

MAINTENANCE AND INSPECTION OF STATIONARY EQUIPMENT

Presented by:

Aziz Vayani

Qazi Ghulam Mustafa

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OBJECTIVE

To understand

- Types of stationary equipment
- Types of Tanks, their maintenance and inspection procedures
- Type of valves, their maintenance procedures
- Pipeline; prevention and inspection



STATIONARY EQUIPMENT

- Storage Tanks
- Valves
- Terminal/Station Piping

TYPE OF STORAGE TANKS

There are several types of Storage Tanks

- Fixed-roof tanks
- External floating roof tanks
- Internal floating roof tanks
- Domed external floating roof tanks
- Horizontal tanks
- Pressure tanks
- Variable vapor space tanks

FIXED ROOF TANKS

This type of tank consists of a cylindrical steel shell with a permanently affixed roof, varying in design from cone-or dome-shaped to flat. Losses from fixed-roof tanks are caused by changes in temperature, pressure & liquid level.

Of current tank designs, the fixed roof tank is the least expensive to construct and is generally considered the minimum acceptable equipment for storing.

Breather vent (open or P/V type)

Float gauge conduit

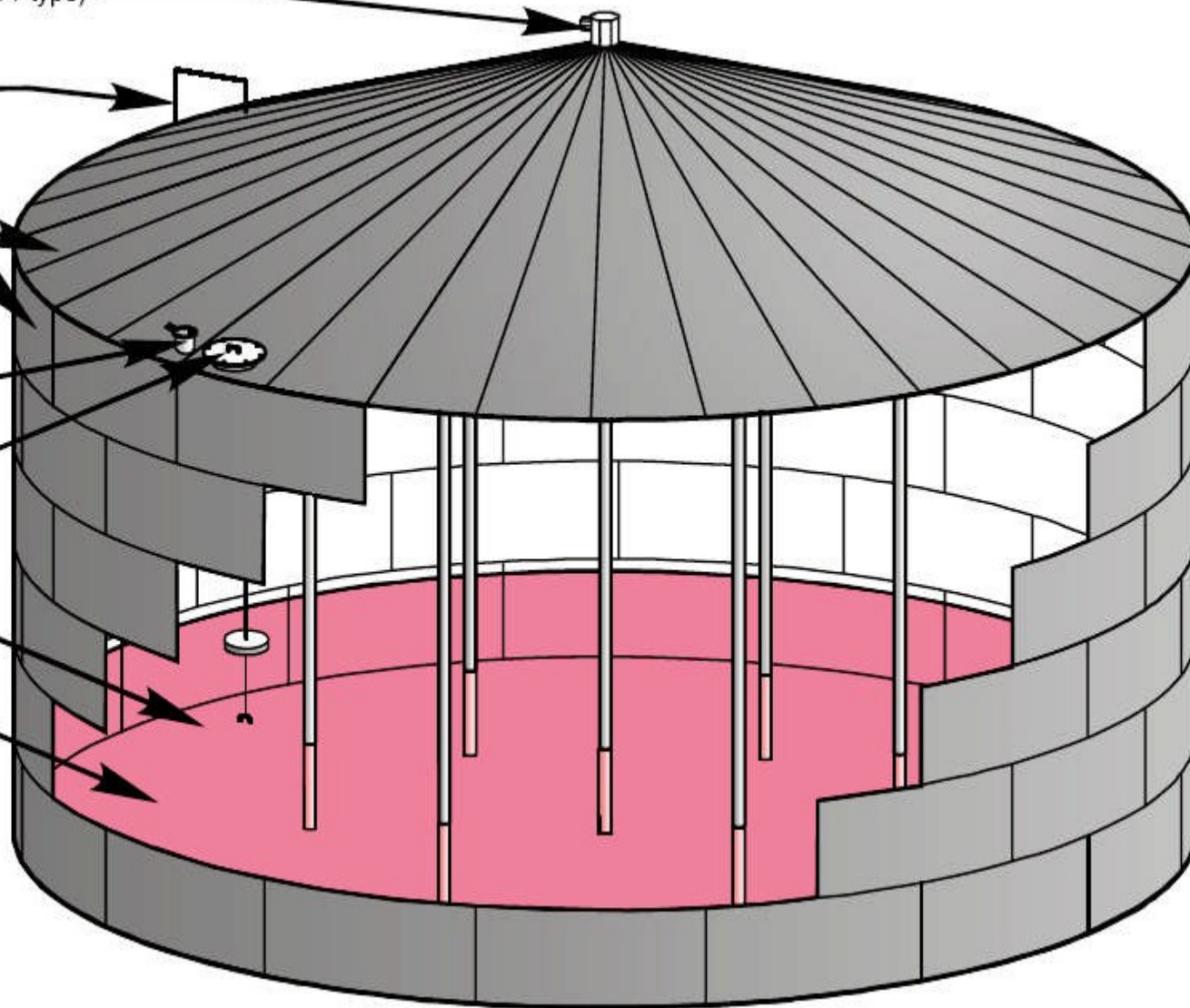
Tank roof and shell
(not insulated)

Gauge-hatch/
sample well

Roof manhole

No floating roof

Stable (nonboiling)
stock liquid

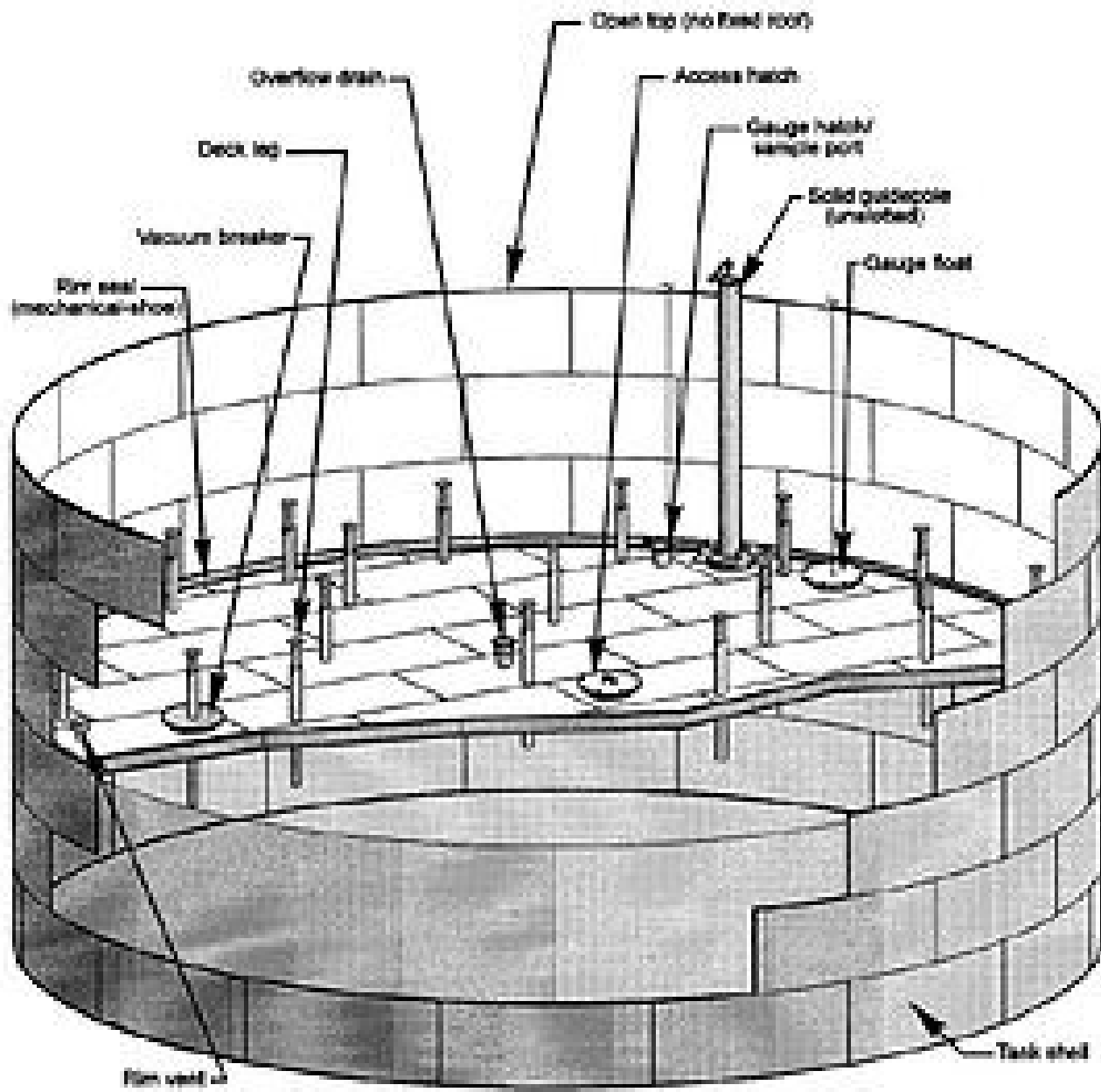


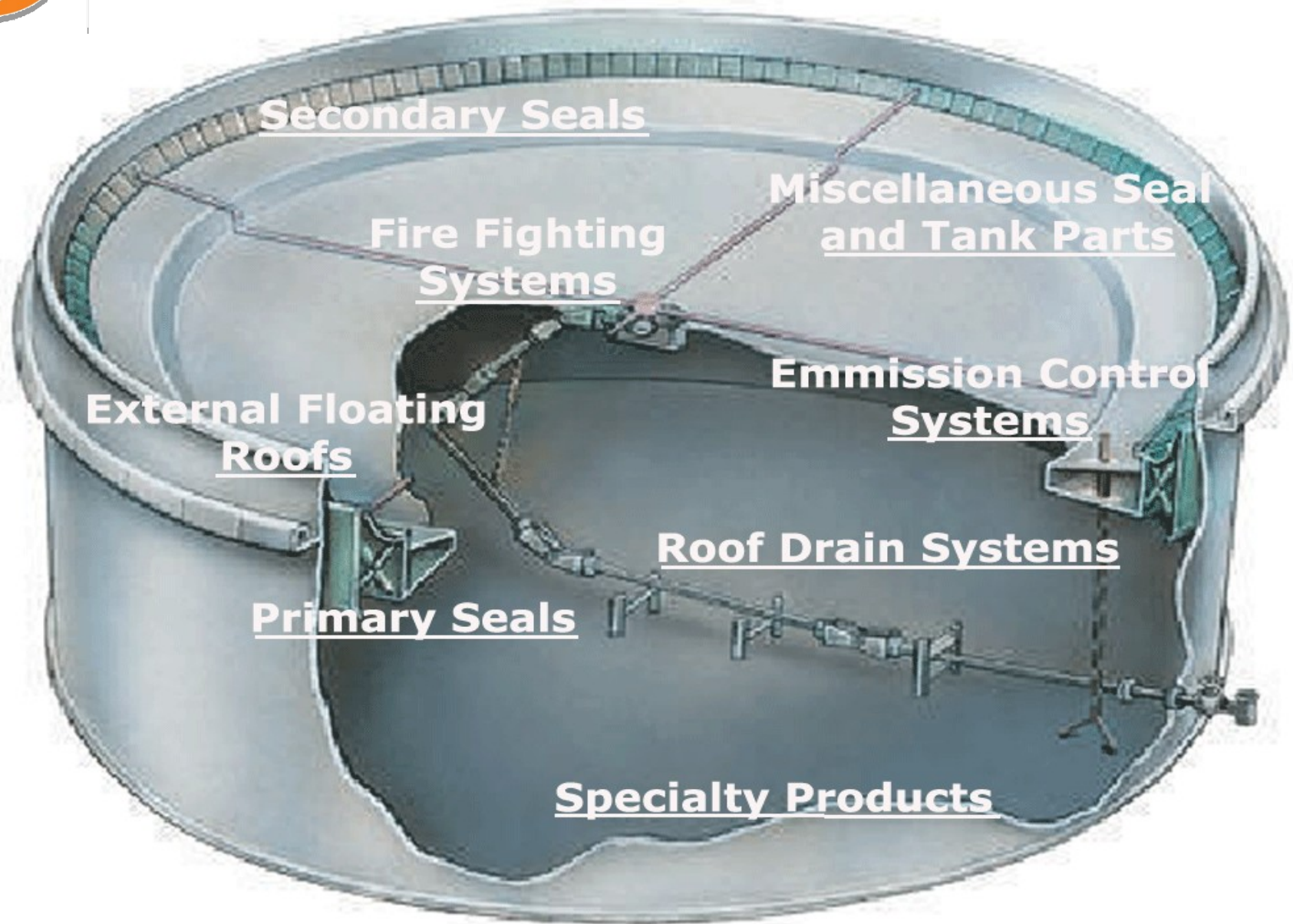
EXTERNAL FLOATING ROOF TANK

- External floating roof tank consists of an open- topped cylindrical steel shell equipped with a roof that floats on the surface of the stored liquid.
- The floating roof consists of a deck, fittings and rim seal system. Floating decks currently in use are constructed of welded steel plate and are of two general types-pontoon and double-deck.
- External floating decks are equipped with a rim seal system attached to the deck perimeter and in contact with the tank wall. The purpose of the floating roof and rim seal system is to reduce evaporative loss of the stored liquid

EXTERNAL FLOATING ROOF TANK

- Some annular space remains between the seal system and the tank wall. The seal system slides against the tank wall as the roof is raised or lower.
- The floating deck is also equipped with fittings that penetrate the deck and serve operational functions.
- In external floating roof design, the roof is made to rest on the stored liquid and is free to move with the level of the liquid.
- These tanks reduce evaporation losses and control breathing losses while filling.





INTERNAL FLOATING ROOF TANK

An internal floating roof has both a permanent fixed roof and a floating roof inside. There are two basic types of internal floating roof tank-tanks in which the fixed roof is supported by vertical columns within the tank. ,and tanks with a self supported fixed roof and no internal support columns.

- The floating roof rises and falls within the liquid level inside the tank achieving a no vapor zone.
- The objective of the internal floating roof is to have minimal or eliminate completely the potential gaseous zone above the stored liquid. This is the safety feature required within many industrial storage tank systems.
- Other benefits of a storage tank internal floating roof is, that removing the gaseous region above the stored liquid, the tank is subjected to less corrosion or oxidizing elements.

PM OF TANKS

- General cleaning of roof and stairs
- Greasing of Rolling ladder wheels (EFR)
- Check rubber seal (EFR) and grease still well pipe roller support bearings
- Check roof drain line (EFR)
- General Cleaning and greasing of tank agitator
- Check gear box oil level of agitator
- Check and clean seal assembly of agitator
- Clean and Grease nut bolts

INSPECTION OF TANKS

Routine In-Service Visual Inspection

- Frequency not to exceed one month.
- Can be performed by Owner/Operator personnel.

External In-Service Inspection

- Visual inspection of the tank exterior.
- By Authorized Inspector (API 653 Certified).
- Frequency not to exceed 5 years, but may be more frequent based on corrosion calculation.

INSPECTION OF TANKS

- Ultrasonic Inspection
- Ultrasonic measurement of tank shell.
- Inspections at 15 year intervals or possibly
- more frequent based on shell corrosion calculation.
- Initial inspection in 5 years to establish a corrosion rate.
- Corrosion rate may be estimated from tanks in similar service.

INSPECTION OF TANKS

Internal Inspection

- Inspections at 20 year intervals or possibly more frequent based on tank bottom corrosion calculation.
- Initial inspection in 10 years to establish a corrosion rate.
- Corrosion rate may be estimated from tanks in similar service.

VALVES

- A typical plant contains many valves of different sizes & shape. Despite the variety in their design , all valves have a common primary purpose: to slow down or stop the flow of a fluid.
- Some valves work best in on-off service, i.e. fully open or fully closed. Other are designed to throttle, to reduce the pressure and flow rate of a fluid.
- Some permits flow in one direction only.
- In all cases, however, the valve initially stops or controls flow. This is done by placing an obstruction, which can be moved almost as desired inside the pipe with little or no leakage of the fluid from the pipe to the outside.

VALVES

- Valves serve not only to regulate the flow of fluids but also to isolate piping or equipment for maintenance without interrupting other connected units.
- Many types of valves are in daily use in process industry. Most of them are operated by hand, but some are equipped with motors or other devices which operate them.
- Valves are made of cast iron, brass, steel or alloys and the allowable working pressures will depend upon the body, flange design and the material of manufacture. Valves are made in different designs on each pressure classification to meet certain requirements in service.

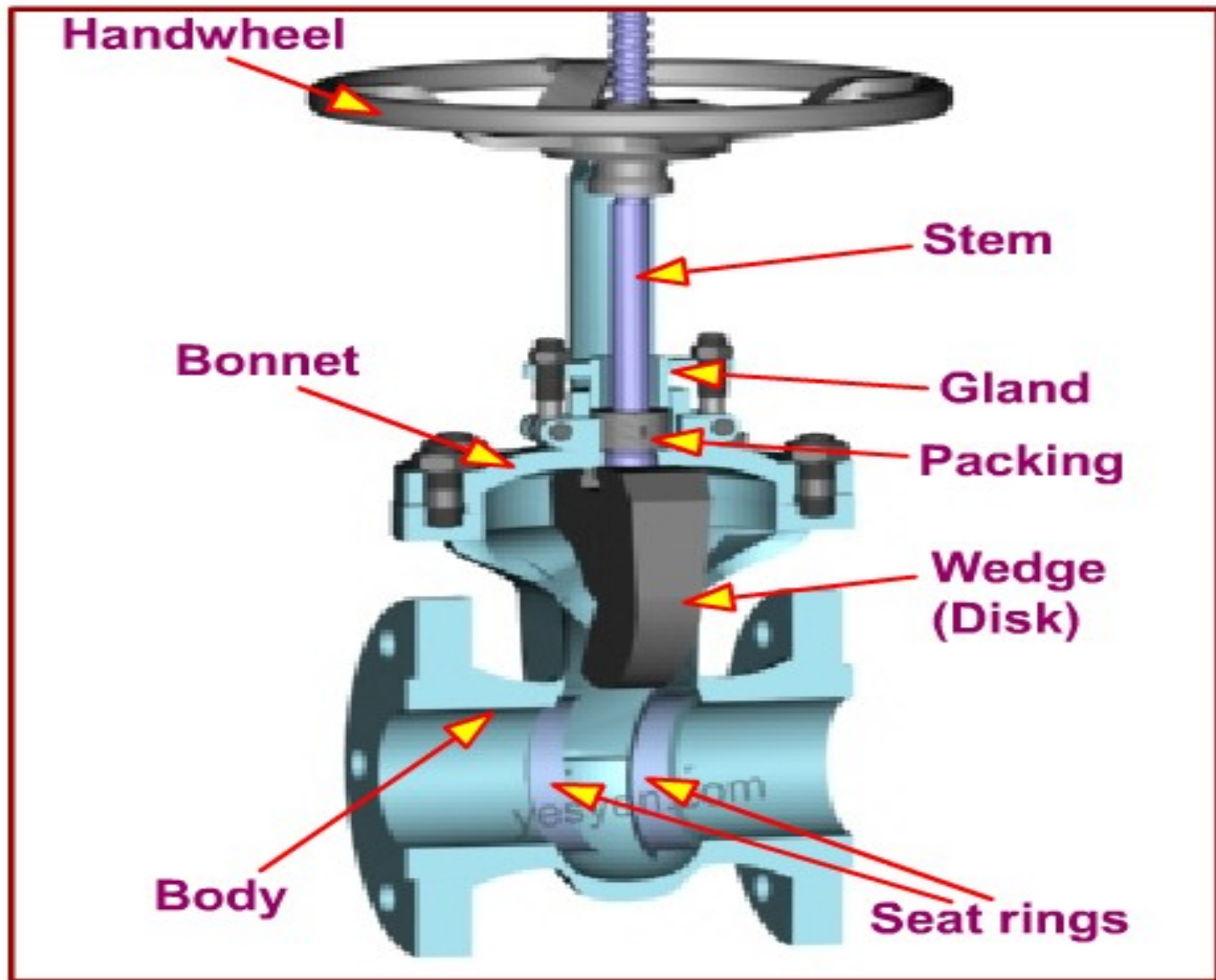
TYPE OF VALVES

- Gate
- Globe
- Plug
- Ball
- Check (Non-return)
- Butterfly

Each category of valve has different characteristics, which become the basis of its selection on a particular services.

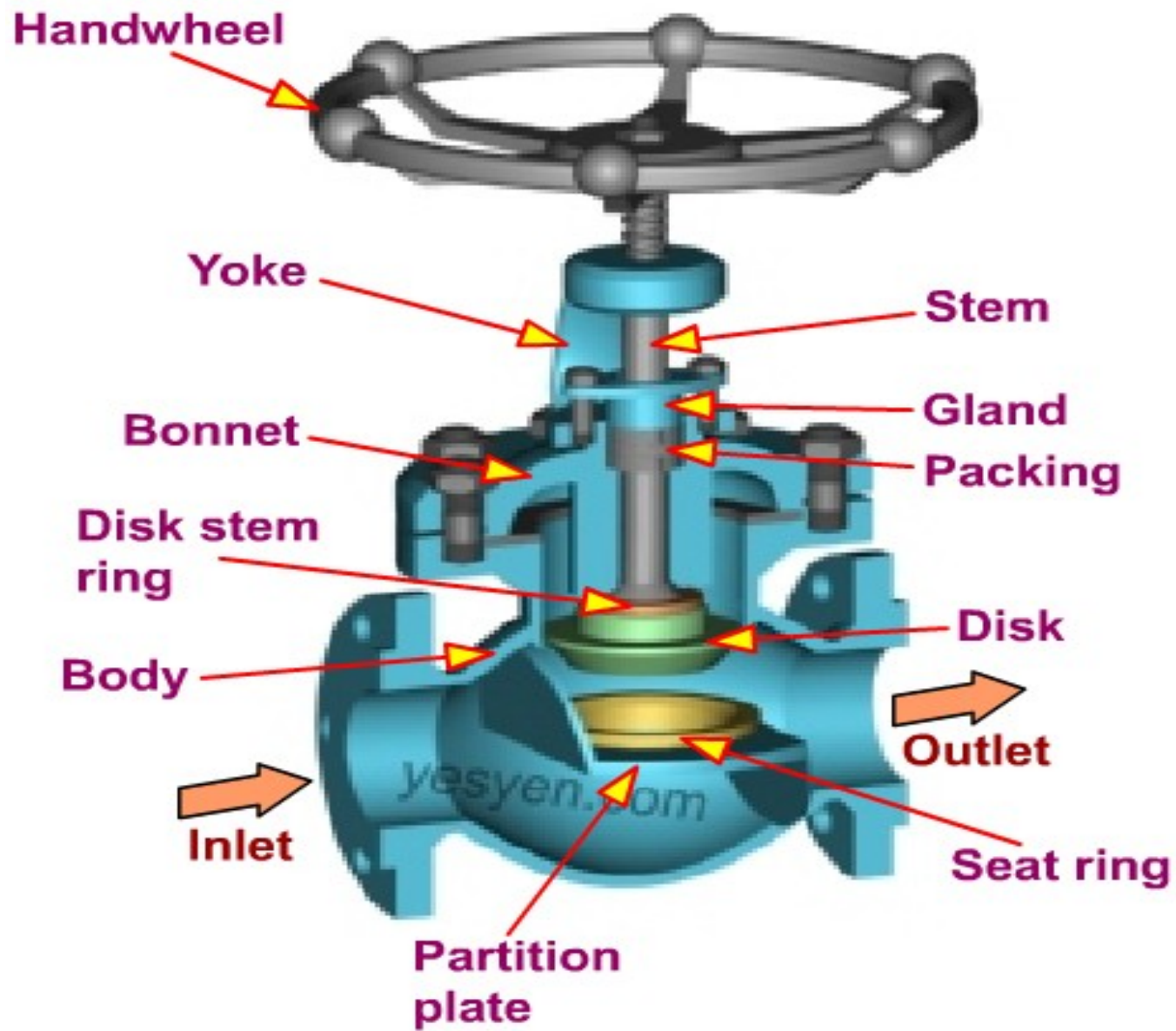
GATE VALVE

- In a gate valve the diameter of the opening through which the fluid passes is nearly the same as that of the pipe and the direction of flow does not change.
- As a result, a wide open gate valve introduces only a small pressure drop.
- The disc is tapered and fits into a tapered seat. When the valve is opened, the disc rises into the bonnet, completely out of the path of the fluid.
- Gate valves are not recommended for controlling flow (throttling) and are usually left fully open or fully closed.



GLOBE VALVE

- Globe valve is a linear motion valve used to start, stop and regulate the fluid.
- This is desirable when throttling of flow is required.
- Globe valves are widely used for controlling flow.
- The opening increases almost linearly with stem position and wear is evenly distributed around the disc.

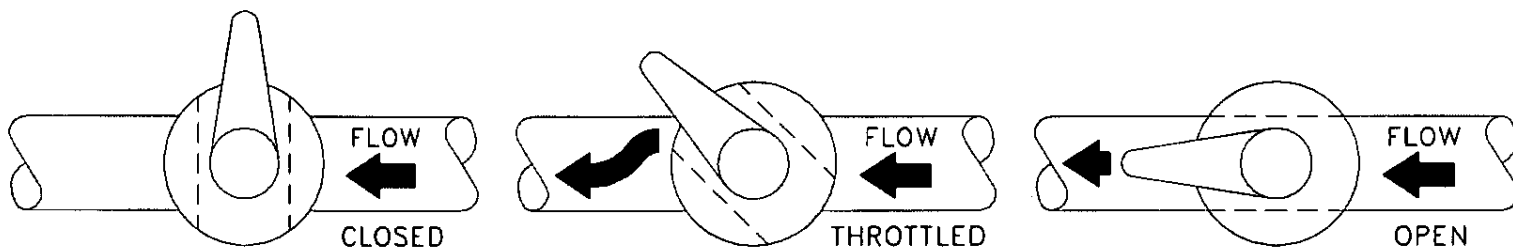
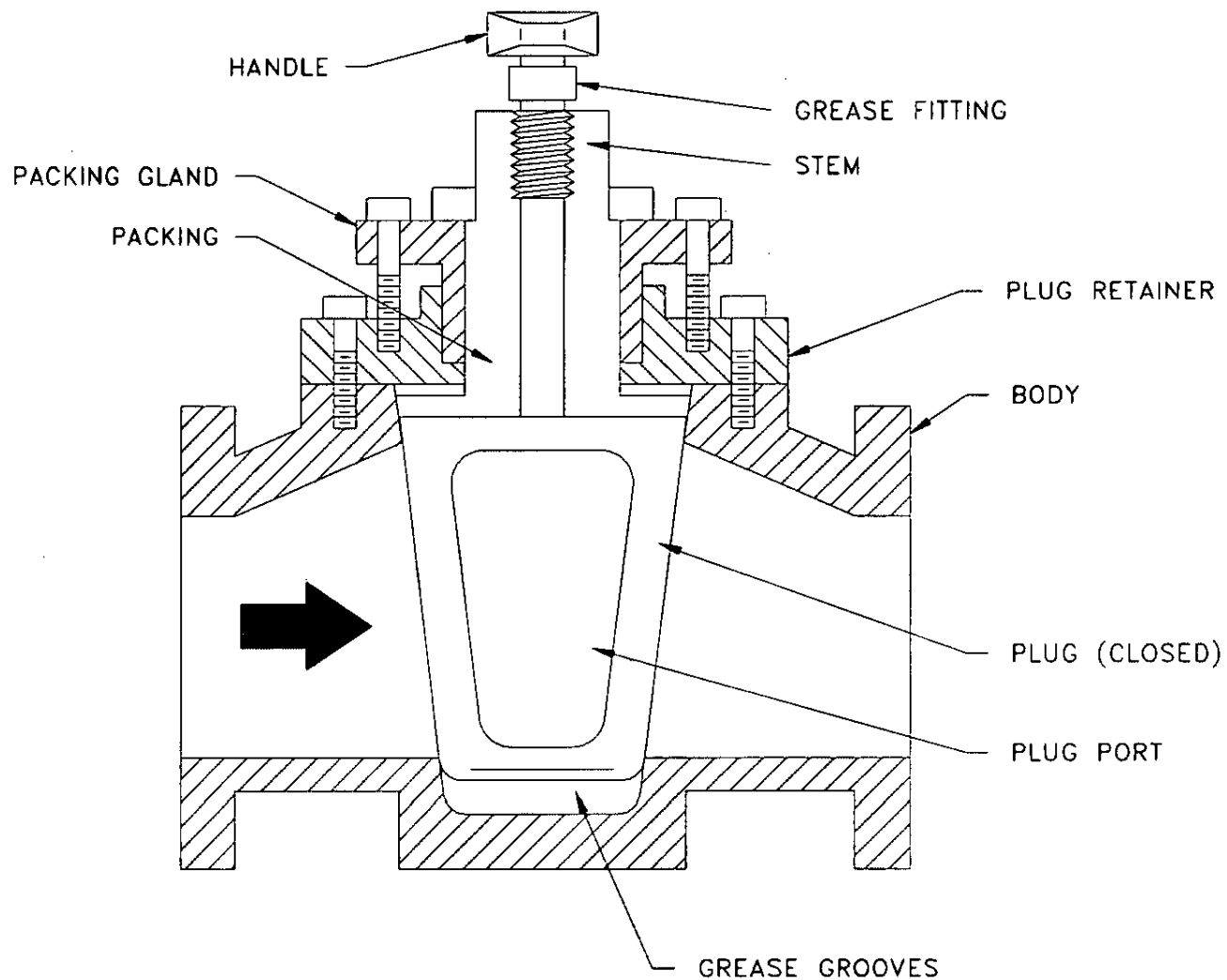


GLOBE VALVES

VIDEO

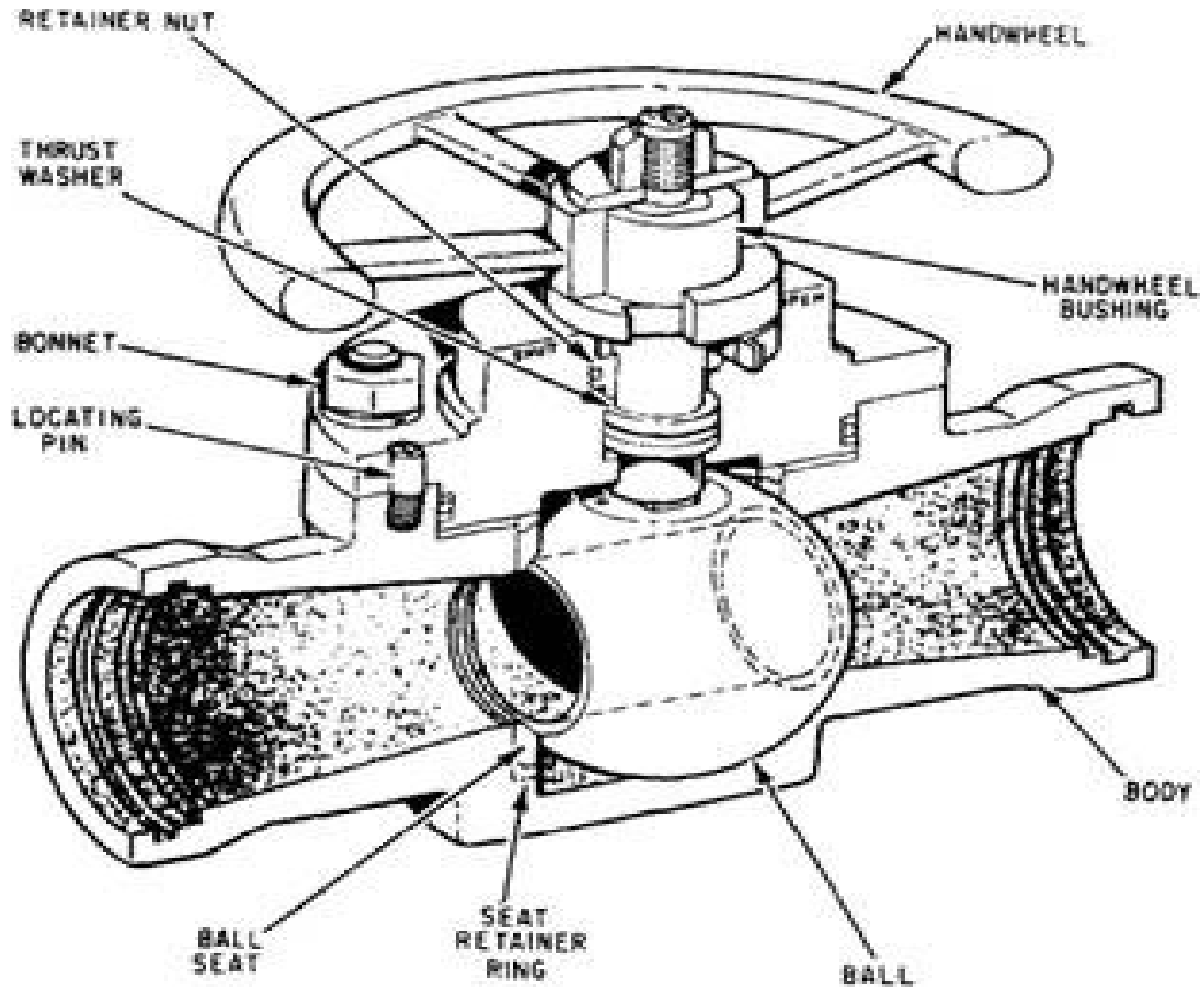
PLUG VALVE

- A Plug valve is a rotational motion valve used to start / stop the fluid.
- The body of a plug valve is machined to receive the tapered or cylindrical plug.
- The disk is a solid plug with a bored passage at a right angle to the longitudinal axis of the plug.



BALL VALVE

- The ball valve incorporates the characteristics of the gate valve, globe valve and plug valve.
- It has large flow capacities of the gate valve, tight shut- off of the globe valve and quick opening and closing of the plug valve.
- The main component of the valve is the ball, which has a hole through the center. When the hole is in line with the pipe, the valve is wide open.
- The ball is fitted between two interchangeable non-metallic seats. The seats are encaged in metal seats and the metal acts as a secondary seat should the non-metallic seat fail.
- These valves are non-sticking. The pressure drop through the valve is negligible because of the smooth, full pipe size opening.

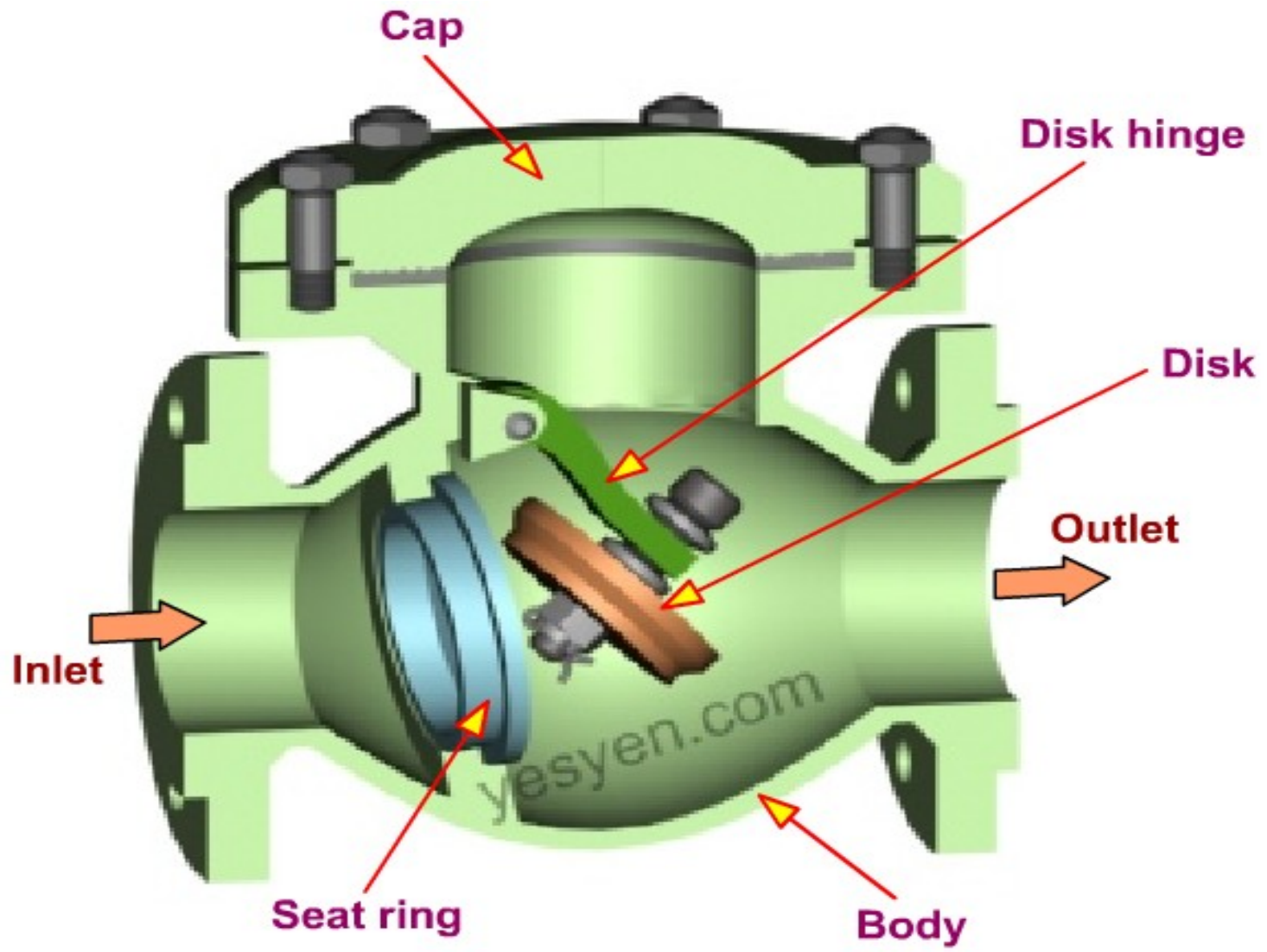


BALL VALVES

VIDEO

CHECK VALVE

- A check valve, sometimes referred to as non-return valve stops backflow in piping.
- In other words a check valve permits flow in one direction only.
- It is opened by the pressure of fluids in the desired directions.
- When the flow stops or tends of reverse the valve automatically closes by gravity or by a spring pressing against the disc.
- Check valves are normally used in pump piping after the discharge nozzles to prevent liquid back up in case of pump failure.

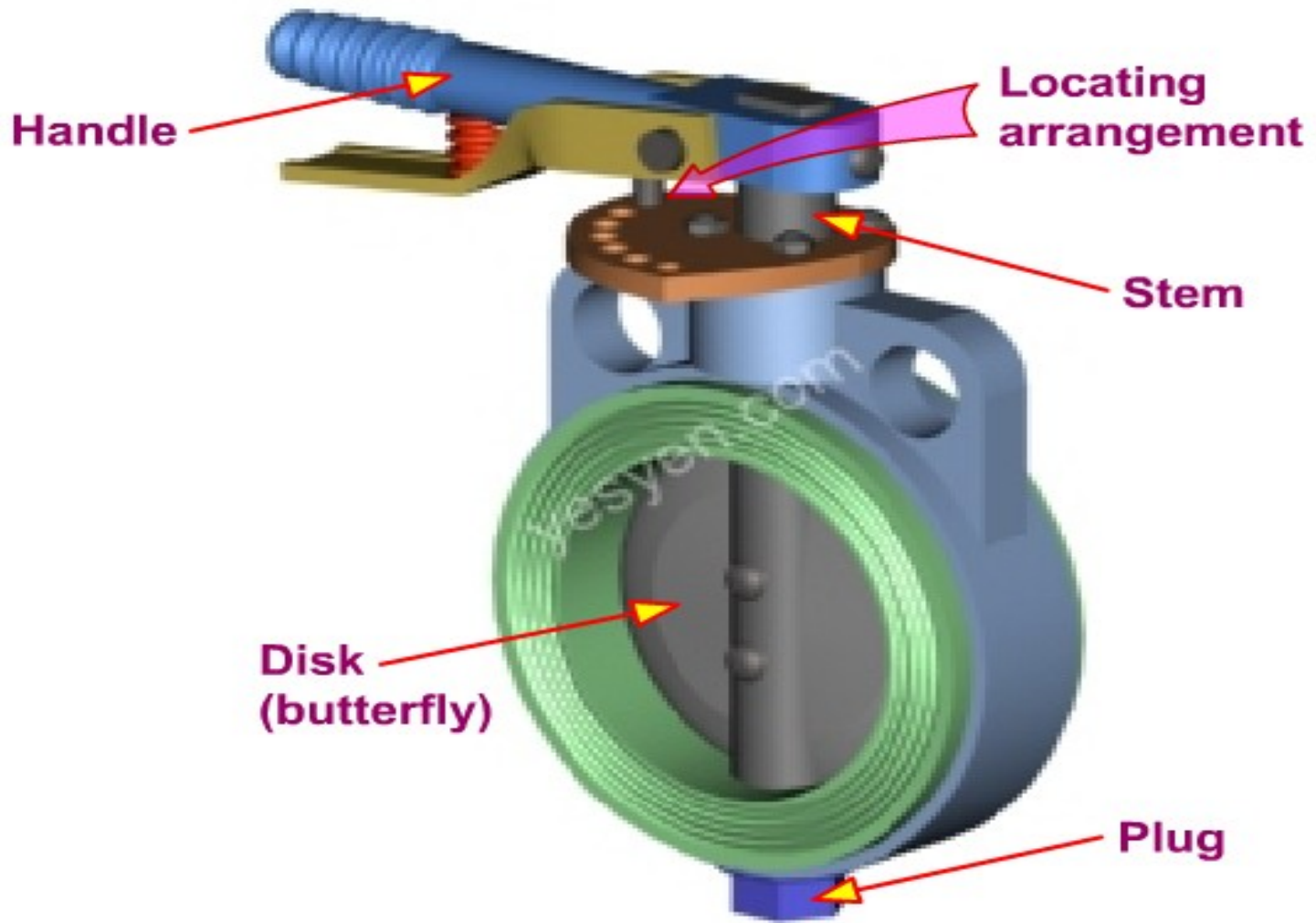


CHECK VALVES

VIDEO

BUTTERFLY VALVE

- A Butterfly Valve is rotational motion valve that is used to start, stop and regulate the fluid.
- Butterfly valves are easily and quickly operated because a 90° rotation of a handle moves the disk from a fully closed to fully opened position.
- Saves thru weight, space and cost.
- Low maintenance cost. Because of minimal number of moving parts





COMMON FAILURES OF VALVES

- Hard to operate
- Stem leakage
- Seat leakage
- Stops not properly set or operator not mounted correctly

PREVENTION

- General conditions
- Lubrication
- Jam-open / over-tightening
- Foreign particles

PM OF VALVES

- Grease, where possible
- Grease, exposed porting of stem
- Check gland packing
- Check gasket

Types of Pipes

- Seamless
- Electric Resistance Weld
- Submerged arc weld
- Gas metal arc weld

INSPECTION OF PIPE

- Underground pipe UT
- Aboveground pipe UT
- Hydro-testing