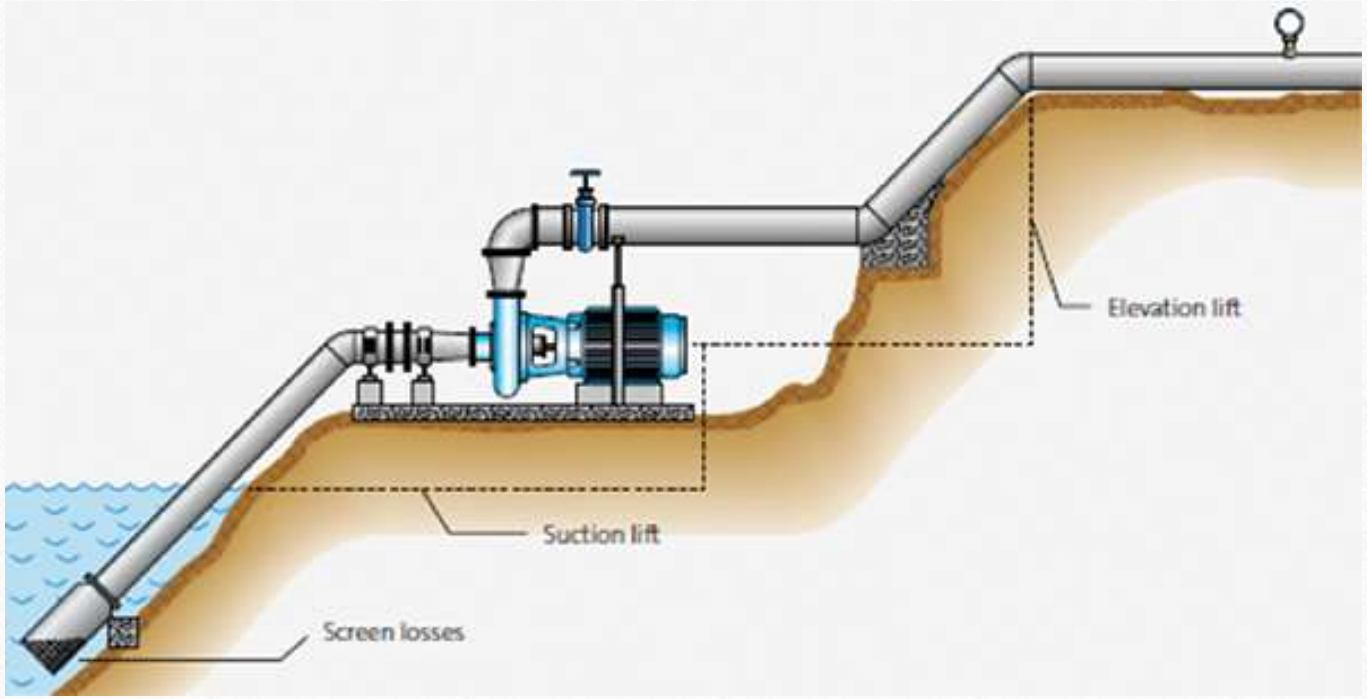
Mechanical Equipment's used in Irrigation

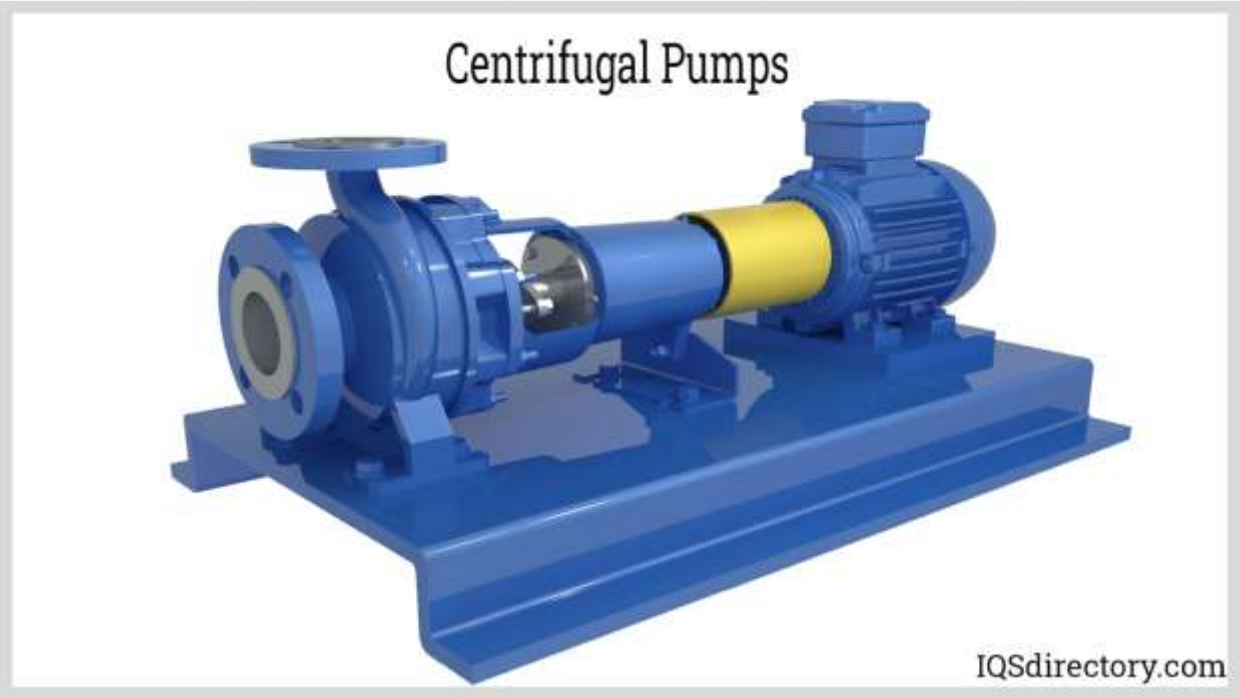
- *Pumps:*
  - *Centrifugal- Open impeller/Closed Impeller*
  - *Vertical Turbine- Mixed flow*
- *Strainer/Foot Valve:*
- *Suction & delivery lines*
- *Reflux valves/NRV*
- *Dresser Couplings*
- *Expansion Joint*
- *Sluice valves, etc.*

Suction/Delivery pipeline

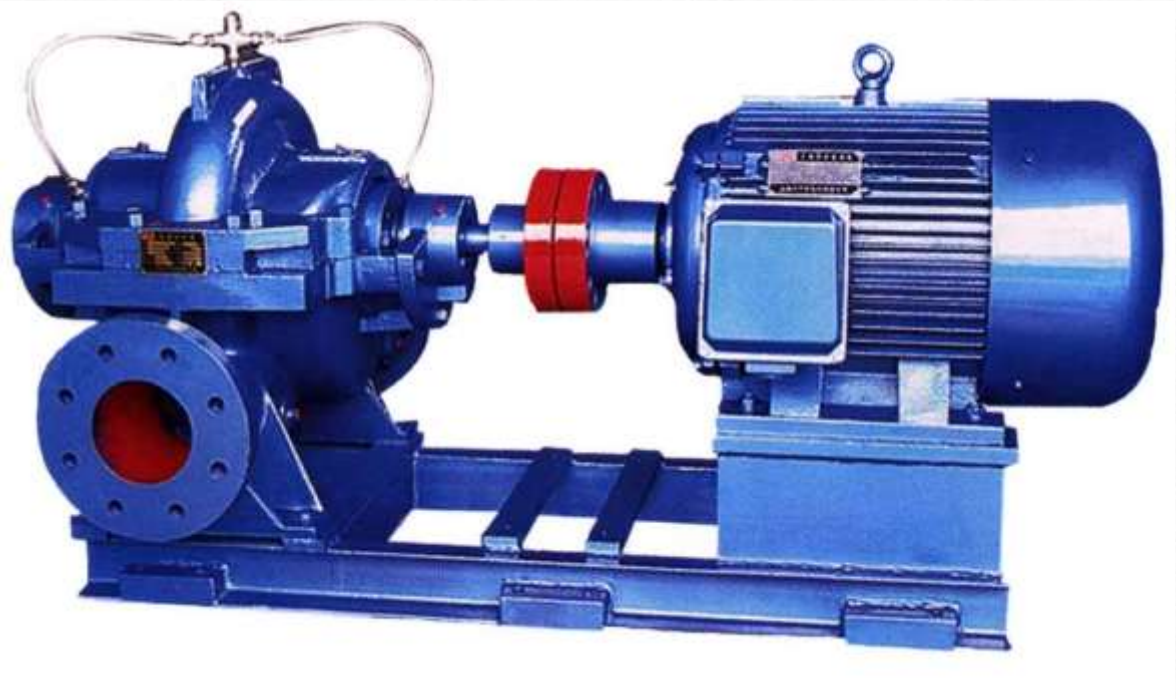


- *Pumps:*
- Centrifugal
  - End suction
  - Split casing

Centrifugal (end suction)



Split casing



Why split casing pumps are used:

- where large volume of liquid needs to be moved such as water supply schemes, irrigation
- these pumps are known for their high efficiency, reliability and ease of maintenance

Vertical Turbine Pump

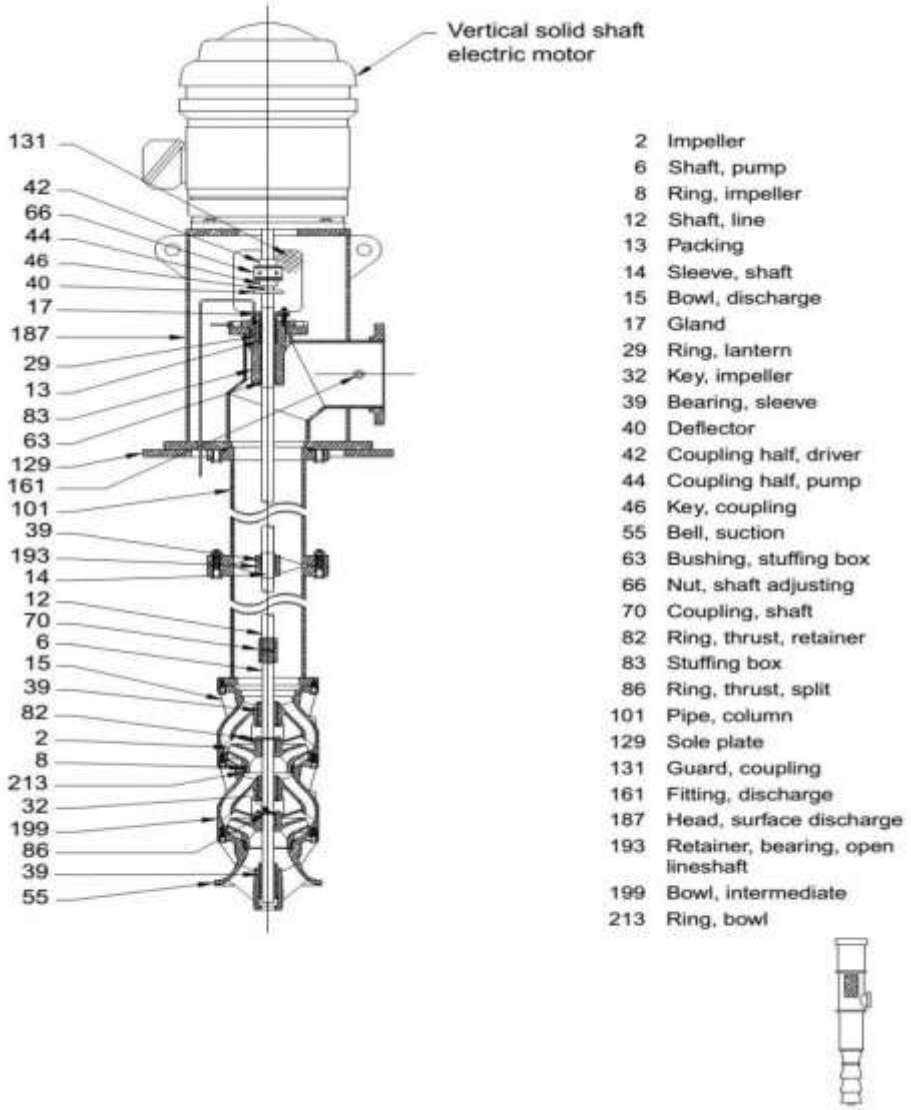


Figure 2.1.3.2a — Vertical single or multistage, short setting, open lineshaft (VS1)

Strainer/Foot Valve

Reflux valve/ Dresser coupling

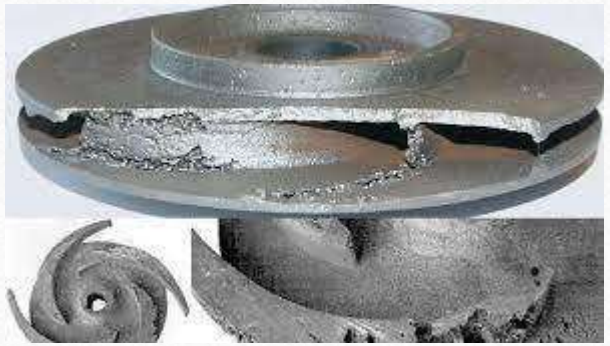
Expansion Joint (rubber)

Sluice valves

Common causes of wear & tear in pumps

- *Commonly there are four causes of pump failure, understanding these causes of failure can help in the selection of the pumping equipment to reduce the chances of it occurring, reducing the degree of damage, downtime if such failures occur*
- Cavitation
- Corrosion
- Wear
- Fouling

CAVITATION



CAVITATION

- Causes

- insufficient pressure at the suction end of the pump or Net Positive Suction Head Available (NPSHa)

- NPSHa= 10-Hv-Hz

- causing the liquid in a pump to turn into vapour at low pressure.

- Effects

- At low pressures, this creates air bubbles which implode as the liquid moves from the suction side of the impeller to the delivery side.

- The air bubble implosion generates a shockwave that stresses the pumps' internal surfaces, creating vibration and mechanical damage, and can ultimately result in failure.

- When this occurs repeatedly, cavitation can cause pitting and fractures in the impeller, volutes and casing, weakening the metal, increasing resistance to flow and reducing pumping efficiency. The shock loads from cavitation can also decrease the service life of the shaft and motor.

- Cavitation and the related problems it causes can greatly impact the life of a pump, reducing it by 10-15 years, or even more in extreme cases.

CAVITATION

- Remedies

- Cavitation is most easily avoided during the design stage, ensuring the chosen pump will have sufficient NPSHa so that the liquid remains above vapour pressure.

- The NPSH will need to be calculated for each application as vapour pressure is different for different liquids and varies with pressure and temperature.

CORROSION

CORROSION

- Causes
- As a result of a chemical reaction between the metal and the fluid being pumped.
- This reaction can cause uniform corrosion of the wet surfaces – found mostly in pumps made from non-stainless steel materials – or localised corrosion of a small portion of the components – occurring most commonly where metals that form oxide layers that adhere to the surface.

CORROSION

- Effect
- pump performance and efficiency is affected, increasing the need for more frequent maintenance and more downtime, and if left untreated it can lead to failure.
- (Rebuilding with the help of specialized electrodes E308L- high chromium & nickel)

- Remedy
- selecting a pump manufactured from the most appropriate materials for the application.
- Cast iron is amongst the cheapest options for pump materials and is often used for casings. It has good corrosion resistance to neutral and high pH liquids, making it a popular choice for general purpose irrigation pumps
- Stainless steel is one of the most commonly used materials for pumps as it has good corrosion resistance in a wide range of environments where other carbon and low alloy steels would corrode.

CORROSION

- This is not an issue for higher grades of stainless steel, which have a high level of corrosion resistance…..however costs are prohibitive.

- Material selection determines the corrosion resistance in a particular application as well as the pump’s overall cost, including initial cost, maintenance, replacement, downtime, lifecycle and reliability.

WEAR

WEAR

- CAUSE

- Wear is inevitable when running a pump, however, there are a few factors that can cause excessive wear, speeding up deterioration of the pump.

- Particulate matter (>850 micron) in the pumped fluid can lead not only to fouling but also increases the pace of wear on a pump. These particulates scour a pump's interior surfaces and roughens them, reducing pumping efficiency over time as it needs to work harder to move the fluid.

WEAR

- Effect
- the pump becomes so worn that it is unable to produce enough lift and may cause excessive vibration which has damaging percolating effect i.e. undue breaking of coupling bolts, couplings, bearings, etc.

WEAR

- Remedy
- Wear rate can be slowed down by ensuring the pump size and materials are suitable for the application, and regular maintenance is carried out to find and fix any problems before they result in unexpected downtime or pump failure.

FOULING

FOULING

- Cause
- Fouling occurs when particulate matter adheres to a pump's internal surfaces, most commonly in the distribution lines connected to the intake or outflow.

- Effect
- pumping efficiency and flow capacity are decreased, and may eventually lead to failure.

FOULING

- Remedy
- This is an unavoidable problem, but is more prevalent in applications where the fluid being pumped contains particles.
- However, cleaning as required is done to maintain the pump and improve efficiency and capacity.

THANK YOU