

Heat load calculation

Expected Learning Outcome

- Meaning of cooling load, refrigerating effect, coefficient of performance, unit of refrigeration
- Calculation of heat removed from the substance
- Calculation of power required by the plant
- Mass of ice produced per day.

9.1.Cooling load

The total heat required to be removed from the space in order to bring it at the desired temperature by the refrigeration and Air-conditioning equipment is known as cooling load.

Refrigerating effect

Refrigerating effect means that cooling action should be done at the rate of heat absorption from any place or thing in a cycle.

A refrigeration machine can be called efficient only if it can create maximum refrigerating effect for the work allotted to it

9.2.Unit of Refrigeration

The practical unit of refrigeration is expressed in terms of tonne of refrigeration.

A tonne of refrigeration effect produced by the uniform melting of one tonne (1000 kg) of ice from and at 0°C in 24 hours. Since the latent heat of ice is 335 KJ/kg.

Therefore

$$\begin{aligned} 1\text{TR} &= 1000 \times 335 \text{ JH ub 24 hours} \\ &= \frac{1000 \times 335}{24 \times 60} = 232.6 \text{ KJ/min} \end{aligned}$$

In actual practice, one tonne of refrigeration is taken as equivalent to 210KJ/min or 3.5KW (i.e. 3.5 KJ/S).

9.3.Coefficient of performance of a Refrigerator

The coefficient of performance (C.O.P) is the ratio of heat extracted in the refrigerator to the work done on the refrigerant. It is also known as theoretical coefficient of performance.

$$\text{C.O.P.} = \frac{Q}{W} \text{ - Heat extracted}$$

Q = Amount of heat extracted in the refrigerator (or the amount of refrigerator produced or the capacity of a refrigerator)

W = Amount of work done

9.4.Calculating heat quantity

The quantity of heat which must be added to or removed from any given material in order to bring about a specified change in its temperature can be computed by using the following equation.

$$H \text{ or } Q = mc\Delta T$$

Q = Quantity of heat either absorbed or rejected by the material

m = the weight of the material

c = The specific heat of the material

T_1 = Initial temp. T_2 = final temp.

ΔT = Difference between the temperature T_1 and T_2