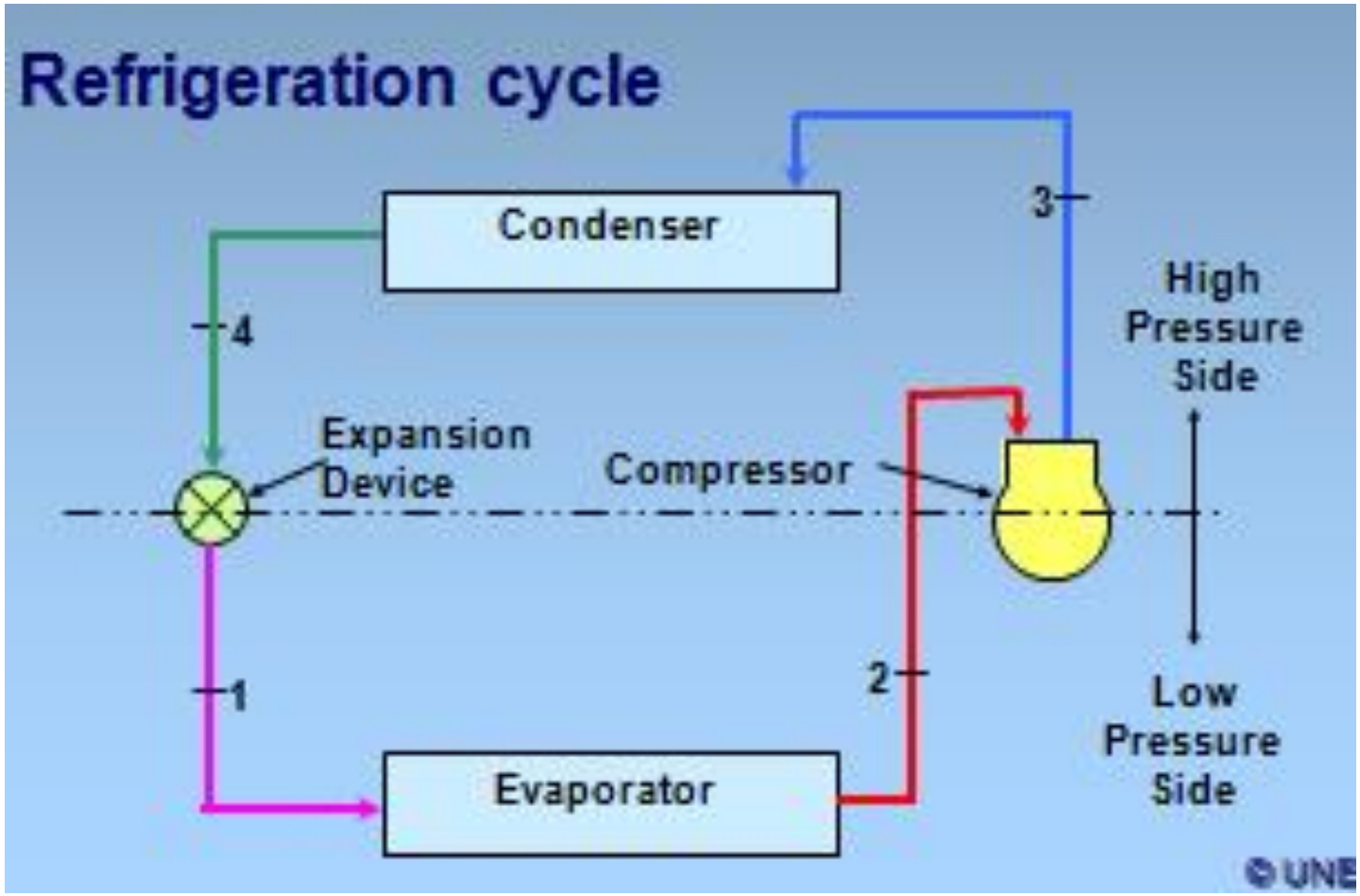
Condensers

Introduction

- The condenser is an important device used in the high pressure side of a refrigeration system.
- Its function is to remove heat of the hot vapour refrigerant discharged from the compressor.
- The hot vapour refrigerant consists of the heat absorbed by the evaporator and the heat of compression added by the mechanical energy of the compressor motor.
- The heat from the hot vapour refrigerant in a condenser is removed first by transferring it to the walls of the condenser tubes and then from the tubes to the condensing or cooling medium.
- The cooling medium may be air or water or a combination of the two.

Working of condenser



Selection of condenser

- Capacity of the refrigerating system
- Type of refrigerant used and
- Type of cooling medium available

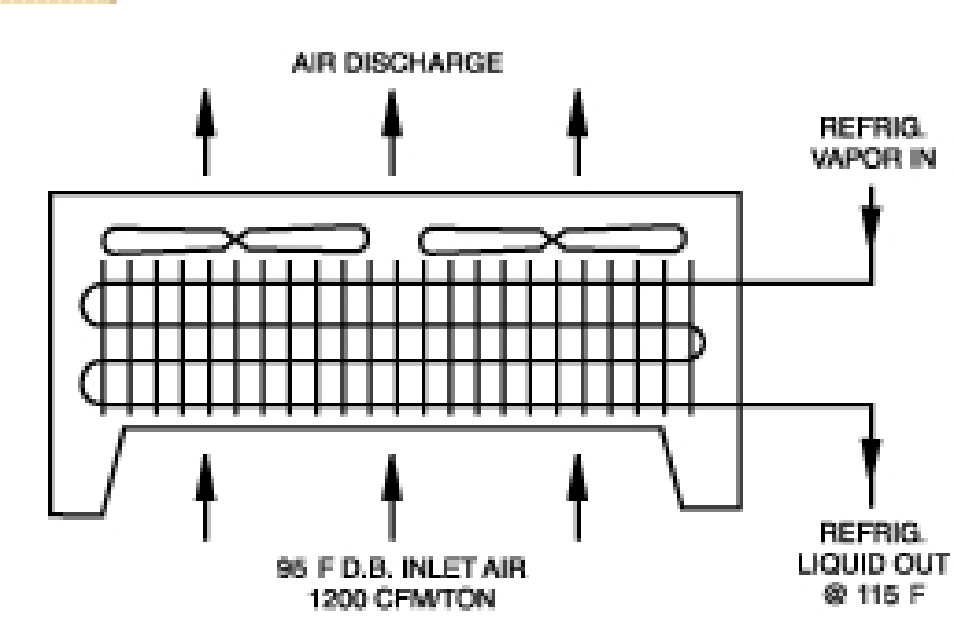
Factors affecting the condenser capacity

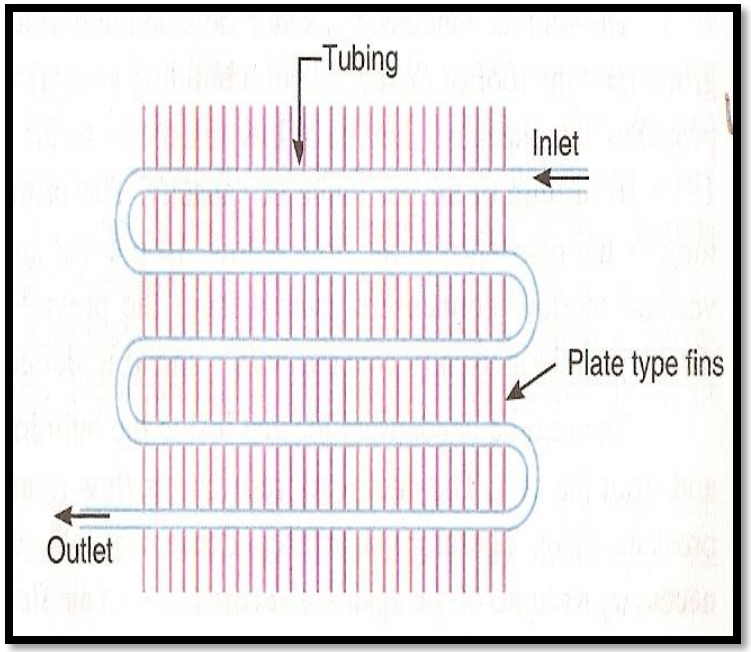
- Type of material
- Amount of contact
- Temperature difference

Classification of condensers

- **Air cooled condensers**
  - Natural condensers
  - Forced condensers
- **Water cooled condensers**
  - Tube-in-tube or double tube condensers
  - Shell and coil condensers
  - Shell and tube condensers
- **Evaporative condensers**

Air cooled condenser

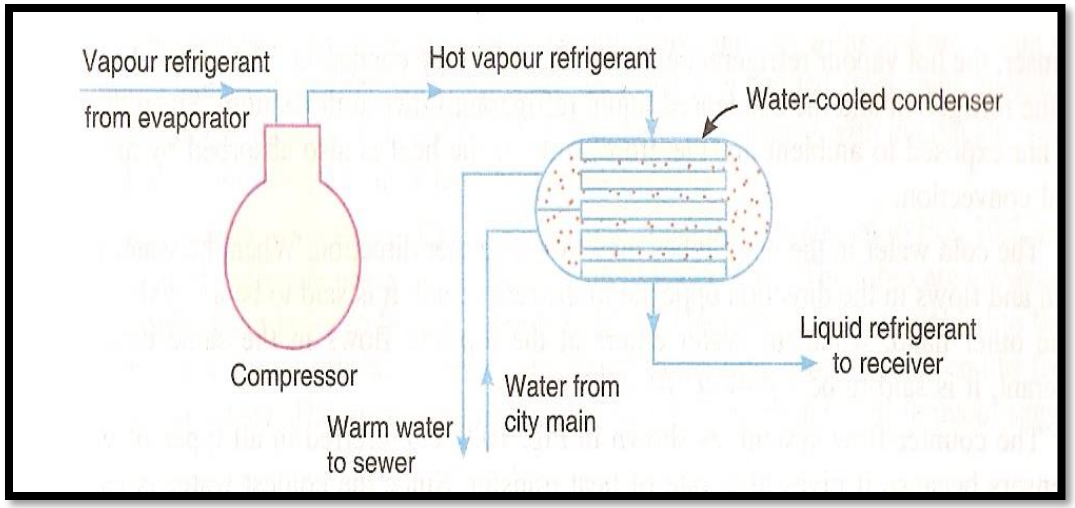


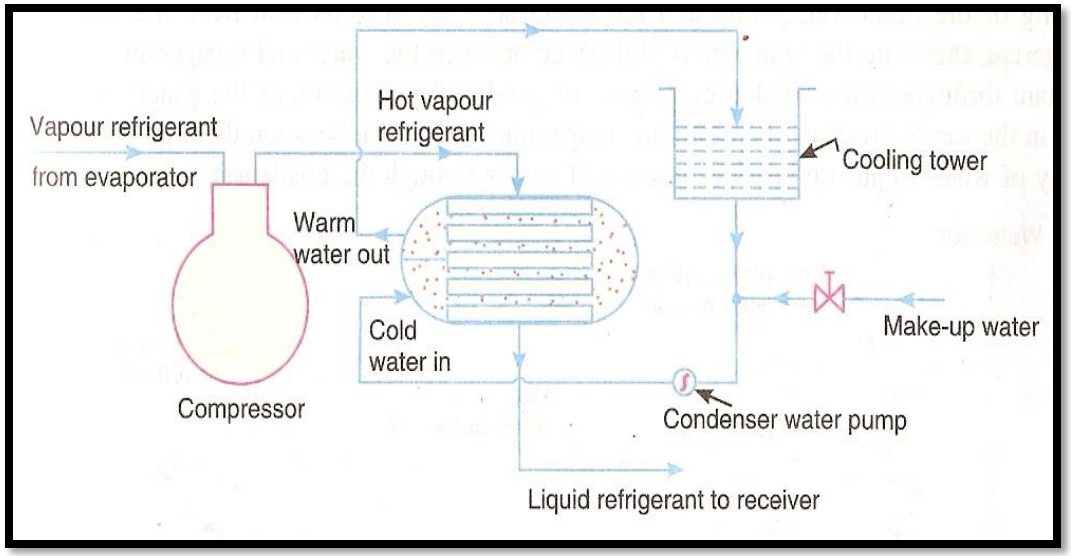


Air cooled condenser

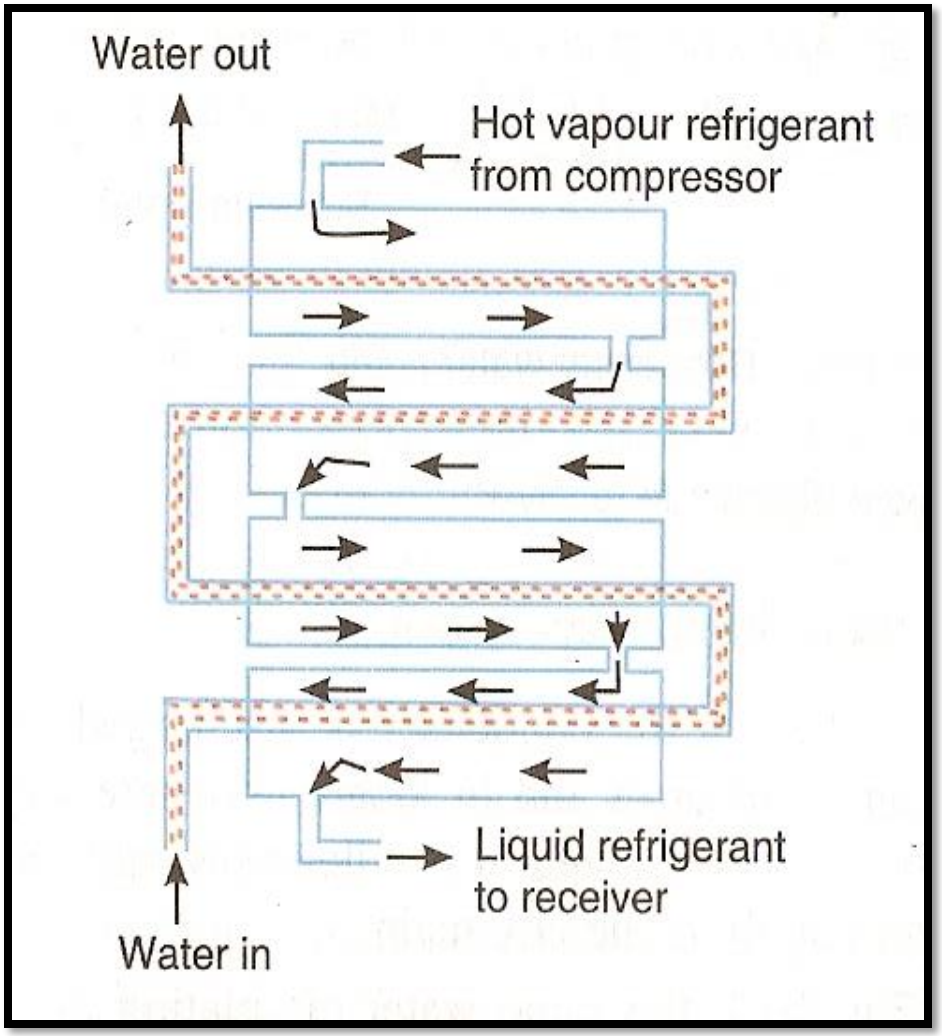
- An air-cooled condenser is one in which the removal of heat is done by air.
- It consists of steel or copper tubing through which the refrigerant flows.
- The size of tube usually ranges from 6 mm to 18 mm outside diameter, depending upon the size of condenser.
- Generally copper tubes are used because of its excellent heat transfer ability.
- The condensers with steel tubes are used in ammonia refrigerating systems.
- The tubes are usually provided with plate type fins to increase the surface area for heat transfer.
- The fins are usually made from aluminium because of its light weight. The fin spacing is quite wide to reduce dust clogging.

Water cooled condenser with waste water system and recirculating water system

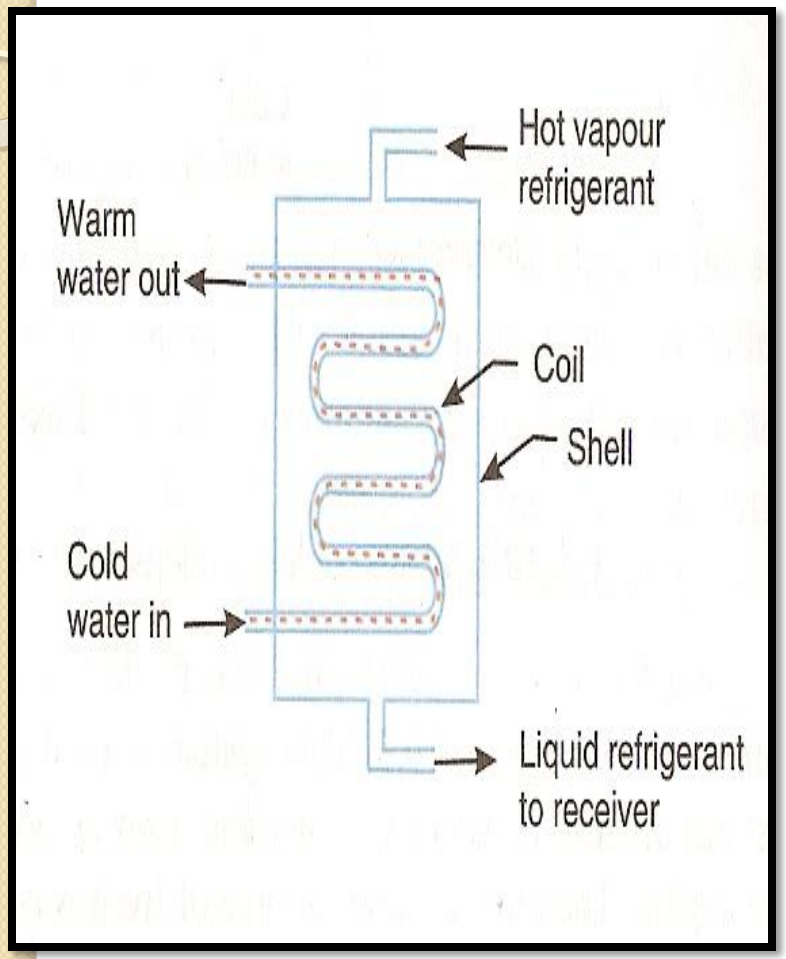


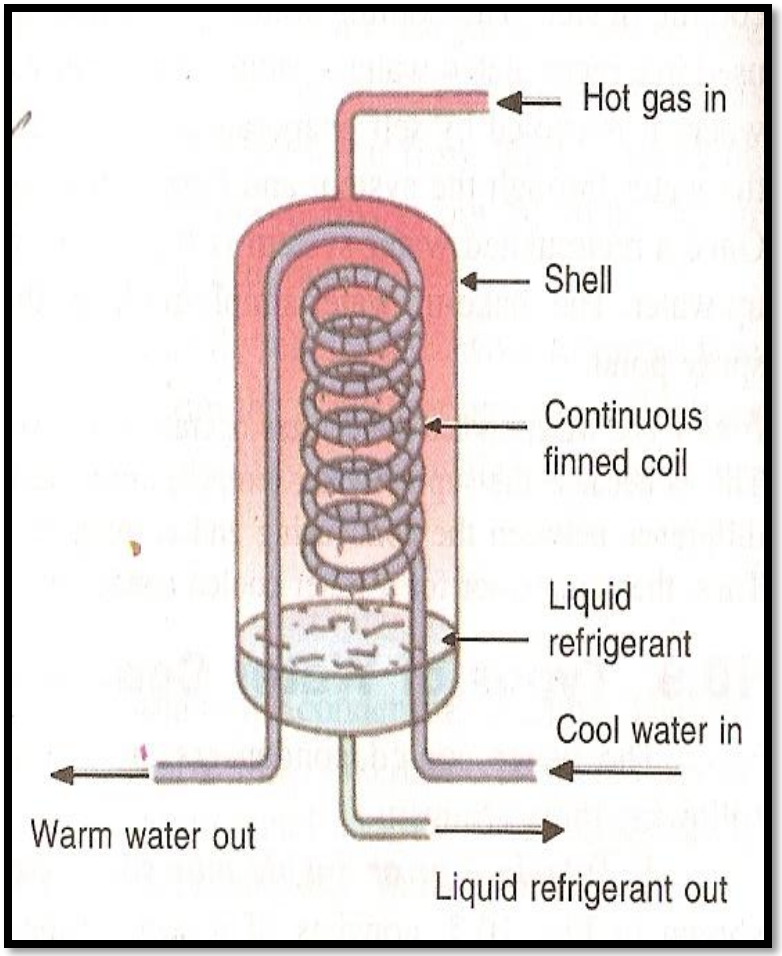


Tube in tube condenser

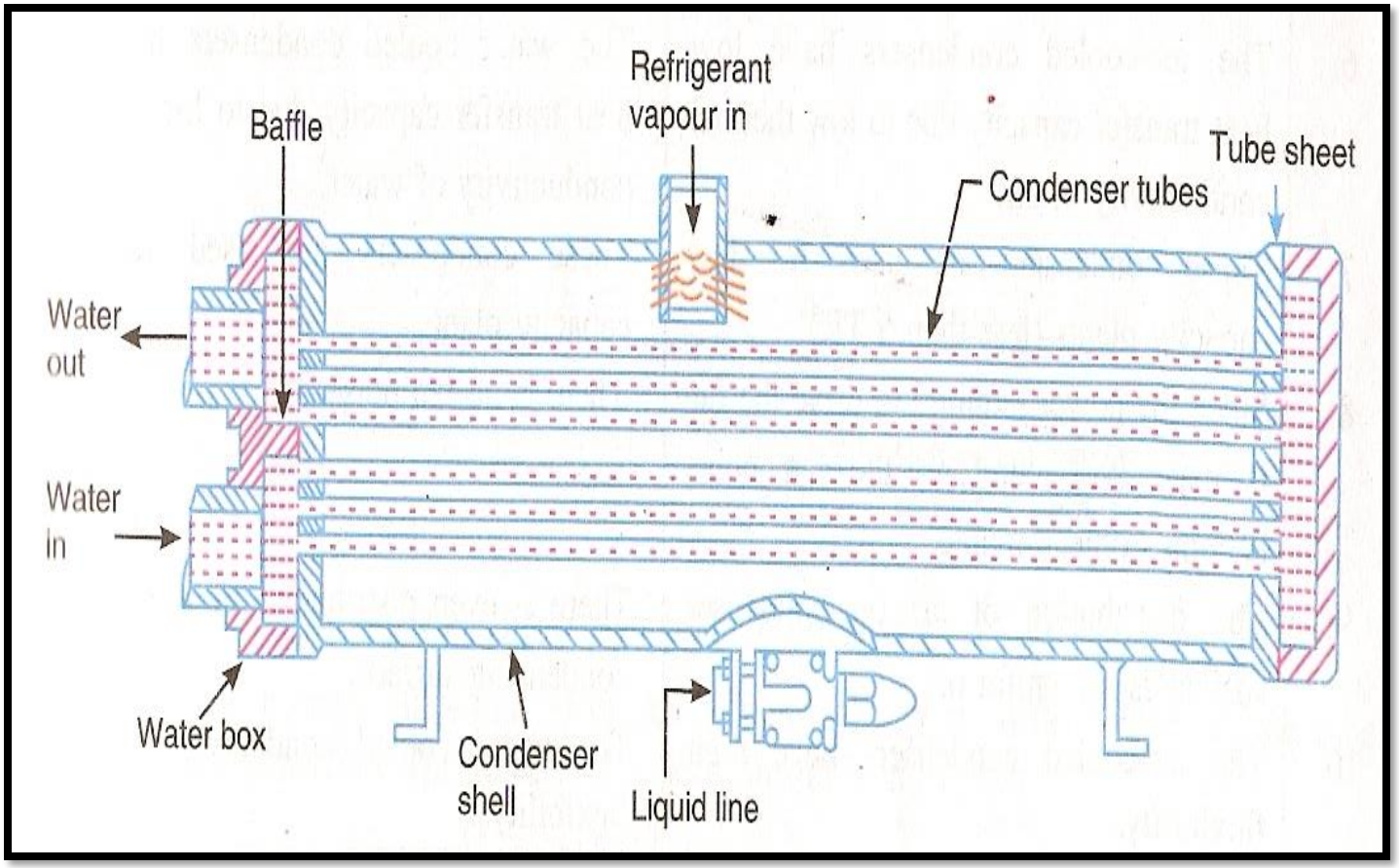


Shell and coil condensers





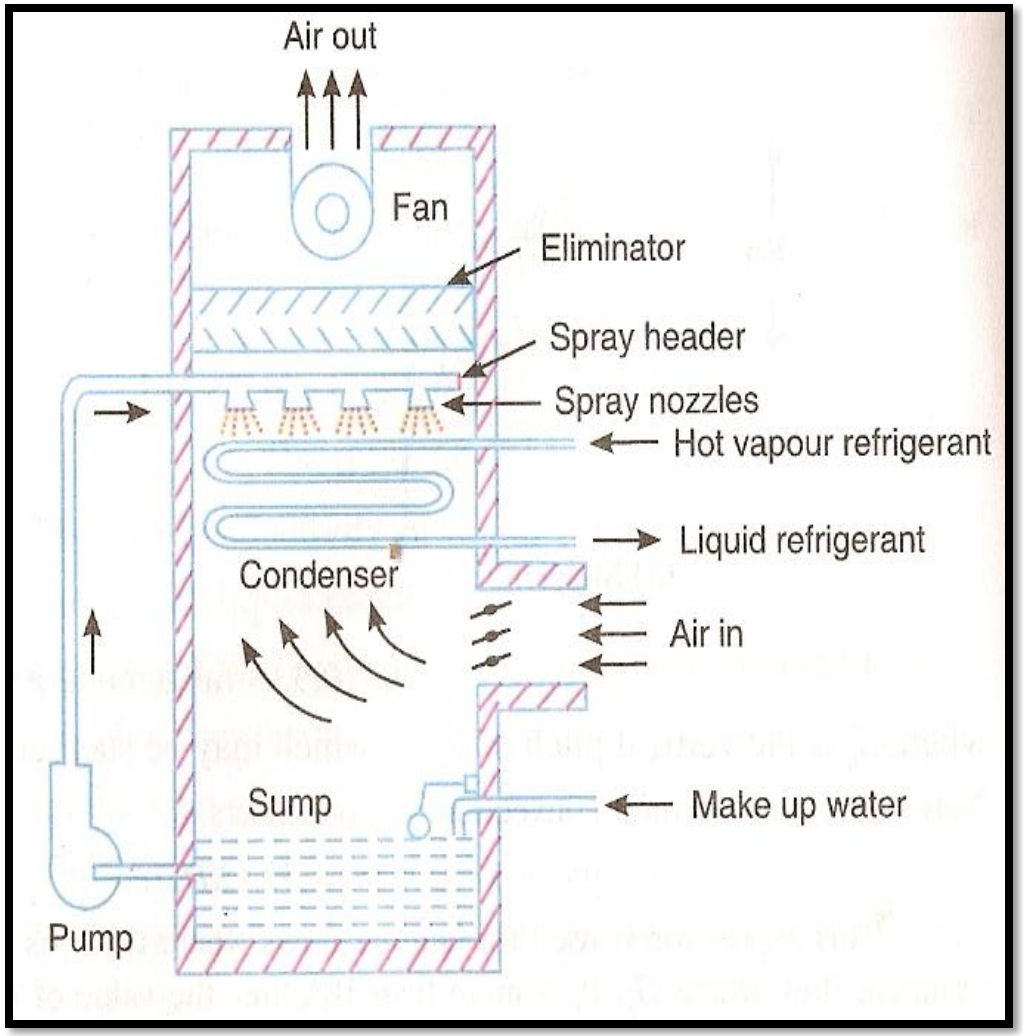
Shell and tube condensers



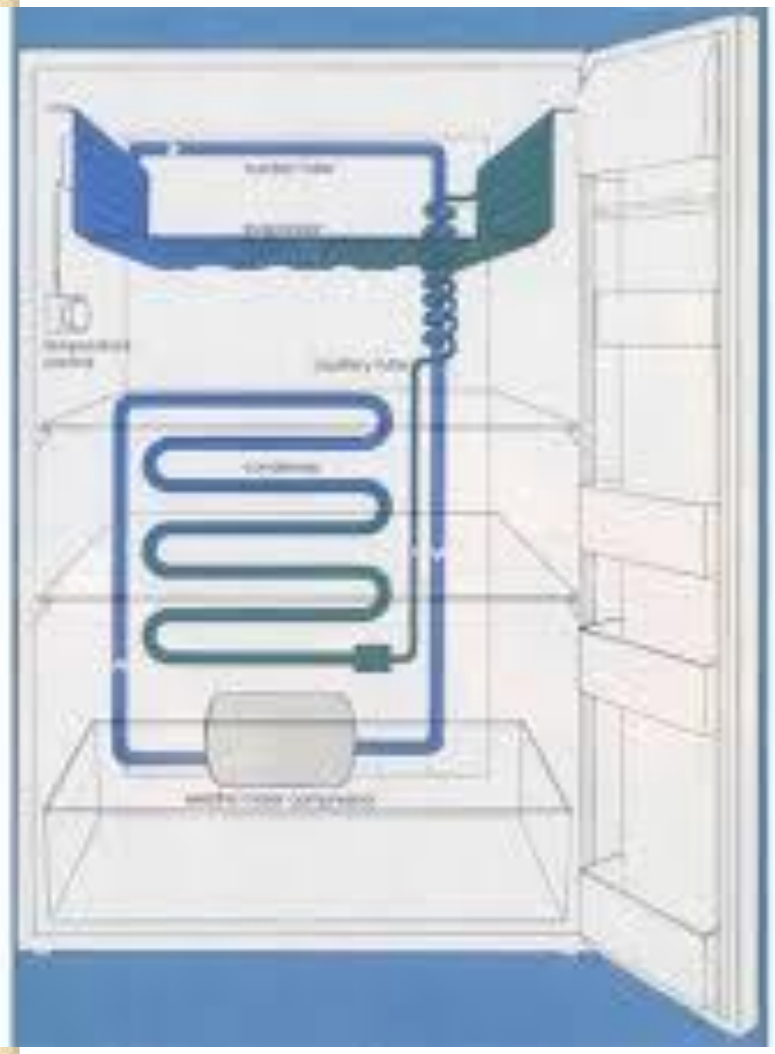
Comparison of Air-Cooled and Water Cooled Condensers

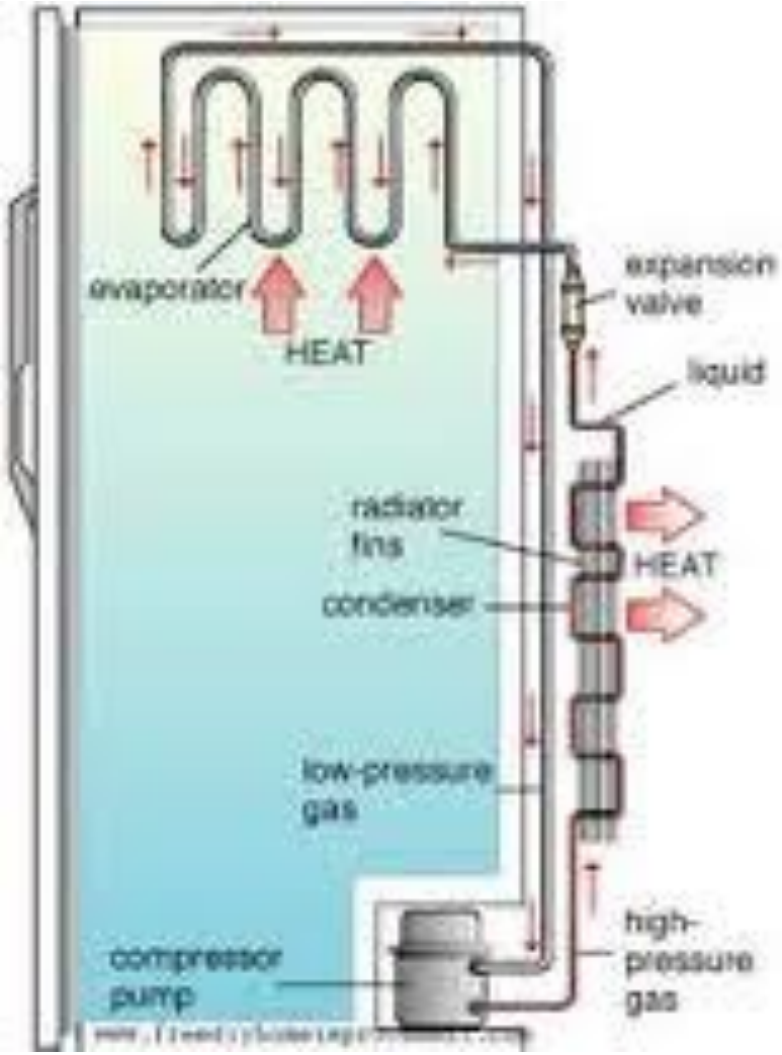
Sl. No.	Air- cooled condenser	Water cooled condenser
1.	Since the construction of air cooled condenser is very simple, therefore the initial cost is less. The maintenance cost is also low.	Since the construction of water cooled condenser is complicated, therefore the initial cost is high. The maintenance cost is also high.
2.	There is no handling problem with air cooled condensers.	The water cooled condensers are difficult to handle
3.	The air cooled condensers do not require piping arrangement for carrying the air	The pipes are required to take water to and from the condenser.
4.	There is no problem in disposing of used air.	There is a problem of disposing the used water unless a recirculation system is provided.
5.	Since there is no corrosion, therefore fouling effect is low.	Since corrosion occurs inside the tubes carrying the water, therefore fouling effects are high.
6.	The air-cooled condensers have low heat transfer capacity due to low thermal conductivity of air.	The water cooled condensers have high heat transfer capacity due to high thermal conductivity of water.
7.	These condensers are used for low capacity plants (less than 5 TR).	These condensers are used for large capacity plants.
8.	Since the power required to drive the fan is excessive, therefore, the fan noise becomes objectionable.	There is no fan noise.
9.	The distribution of air on condenser surface is not uniform.	There is even distribution of water on the condensing surface.
10.	The air-cooled condensers have high flexibility.	The water cooled condensers have low flexibility.

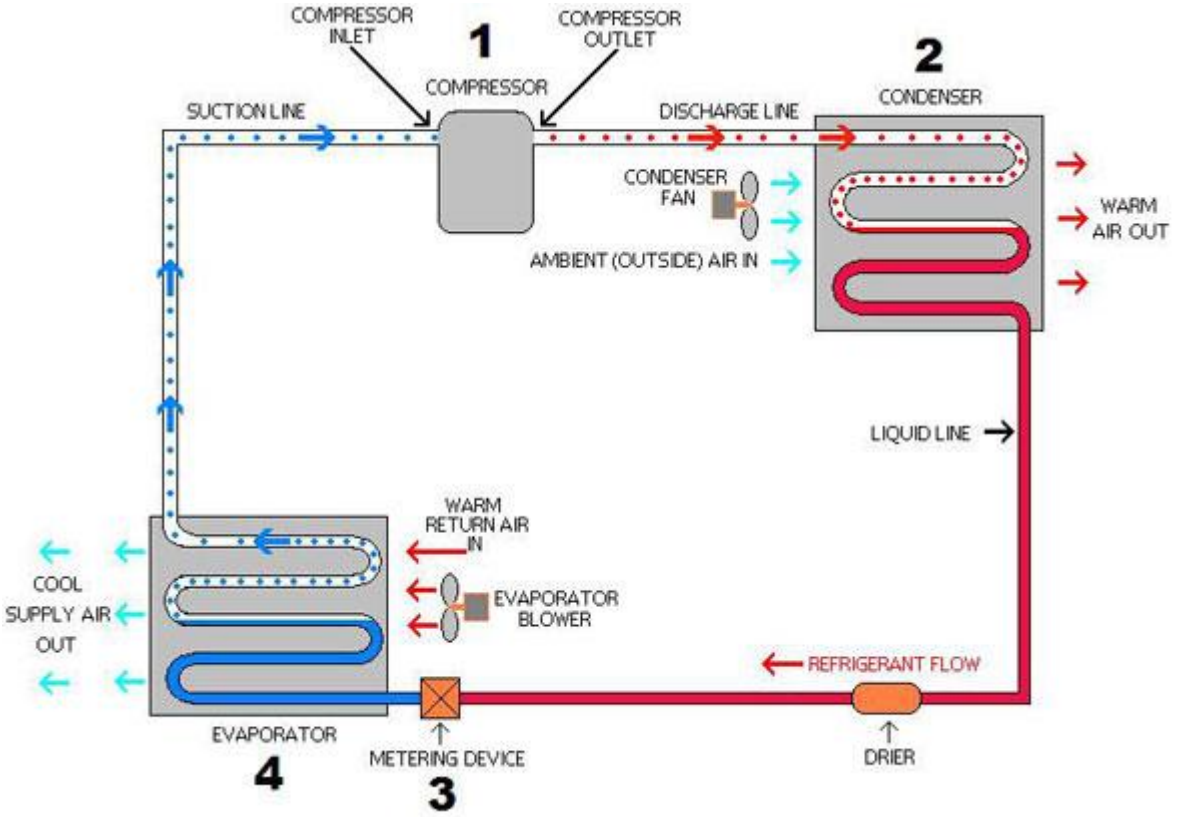
Evaporative condensers



Domestic refrigerator






COMPRESSOR INLET
1
COMPRESSOR OUTLET
COMPRESSOR
2
CONDENSER
SUCTION LINE
DISCHARGE LINE
CONDENSER FAN
WARM AIR OUT
AMBIENT (OUTSIDE) AIR IN
LIQUID LINE
WARM RETURN AIR IN
COOL SUPPLY AIR OUT
EVAPORATOR BLOWER
REFRIGERANT FLOW
EVAPORATOR
4
METERING DEVICE
3
DRIER