

UNIT: IV

REFRIGERATION AND AIR CONDITIONING

Definition of Refrigeration :

Refrigeration is defined as the process of maintaining the temperature of a given space or substance below the surrounding or atmospheric temperature. To provide refrigeration, heat must be extracted continuously from the given space whose temperature is already below the atmospheric temperature.

Terminology of Refrigeration and Air conditioning :

1. Refrigeration :

Refrigeration is the process of reducing and maintaining the temperature of a body below the general temperature or it is the process of removing heat from a substance under controlled conditions.

2. Refrigerator :

Refrigerator is an equipment used to reduce and maintain the temperature below the atmospheric temperature. It is obtained by removing the heat from the space continuously.

3. Refrigerant :

Refrigerant is a fluid which absorbs the heat from the body and rejects the heat at high temperature.

(EX): Ammonia, carbon-di-oxide, Freon-12, methyl chloride, chloro fluoro carbons [CFC]

4. Capacity of Refrigerator (or) Refrigerating Effect

It is the amount of heat extracted from the cold body per unit mass per minute. (or) The rate at which refrigeration produced is called the capacity of refrigerator. It is expressed in tonne of refrigeration.

Tonne of Refrigeration :

A tonne of Refrigeration is defined as the amount of refrigeration effect produced [amount of heat extracted] by uniform melting of one tonne [1000 kg] of ice at 0°C to water at 0°C in 24 hours.

1 Tonne of Refrigeration = 210 kJ/min (or) 3.5 kJ/sec

5. COP [Co-efficient of performance] :

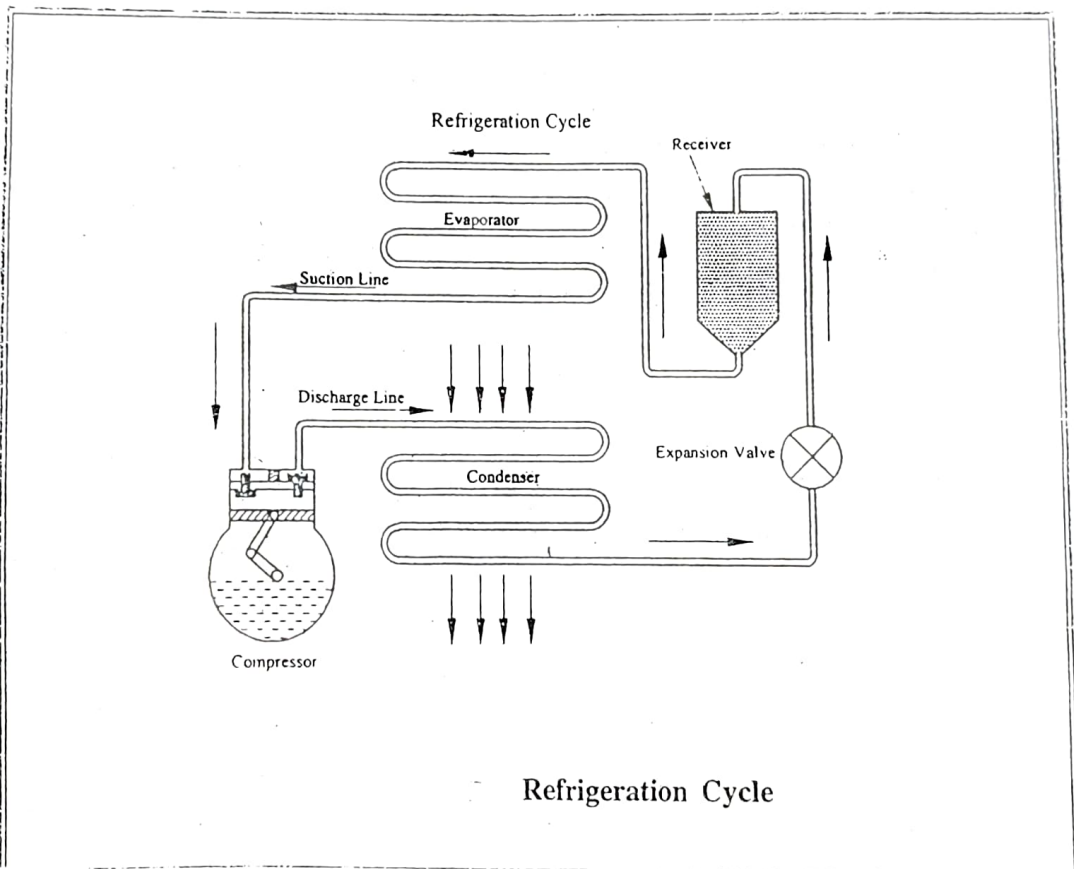
Co-efficient of performance [COP] is the ratio of heat extracted and the work input.

$$\therefore \text{COP} = \frac{\text{Heat Extracted}}{\text{Work done}}$$

6. Refrigeration cycle :

The cycles at which heat is absorbed at a low temperature and heat is rejected at high temperature are called refrigeration cycles.

Four processes in a refrigeration cycle are, compression, condensation, expansion and evaporation.



Refrigerants :

Refrigerant is a fluid which absorbs the heat from the body and rejects the heat at high temperature.

classification of refrigerants :

Refrigerants

Primary Refrigerants.

- (i) R-12 [Freon]
- (ii) R-22
- (iii) Ammonia [R-717]
- (iv) Carbon dioxide [R-744]

Primary Refrigerants :

- (i) R-12 [Freon] :

Secondary

Refrigerants

- (i) calcium chloride
- (ii) sodium chloride [NaCl]
- (iii) Glycols.

R-12 is a very popular refrigerant. It is nothing but dichloro difluoro methane [CCl_2F_2]. The refrigerant is a colourless, odourless liquid with a boiling point of -29°C .

uses :

used in refrigerators, freezers, water coolers, room air conditioners, rotary compressors etc.

(ii) R-22 :

It is a man made refrigerant which is stable, non-toxic and non-corrosive. The chemical name is monochloro difluoro methane $[CHClF_2]$ and its boiling point is $-41^\circ C$.

Use :

used in household refrigerators, air conditioning, centrifugal compressors.

(iii) Ammonia $[R-717]$:

Ammonia $[NH_3]$ is one of the oldest and most widely used of all the refrigerants. It is a colourless gas with a boiling point of $-33.3^\circ C$.

Use :

used in absorption systems, reciprocating compressors.

(iv) carbon dioxide $[R-744]$

carbon dioxide $[CO_2]$ is a non-toxic, non-flammable refrigerant with a boiling point of $-73.6^\circ C$.

Use :

used in ships and for industrial applications.

secondary Refrigerants :

(i) calcium chloride [CaCl_2]

It is used where temperatures below -18°C are required.

use :

used in process cooling, product freezing, ice creams

(ii) sodium chloride [NaCl]:

It is nothing but common salt. It is corrosive in nature for metallic containers and limited use only.

use :

For chilling and freezing of meat, fish etc.

(iii) Glycols :

Glycols are water soluble compounds used for refrigeration. They are non-corrosive even in the presence of water and therefore used as antifreeze elements.

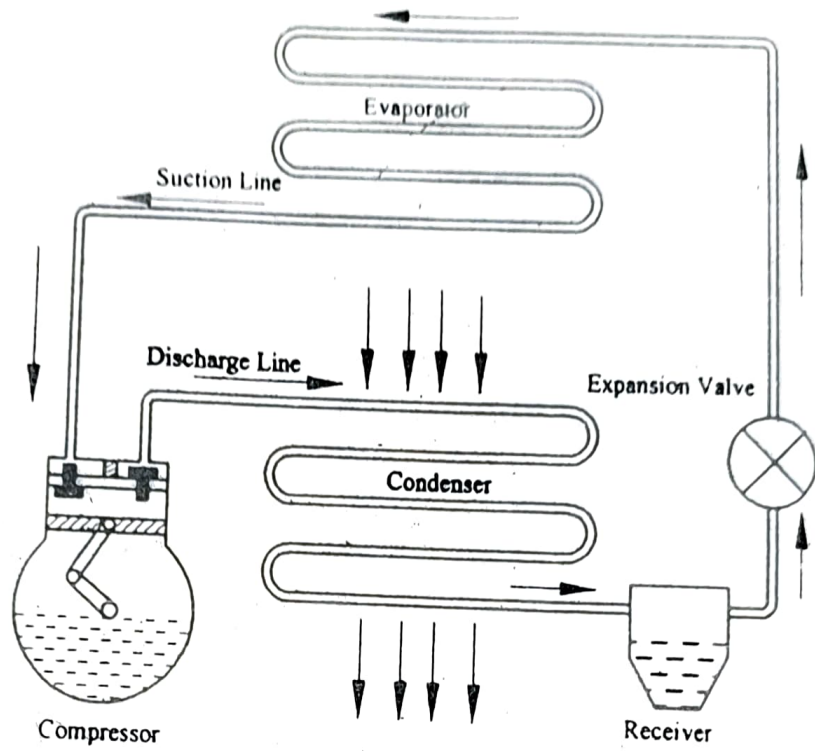
(EX) : Ethylene glycol, propylene glycol.

use :

Used in breweries, food processing, dairies.

Vapour Compression Refrigeration System : [VCR]

I: layout diagram of Vapour Compression Refrigeration System



Vapour Compression System

II: Description :

Main parts of a vapour compression refrigerator are,

1. Compressor
2. Condenser
3. Receiver
4. Expansion Valve.
5. Evaporator .
6. Suction line
7. Discharge line