

UNIT-VIII

AIR CONDITIONING

RANGE

- By the end of this unit you will be able to understand:
- TYPES OF AIR CONDITIONING SYSTEMS
- COMPONENTS & SELECTION FACTORS FOR AIR CONDITIONING
- CONDITIONS FOR COMFORT
- HEAT LOAD FACTORS
- SELECTION OF AIR CONDITIONER
- COMPUTATION

TERMS FOR AIR CONDITIONING

- Following are the various terms used to cool air:
 1. AIR CONDITIONING: This refers to any type of treatment given to the air inside the room.
 2. AIR COOLING: This refers to any process which reduces the temperature of the air. For e.g. Fan moving over a bucket of ice.
 3. REFRIGERATED AIR: The main refrigerated systems used are VAPOR COMPRESSION & ABSORPTION CYCLE.

AIR CONDITIONING CLASSIFICATION

- **AIR COOLING SYSTEM:** The system requires a FAN and WATER.
- **REFRIGERATED AIR SYSTEMS:** These systems provide cool air & humid free air. It is of two types:
 - A. VAPOR COMPRESSION
 - B. ABSORPTION COOLING SYSTEM
- **VAPOR COMPRESSION :** It is of two types:
 - 1) DX DIRECT EXPANSION
 - 2) CHILLED WATER

VAPOUR COMPRESSION REFRIGERATION

➤ DX-DIRECT EXPANSION

- Each room has a evaporator & fan to blow air over the evaporator.

Air in room is contaminated in case of leakage.

➤ CHILLED WATER COMPRESSION SYSTEM

The compression system produces chilled H₂O.

Chilled water is pumped to areas that have to be cooled.

Air is then blown over the chilled water indirect evaporators.

ACTIVE SOLAR SPACE COOLING

- **DESSICANT SYSTEM:** The air going into the living space is passed through a moisture absorbing material (desiccant).
- **ABSORPTION AIR CONDITIONING:** Solar collectors are used to separate low boiling refrigerant in a generator
- **ENTHALPY:** It is a thermodynamic quantity equal to the internal energy of a system plus the product of its volume & pressure.

COMPONENTS OF AIR CONDITIONING

- FILTERS:
- PREHEATERS & REHEATERS
- PRE-COOLERS:
- DE-HUMIDIFIERS:
- FANS:
- SYSTEM AIR SUPPLY

CONDITIONS FOR COMFORT

- Following three factors are necessary for comfort levels:
- **WIND CHILL FACTOR/ INDEX:** This relates to the speed of the air. This means that the movement of air causes cooling effect in the body.
- **VENTILATION:** This means fresh air is circulated inside the room in controlled manner.
- **HUMIDITY CONTROL:** This refers to the relative humidity or percentage relative humidity.

SELECTION OF AIR CONDITIONING SYSTEM

➤ The a/c system is designed to remove heat from the area which is expressed in BTU PER HOUR OR WATTS PER HOUR. Various heat load factors:

1. TRANSMISSION & RESIDUAL HEAT

LOADS:

2. SOLAR HEAT LOAD:

3. OCCUPANT HEAT LOAD:

4. INFILTRATION HEAT LOAD

5. APPLIANCE HEAT LOAD

6. VENTILATION HEAT LOAD

SELECTION OF SIZE OF AIR CONDITIONER

- Factors determining size of the air conditioner.
 1. LOCATION(i.e. Australia, UAE, Sharjah)
 2. Size of the room or rooms
 3. Size of the windows
 4. Direction of the windows and shading
 5. Amount of insulation

SELECTION OF SIZE OF AIR CONDITIONER (continued)

6. Construction materials
7. Whether adjacent rooms are air conditioned or not.
8. Performance of models
9. Purpose of using the room.
10. The selector should be aware of the items that are contributing most to the load.

AIR CONDITIONER COMPTUTATION

➤ $h_3 = h_1 * f_1 + h_2 * f_2$

Wherein $f_1 + f_2 = 1.0$

h_3 = enthalpy in BTU PER POUND(WATTS PER KG.) of the air entering the air conditioner

h_1 = enthalpy of fresh air

f_1 = decimal equivalent of the % of fresh air entering the a/c.

h_2 = air enthalpy of the re-circulated

f_2 = decimal equivalent of the % of re-circulated air entering the a/c.

AIR CONDITIONER COMPUTATION

- Horsepower, tons = $W * (h_3 - h_4) / 12000$
- WATTS = $W * (h_3 - h_4) / 4.713$
- W = weight of air
- h_3 = enthalpy of air entering the a/c
- h_4 = enthalpy of air leaving the a/c
- $12,000(3516) =$ constant (Btu [watts] per hour)

REVIEW

- Meaning of air conditioning & types of air conditioning
- Components of air conditioning
- Conditions for comfort
- Heat load factors
- Selection of size of air conditioner
- Air conditioner computation

ASSIGNMENT

- Explain a) Wind chill factor b) Dessicant system c) Ventilation d) Relative humidity e) DX- direct expansion air conditioning
- What are the various heat load factors on an air conditioner?
- Explain types of air conditioning
- What are the factors determining the size of air conditioner?

Consider the following heat load factors;

HEAT GAIN	BTU PER HOUR
TRANSMISSION	50,000
SOLAR	30,000
APPLIANCE	35000
INFILTRATION	20,000
OCCUPANT	40,000

The enthalpy of the room exhaust air is 31.4BTU per pound or 20.4 watts per kilogram. Dry bulb temperature is 80°F Or 26.7°C; Wet bulb temperature is 67°F or 19.4°C & relative humidity of room exhaust air is 50%. (contd. in next slide)

The enthalpy of the fresh air is 44 BTU per pound (28.3watts per kilogram). Dry bulb temperature is 95⁰F (35⁰C) & wet bulb temperature is 80⁰F (26.7⁰C). Assume that the volume air to be ventilated is 200,00 cubic feet per hour. Calculate

1. ENTHALPY OF THE AIR ENTERING THE AIR CONDITIONER WHEN IT DRAWS:
 - a) 100 % fresh air
 - b) 100% room exhaust air
 - c) 50% fresh air & 50% room exhaust air
1. ENTHALPY OF THE AIR LEAVING THE AIR CONDITIONER
2. SIZE OF THE A/C IN TONS or HP. & WATTS.

REFERENCES

➤ TYPES OF AIR CONDITIONING:

<http://www.brighthub.com/engineering/mechanical/articles/906.aspx>

➤ DESSICANT: <http://en.wikipedia.org/wiki/Desiccant>

➤ ENTHALPY & ENTROPY:

<http://in.answers.yahoo.com/question/index?qid=20100102184743AAg9cls>

➤ TEXT BOOK OF HOTEL MAINTENANCE BY
N.C. GOYAL & K.C. GOYAL

<https://www.facebook.com/GautamKumar61>



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Gautam Singh , Hospitality Trainer , 07830294949