Pump and pumping system basics

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Purpose

- This presentation is designed to educate you with the appropriate knowledge of pumping principles. Also knowing what are the basics methods of pump and pumping system .

Introduction

- The first pump was invented by Joseph Michel Montgolfier in 1796. This pump was used for his paper mill. It was the first type of self acting ram pump and was patented a year after it's invention. And now pumps are the second most common machine in use today. They are exceeded in numbers only by the electric motor.

  To study pumps, a thorough understanding of their various types and functions is essential.

What is a pump?

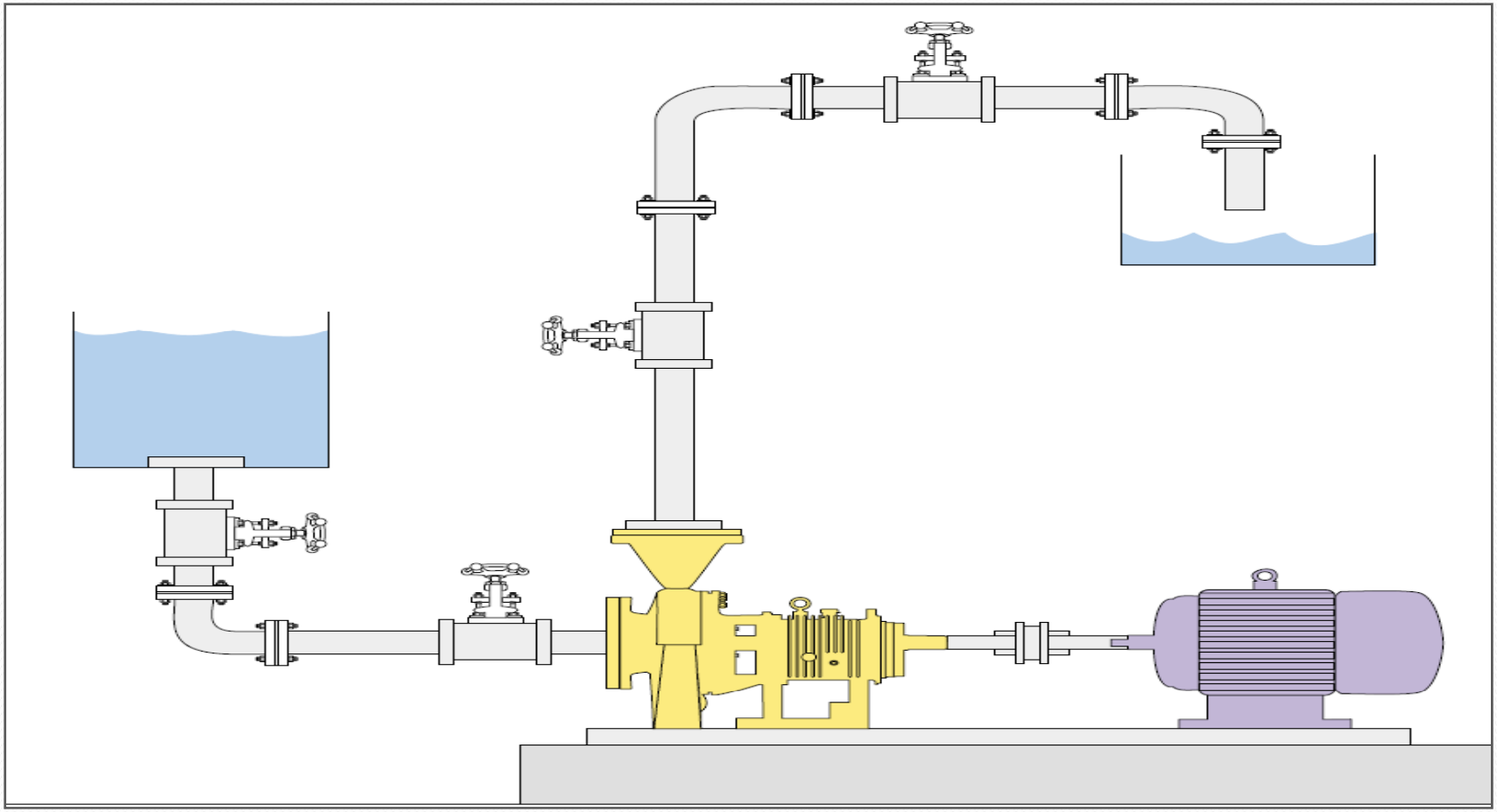
- the pump is a machine which has the function of increasing the total (mechanical) energy of a liquid; this means that the pump transfers energy to the fluid that it receives from the driving motor.

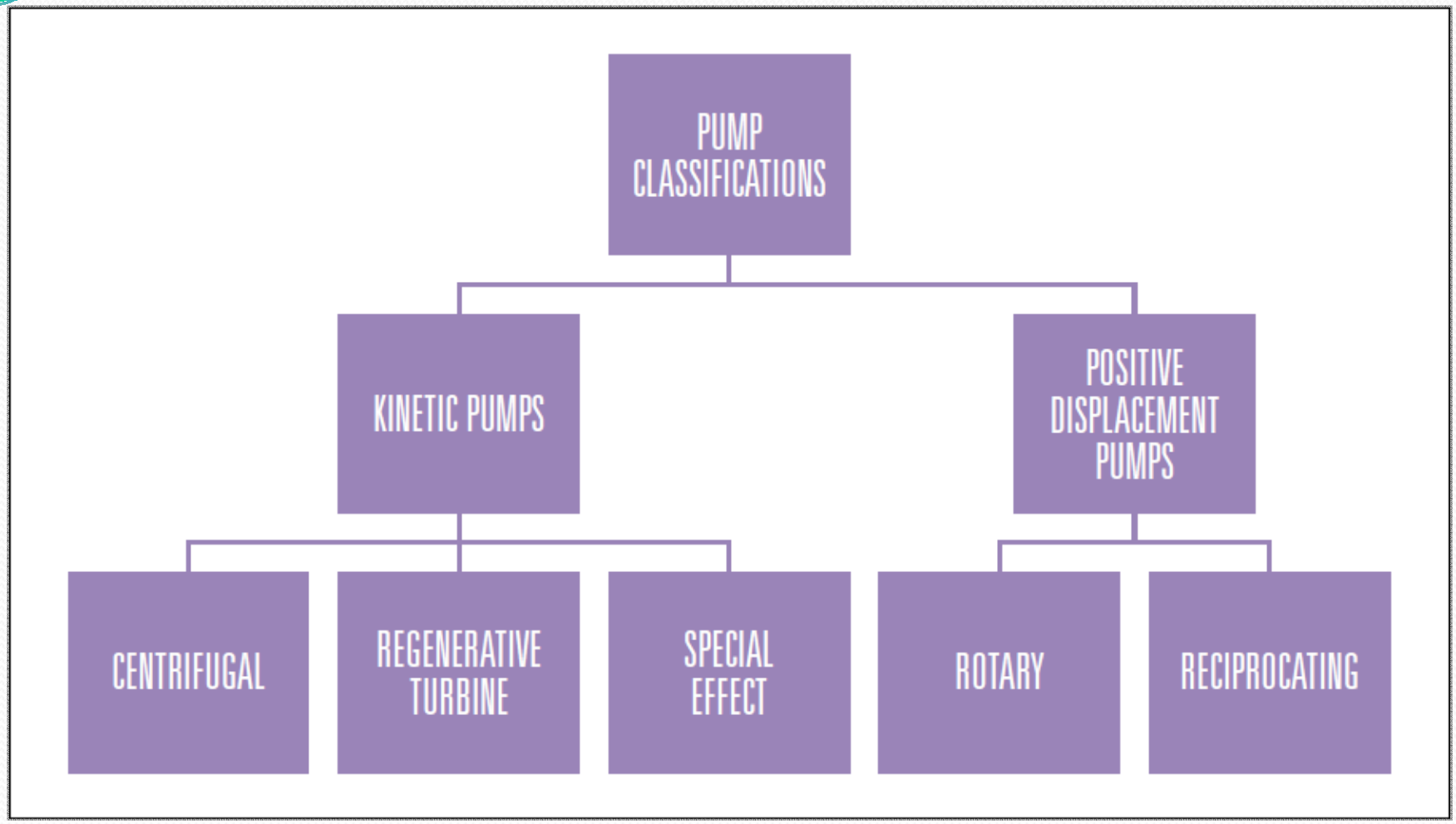
The old days.

Pumping systems account for nearly 20% of the world's electrical energy demand and range from 25-50% of the energy usage in certain industrial plant operations.

A Pumping System in an Industry.

Typical industrial pump system.

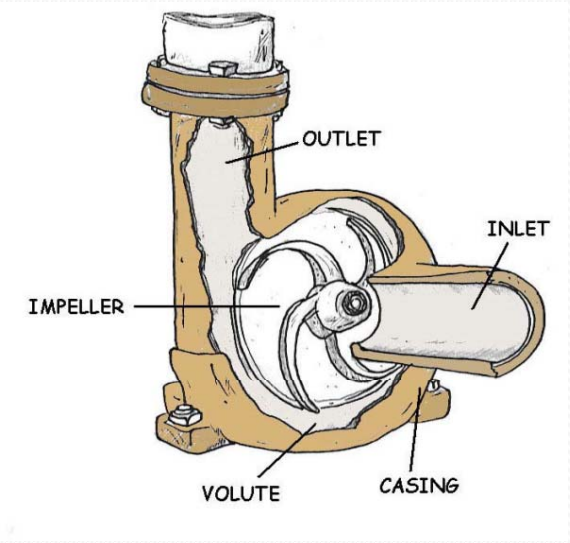


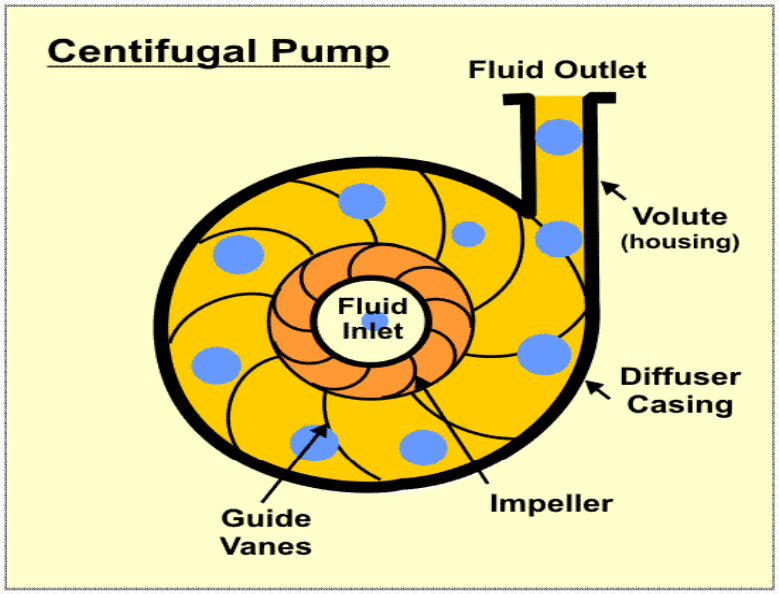


Pumps are classified according to the way in which energy is imparted to the fluid.

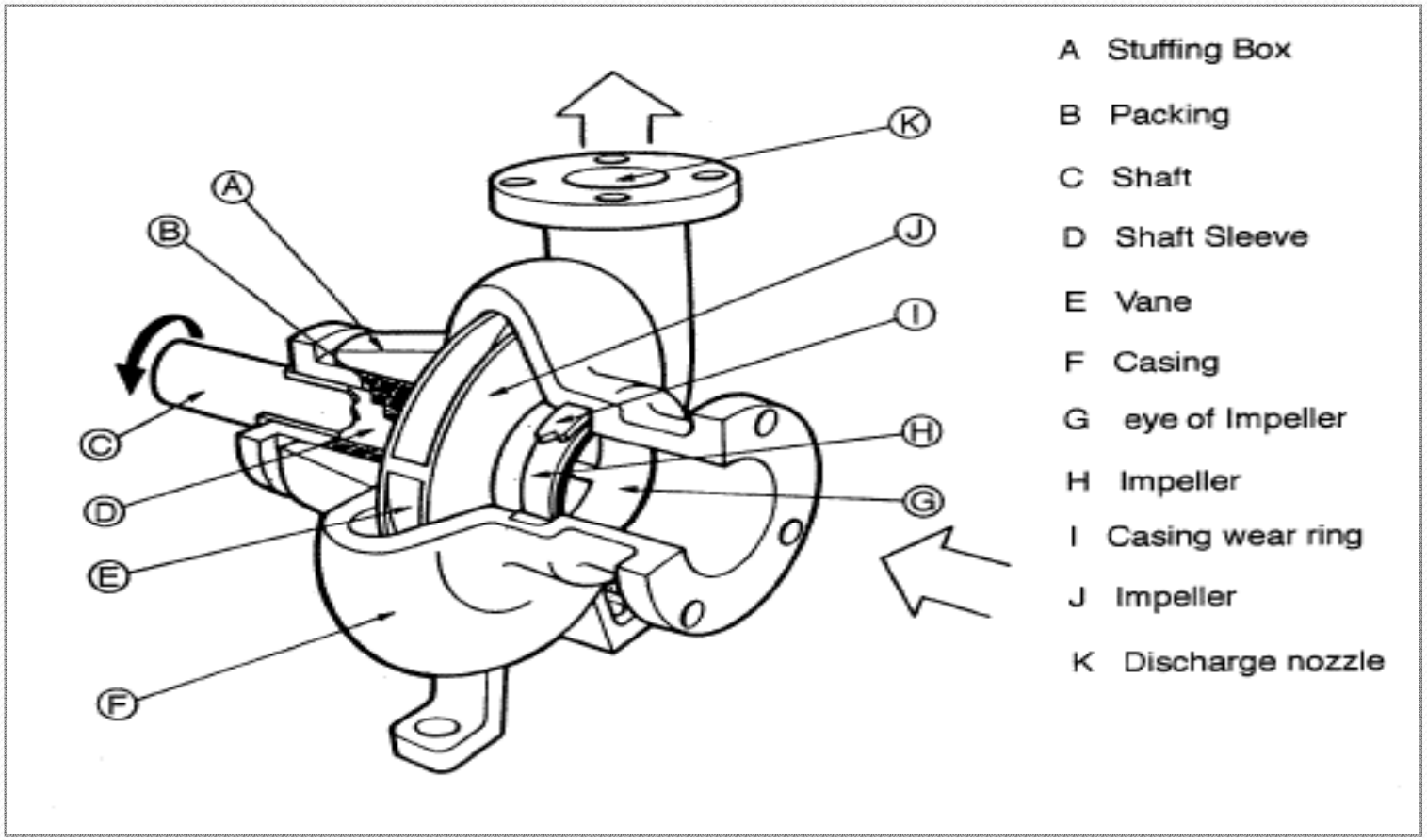
Centrifugal pump .

A centrifugal pump is a rotodynamic pump that uses a rotating impeller to increase the pressure and flow rate of a fluid. Centrifugal pumps are the most common type of pump used to move liquids through a piping system.





Cut-away view of a centrifugal pump.



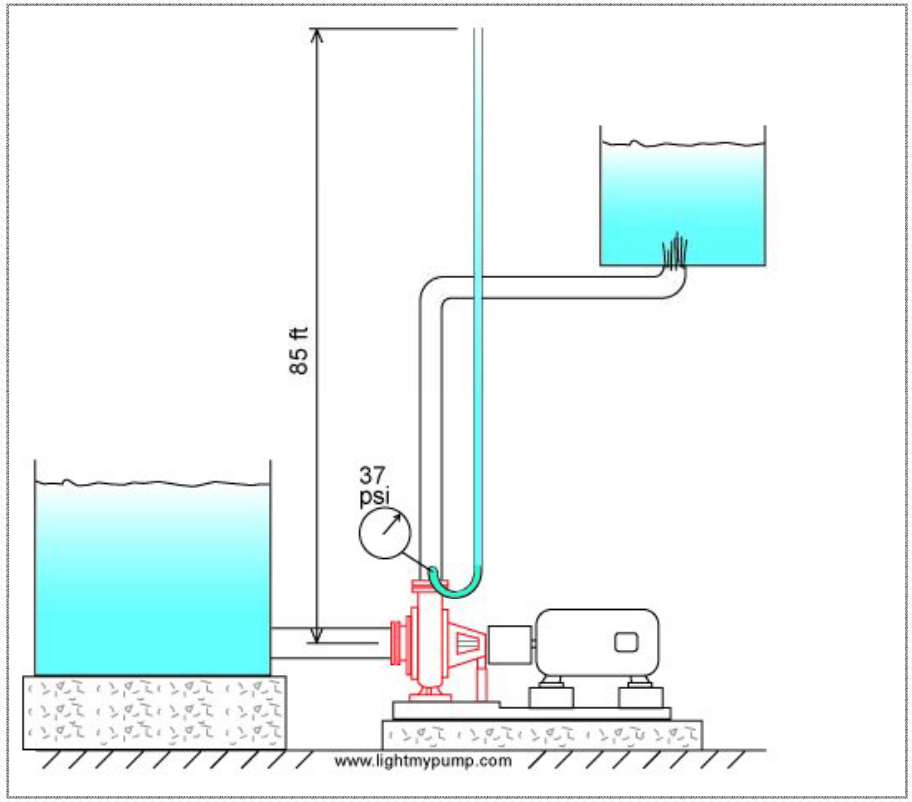
Overhung Impeller Centrifugal Pump

Pressure can be converted to head by the equations:

$$\text{Head (ft.)} = \frac{\text{Pressure (psi) x 2.31}}{\text{Specific Gravity}}$$

$$\text{Head (m)} = \frac{\text{Pressure (kg/cm}^2\text{) x 10}}{\text{Specific Gravity}}$$

$$\text{Head (m)} = \frac{\text{Pressure (bar) x 10.2}}{\text{Specific Gravity}}$$



Head vs. pressure measurement.

Characteristic relation between head and flow rate.

Each pump has a characteristic relationship between head and flow rate.

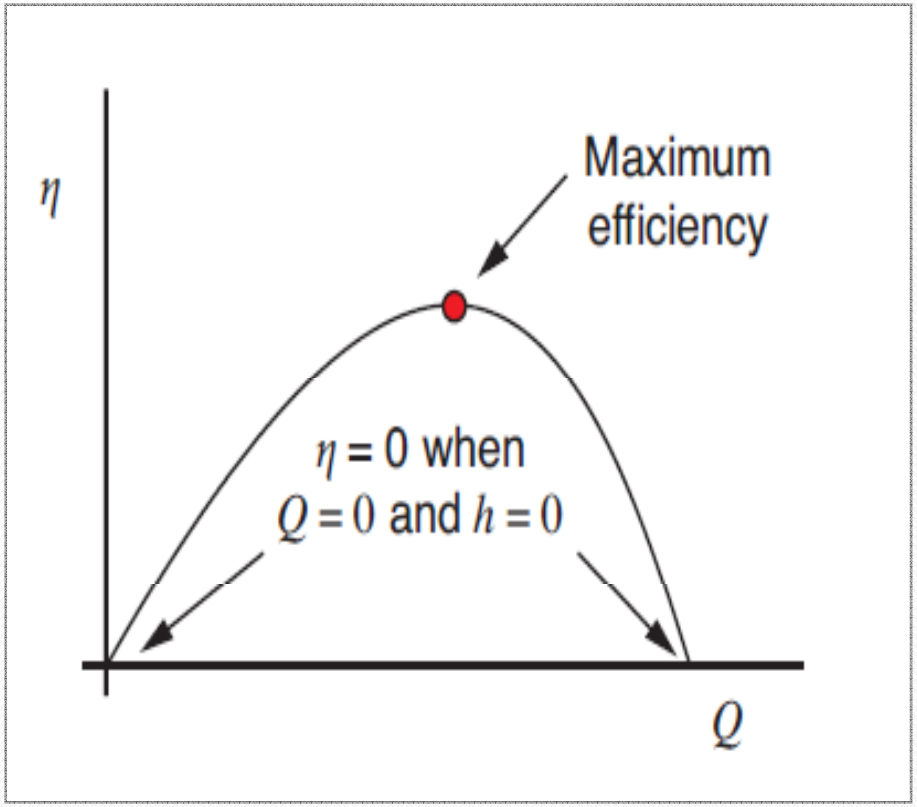
- An increase in head causes a decrease in Q
- There is a maximum h for which $Q = 0$
- At $h = 0$ (no uphill) then Q is a maximum

Pump Efficiency(η).

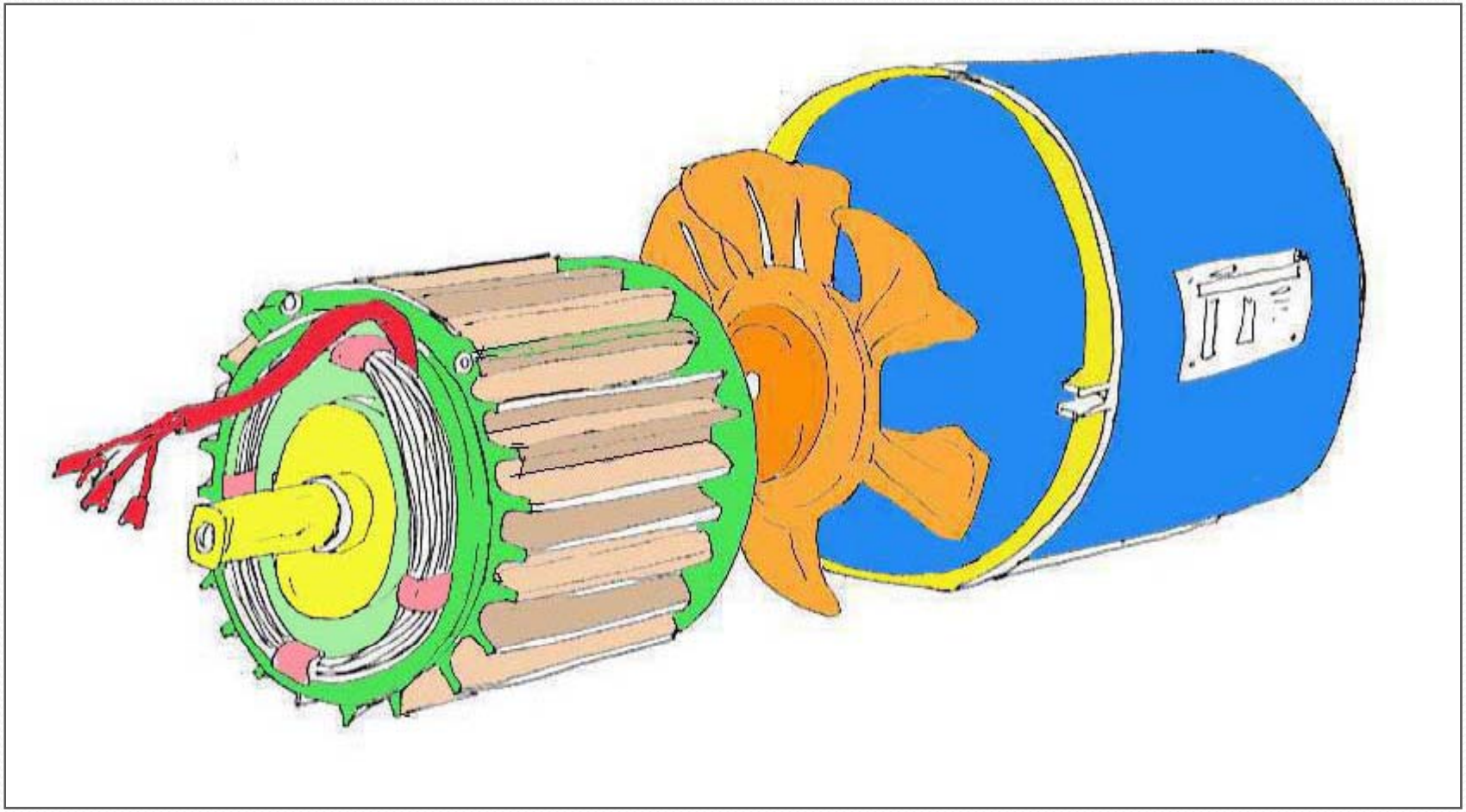
What is efficiency?

$$\eta = \frac{\text{Output}}{\text{Input}}$$

The maximum efficiency point is between the maximum head condition $(Q = 0)$ and the maximum flow condition $(h = 0)$.



Max efficiency point is taken from the highest point from the curve.



The efficiency of most motors range from 80-95%.

Power source.

Pumps can be driven by a number of different power sources. The most common are electric motors, but many other types exist.

1. **AC powered** - pump operates on a form of alternating current (AC) voltage.
2. **DC powered** - pump operates on a form of direct current (DC) voltage.
3. **Air (pneumatic)** - pumps power dusing a compressed air source.
4. **Combustion engine (gasoline or diesel)** - pump is powered using a gasoline or diesel engine.
5. **Hydraulic** - pump is powered by a hydraulic system.
6. **Steam** - pump is powered by steam.

Summary

- Pump operation and performance can best be described by a few fundamental parameters; flow rate, pressure, head, power, and efficiency.
- Pumps has a long history that worth to search and study .
- Pumps has many power sources , also pumps systems consumes a lot of power and we have to be more careful about that also safety first in the operation of any pump.
- Types of pumps are so many and the most used pumps for hydraulic purposes in the world today is the Centrifugal Pump.
- We always have to consider the pump curves in mind when we want to buy a new pump.