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Calculation of volume flow rate required for air conditioners using software

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ABSTRACT

Automation is the present trend which is going on in industries. From cleaning of dishes to the preparation of latest equipment's everything is prepared by automation technology. So, in this paper, we have concentrated on an important part of Air conditioning Industry which is the calculation of heat loads for a civil building plan. In this paper, we have used E-Quest software by the action of which Calculation of volumetric flow required for an air conditioner along with the summer heat load is being found out easily accurately and in a precise manner. We will get accurate load calculations within the shortest time.

Keywords: *The tone of refrigeration, Latent heat, Sensible heat, Cubic flow per minute, Total heat, E-Quest.*

1. INTRODUCTION

Heating, ventilation, and air-conditioning (HVAC) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a sub-discipline of mechanical engineering, based on the principles of thermodynamics, fluid mechanics, and heat transfer. HVAC is an important part of residential structures such as single family homes, apartment buildings, hotels and senior living facilities, medium to large industrial and office buildings such as skyscrapers and hospitals, onboard vessels, and in marine environments, where safe and healthy building conditions are regulated with respect to temperature and humidity, using fresh air from outdoors.

In this paper, we have used E-Quest software by the action of which Calculation of volumetric flow required for an air conditioner along with the summer heat load is being found out easily accurately and in a precise manner.

E-Quest software is a sophisticated, yet easy to use building energy use analysis tool which provides professional-level results with an affordable level of effort.

This freeware tool was designed to allow us to perform detailed analysis of today's state-of-the-art building design technologies using today's most sophisticated building energy using simulation techniques without requiring extensive experience in the "art" of building performance modeling. This is accomplished by combining a building creation wizard, an energy efficiency measure (EEM) wizard and graphical results display module with an enhanced building energy use simulation program.

2. PROPERTIES OF AIR

PSYCHROMETRY: It is the subject which deals with the properties of air and water vapor.

DRY AIR: The mixture of gases consisting of nitrogen, oxygen, and carbon-di-oxide is known as dry air.

MOIST AIR: It is the mixture of dry air and water vapor.

WATER VAPOR: The moisture or water content present in the air in the form of vapor.

DRY BULB TEMPERATURE: The temperature of air measured by an ordinary thermometer.

WET BULB TEMPERATURE: The temperature of air measured using a thermometer when it is covered with a wet cloth.

SENSIBLE HEAT OF AIR: The quantity of heat that can be measured by measuring the dry bulb temperature of the air.

LATENT HEAT OF AIR: The quantity of heat present in the air due to the vapor content present at the saturation temperature of water.

TOTAL HEAT OF AIR: The total heat of humid air is the sum of sensible heat of the dry air as well as the sensible and latent heat of water vapor associated with dry air.

DEW POINT TEMPERATURE: It is the saturation temperature corresponding to the partial pressure of water vapor.

HUMIDITY: It is the mass of water vapor present in 1 kg of dry air known as specific humidity or humidity ratio in (g/kg of dry air)

ABSOLUTE HUMIDITY: It is the mass of water vapor present in 1 m3 of dry air in (gm/cm3)

RELATIVE HUMIDITY: It is the ratio of the actual mass of water vapor in a given volume of moist air to the mass of water vapor in the same volume of saturated air at the same temperature and pressure.

3. HEATS PRESENT IN A BUILDING

The Air conditioning system has to remove two types of heat loads

a) Sensible heat energy b) Latent heat energy.

SOURCES OF SENSIBLE HEAT LOADS:

1) Heat flow from exterior walls, ceilings, floor, windows, doors, glass due to temperature difference on two sides.
2) Solar radiation load transmitted directly through the glass in windows and ventilators.
3) Solar radiation load absorbed by walls and roof & later transmitted inside the room.
4) Metabolic heat generated by occupants.
5) Equipment heat
6) Heat transfer from unconditioned rooms to conditioned rooms through the partition
7) Outdoor air infiltration through cracks in doors, windows etc & their frequent opening.
8) Heat air by ducts carrying air to the room.

Sources of Latent Heat Loads

1) Metabolic heat loads from occupants.
2) Heat load from cooking food or stored material.
3) Moisture penetration through walls due to high vapor pressure.
4) Heat load due to infiltrated air

4. STEPS FOR CALCULATION OF HEAT LOAD USING E-QUEST

1) Find the building orientation (Location, latitude, time & temperature)

2) The required design conditions such as dry bulb temperature, wet bulb temperature,

Relative Humidity& Specific humidity in the right side corner of the sheet.

3) Find the C.F.M. ventilation required for people, area, air changes.

4) Find the External Heat loads:

i) Solar heat gain through glass:

ii) Heat gain through walls & roof

iii) Heat gain through Partition

iv) Heat gain through Infiltration

v) Outside air

5) Find the Internal Heat loads:

i) From People present:

ii) From lights

iii) From appliances used.

6) Find the Room Sensible Heat & Effective Room Sensible Heat.

7) Finding the Latent Heat:

i) Latent Heat due to infiltration.

ii) Latent Heat due to outside source

iii) Latent Heat due to people

8) Find the room latent heat & effective room latent heat:

9) Find the Effective Room Total Heat.

10) Find the sensible & latent Heat due to outside air

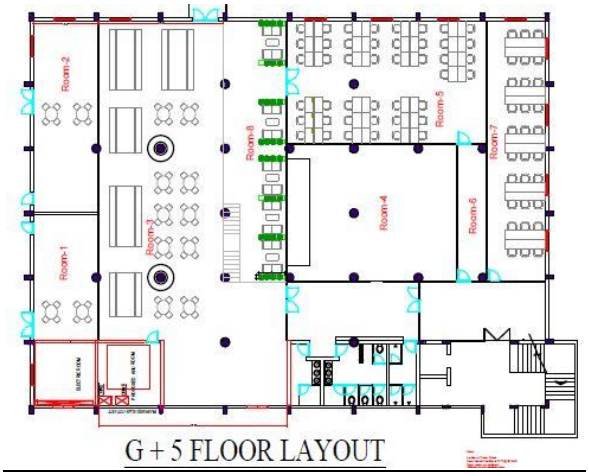
11) Find the GRAND SUB TOTAL HEAT & convert it into tonnes of refrigeration (TR)

12) Find the Effective Sensible Heat Factor.

13) Using ESHF find Apparatus Dew Point & Dehumidified Rise.

14) Using Dehumidified rise find the

5. RESULTS AND DISCUSSION



G + 5 FLOOR LAYOUT

Light Load (Watt)	ERSH	ERLH	THG	ESHF	ADP	TR	CFM	Diffuser Size	Diffuser Qty
1817	23,477	2,991	34,446	0.9	54	2.87	1479	12"*12"	3
2753	31,521	3,398	45,525	0.9	52	3.79	1813	12"*12"	4
11500	133,166	15,500	193,047	0.9	52	16.09	7659	15"*15"	11
5216	57,365	3,575	80,872	0.9	54	6.74	3613	12"*12"	7
5514	72,186	12,793	106,669	0.9	52	8.89	4152	15"*15"	6
881	9,993	991	14,372	0.9	54	1.2	629	15"*15"	1
3495	48,534	11,119	88,385	0.8	52	7.37	2791	12"*12"	6
3754	42,698	4,425	61,567	0.9	54	5.13	2689	12"*12"	5
1817	29,300	2,991	40,445	0.9	54	3.37	1846	12"*12"	4
2753	40,149	3,398	54,411	0.9	54	4.53	2529	12"*12"	5
11500	169,201	15,500	230,163	0.9	54	19.18	10658	15"*15"	15
5216	74,079	3,575	98,088	1	54	8.17	4666	15"*15"	7
5514	89,857	12,793	124,870	0.9	52	10.41	5168	15"*15"	7
881	12,754	991	17,215	0.9	54	1.43	803	12"*12"	2
3495	57,161	11,119	97,271	0.8	52	8.11	3287	15"*15"	5
3754	54,460	4,425	73,681	0.9	54	6.14	3430	15"*15"	5
1817	23,477	2,991	34,446	0.9	54	2.87	1479	9"*9"	5
2753	31,521	3,398	45,525	0.9	52	3.79	1813	9"*9"	6
11500	133,166	15,500	193,047	0.9	52	16.09	7659	12"*12"	15
5216	57,365	3,575	80,872	0.9	54	6.74	3613	9"*9"	12
5514	72,186	12,793	106,669	0.9	52	8.89	4152	12"*12"	8
881	9,993	991	14,372	0.9	54	1.2	629	12"*12"	1
3495	48,534	11,119	88,385	0.8	52	7.37	2791	9"*9"	9
3754	42,698	4,425	61,567	0.9	54	5.13	2689	9"*9"	9.0
1817	23,477	2,991	34,446	0.9	54	2.87	1479	30"*6"	2
2753	31,521	3,398	45,525	0.9	52	3.79	1813	30"*6"	2
11500	133,166	15,500	193,047	0.9	52	16.09	7659	24"*6"	15
5216	57,365	3,575	80,872	0.9	54	6.74	3613	24"*6"	7
5514	72,186	12,793	106,669	0.9	52	8.89	4152	30"*6"	6
881	9,993	991	14,372	0.9	54	1.2	629	24"*6"	1
3495	48,534	11,119	88,385	0.8	52	7.37	2791	30"*6"	4
3754	42,698	4,425	61,567	0.9	54	5.13	2689	30"*6"	4

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