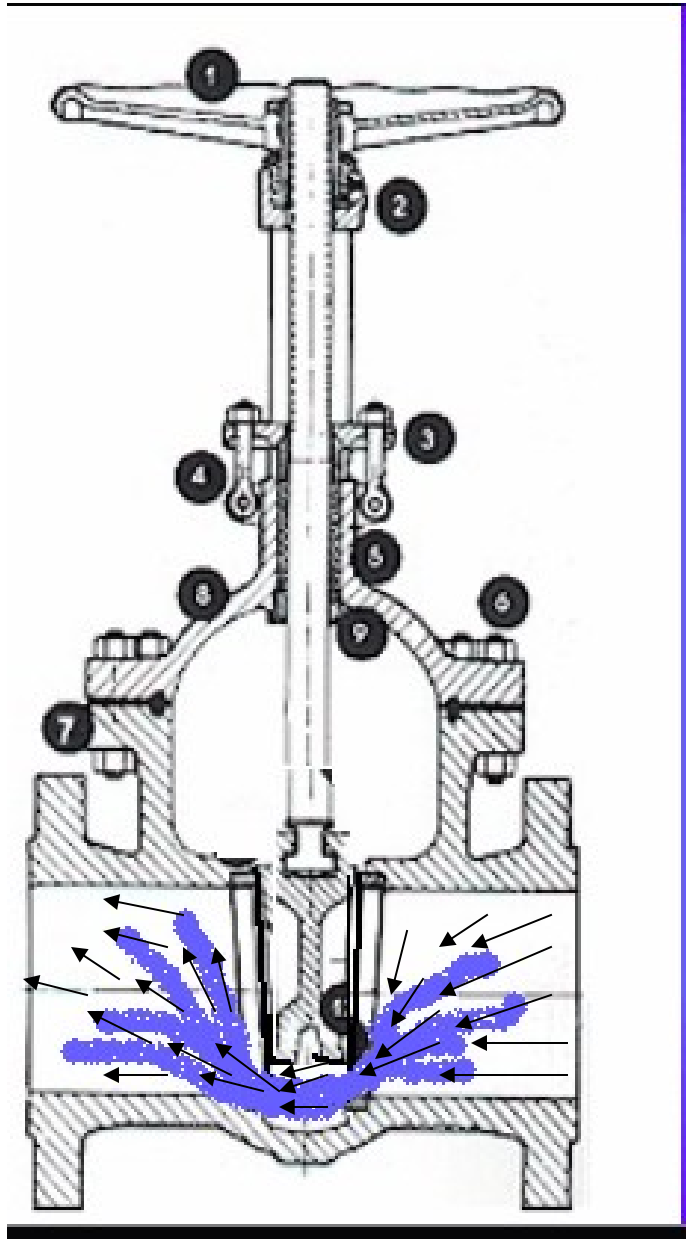
Gate Valve
OS & Y Type, Rising Stem, Bolted Bonnet
Design Standard: API 600
Size Range - 1" to 12"
Pressure Rating - 125# / 150# / 300#
End Connection Flanged End

GATE VALVE

They can also be used where throttling capabilities are desired, although this is not generally recommended as erosion of the seat and disc occurs due to the vibrations of the disk in throttling applications



GATE VALVE



THROTTLING OF
GATE VALVE
LEADS TO
CHATTERING
AND VIBRATION

GATE VALVES

Gate valves are usually divided into two types:
Parallel and
•wedge-shaped.

The parallel gate valve uses a flat disc gate between two parallel seats, upstream and downstream. Knife valves are of this type, but with a sharp edge on the bottom of the gate to shear entrained solids or separate slurries.

Gate valves are characterised as having either a rising or a non-rising stem. Rising stems provide a visual indication of valve position. Non-rising stems are used where vertical space is limited or underground





GATE VALVE

Sliding disk, perpendicular to flow

Applications: Stop valves, (not throttling), high pressure and temp, not for slurries, viscous fluids

Advantages – low pressure drop when fully open, tight seal when closed, free of contamination buildup

Disadvantages – vibration when partially open, slow response and large actuating force.



GATE VALVE

Pressure Seal Bonnet



This construction is adopted for valves for high pressure service, typically in excess of 2250 psi. The unique feature about the pressure seal bonnet is that the body - bonnet joints seals improves as the internal pressure in the valve increases, compared to other constructions where the increase in internal pressure tends to create leaks in the body-bonnet joint.

Gate valves normally have flanged ends which are drilled according to pipeline compatible flange dimensional standards. Cast iron, cast carbon steel, gun metal, stainless steel, alloy steels, and forged steels are different materials from which gate valves are constructed.



GATE VALVE



Packing



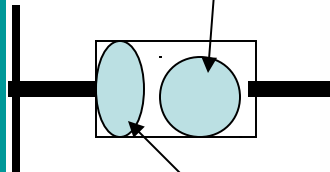
Low Pr Valve Packing

Normal O-
Ring Position

Bonnet

Body

Under
Pressure



High pressure Valve packing

GLOBE VALVE



A Globe valve is a type of valve used for regulating flow in a pipeline, consisting of a movable disk-type element and a stationary ring seat in a generally spherical body .



Globe valves are linear motion valves with rounded bodies, from which their name is derived. They are widely used in industry to regulate fluid flow in both on/off and throttling service .



GLOBE VALVE



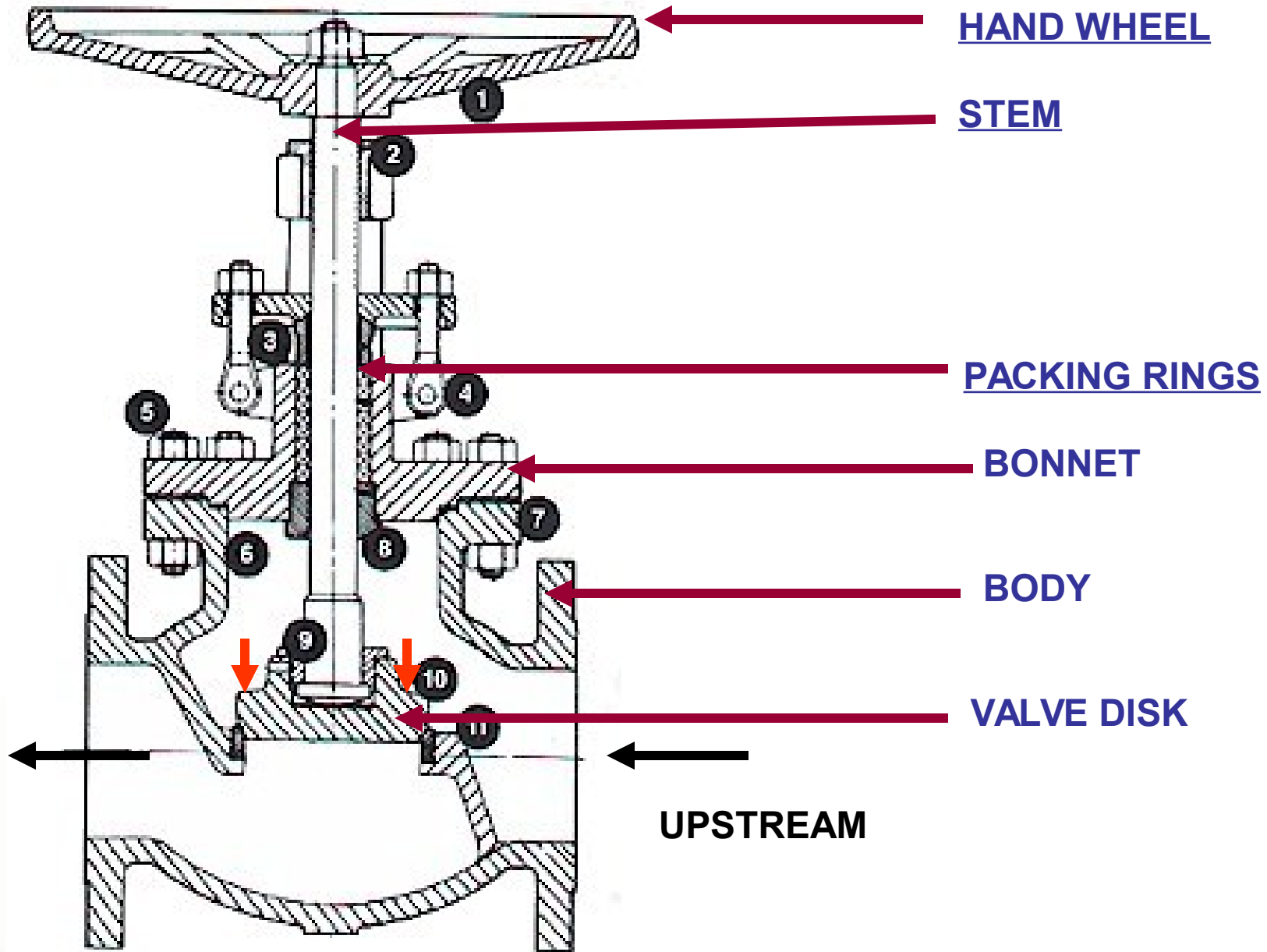
GLOBE VALVE



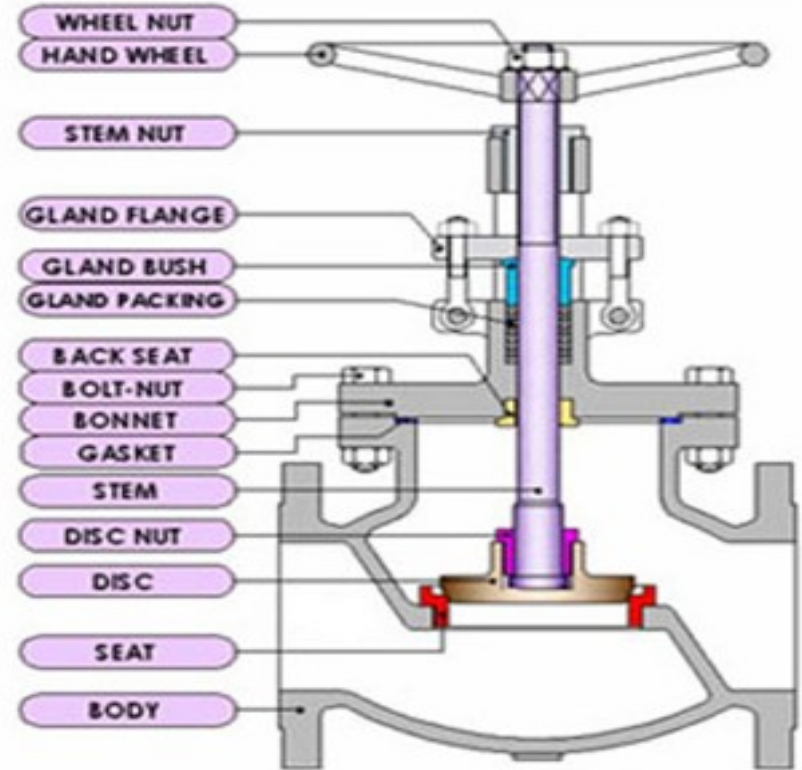
Globe valves are linear motion valves with rounded bodies, from which their name is derived. They are widely used in industry to regulate fluid flow in both on/off and throttling service. Globe valves consist of the following moving parts – the **disk**, the **valve stem**, and the **handwheel**. The stem is threaded and fits into the threads in the valve bonnet. The location of the valve disk in relation to the valve seat allows or restricts flow. The direction of fluid flow through the valve changes several times, which increases the pressure drop across the valve. In most cases, globe valves are installed with the stem vertical and the higher-pressure fluid stream connected to the pipe side above the disk, which helps to maintain a tight seal when the valve is fully closed.



GLOBE VALVE



GLOBE VALVE



© www.jdvalves.com

Globe Valve (ASA Design),
OS & Y Type, Rising Stem
Bolted Bonnet

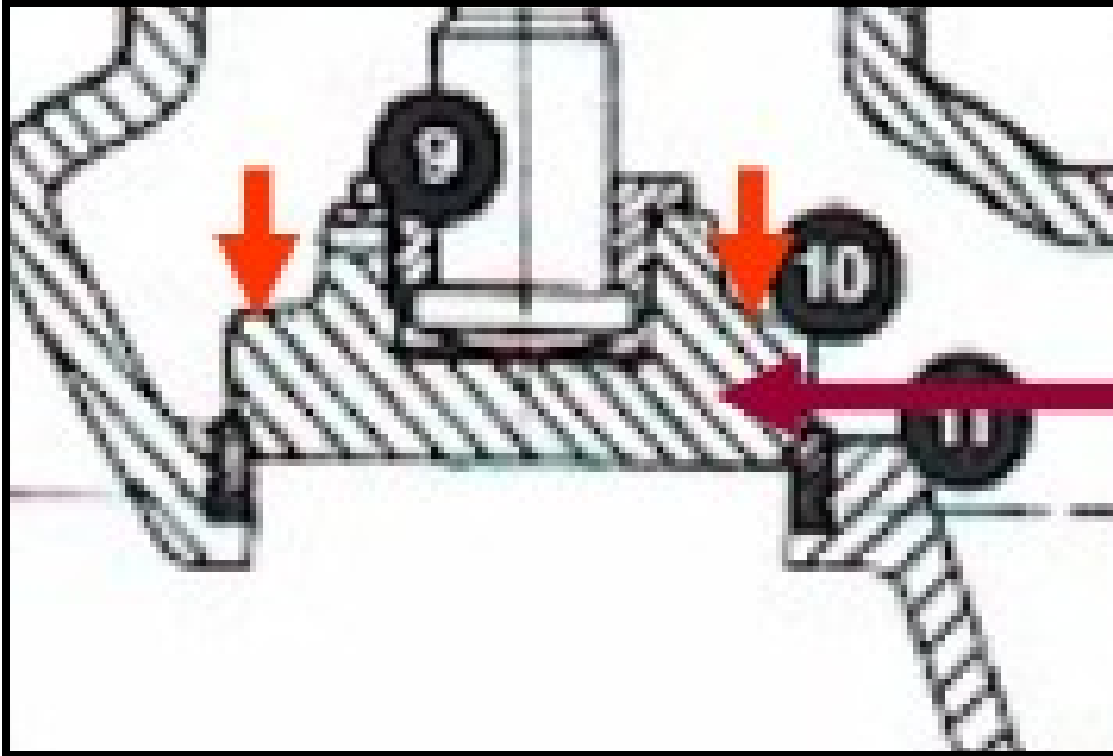
Design Standard: BS 1873

Size Range - 1" to 12"

Pressure Rating - 125# / 150# / 300#

End Connection Flanged End

GLOBE VALVE



The Globe Valve should be so fitted that the fluid flows upside down through the disk.

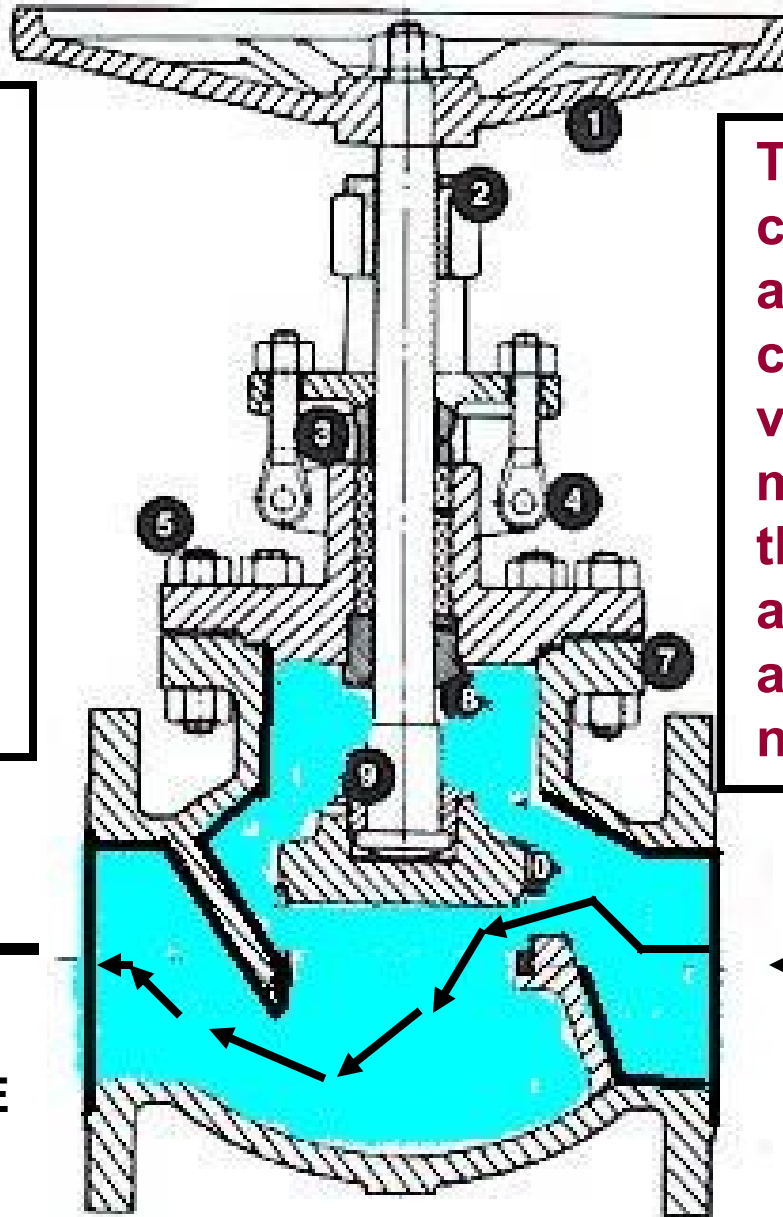
This would help in tight sealing of the disk on the seat due to water pressure

GLOBE VALVE



When globe valves are open, the fluid flows through the space between the edge of the disk and the seat.

DOWN
STREAM SIDE



These valves are commonly used as a fully open or fully closed on/off valves, but they may be used for throttling as long as fine adjustments are not required.

UPSTREAM SIDE

GLOBE VALVE



•Globe valves are available in three main body types (although custom designs are available as well):

•Angle design,

•Y-design and

•Multi-piece design.

•Angle valves are designed so that the inlet and outlet are perpendicular, for transferring flow from vertical to horizontal.

• Y-design valves derive linear action from the incline between the axis of the inlet and outlet ports.

•The bodies of multi-piece design valves are bolted together. The inlet and outlet are not of single piece construction.



GLOBE VALVE

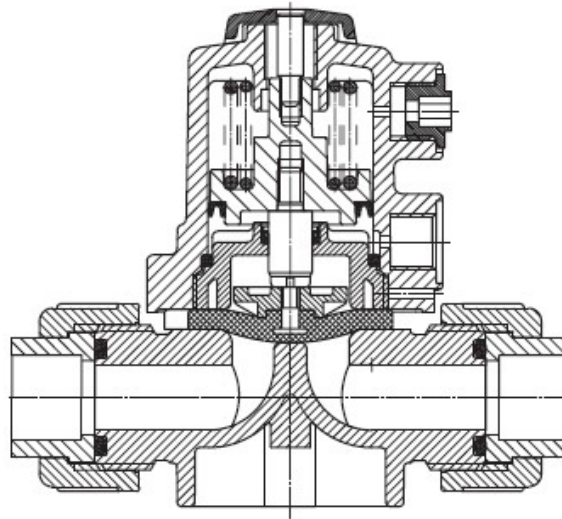
Economical globe valves or stop valves with a similar mechanism used in plumbing often have a rubber washer at the bottom of the disc for the seating surface, so that rubber can be compressed against the seat to form a leak-tight seal when shut.



DIAPHRAGM VALVE



Sectional drawing



GEMÜ® 610

Normally used in corrosive media . A rubber diaphragm when moved through an actuator Air/ Hydraulic/ Manual cuts off the flow path thus controlling the flow.

DIAPHRAGM VALVE



The diaphragm valve closes by means of a flexible diaphragm attached to a compression device. While the device is lowered into a weir, the diaphragm seals and cuts off flow.

The diaphragm valve handles corrosive , erosive and dirty services

The actuator may be Manual, Air or Hydraulic operated.





QUARTER TURN VALVE FAMILY



BUTTERFLY VALVE

Butterfly valves are quick opening valves that consist of a metal circular disc or vane with its pivot axes at right angles to the direction of flow in the pipe, which when rotated on a shaft, seals against seats in the valve body. They are normally used as throttling valves to control flow. These valves offer a rotary stem movement of 90 degrees or less, in a compact design. Unlike ball valves, butterfly valves do not have any pockets in which fluids may become trapped when the valve is closed.



BUTTERFLY VALVE



Rotating disk on a shaft, in a housing

Low pressure, large diameter lines where leakage is unimportant

Advantages – low pressure drop, small and light weight

Disadvantages – high leakage, high actuation forces so limited to low pressures

BUTTERFLY VALVE



Butterfly valves offer a number of advantages. They may be used in a wide variety of chemical services, they are available with small dimensions allowing for use in areas where space is limited, and they allow a high coefficient of flow.



A butterfly valve is from a family of valves called **quarter-turn valves**. The "butterfly" is a metal disc mounted on a rod. When the valve is closed, the disc is turned so that it completely blocks off the passageway. When the valve is fully open, the disc is rotated a quarter turn so that it allows an almost unrestricted passage of the process fluid. The valve may also be opened incrementally to regulate flow.



BUTTERFLY VALVE

PARTS OF BUTTERFLY VALVE

HANDLE OR ACTUATOR

STEM

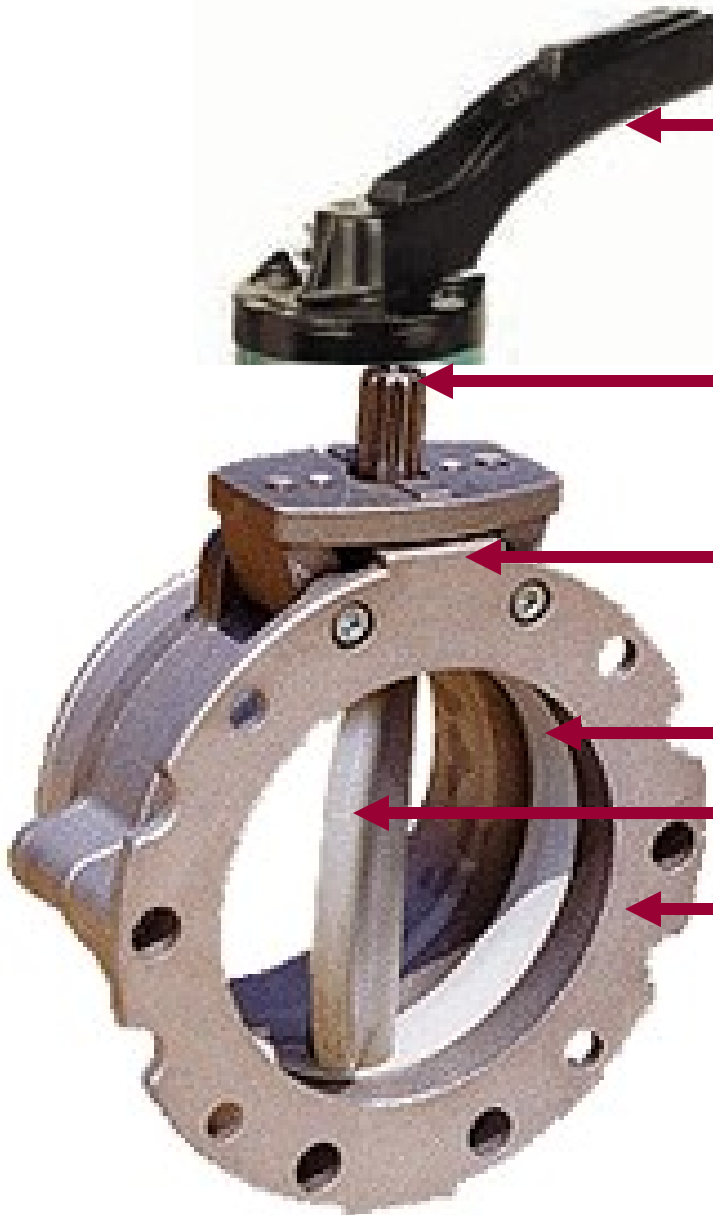
BODY

RESELIENT SEAT

BUTTERFLY DISK

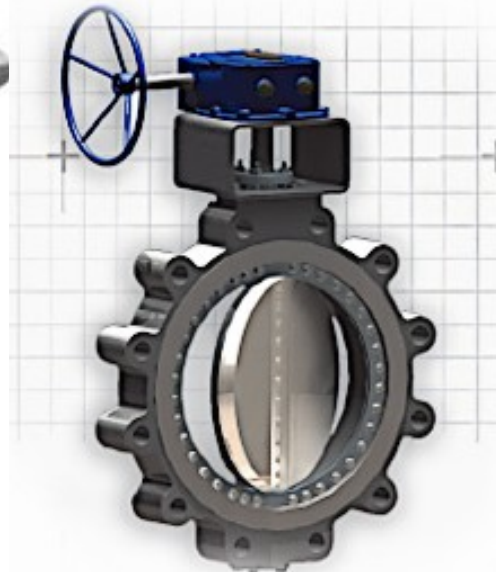
END PACKINGS

[To be Placed Here]



BUTTERFLY VALVE

A simple handle oriented in the same direction of the metal disc (to indicate valve position) is common. Some larger butterfly valves may have a handwheel that operates through a gearing arrangement to operate the valve. Actuators may also be air driven or electrically operated when used as part of an automated control system. Butterfly valves are relatively easy to maintain. The resilient seat is held in place by mechanical means, and neither bonding nor cementing is necessary. Because the seat is replaceable, the valve seat does not require lapping, grinding, or machine work.



BUTTERFLY VALVE

Selecting the Valve Operator

There are three operator types generally used on butterfly valves in power plants. These are:

- (1) Manual gear reducer;
- (2) Electric motor; and
- (3) Hydraulic cylinder.

The most popular of these operators is the electric motor because , the push-button control requirements of the modern generating station require an operator which can be remotely controlled, and which is reliable and essentially maintenance-free.

The electric motor operator satisfies all of these requirements. The operator consists of an electric motor, coupled through a worm gear assembly which is spline-connected to the valve



BUTTERFLY VALVE

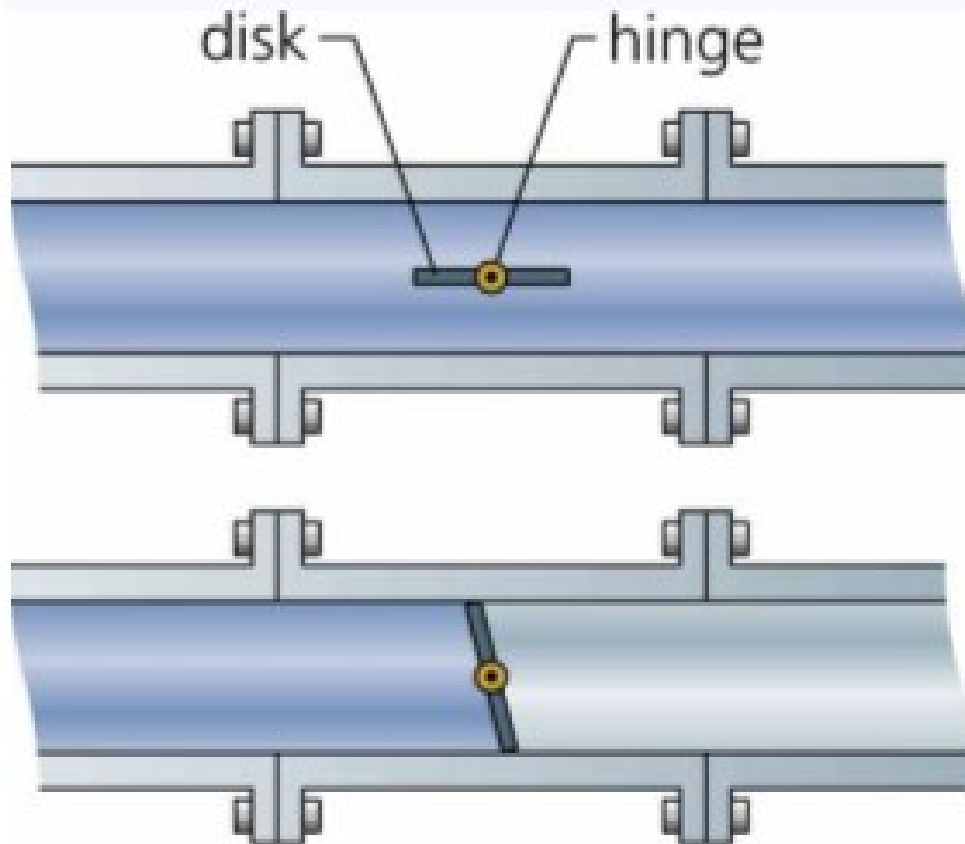


Hydraulic cylinder operators are finding increasing usage in modern power plants. Available in a wide range of sizes, the cylinder operator offers considerable flexibility of selection to meet a particular application. For maximum economy, hydraulic cylinders operating in the range of 1000-2000 psi are usually specified. Where a number of valves are involved, a common hydraulic system may be employed, using a single source of high pressure oil. For single valves, or where their installation is otherwise desirable, self-contained "power packages" are available. These units include the hydraulic cylinder, pump, motor, oil reservoir, and all related valves and controls, mounted together on the butterfly valve



BUTTERFLY VALVE

Flow Characteristics of Valve



Butterfly valves, in addition to serving as shutoffs, can also be used for throttling applications. An index of the excellent throttling characteristics of the butterfly valve is the fact that it has a control rangeability of 45 to 1. A rubber-seat butterfly valve can be used for throttling service and, when required, can be moved to the full closed position to give tight shutoff.



BALL VALVE

Sphere with a port in a housing, rotate to expose channel.

• Applications: Flow control, pressure control, shutoff, corrosive fluids, liquids, gases, high temp.

• Advantages – low pressure drop, low leakage, small, rapid opening

• Disadvantages – seat can wear if used for throttling, quick open may cause hammer

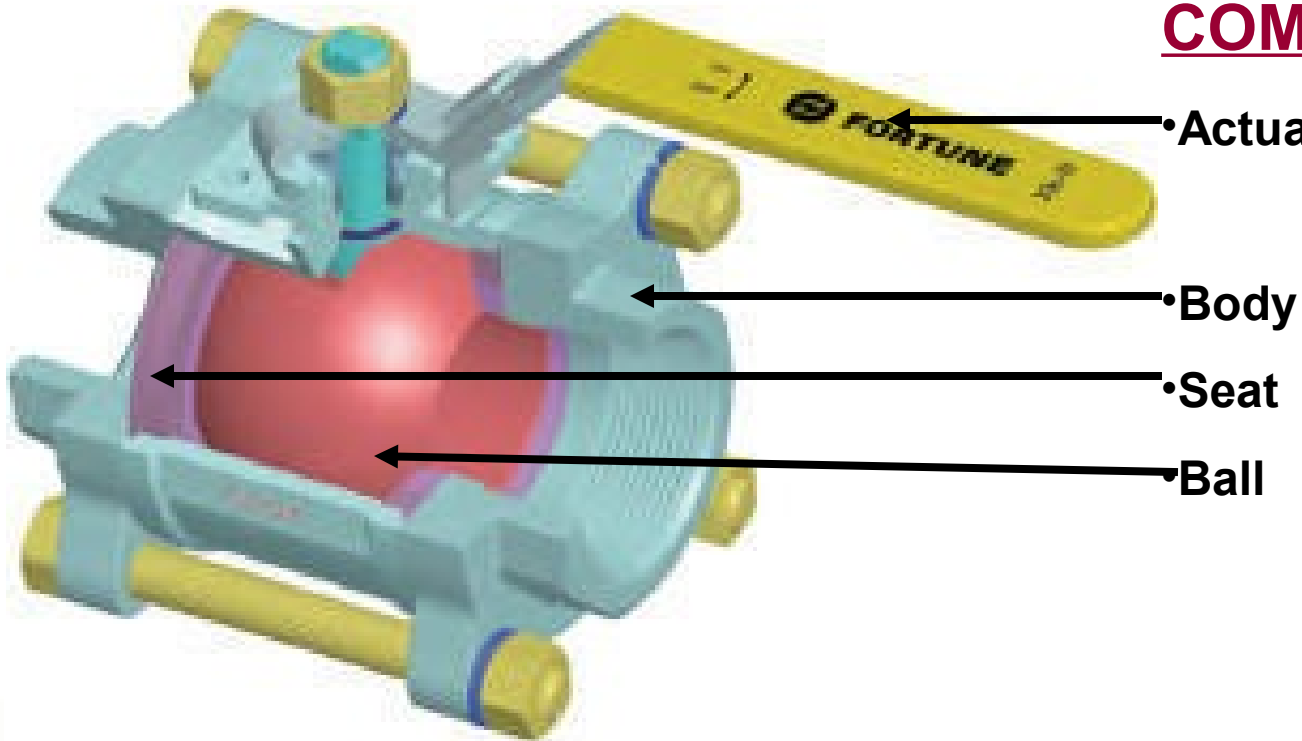


BALL VALVE



BALL VALVE

COMPONENTS



BALL VALVE



A ball valve (like the **butterfly valve**, one of a family of valves called quarter turn valves) is a **valve** that opens by turning a handle attached to a ball inside the valve. The ball has a hole, or port, through the middle so that when the port is in line with both ends of the valve, flow will occur. When the valve is closed, the hole is perpendicular to the ends of the valve, and flow is blocked. The handle position lets you "see" the valve's position.

Ball valves are durable and usually work to achieve perfect shutoff even after years of disuse. They are therefore an excellent choice for shutoff applications (and are often preferred to **globe valves** and **gate valves** for this purpose). They do not offer the fine control that may be necessary in throttling applications but are sometimes used for this purpose.



BALL VALVE



Ball valves are used extensively in industry because they are very versatile, pressures up to 10,000 psi, temperatures up to 200 Deg C. Sizes from 1/4" to 12" are readily available They are easy to repair, operate manually or by actuators.

The body of ball valves may be made of metal, plastic or metal with a ceramic center. The ball is often chrome plated to make it more durable.





BALL VALVE

There are three general types of ball valves:

- **FULL PORT**
- **STANDARD PORT** and
- **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 valve is usually less expensive, but has a smaller ball and a correspondingly smaller port. Flow through this valve is one pipe size smaller than the valve's pipe size resulting in slightly restricted flow.

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



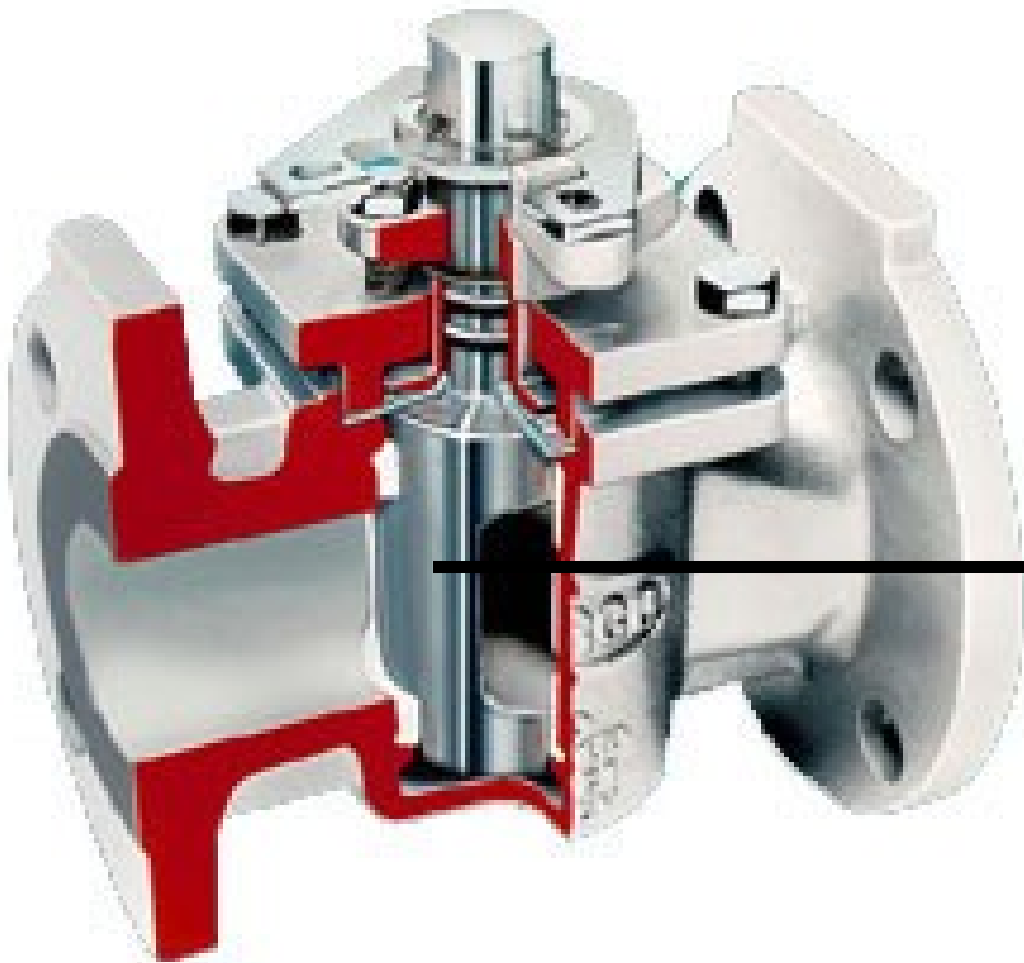
BALL VALVE



Some ball valves are equipped with an actuator that may be pneumatically or motor (electric) operated. These valves can be used either for on/off or flow control. A pneumatic flow control valve is also equipped with a positioner which transforms the control signal into actuator position and valve opening accordingly.



TAPER PLUG VALVE



TAPER
PLUG

TAPER PLUG VALVE



Because of its compactness and simplicity, the lubricated plug valve is gaining fast acceptance by power plant engineers. It is easy to operate, offers positive closure, and lends itself to automatic control - a popular trend in power plant operation.

Already well established in petroleum, chemical process and related fields, the lubricated plug valve now is proving its worth in power plants, within a wide range of temperatures and pressures. It can safely and efficiently handle gas and liquid fuel, boiler feedwater, condensate, and similar elements.

It has no high projecting yokes or bonnets, no exposed threads, no underhanging body to waste vital space. In complex piping systems, valves may be easily operated by centralized control. And there's no danger of leaks, even in gas piping systems, because of the valve's unique method of sealing.



NEEDLE VALVE

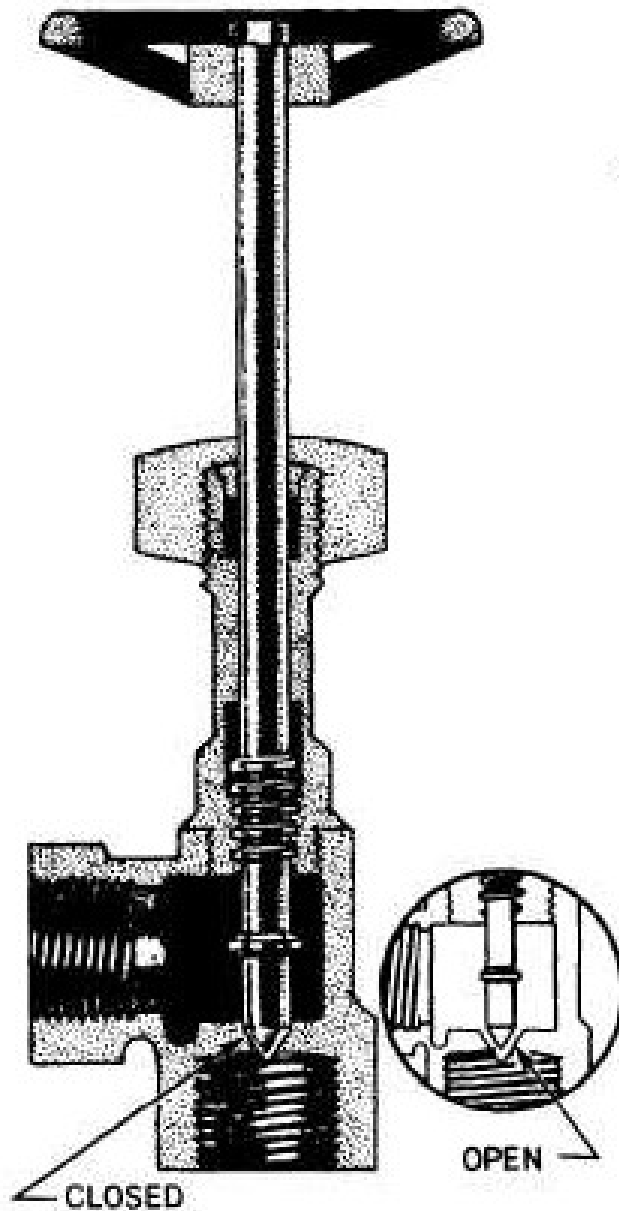


The Needle valve is a Volume control Valve that restricts flow in small lines. The fluid going through the valve turns 90 Degree and passes through an orifice that is seat for a rod with cone shaped tip. The size of the orifice is changed by positioning the cone in relation to the seat.

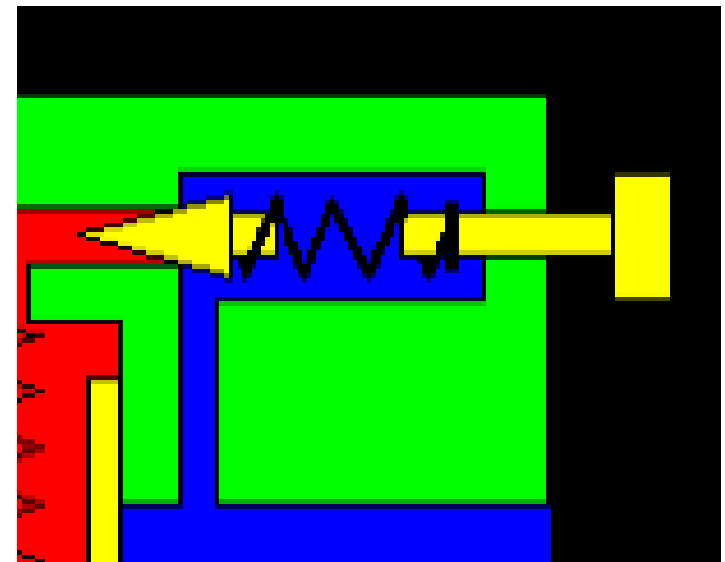
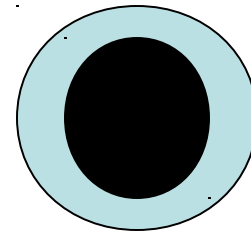
Needle valves are used to control flow into delicate gauges which might be damaged by sudden surges of fluid under pressure. Needle valves are also used to control the end of a work cycle, where it is desirable for motion to be brought slowly to a halt, and at other points where precise adjustments of flow are necessary and where a small rate of flow is desired.



NEEDLE VALVE



ANNULAR FLOW AREA



CHECK VALVE



- Allows flow in only one direction



- Swing valve similar to butterfly except hinged along one edge rather than rotate about the diameter, used primarily for check valves.



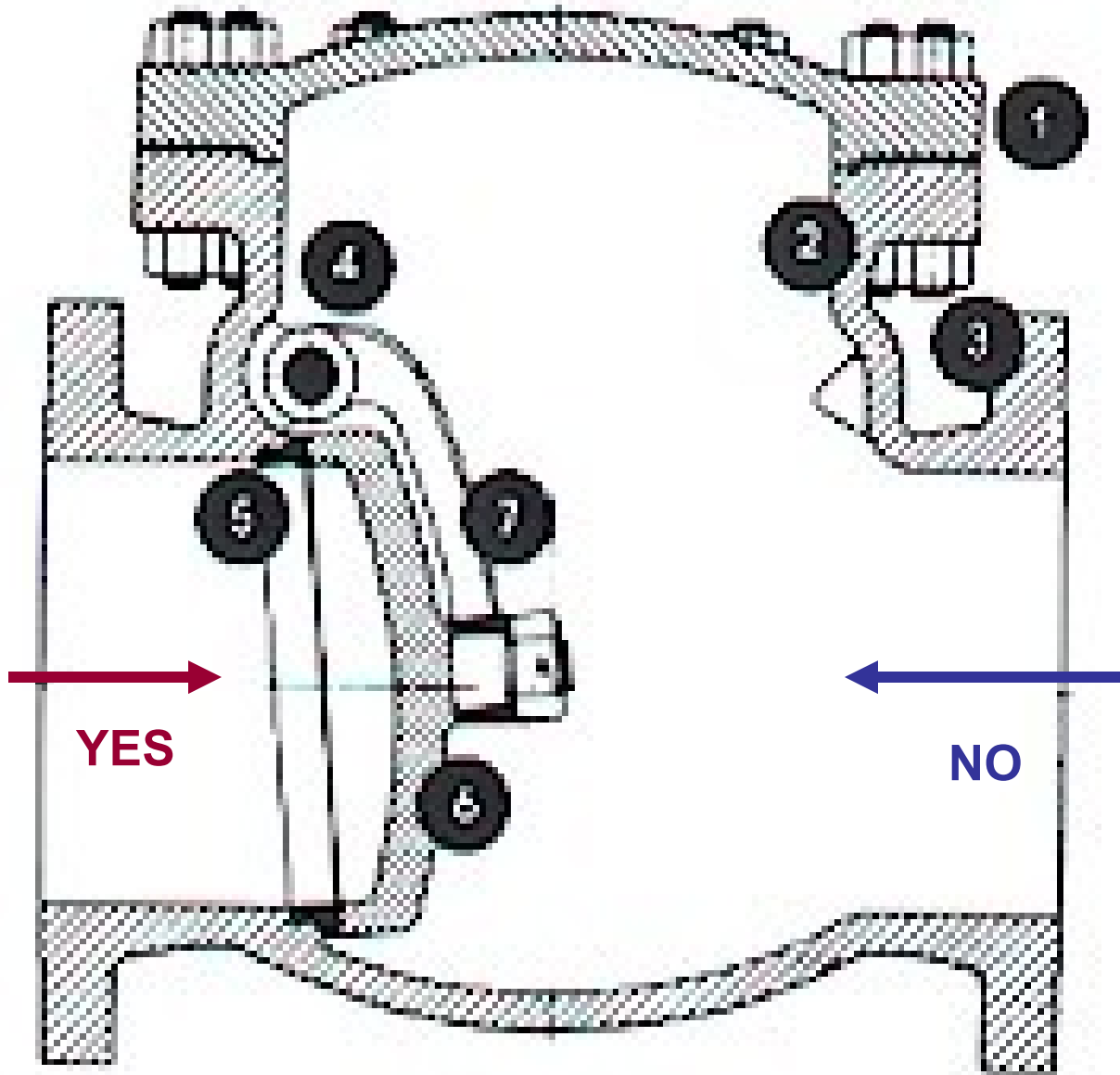
CHECK VALVE



CHECK VALVE

PARTS

1. COVER
2. BODY
3. FLANGE
4. HINGE PIN
5. SEAT
6. DISK
7. HINGE ARM



CHECK VALVE

Check Valve Gate Open



Mechanical valves

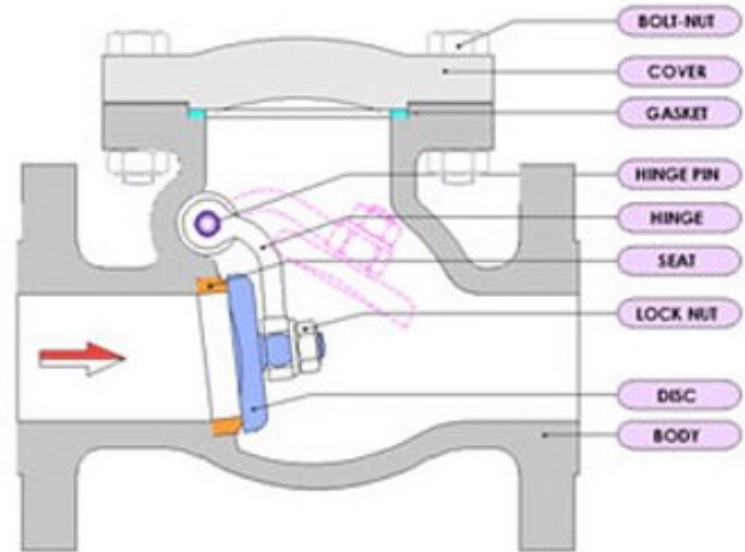


CHECK VALVE

Check Valve Gate Closed



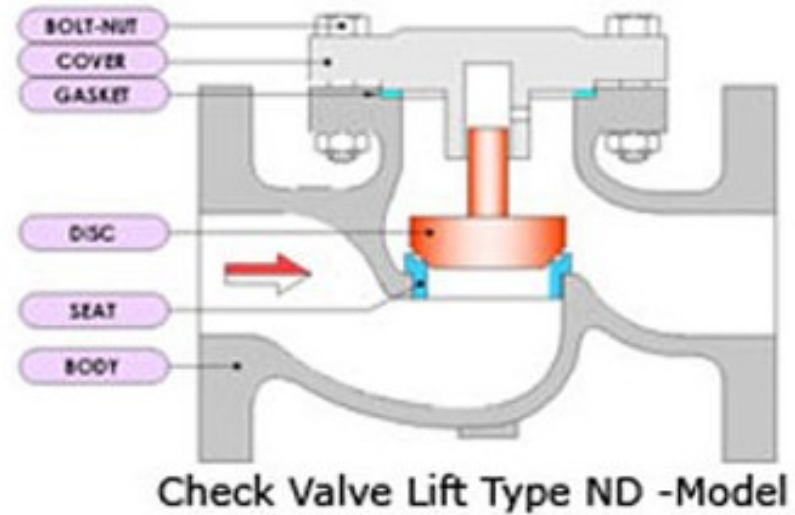
CHECK VALVE



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Swing Type Check Valve [NRV]
Bolted Cover, Suitable for Horizontal & Vertical Line
Design Standard: BS 1868
Size Range - 1" to 12"
Pressure Rating - 125# / 150# / 300#
End Connection Flanged End

CHECK VALVE

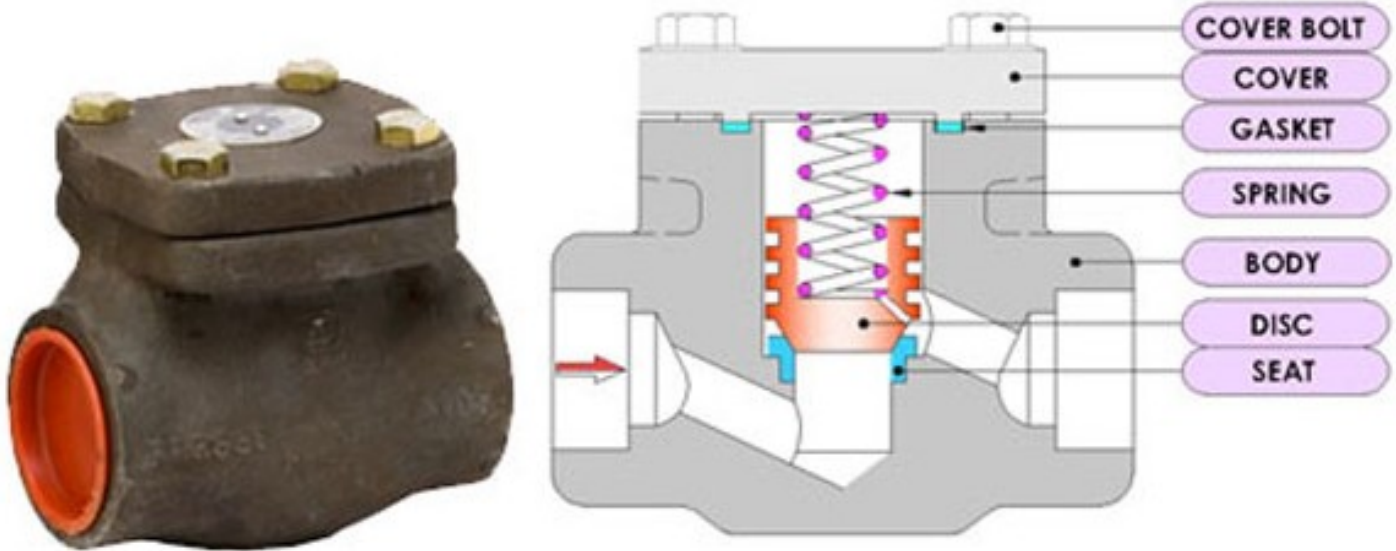


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Lift Type Check Valve



CHECK VALVE



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Forged Steel Lift Check Valve

PINCH VALVE

Pinch Valve is particularly suited for application of slurries or liquids with large amount of suspended solids. It seals by means of one or more flexible elements such as rubber tube that can be pinched to shut off flow. The pinch actuator can be either through

- Manual operation
- Through Pneumatically operated PINCERS or
- Through Air operation.



PINCH VALVE



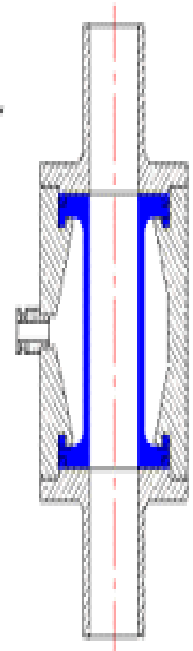
Stainless steel inlet and outlet connections.
They are available as threaded, straight or to
customer's specifications.

Rubber sleeve is made from high quality
elastomers to offer the maximum in
durability. This allows for millions of
operations before replacement.

Pneumatic cylinders actuate pinchers to
pinch (choke) rubber sleeve to close valve.
For lighter duty applications, the unit is
available with operation strictly through
air pressure.

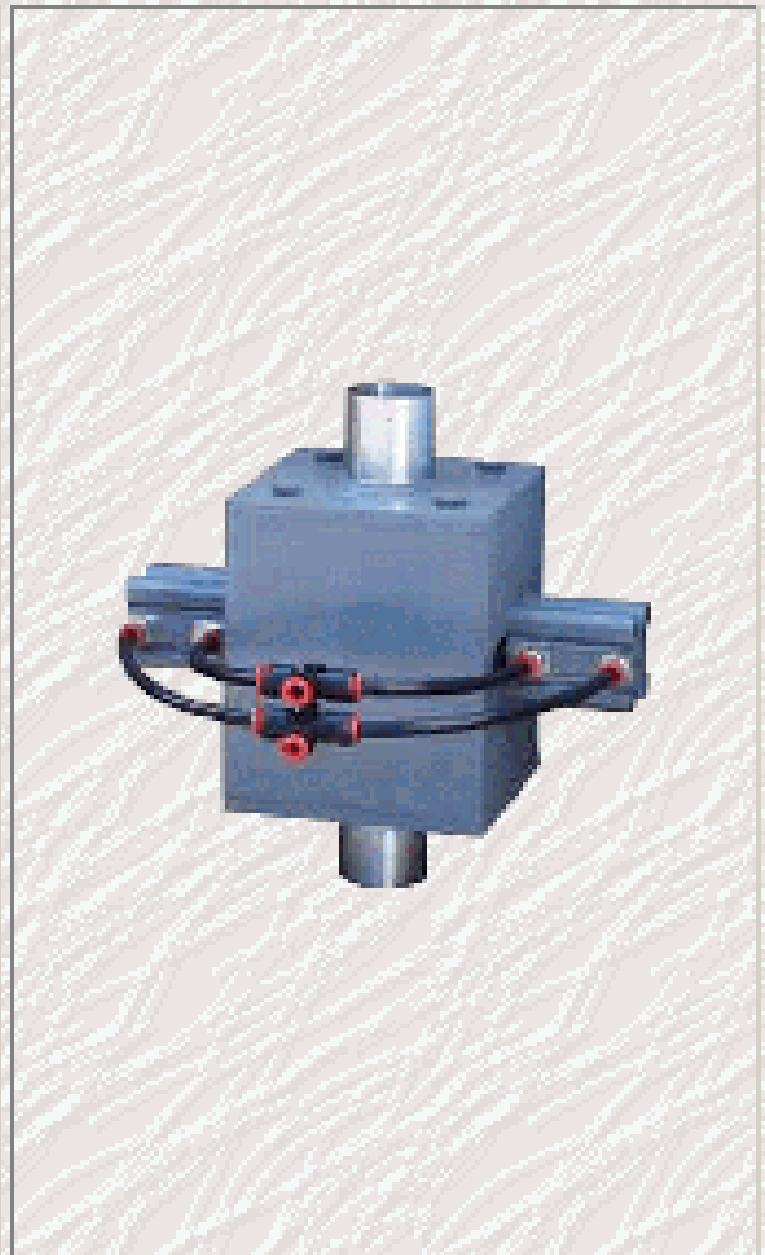
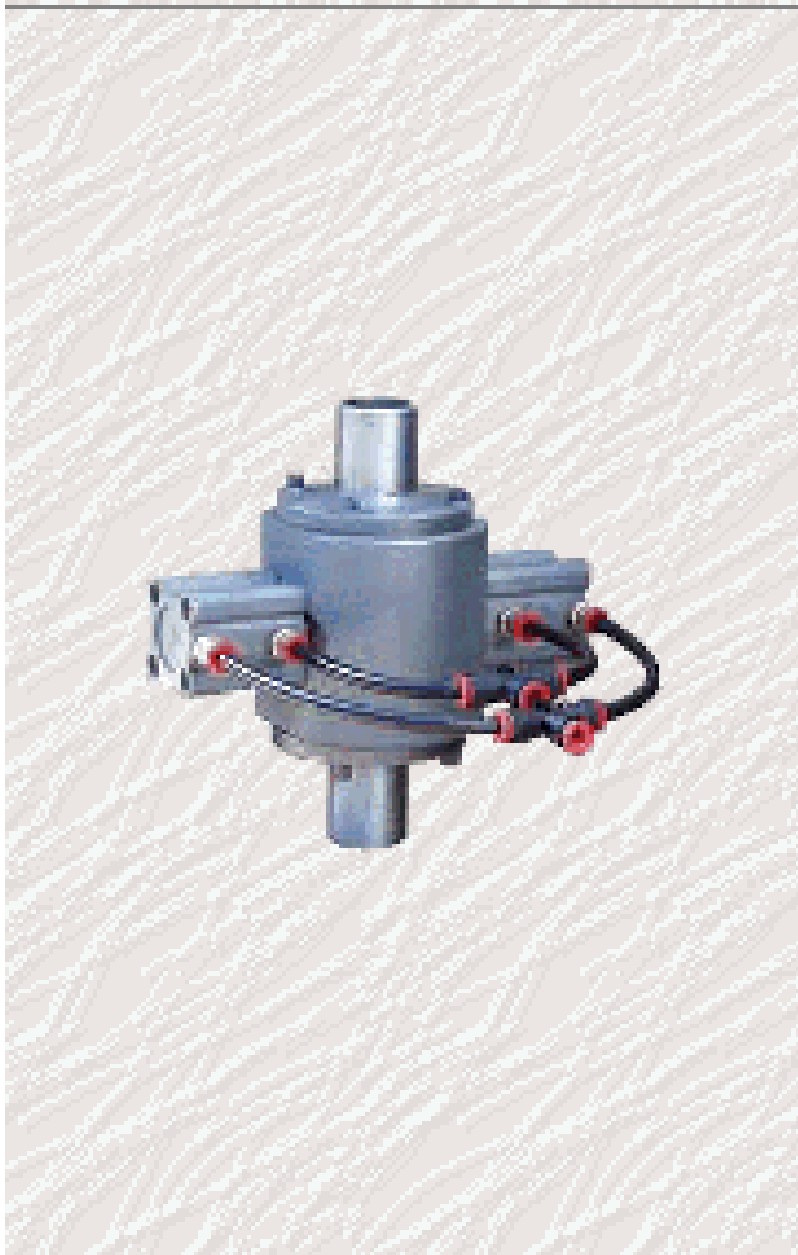
Model MA
Mechanically Actuated

Model PA uses air
pressure directly
to choke valve

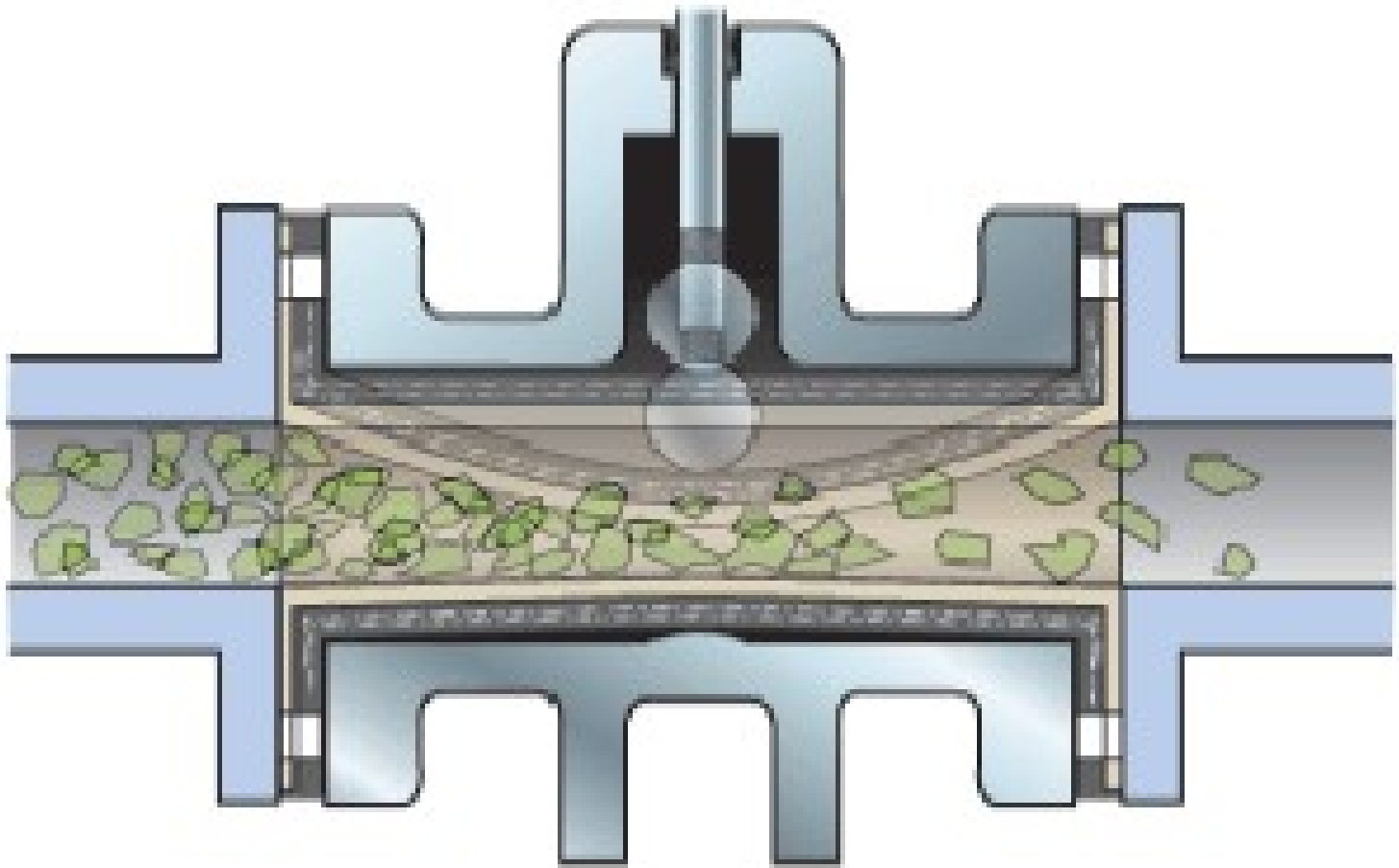


Model PA
Pneumatically Actuated

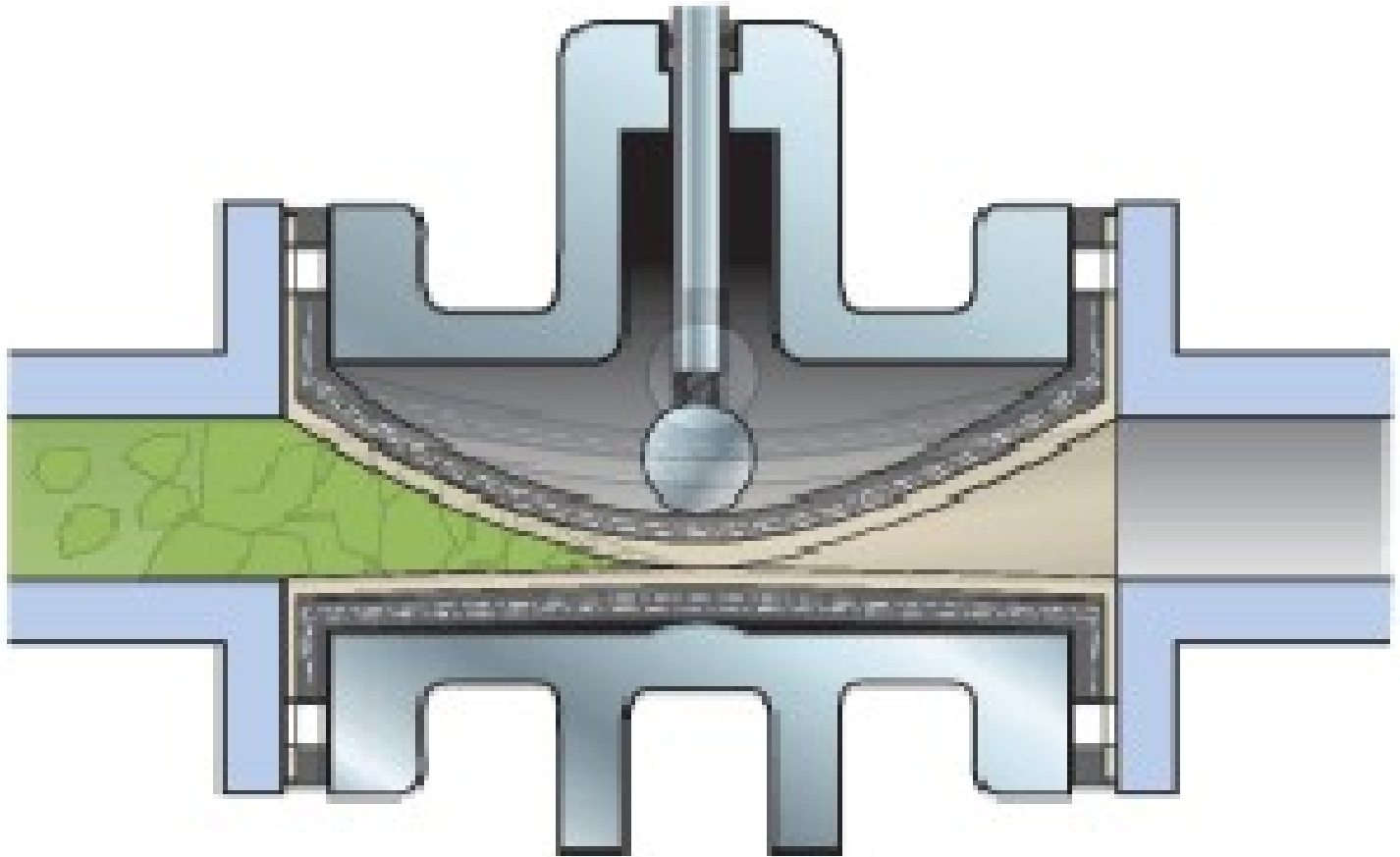
PINCH VALVE



PINCH VALVE



PINCH VALVE



5



3 -

10



PINCH VALVE



Advantage of Air operated Pinch Valves

[edit]

The most important benefits of using air operated Pinch Valves are their complete and true full bore, and the 100% tight shut off – even on solids such as [granules](#), [powders](#), [pellets](#), chippings, [fibres](#), [slivers](#), any kind of [slurries](#) and many more aggressive products.

Usually conventional valves such as ball valves, butterfly valves, piston valves or gate valves tend to fail when in process with the above mentioned aggressive products. The reason is that the valve body seat or the gate/piston of the valves wears out too quickly and the valve can no longer shut off tightly, whereas air operated Pinch Valves work without almost any wear of the elastic rubber hose because the kinetic energy of the solids are absorbed through the extremely high elasticity of the rubber. The rubber mixture is also anti abrasive.

Industrial sectors

[edit]

Therefore using air operated Pinch Valves in aggressive product processes saves a lot down time, and guarantees a free flow through the valve, avoiding any blockages.

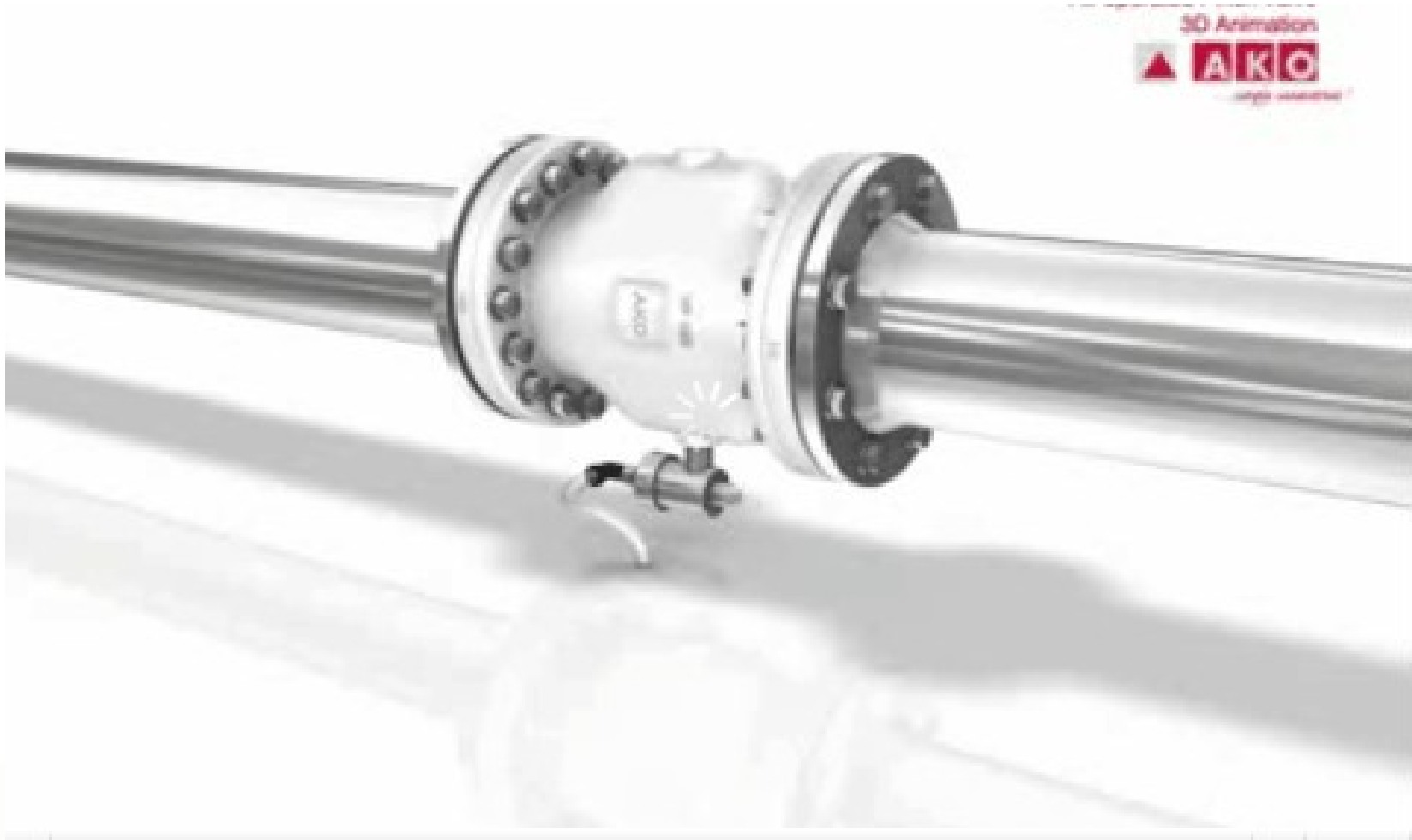
Several [rubber](#) qualities are available for air operated Pinch Valves such as [natural rubber](#), [EPDM](#), [nitrile](#), [viton](#), [neoprene](#) and [butyl](#). Different housings and end covers/flange materials such as [aluminium](#), [plastics](#) and [stainless steel](#) are also available; resulting in air operated Pinch Valves being commonly used in a wide range of many different industries such as:

- [Bulk](#) and solids handling,
- [Cement](#) industry,
- [Waste water](#) industry,
- [Chemical](#) industry,
- [Food](#) industry,
- [Beverage](#) industry,
- [Ceramic-/Glass-/Plastic](#) industry

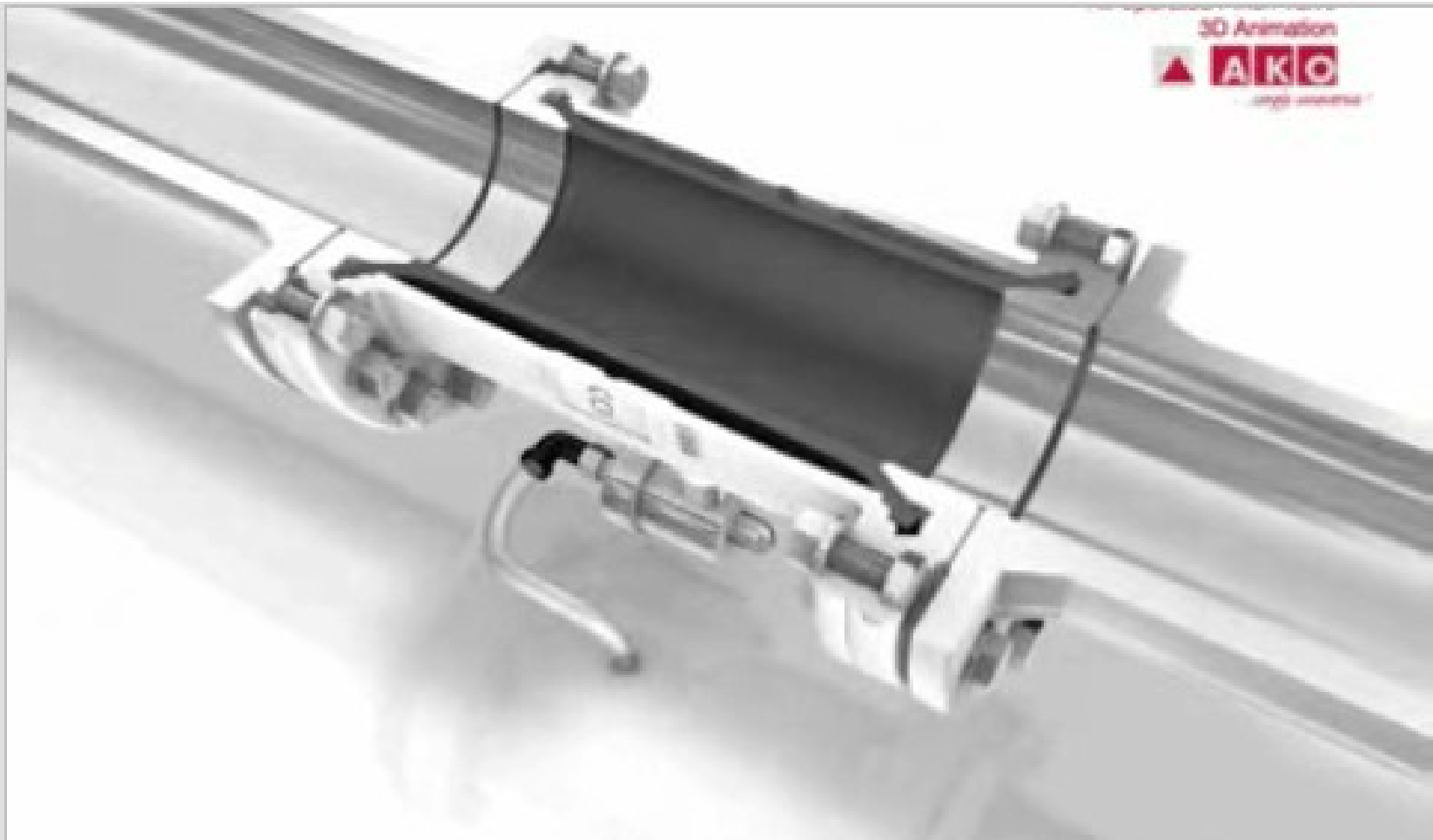
plus many more.



PINCH VALVE



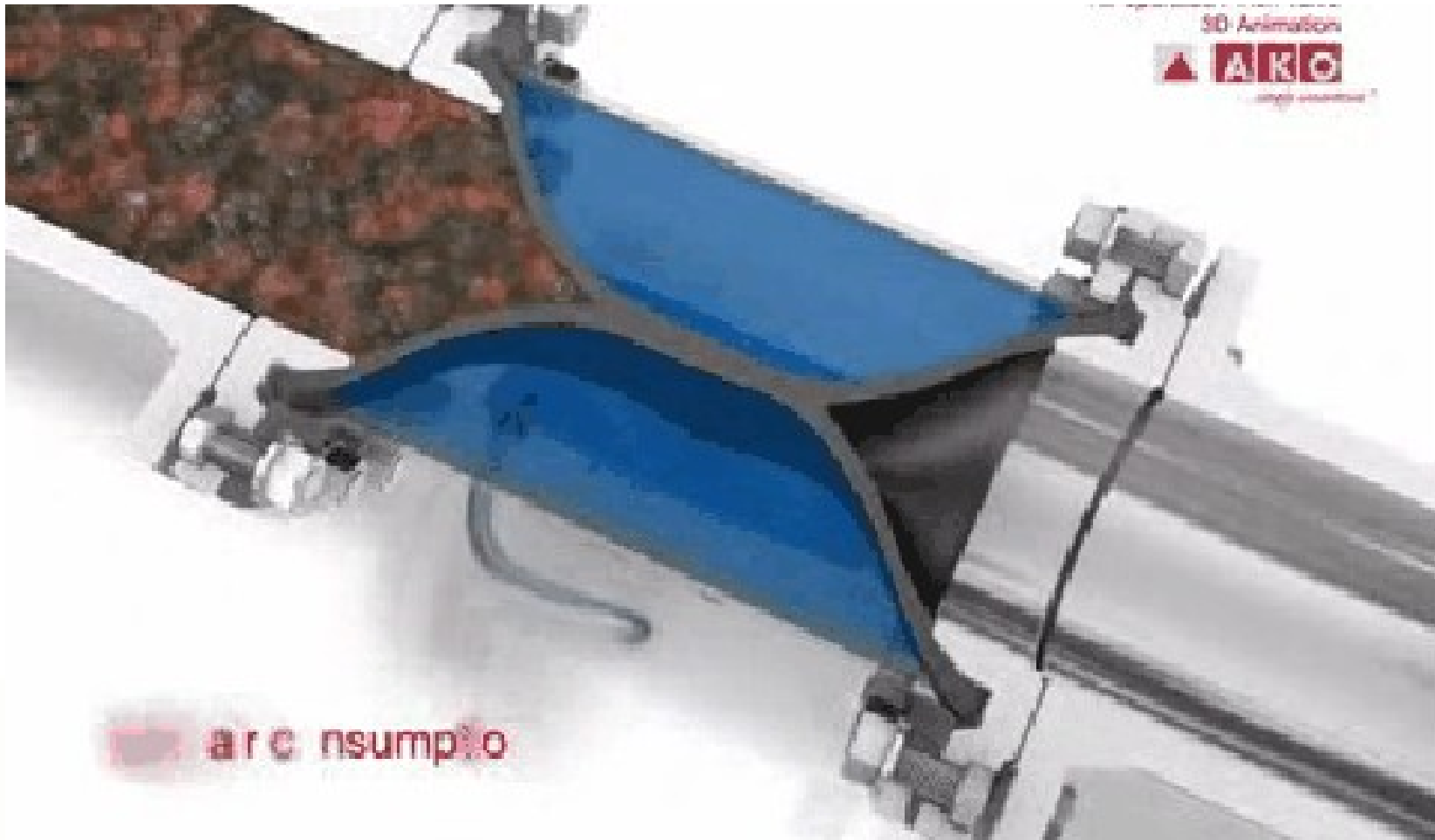
PINCH VALVE



PINCH VALVE



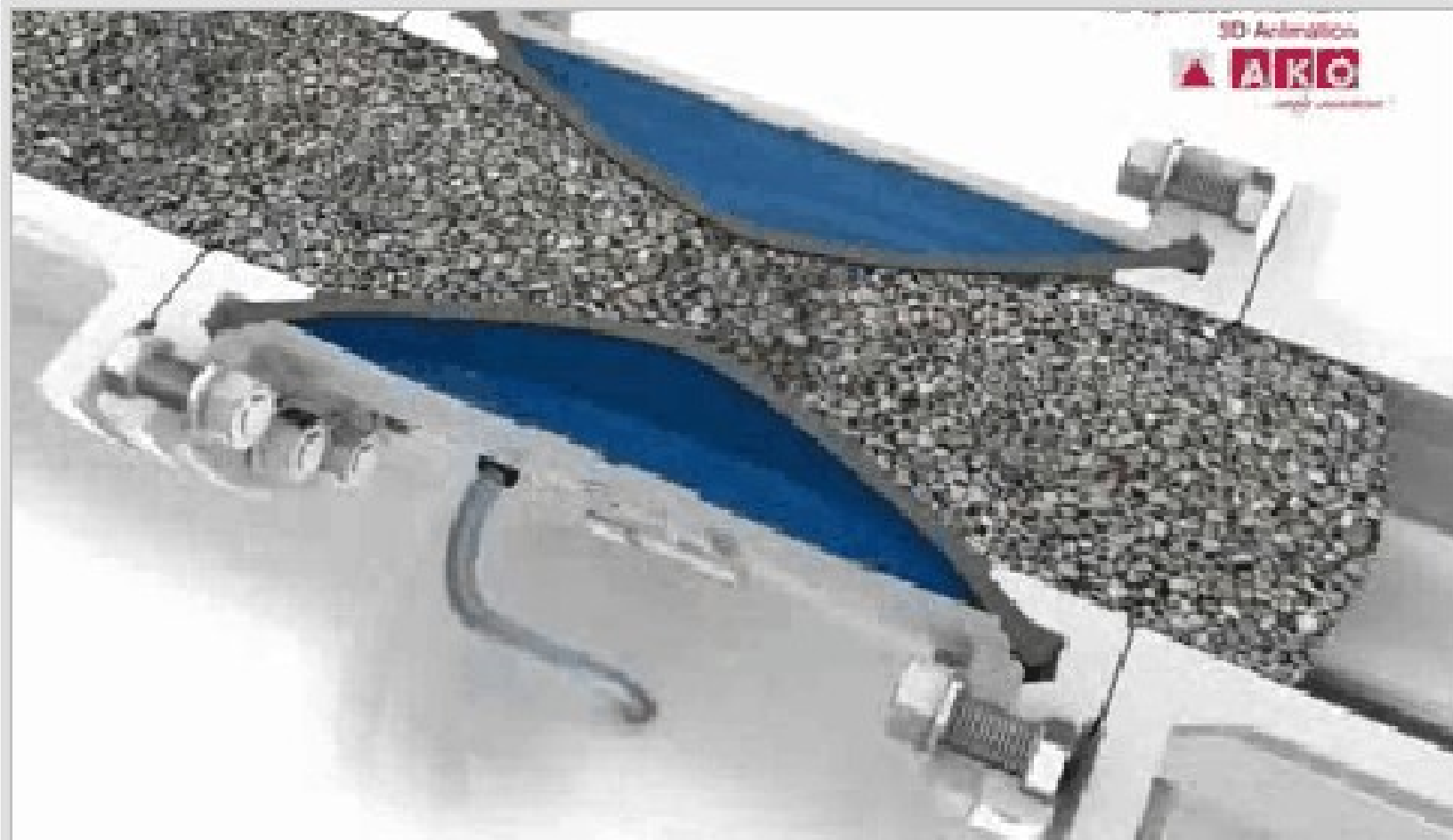
PINCH VALVE



PINCH VALVE



PINCH VALVE



SAFETY /RELIEF VALVE

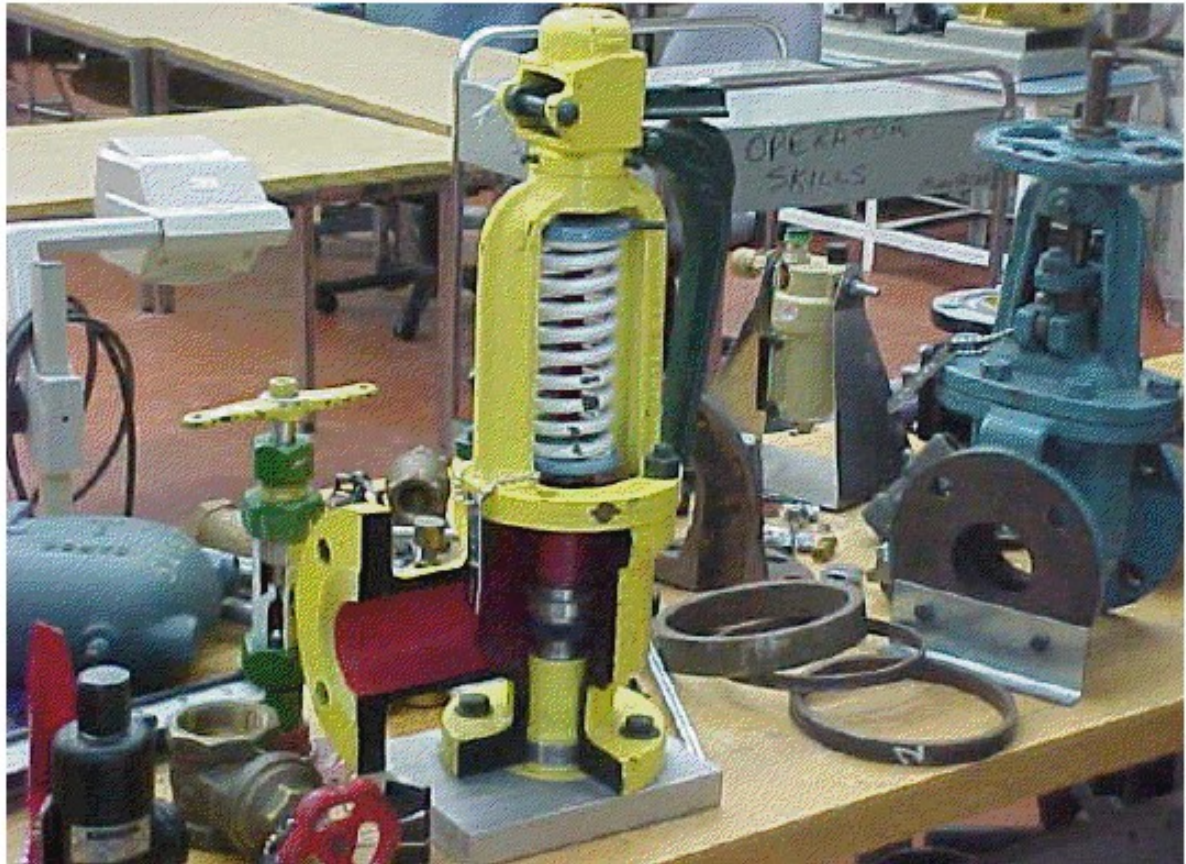


Prevents Build up of Over Pressure in the system. Operates on its own after the Set-Point is reached.



Safety / Relief Valve

Safety or Relief Valve



SAFETY / RELIEF VALVE



Safety --- Relief

- **Relief**

- Lift proportional to overpressure
- Liquid service

- **Safety**

- Open quickly and completely on overpressure
- Generally for gases

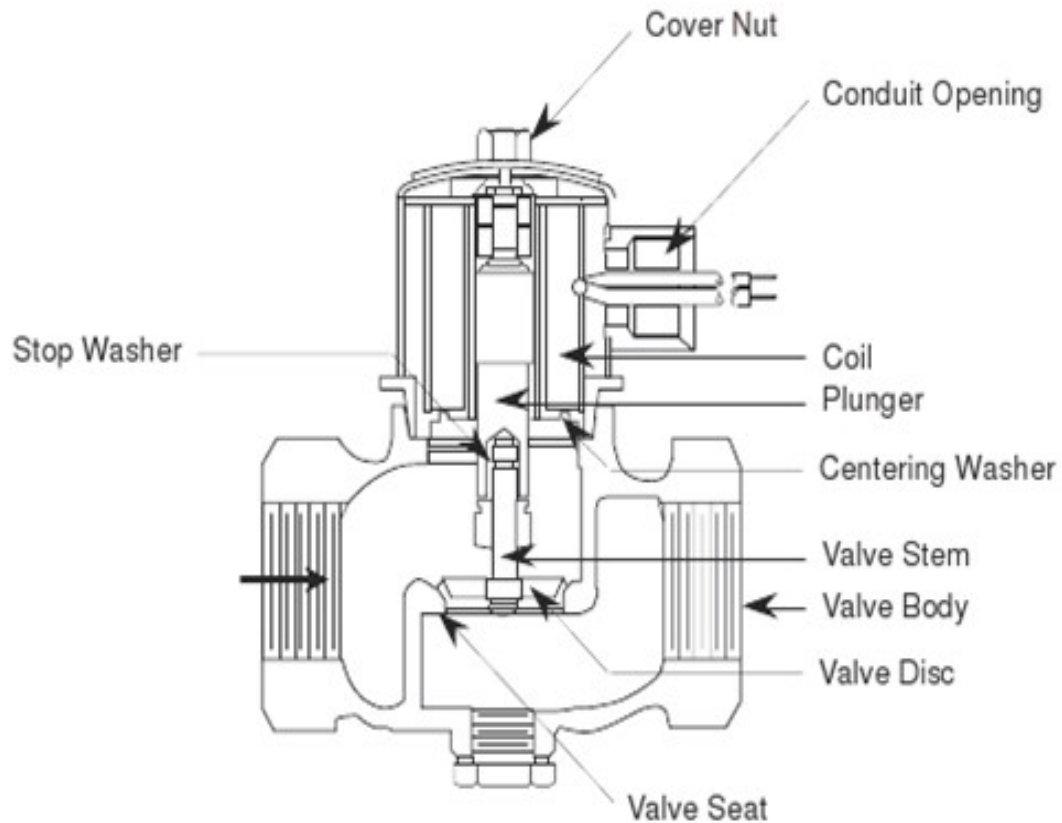
- **Safety Relief**

- Good for liquid and gas service



Solenoid Operated Valve

Solenoid Valve



Valve Selection Criteria

APPLICATION

- **Media Being Handled** (e.g., liquid, gas, slurry or solid)
- **Corrosiveness of Media** (e.g., pH, concentration)
- **Corrosiveness of Atmosphere**
- **Flow** (Velocity, Capacity, Cv, Direction)
- **Pipe Size**
- **Media Temperature** (Maximum and Minimum)
- **Pressure**
 - Maximum Operating Pressure
 - Maximum Differential Pressure
- **Operation** (e.g., Manual/Automatic, On-Off/Throttling)

The factors generally considered in the selection of a valve include:

- The substance to be handled and the required flow rate.
- The requirement that the valve control and/or shut off the flow in the manner demanded by the service conditions.
- The ability of the valve to withstand the maximum working pressure and temperature.
- The ability of the valve to resist attack by corrosion or erosion.
- Actuator requirements, if any.
- Maintenance and repair requirements.



FOOT VALVE



FOOT VALVE



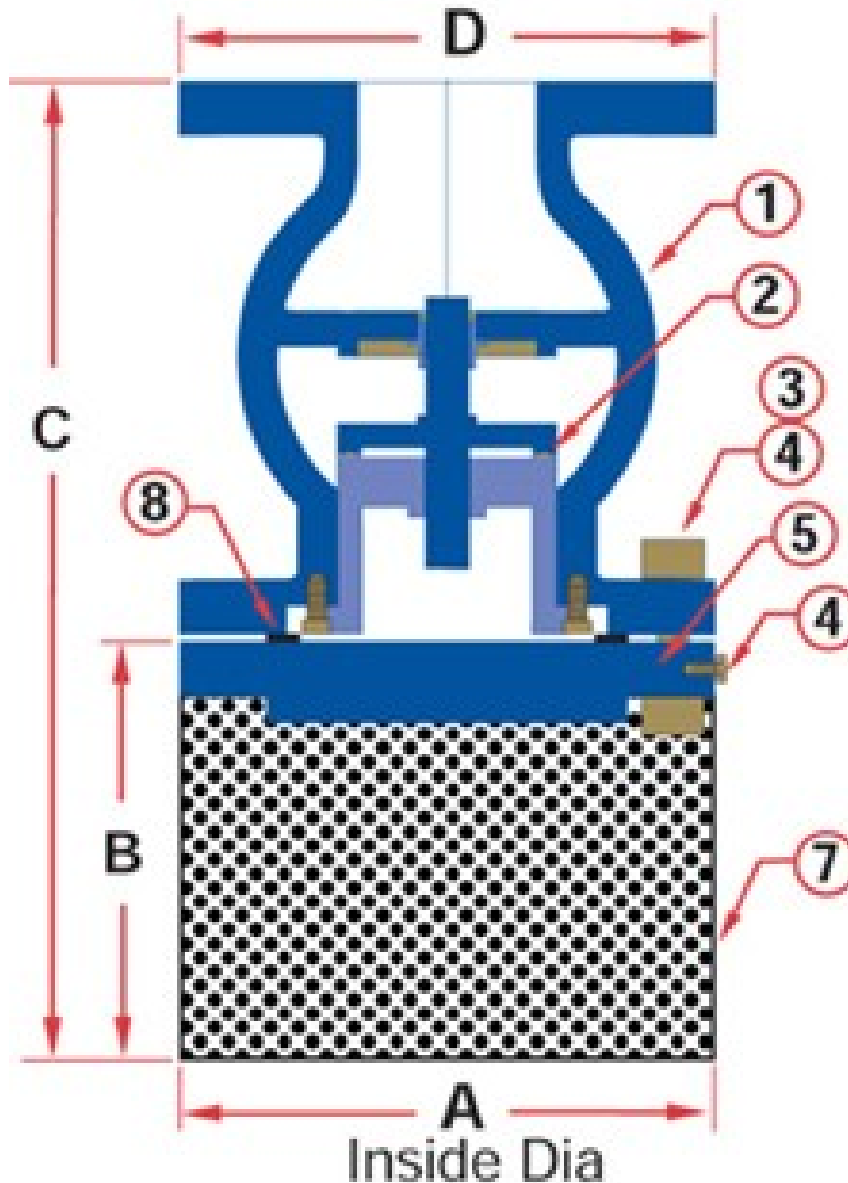
Installed on the pump suction, Foot Valves prevent the pump column from draining upon pump shutdown. Silent during operating and normally closed, the valve has a center-guided disc with a Buna-N seat to provide a drip tight seal.



FOOT VALVE

COMPONENTS

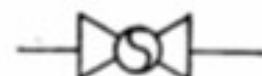
1. BODY
2. VALVE DISC
3. FIXING BOLTS
4. FIXING SCREW
5. STRAINER FLANGE
6. .
7. STRAINER



VALVE SYMBOLS



BUTTERFLY VALVE



BALL VALVE



GATE VALVE



GLOBE VALVE





THANK

YOU

