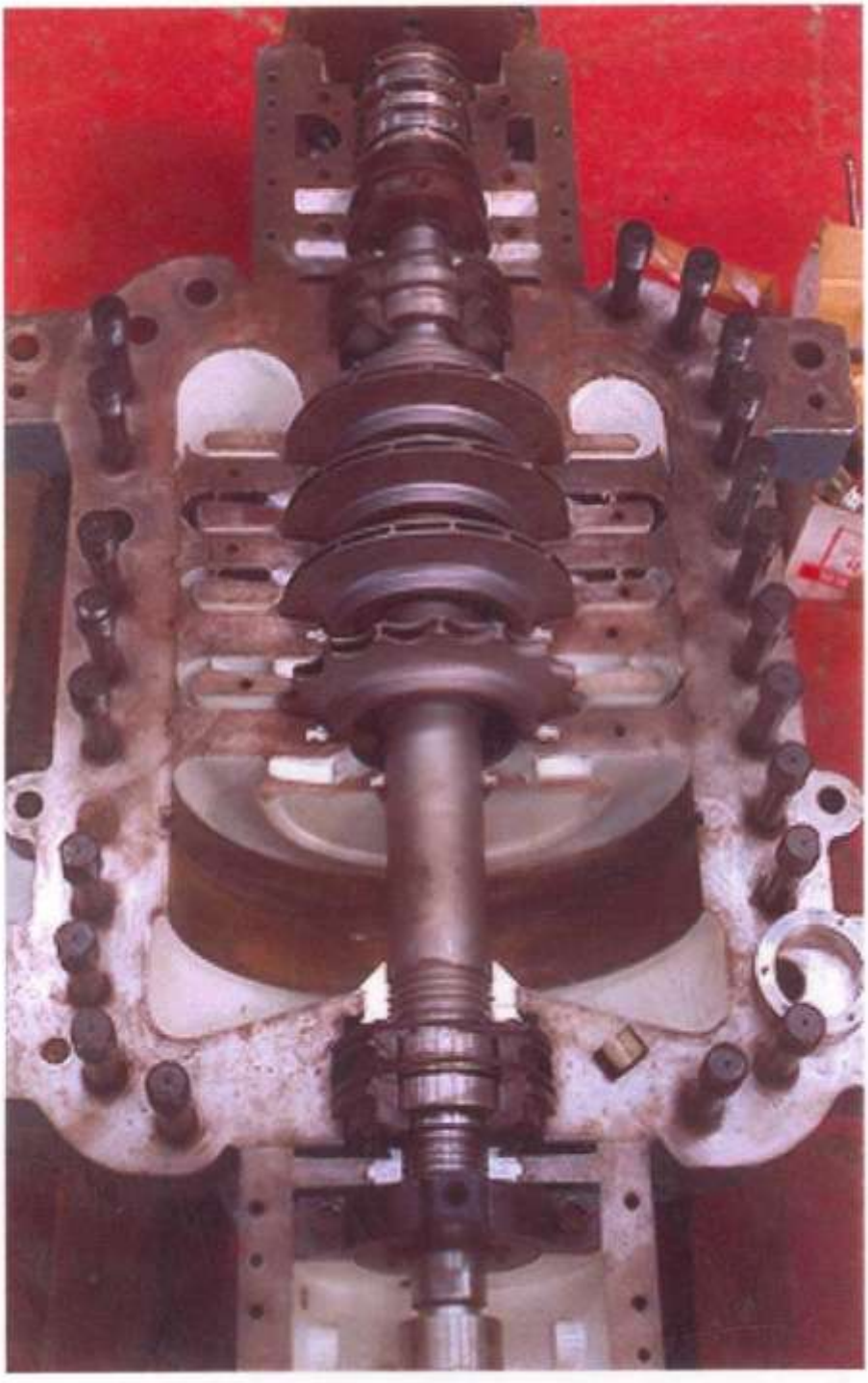
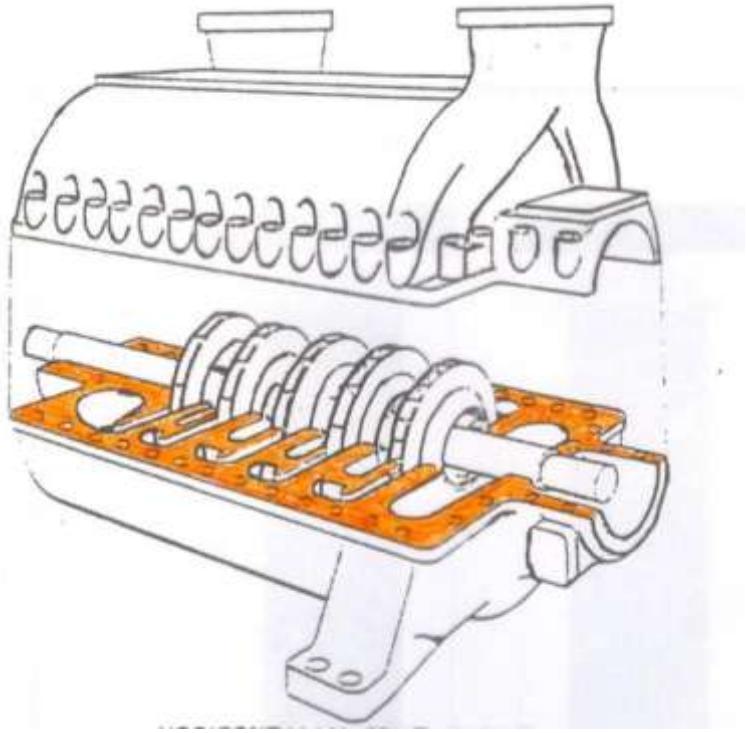
CENTRIFUGAL COMPRESSORS

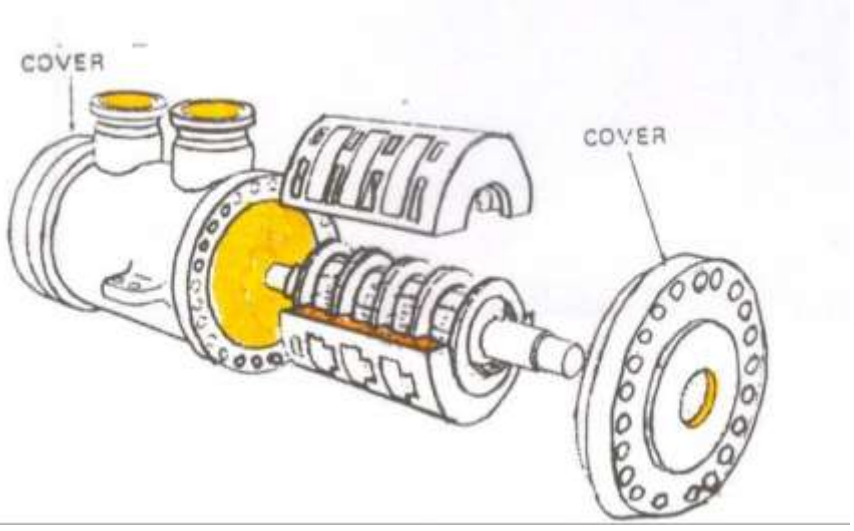


There are two casing designs for centrifugal compressors

Horizontally split casing



Vertically split casing

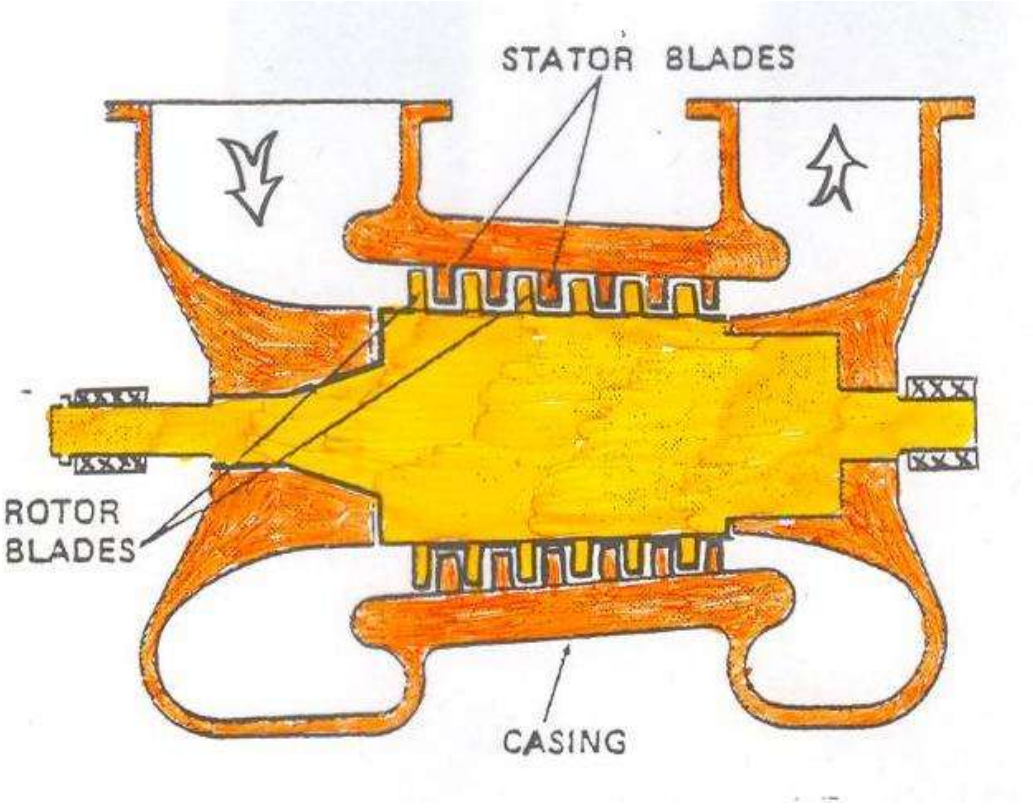


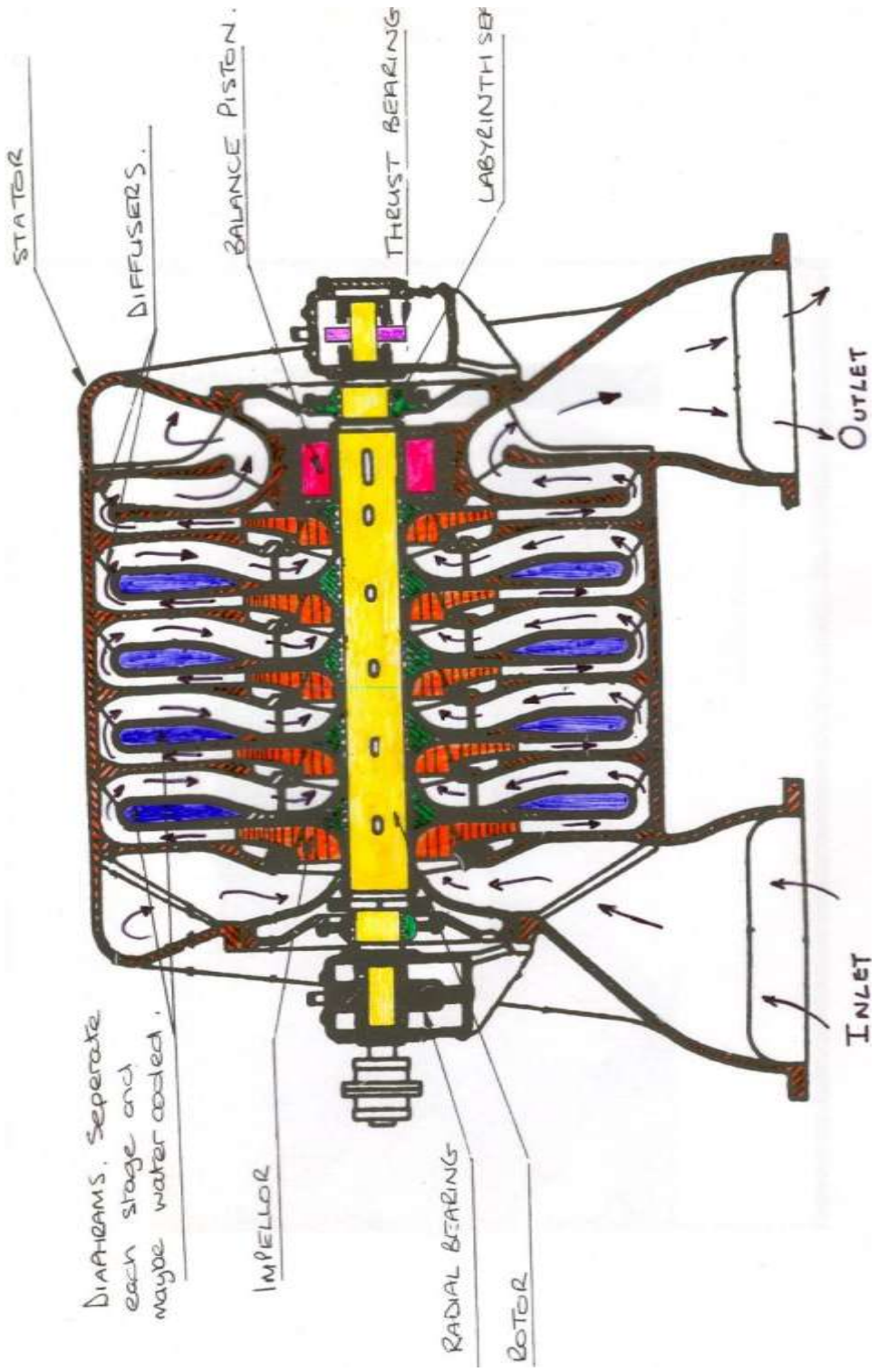
There are two basic elements within a centrifugal compressor these are:

1. The Rotar
2. The Stator

These are kept apart by bearings mounted at each end of the compressor rotor. The bearings will comprise of:

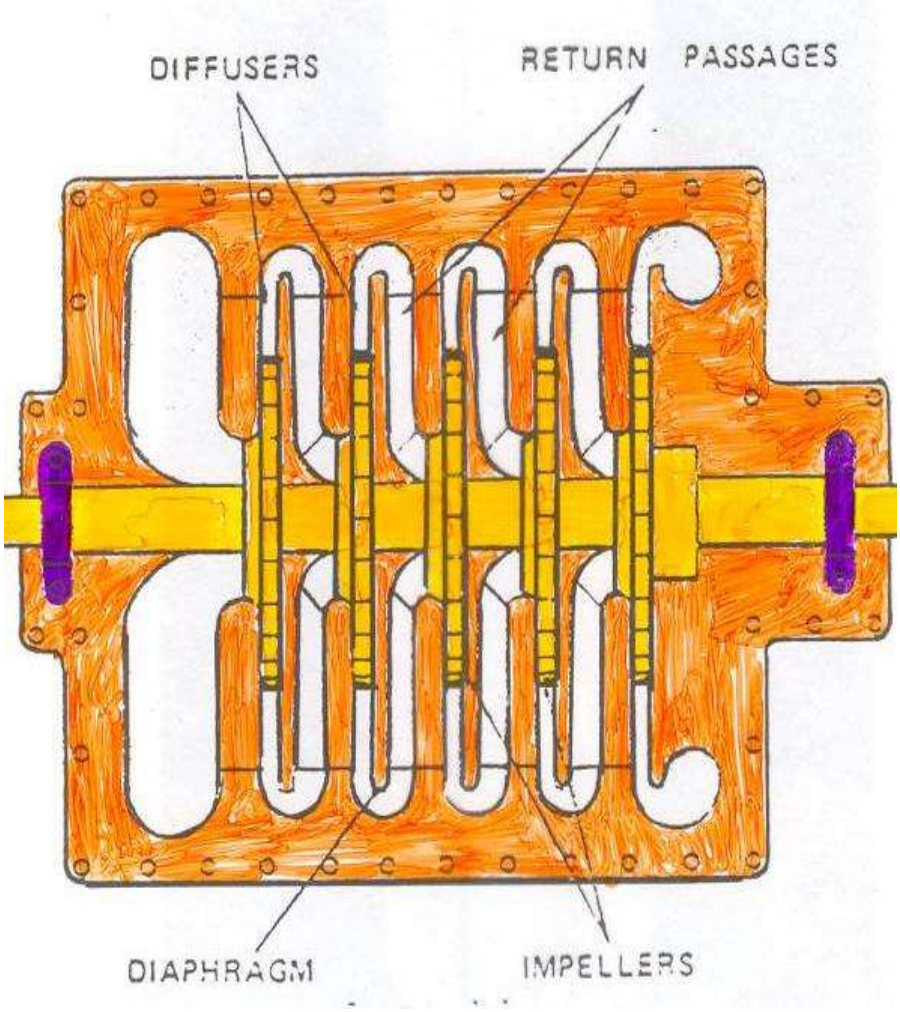
1. Radial contact bearings
2. Thrust bearings





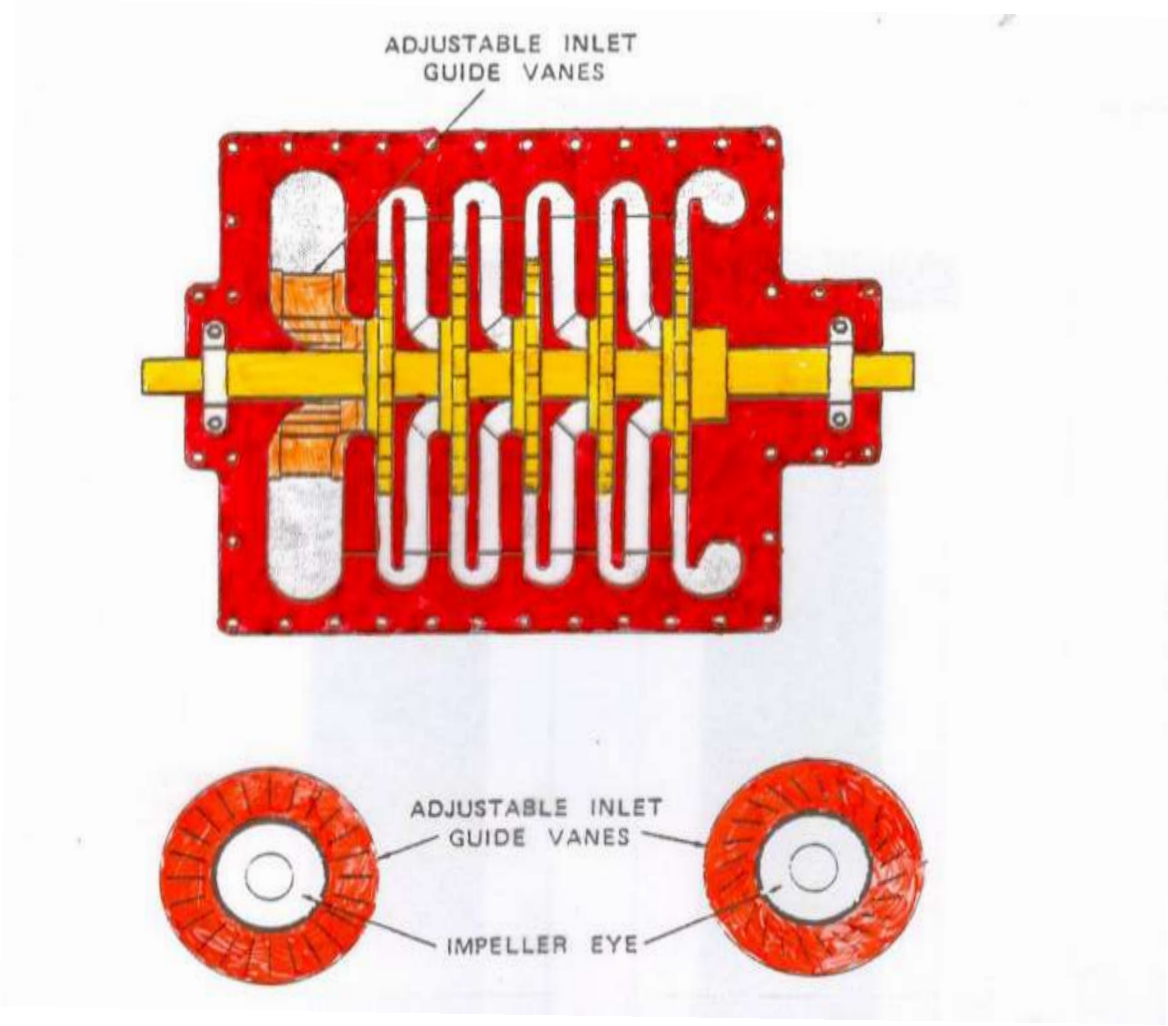
Diaphragms

A Multi-stage centrifugal compressor contains diaphragms.



The diaphragms are located between the impellers.

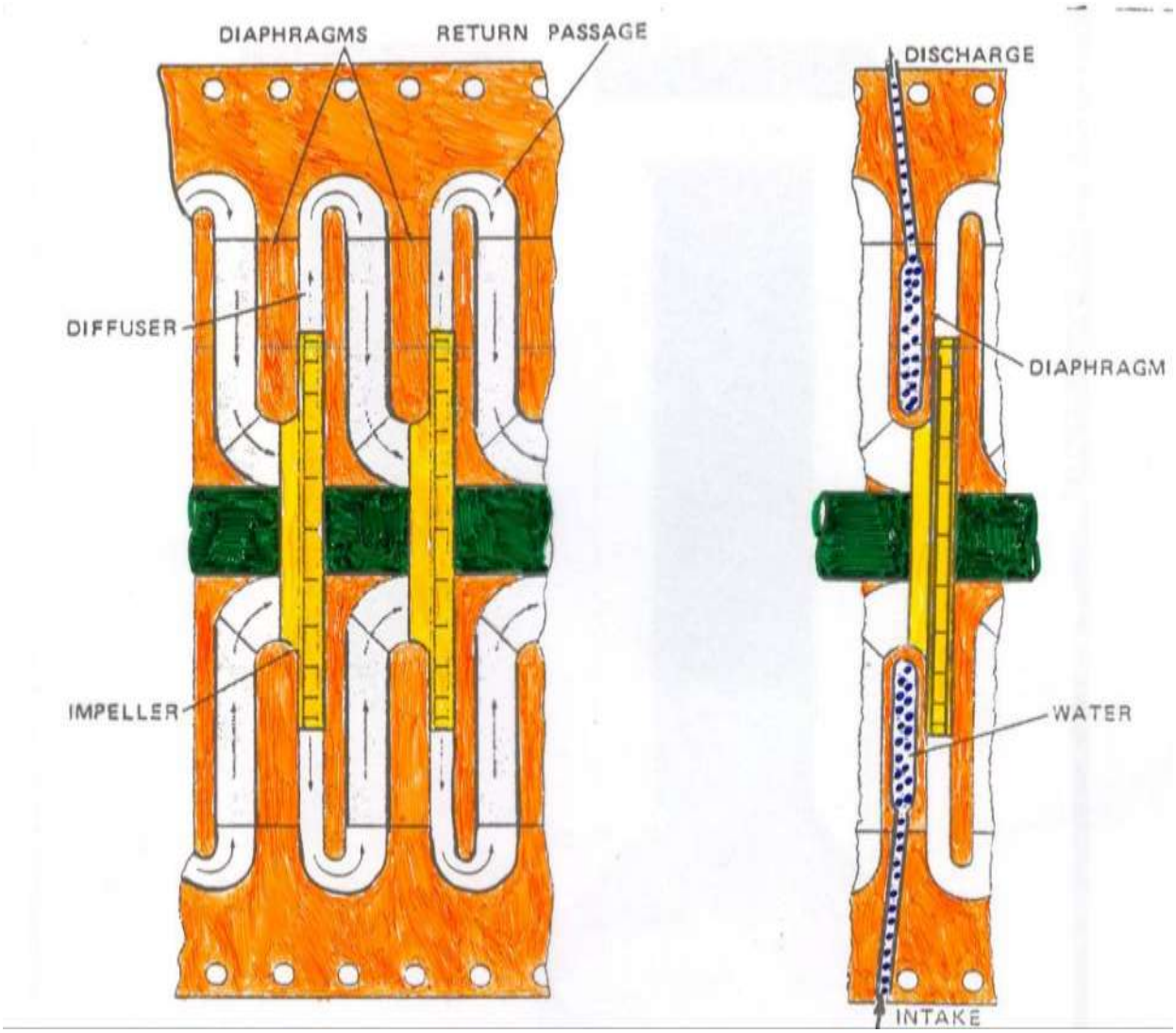
Adjustable Guide Vanes



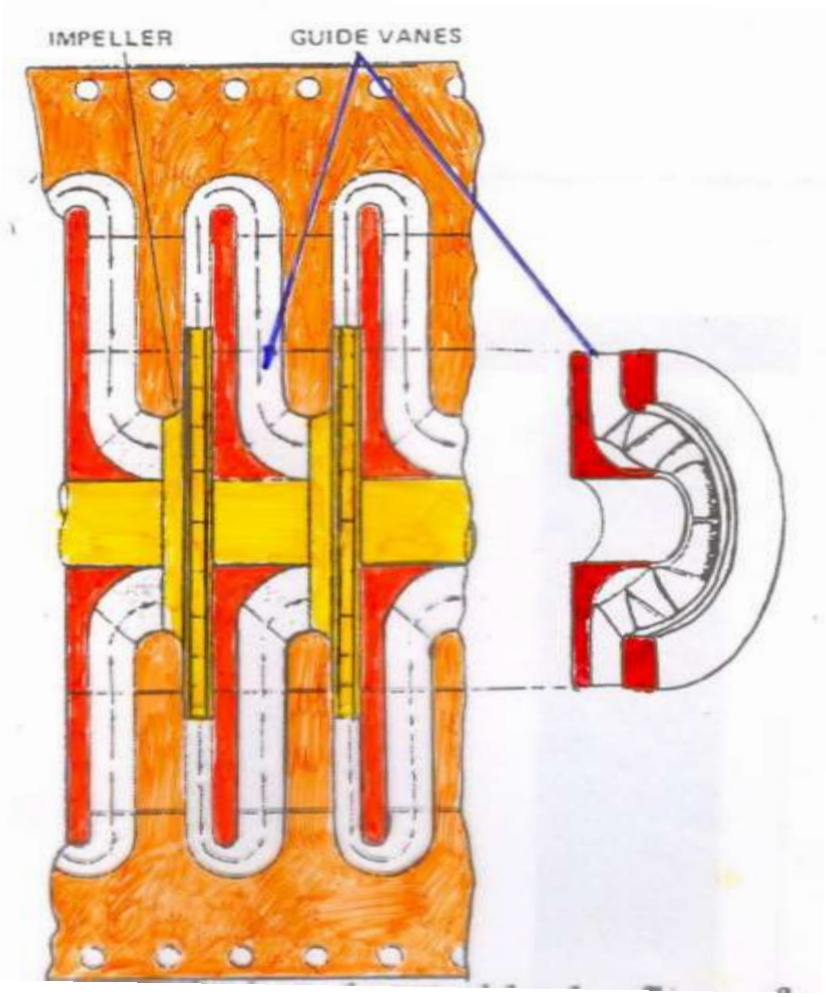
With adjustable vanes, the angle of gas flow into the eye of the impeller can be changed or controlled. The angle of flow into the eye of the impeller affects the characteristic performance curve of the impeller.

Compressor capacity can be controlled by adjusting the guide vanes.

Diaphragms

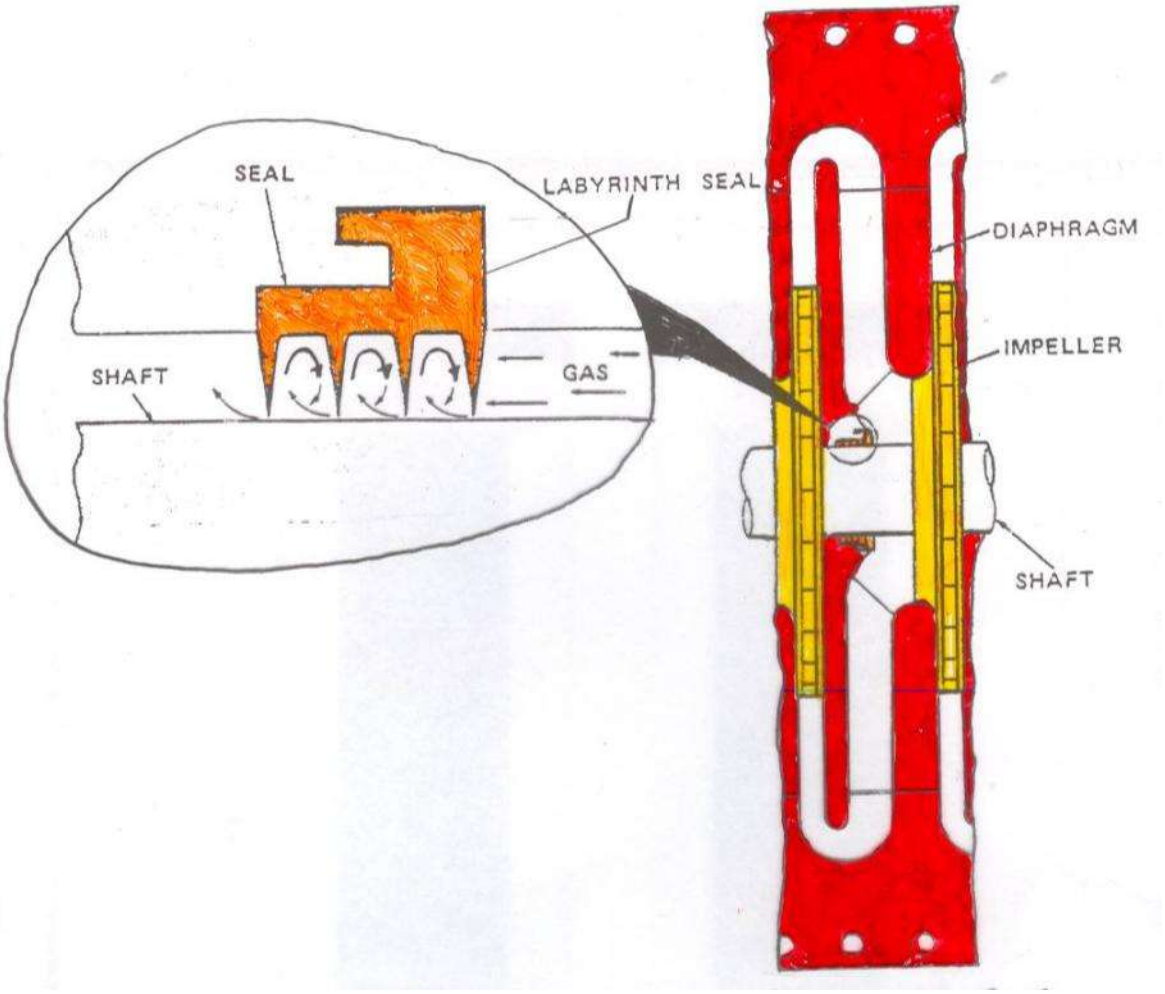


Guide Vanes



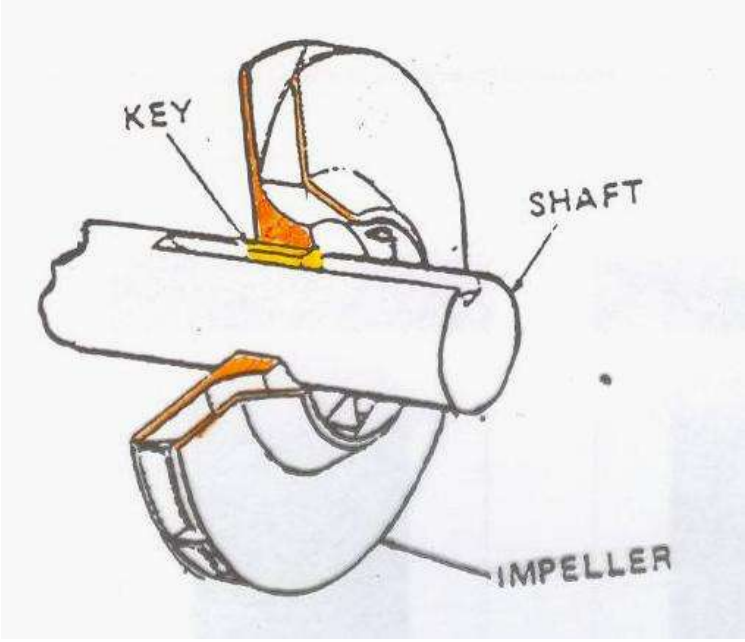
These vanes are designed to guide the flow of gas efficiently into the eye of the impeller. The guide vanes in multi-stage centrifugal compressors are placed at the end of the return passage of the diaphragm. The gas that leaves an impeller passes through the diffuser passage and in the return passage is guided by guide vanes into the next impeller.

Labyrinth Seals



The labyrinth seal is a set of metal rings or teeth that encircle the shaft. The teeth do not contact or touch the shaft. The rings or teeth are made of soft metal so that the shaft will not be damaged in case of accidental contact. The rings or teeth are also sharp so that any friction generated by contact would be small. The spaces between the teeth form a labyrinth passage.

Fitting Impellers



An unbalanced or loose impeller vibrates. To prevent vibration, the impeller must be shrunk onto the shaft and well balanced.

Compression Ratio

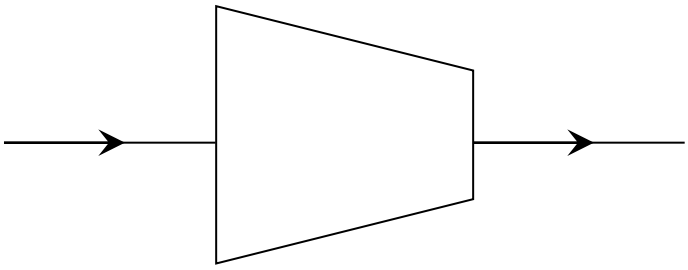
$$\text{Compression Ratio} = \frac{Po}{Pi} = \frac{\text{Output Pressure}}{\text{Input Pressure}}$$

If a compressor had an output pressure of 5 bar and an inlet pressure of 2 bar the compression ratio would equal:

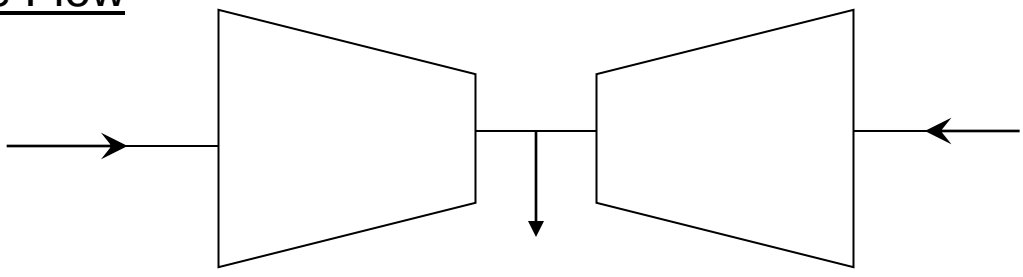
$$R = \frac{Po}{Pi} = \frac{5}{2} = 2.5$$

Types of Flow

Single Flow

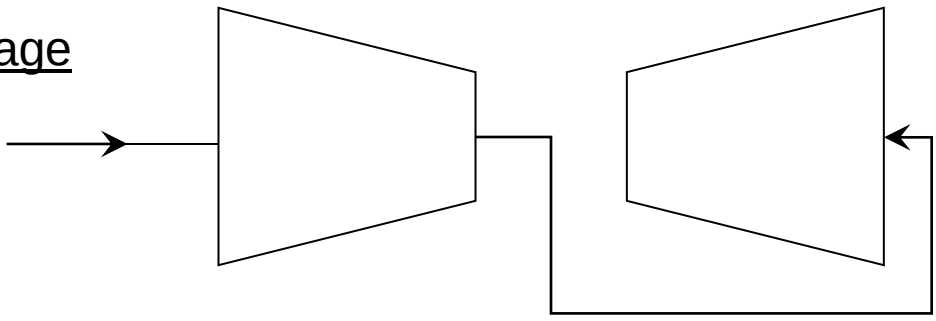


Double Flow



This has a double suction with a common discharge, minimising axial thrust

Multi-Stage



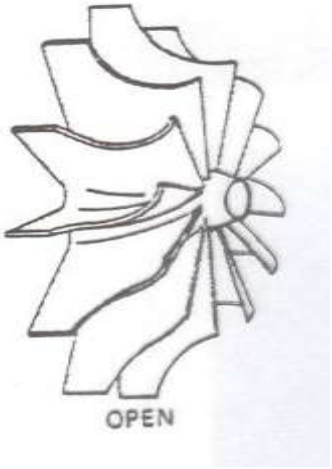
The discharge of one impeller feeds the suction of the next impeller.

Axial thrust can be a problem with this design.

Impellers

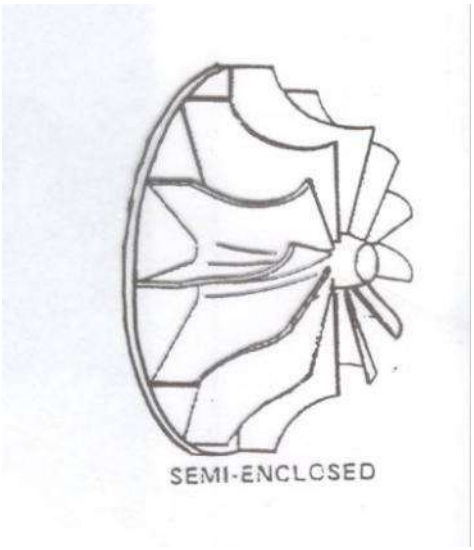
The part of the centrifugal compressor that adds velocity to the gas is the impeller,

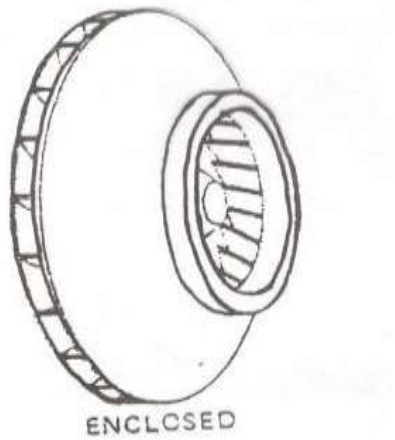
There are three basic impeller designs:



Used for high heads and small to large flow in single stage compressors only.

Used for large flow, usually in single stage compressors, or as the first stage in multi-stage compressors.





Used mainly in multi-stage compressors.