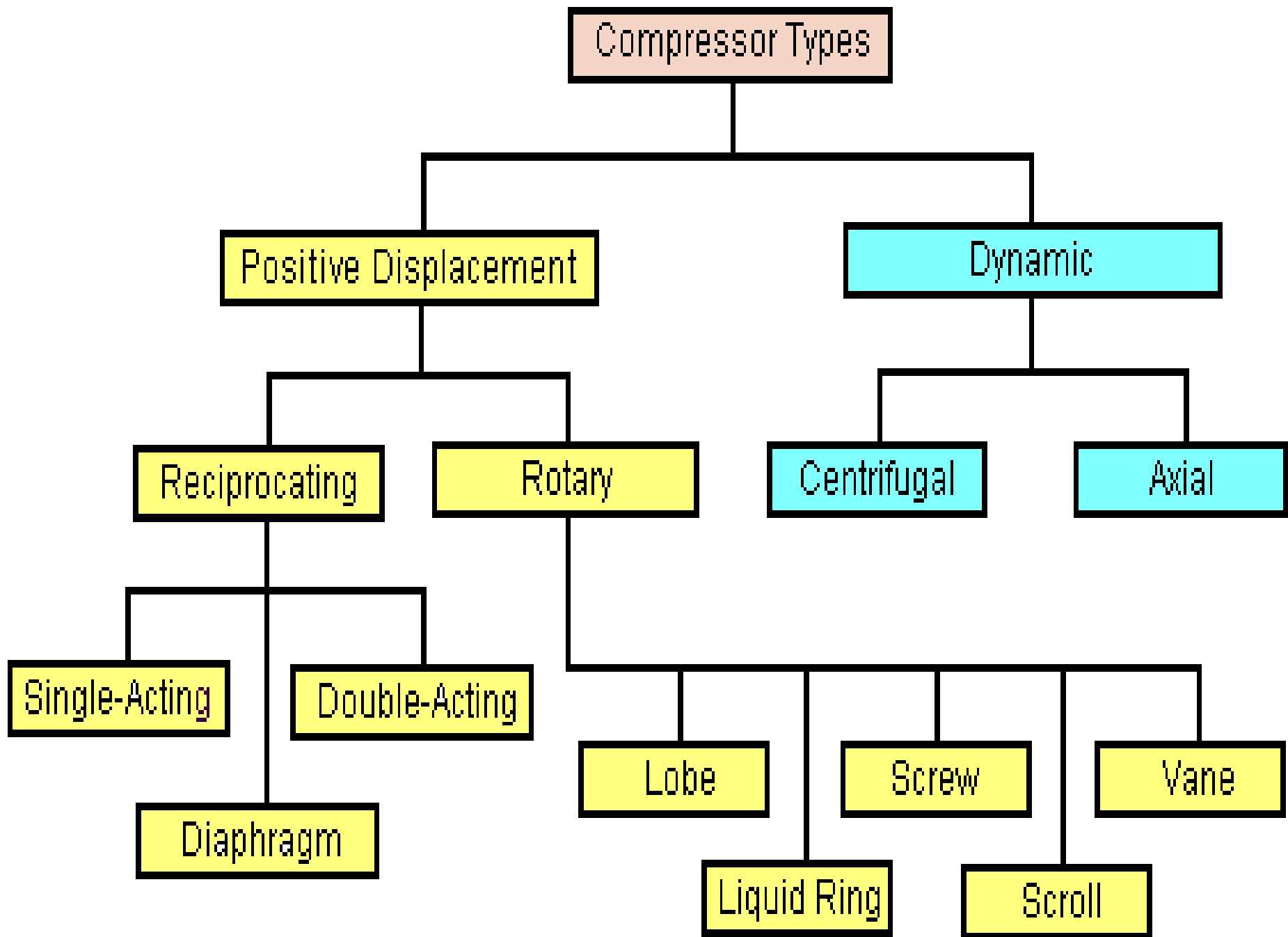


REFRIGERATION AND AIR- CONDITIONING EQUIPMENTS

Type of compressors

- ⊙ Centrifugal compressor
- ⊙ Rotary compressor
- ⊙ Reciprocating compressor
- ⊙ screw compressor
- ⊙ roots blower compressor
- ⊙ sliding vane type compressor
- ⊙ plunger type compressor
- ⊙ ejector type compressor
- ⊙ liquid-ring type compressor
- ⊙ axial type compressor
- ⊙ swash plate type compressor
- ⊙ gear lobe type compressor



CLASSIFICATION OF COMPRESSORS

1. according to the method of compression
 - ⊙ Reciprocating compressor
 - ⊙ Rotary compressor
 - ⊙ Centrifugal compressor
2. According to the number of working strokes
 - ⊙ Single acting compressors
 - ⊙ Double acting compressor
3. According to the number of stage
 - ⊙ Single stage
 - ⊙ Multi-stage

CLASSIFICATION OF COMPRESSORS

4. According to the method of drive employed

- ⦿ Direct drive compressor
- ⦿ Belt drive compressor

5. According to the location of prime mover

- ⦿ semi- hermetic compressor
- ⦿ Hermetic compressor

RECIPROCATING COMPRESSOR

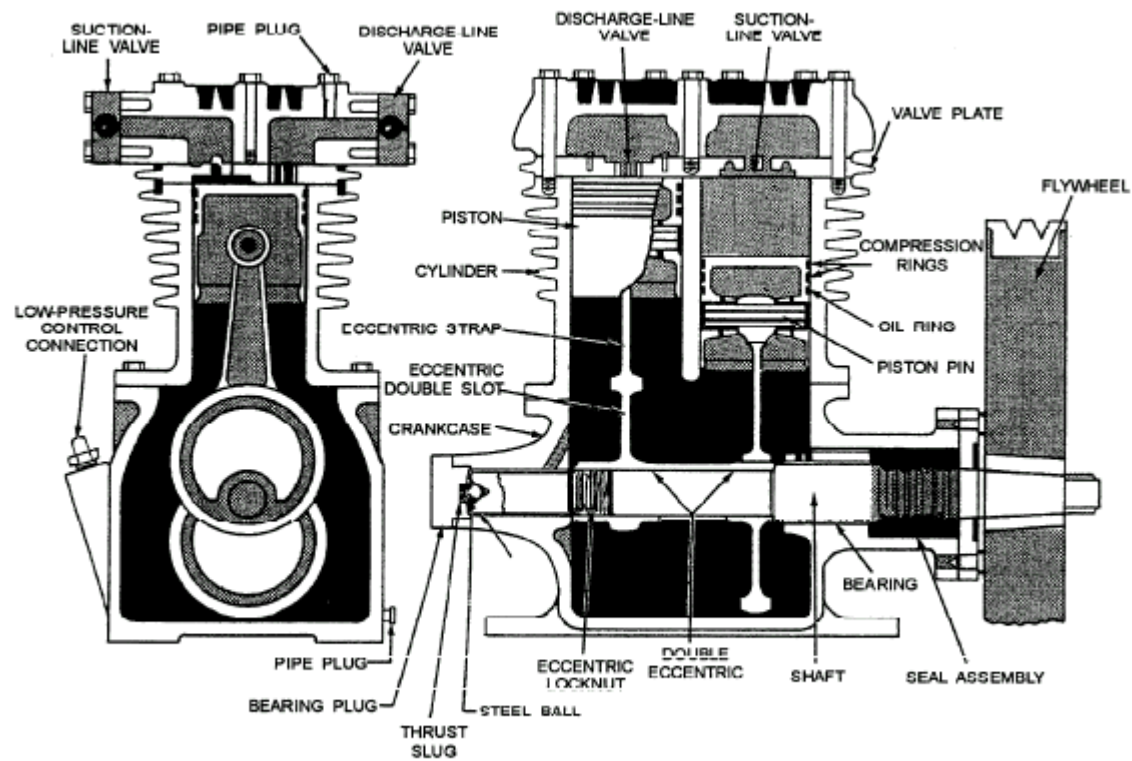
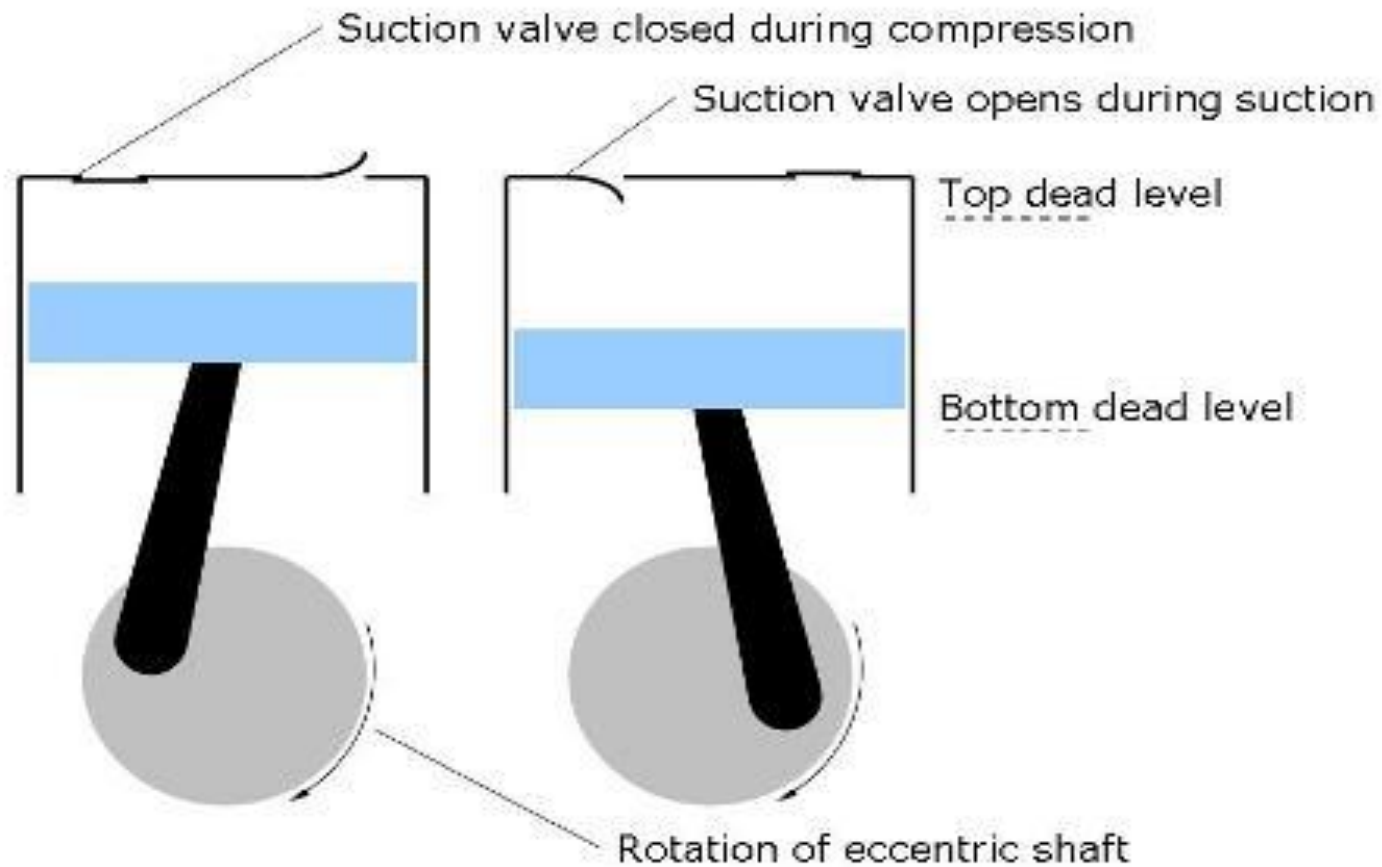


Figure 6-61.—Vertical single-acting reciprocating compressor.

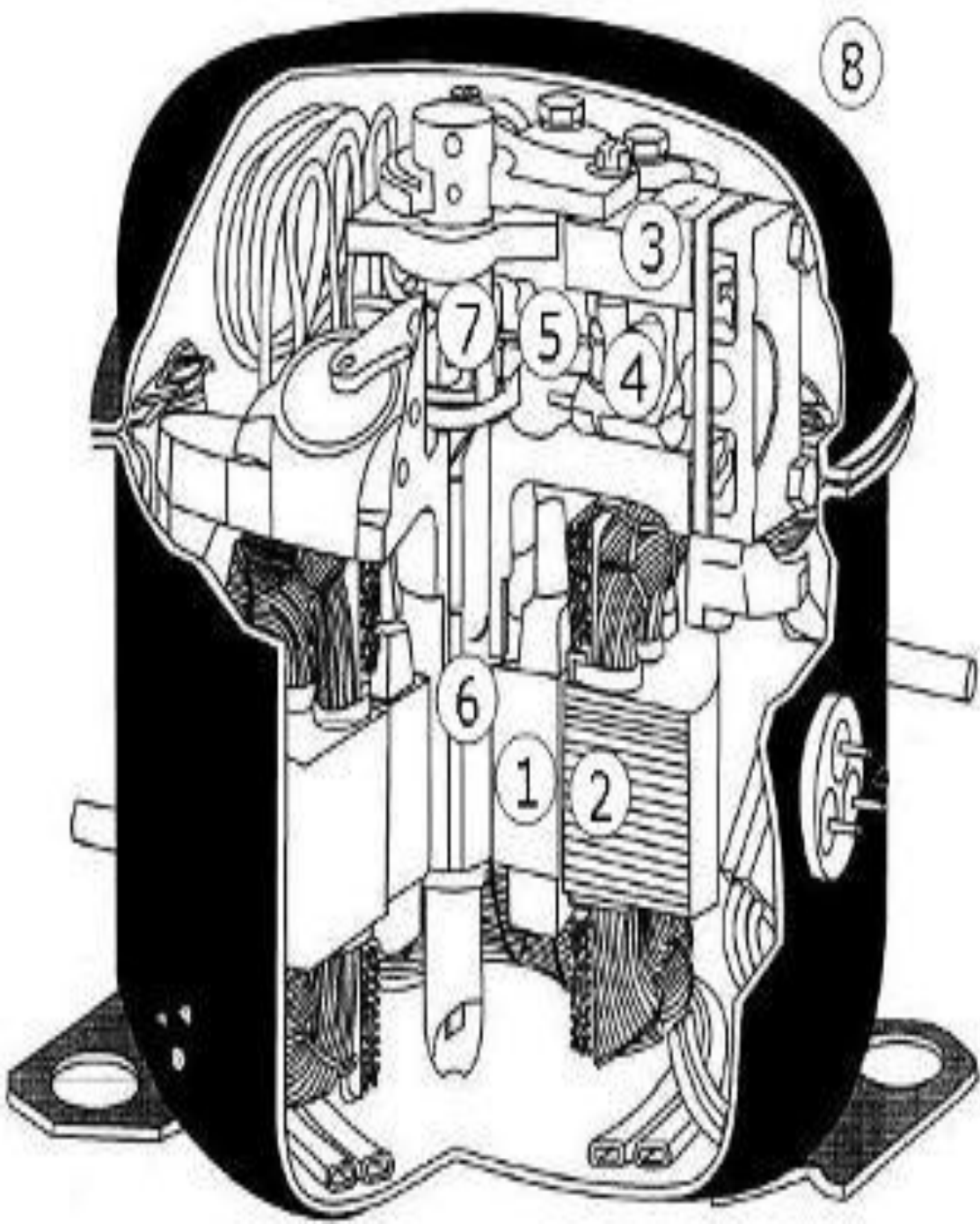
RECIPROCATING TYPE COMPRESSOR



THE PISTON OR RECIPROCATING

COMPRESSOR

- ⊙ piston head – functions as the gas compressing “agent” by continuously reducing the cylinder volume
- ⊙ piston rings – functions as the sealant between the piston head, and the cylinder, to prevent gas leakage from the compression chamber
- ⊙ crank shaft – a shaft that enables the reciprocating motion of the piston
- ⊙ piston rod – the connecting piece between the piston head, and the crankshaft
- ⊙ spring loaded suction and discharge valves – separates low pressure side and high pressure side from the compression chamber. Enables positive displacement of gases, by correct opening and closing of the valves. Suction valve will open as the piston moves away from the valves, and discharge valve will open as the piston moves towards the valves. The valves will otherwise, be in closed position
- ⊙ and, compressor’s cylinder block – functions as the housing for the compressor parts



- ① Motor rotor
- ② Motor stator
- ③ Cylinder
- ④ Piston
- ⑤ Connecting rod
- ⑥ Shaft
- ⑦ Crank
- ⑧ Casing

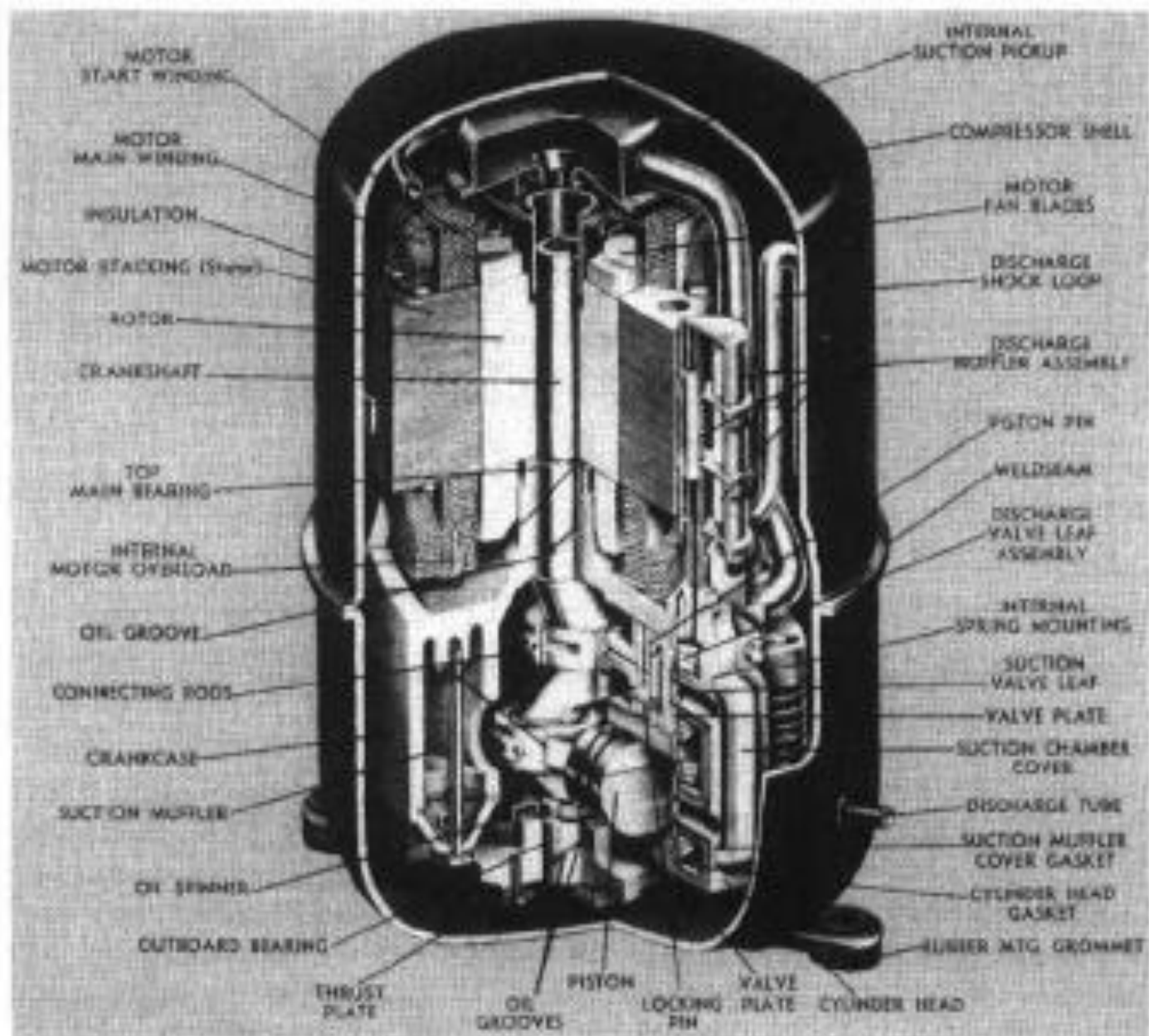
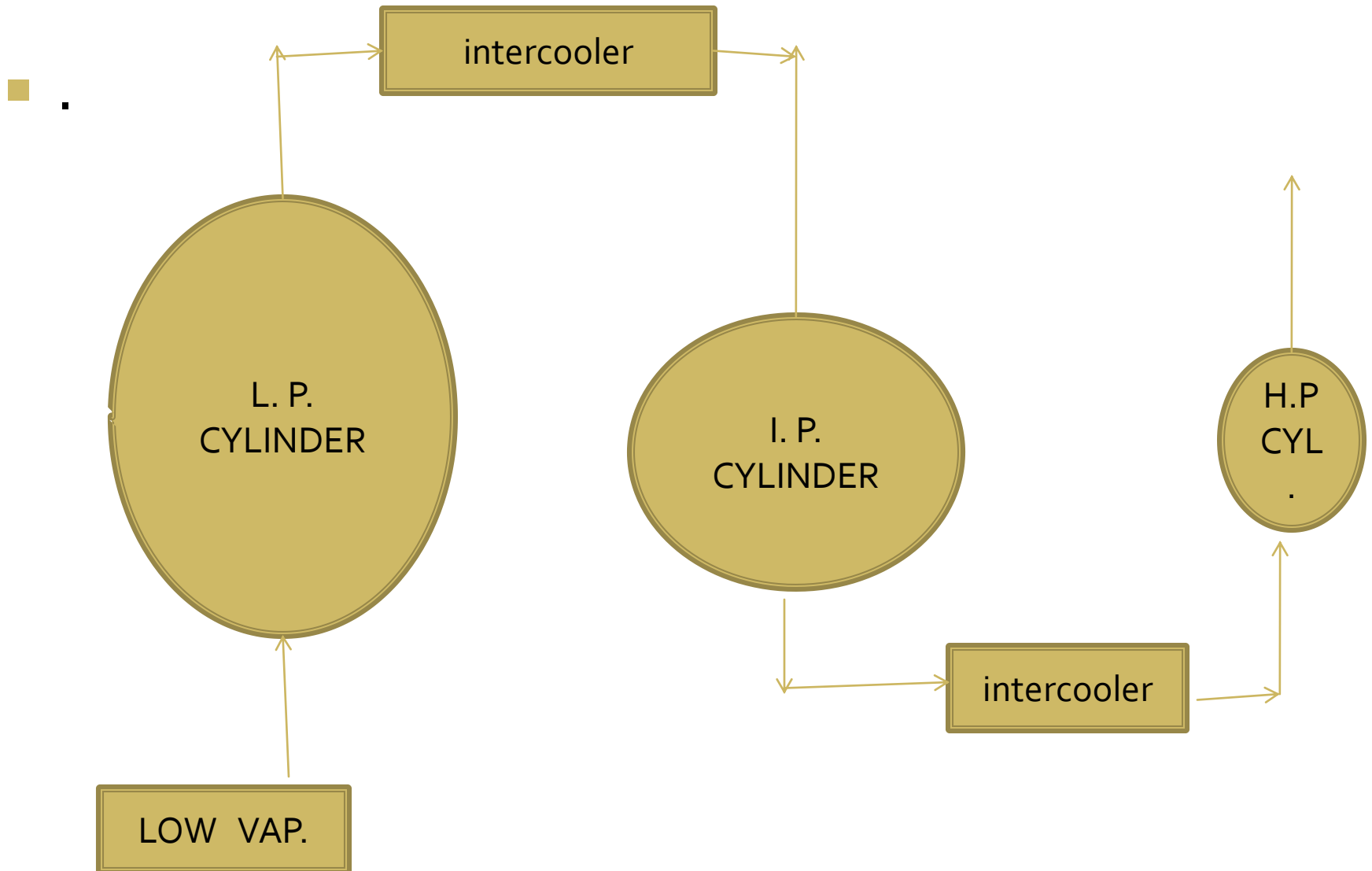


Figure 3.3 A typical hermetic reciprocating compressor (*Courtesy of Tecumseh Products Co.*).

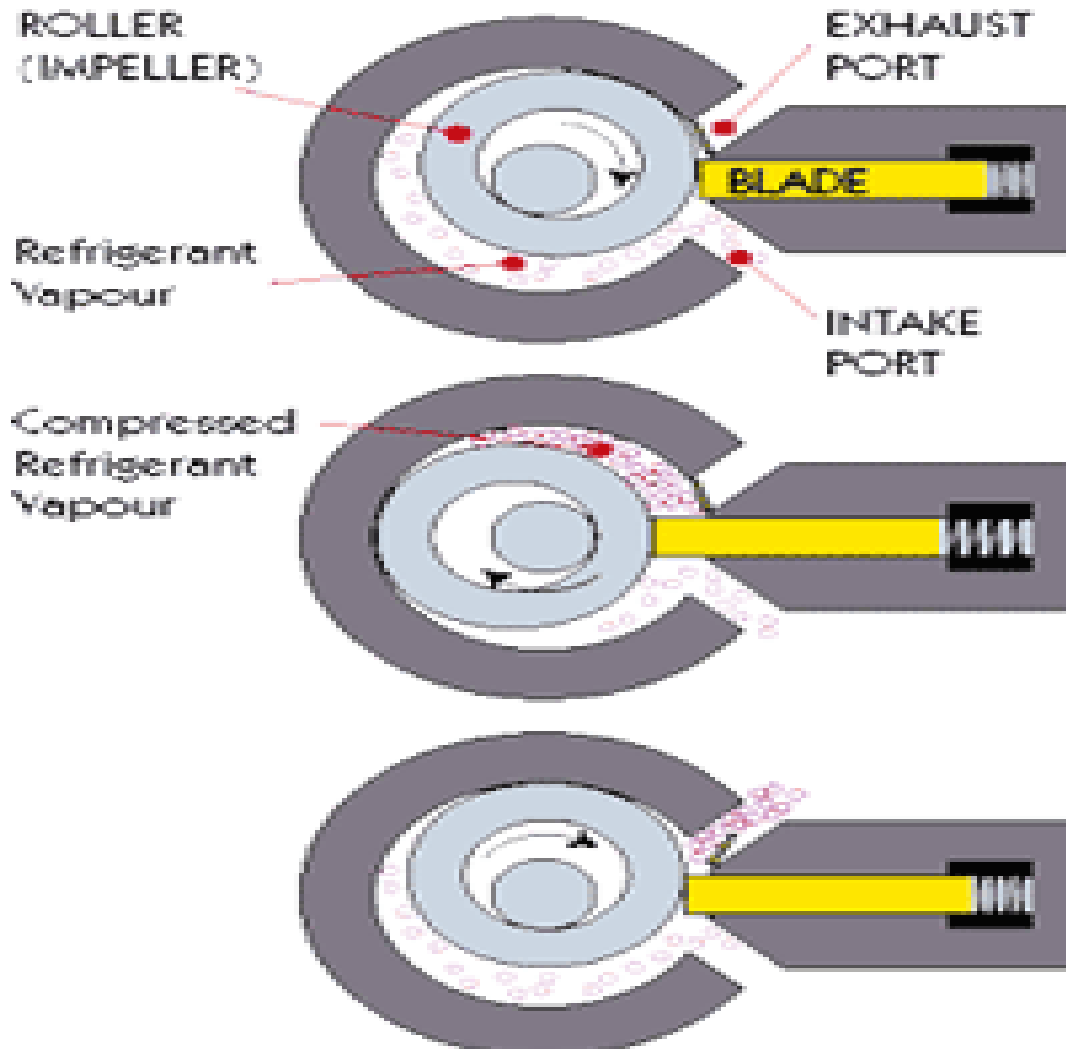
Multistage reciprocating compressors



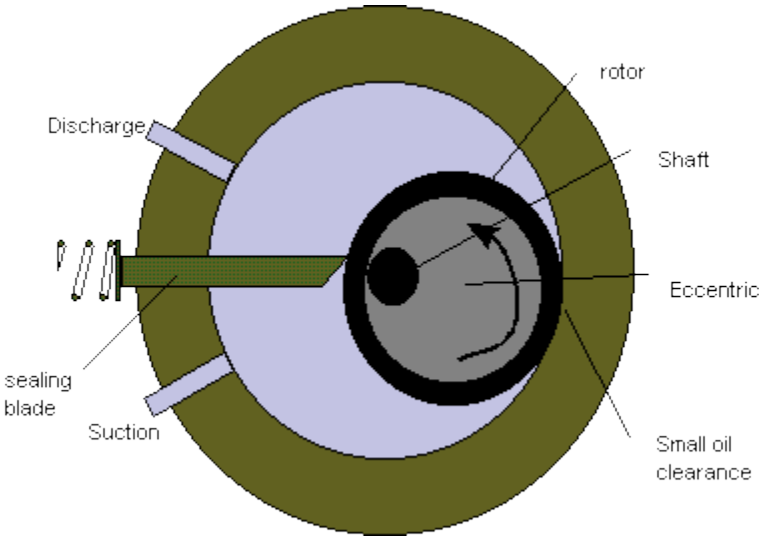
ROTARY COMPRESSOR

- ◉ Roller type rotary compressor (stationary blade type rotary compressor)
- ◉ Vane type rotary compressor (Rotating blade type rotary compressor)
- ◉ This is mainly used for domestic refrigerators (R-21 and R114)

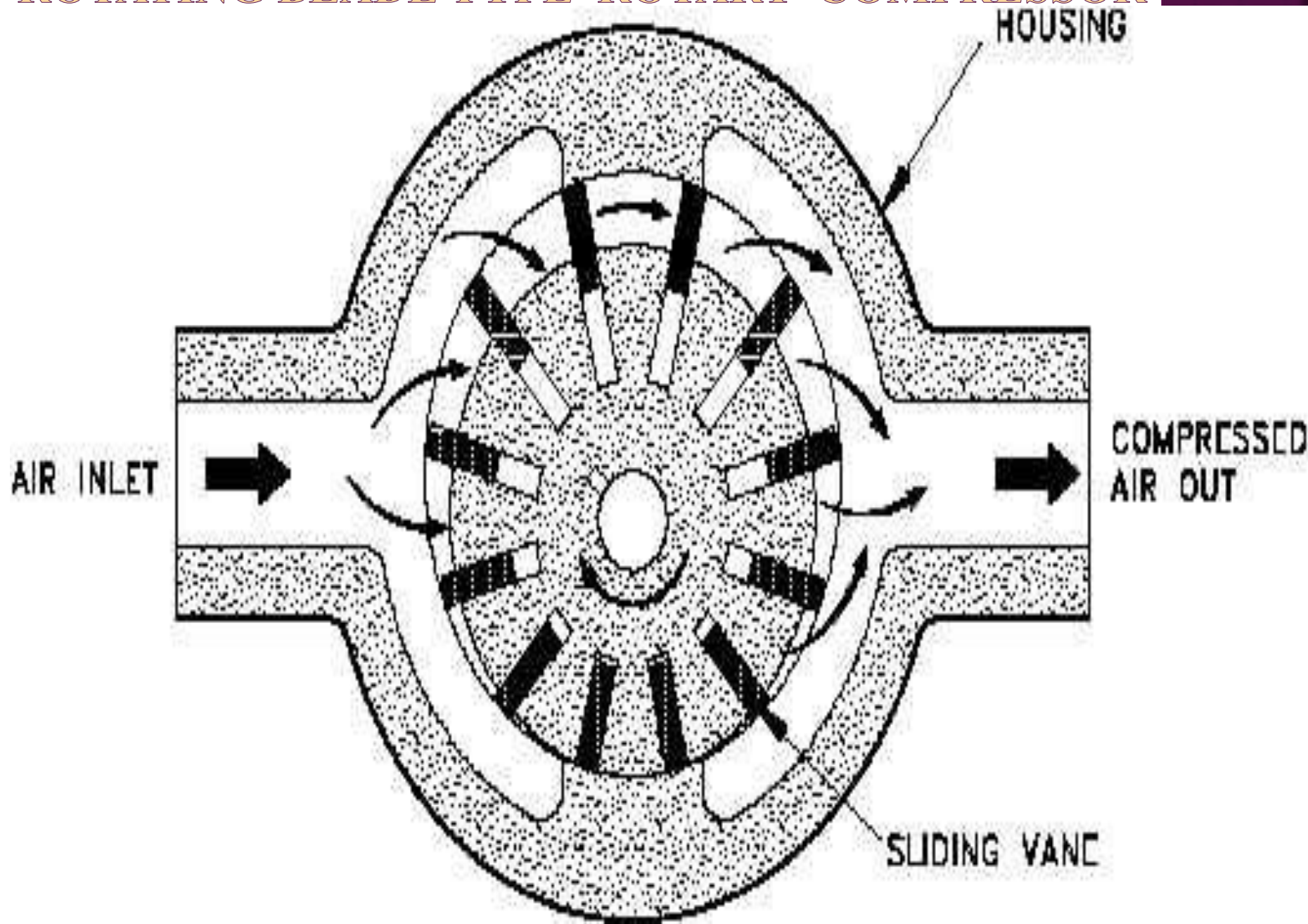
ROLLER TYPE ROTARY COMP.



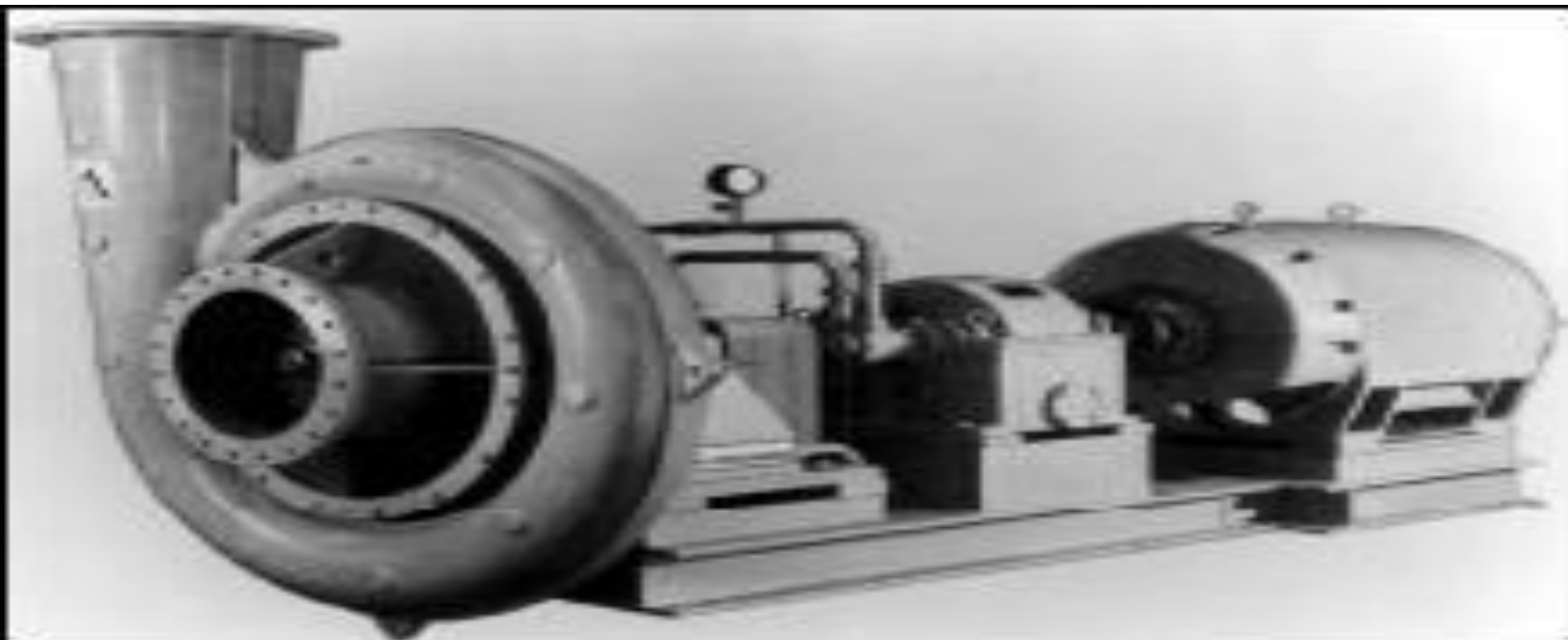
SINGLE STATIONARY BLADE TYPE COMPRESSOR



ROTATING BLADE TYPE ROTARY COMPRESSOR

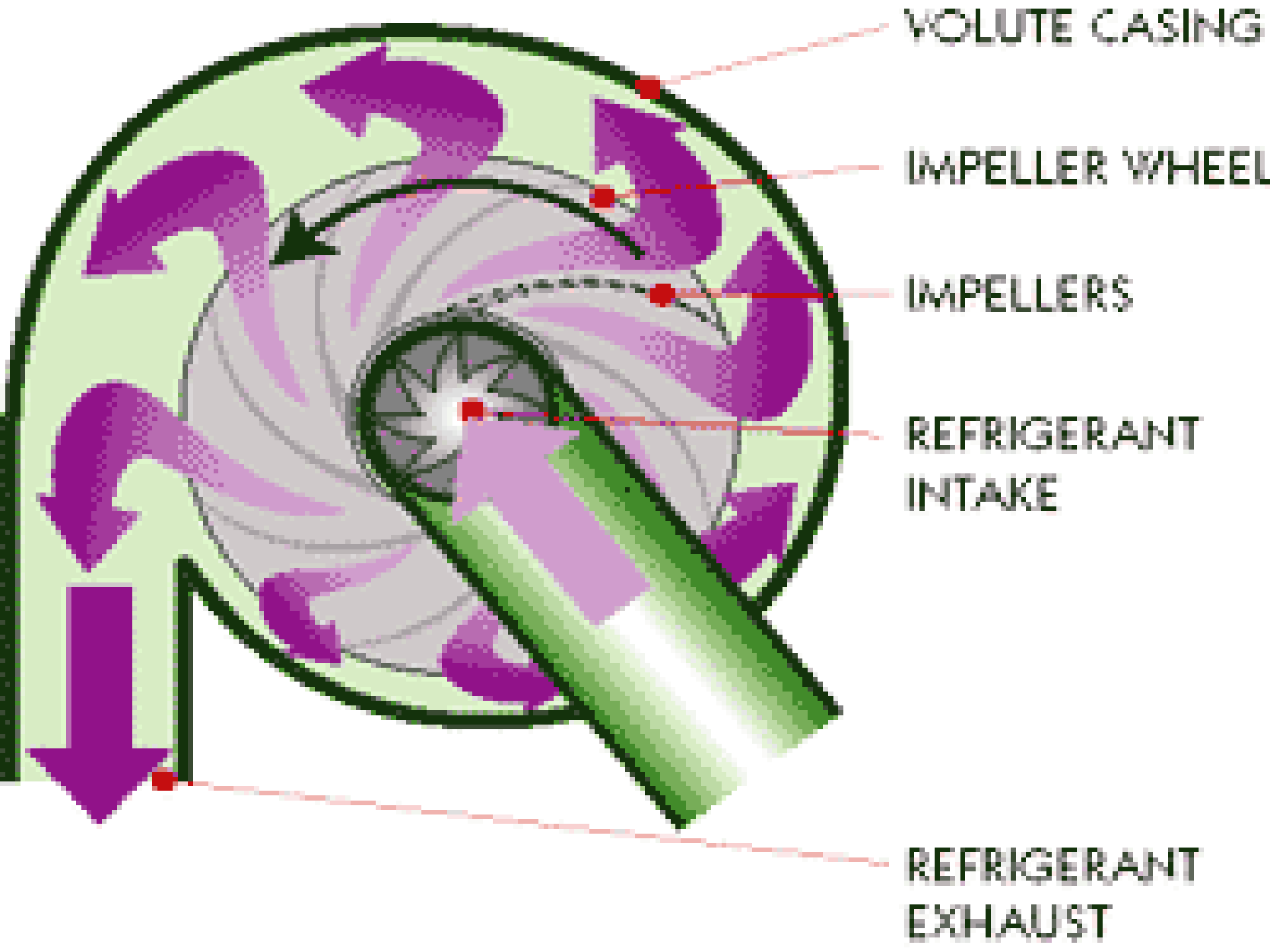


CENTRIFUGAL COMPRESSOR

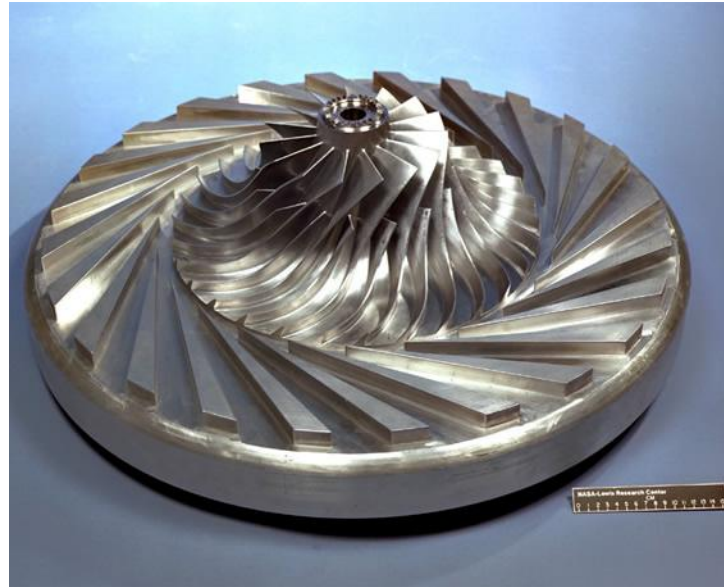


A single stage centrifugal compressor (left) driven by an electric motor (right) using gearbox (center). Process gas enters the compressor through the flanged opening at left center and is discharged through the flange in the upper left corner.

- ⦿ IN THIS COMPRESSOR , centrifugal force change low pressure vapour with high pressure vapour
- ⦿ these compressor are generally used for refrigerants that require large displacement and low condensing pressure such as R-11 and R-113,
- ⦿ R-12 refrigerant is also used for large capacity and low temperature application.



IMPELLER



CONDENSERS

- ⦿ Working of condenser
- ⦿ Factor affecting the condenser capacity
- ⦿ Heat rejection factor
- ⦿ Classification of condenser

FACTOR AFFECTING THE CONDENSER CAPACITY

- Condenser capacity is the ability of condenser to transfer heat from the hot vapor refrigerant to the condensing medium .
- heat transfer capacity of a condenser depends upon the following factors
- Materials-higher ability of a material to transfer heat , and the smaller will be size of condenser
- Amount of contact
- Temperature difference

HEAT REJECTION FACTORS

- Heat rejection factors depends upon the evaporator and condenser .
- The condenser has to rejected heat absorbed at the evaporator (R_n) and also the heat of compression added to the system by the compressor (W)
- Load on the condenser

$$Q_c = R_n + W$$

- . Heat rejection factor for a condenser is defined as the ratio of the heat rejected at the condenser to the refrigerating effect
- $HRF = Q_c / R_n = (R_n + W) / R_n = 1 + W / R_n$
- $= 1 + 1 / C.O.P$
- $C.O.P. = R_n / W$

CLASSIFICATION OF CONDENSER

- Air cooled condenser
 1. natural convection condenser
 2. forced air circulation condenser
 - i. base mounted
 - ii. remote air cool condenser
- Water cooled condenser
 - i. shell and tube condenser
 - ii. Shell and coil condenser
 - iii. double tube condenser

- Evaporator condenser

TYPES OF AIR COOLED CONDENSER

- Natural convection air cooled condenser
- Forced convection air cooled condenser
 1. base mounted air cooled condenser
 2. remote air cooled condenser

AIR COOLED CONDENSER



FORCED CONVECTION AIR COOLED



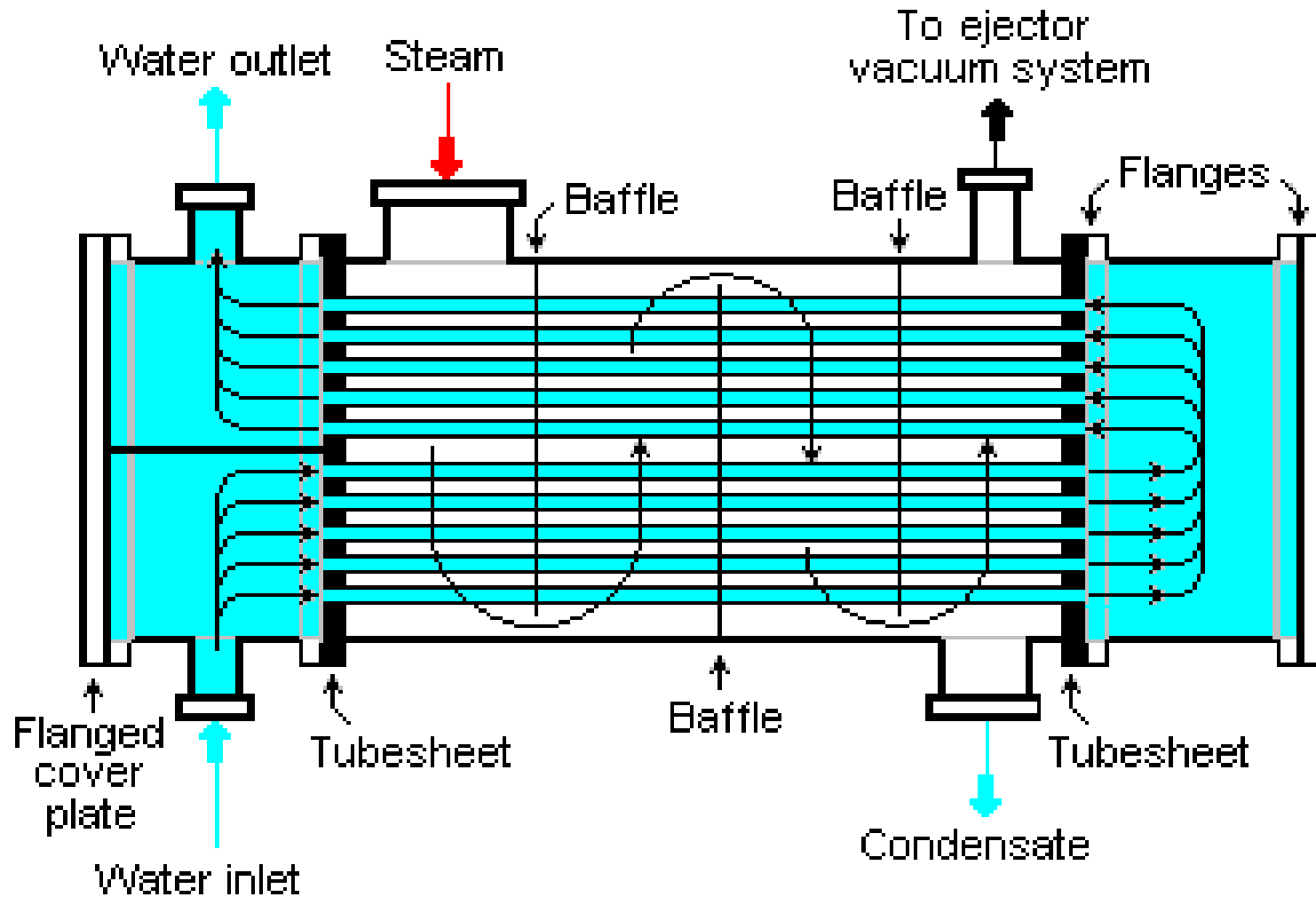
ADVANTAGE OF AIR COOLED CONDENSER

- ⦿ it is easy to clean dust or gummy matter that collects over fins and tubes.
- ⦿ It is easy to quit compact and easy to mount.
- ⦿ There is no problem about the disposal of hot air flowing through fins.
- ⦿ As surface are visible its cleaning can be easily checked without special care.

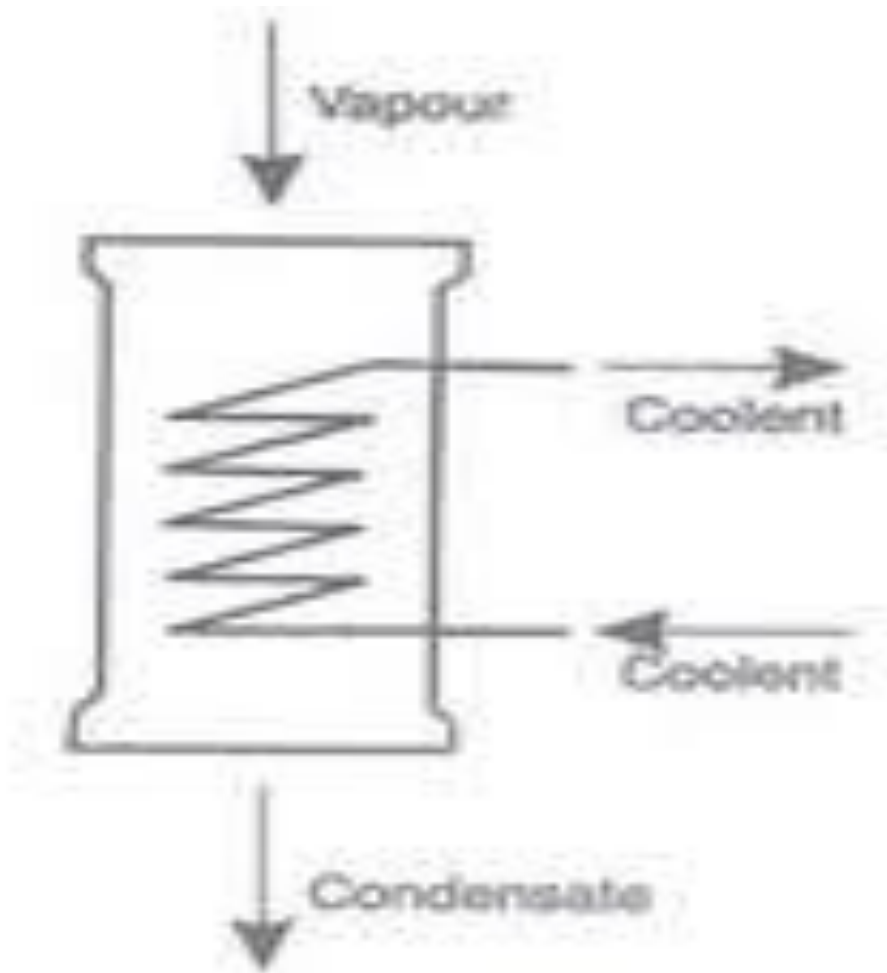
WATER COOLED CONDENSER

- ◉ Shell and tube type
- ◉ Shell and coil condenser
- ◉ Double tube condenser

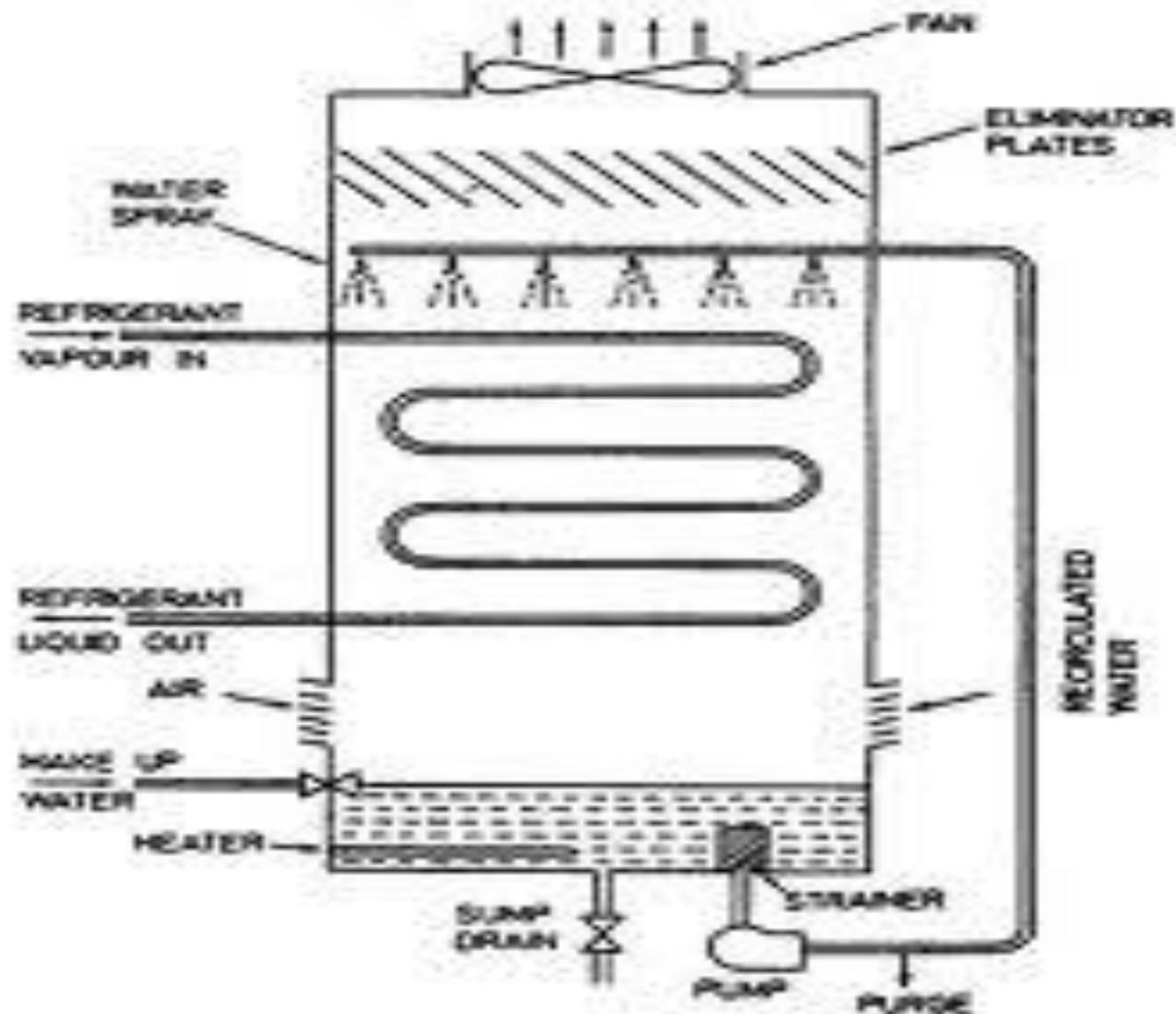
SHELL AND TUBE CONDENSER



SHELL AND COIL CONDENSER



EVAPORATIVE CONDENSER



EVAPORATOR

- ◉ Introduction of evaporator
- ◉ Capacity of an evaporator
- ◉ Classification of evaporator
- ◉ Refrigerant control device

CAPACITY OF EVAPORATOR

- The capacity of an evaporator is defined as the amount of heat absorbed by it over its given period of time .

heat transfer capacity of an evaporator

$$Q = UA(t_2 - t_1) \text{ Watts}$$

U = overall heat transfer coefficient

A = area of evaporator surface

t_2 = temperature of medium to be cooled

t_1 = temperature inside the evaporator

FACTORS AFFECTED THE HEAT TRANSFER CAPACITY OF AN EVAPORATOR

- Following some important factors which affected the heat transfer capacity of an evaporator
- Materials
- Temperature
- Velocity gradient
- Wall thickness of evaporator coil.
- Contact surface area

HEAT TRANSFER IN EVAPORATOR

- Refrigerant side for the transfer of heat from solid surface to the liquid refrigerant
- Metal wall
- Cooling medium side which could be due to air water, brine or any other fluid.

CLASSIFICATION OF EVAPORATOR

- On the basis of evaporating condition
 1. flooded type evaporators
 2. dry or direct expansion
- On the basis of construction of the surface
 1. bar tube evaporator
 2. plate surface evaporator
 3. finned tube evaporator

REFRIGERATION CONTROLS

- ◉ Expansion valve
- ◉ Suction line regulators
- ◉ Hold back valves
- ◉ Solenoid valves
- ◉ Check valve
- ◉ Reversing valve
- ◉ Hot gas defrost