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AI3001 REFRIGERATION AND COLD STORAGE

UNIT IV

Air conditioning is the controlling of air temperature, its humidity, its purity, noisefree and its flow rate at a certain place to produce a comfort zone.

Ventilation is refreshing the air in a crowded place by feeding the place with a mount of air at a certain time and draw the same a mount of air to obtain an healthy environment empty of dust, gases and bad smell.

• The human needs 16 kg. of air per day. The healthy requirements is:

• One third of the feeding air must be fresh air and

• two third return air after purifying.

• Entire air in the air-conditioned areas must be moved at a velocity between 0.15 to 0.25 m/s . This velocity doesn't cause a noise.

• Fresh air requirement in a railway coach – 0.35 m3 /min/passenger

Air-conditioning deals with Human comfort, while refrigeration deals with preservation of perishables.

• Air-conditioning involves both heating & cooling while refrigeration means only cooling.

WHY?

Humans being warm blooded are comfortable in the TEMP.RANGE 25-30 deg. C

• Excess Humidity is uncomfortable as sweat doesn't dry and the body doesn't cool down

• Extremely dry weather is also uncomfortable

Chaffing of skin and dryness

• In addition

Purity

Draft/Velocity

Noise

Power Consumption

Thermal comfort

o Condition of mind that expresses satisfaction with the thermal environment

High temperature & high relative humidity

o Reduce thermal comfort and indoor air quality

Depends on Various Factors

Metabolic rate- Varies from Individual to Individual

• Level of transformation of chemical energy into heat & mechanical work by metabolic activities

within an organism

• Usually expressed in terms of unit area of the total body surface

• 1 met = 58.2 W/m²-Surface area of an average person seated at rest

• Surface area of an average person is 1.8 m²

• 0.7 met for sleeping, 1.0 met for a seated and quiet position, 1.2-1.4 met for light activities

• For activities above 2.0 Met, these values are not very reliable as there are multiple ways of

conducting activities

Mean Radiant Temperature

Amount of radiant heat transferred from a surface o For example, the area exposed to sunlight

Air Speed

Moving Air feels cooler - FRESH AIR MASS moving in & easy evaporation

Relative Humidity

% of water vapor present to the max. amount that can be held at that temp. & pressure

Heat loss through sweating is reduced at HIGH RH & LOW RH has adverse impact on mucous membranes.

Comfort means treatment of 5 properties of air

1. Dry bulb temperature(d.b.t) : cooling or heating
2. RH (%) : humidification or de-humidification.
3. Air purity : Free from dust & bacteria
4. Ventilation : Fresh air to provide the needed oxygen
5. Air movement : homogeneous flow rate and distribution

UNITS OF AIR CONDITIONING

Kilo Calorie - It is defined as the amount of heat to be added/removed to raise /lower the temperature of one kg of water by one degree Celsius.

• BTU(British Thermal Unit)- It is defined as the amount of heat to be added (removed) to raise (lower) the temperature of one pound of water by one degree Fahrenheit.

• 1 Kilo Calorie = 3.97 BTU.

• TR -One ton of refrigeration is the heat required to melt 2000 lbs of ice at 0°C into water at the same temperature in 24 hrs

• 1 TR = 3024 Kcal/hr

Factors Affecting Comfort Air Conditioning

1. Temperature of air: In air conditioning, the control of temperature means the maintenance of any desired temperature within an enclosed space even through the temperature of the outside air is above or below the desired room temperature. This is accomplished either by the addition or removal of heat from the enclosed space as and when demanded. It may be noted that a human being feels comfortable when the air is at 21° C with 56% relative humidity.

2. Humidity of air: The control of humidity of air means the increasing or decreasing of moisture contents of air during summer or winter respectively in order to produce

comfortable and healthy conditions. The control of humidity is not only necessary for human comfort but it also increase the efficiency of the workers. In general, for summer air conditioning, the relative humidity should not be less than 60% whereas for winter air conditioning, the relative should not be more than 40%.

3. Purity of air. It is an important factor for the comfort of a human body. It has been noticed that people do not feel comfortable when breathing contaminated air, even if it is within acceptable temperature and humidity ranges. It is thus obvious that proper filtration, cleaning and purification of air is essential to keep it free from dust and other impurities.

4. Motion of air: The motion or circulation of air is another important factor which should be controlled, in order to keep constant temperature throughout the conditioned space. It is, therefore, necessary that there should be equi-distribution of air throughout the space to be air conditioned.