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Determination of Heat Load Distribution of Air Conditioning Unit for Official Rooms of Kirloskar Block at ITM University

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ABSTRACT

In the present scenario due to the effect of Global warming. The temperature of the earth Increasing day by day which causes the requirement of Air conditioning for Domestic as well as official purposes .In this context, for the designing of air conditioning unit for office room of KIRLOSKAR block, ITM UNIVERSITY, GWALIOR. Complete calculation and analysis of heat load distribution inside an office has done, which include determination of total heat available inside the room due to internal as well as external heat sources. For designing of air conditioning unit of KRILOSKAR block having 30 official rooms (excluding laboratories), the heat load calculation has been done. A Single room of KIRLOSKAR blocks KB SF 315, (18040656) cm3, has been consider for determination of total heat load. After calculating the various sensible and latent heat load of room and outside air passing through room, it has been concluded that the Room sensible heat was 5676 W, Room latent heat was 995 W , Outside air sensible heat was 945 W and Outside air latent heat was 880 W. Total heat load was found 1.89 TR for a single room and Sensible heat factor was 0.85.So total air containing load of whole KIRLOSKAR block having 30 official room has been determined (56.7) TR.

Keyword : Room sensible heat, Room latent heat, Total heat load

I. INTRODUCTION

Air conditioners often use a fan to distribute the conditioned air to an occupied space such as a building or a car to improve thermal comfort and indoor air quality. Electric refrigerant-based AC units range from small units that can cool a small bedroom, which can be carried by a single adult, to massive units installed on the roof of office towers that can cool an entire building. The cooling is typically achieved through a refrigeration cycle, but sometimes evaporation or free cooling is used. Air conditioning systems can also be made based on desiccants (chemicals which remove moisture from the air) and subterraneous pipes that can distribute the heated refrigerant to the ground for cooling .Air conditioner can be utilized as a part of both residential and business situations. This procedure is most generally used to accomplish a more agreeable inside condition, commonly for people or creatures; be that as it may, ventilating is additionally used to cool/dehumidify rooms loaded with warm delivering electronic gadgets, for example, PC servers, control enhancers, and even to show and store work of art. Air conditioner and cooling systems regularly utilize a fan to convey the adapted air to a possessed space.[1]

Concept of Psychometric

Air contains settled gasses basically, nitrogen and oxygen with an admixture of water vapour in fluctuating sums. In air water is constantly present and its relative weight midpoints under 1% of the heaviness of air in mild atmospheres and under 3% by weight under the most extraordinary regular climatic conditions, it is in any case one of most critical factors in human solace and effect sly affects numerous materials.[2]

Refrigerants

A 'refrigerant' is characterized as any substance that retains warm through extension or vaporization and loses it through build-up in a refrigeration framework. The term 'refrigerant' in the broadest sense is likewise connected to such optional cooling mediums as icy

water or saline solution, arrangements. Typically refrigerants incorporate just those working mediums which go through the cycle of vanishing, recuperation, pressure, build-up and liquification. These substances retain warm at one place at low temperature level and reject the same at some other place having higher temperature and weight.[2,3]

II. LITERATURE REVIEW

Many research works has been carried out in this field**. Pereira & Mendes** [4] gave the experimental information about the calorimeters and gives a numerical version to incorporate with atmospheric fitness version with simulation and this is useful for transported out display energy usages. **Hoon** et**.al** [5] suggested a whole new control formula which is applicable the idea of an individual air-conditioner and a community air conditioning method to a floor-standing space air-conditioner. **Meissner et.al** [6] they researched to enhance the creating of air conditioners in structure simulation equipment. **Lucas et.al** [7] presented a useful, worldwide approach to analyses the functionality of known little air-conditioning installation in houses used in Reunion region .and further also consider as per climate circumstances and an estimated annual electric power. **Sogut** [8] studied which utilizes two factors, EEF and COP, In the research, fumes compression chilling routine used entire RAC models is accepted as model for the studies.**Hanet.al** [9] suggested a fresh air conditioner that merged evaporative chilling technology, individual type temperature pipe technology, and vapor compression refrigeration concept and In this case study it was found the fact that merged AC got very energy-saving feasible in cool and dry cities. **Shao et.al** [10] focused upon the overall performance graph and functionality chart can provide the affordable and quantitative styles of MUAC's performance. **Zhoua et.al** [11] suggested a cheap and minimally intrusive method, to identify habit info coming from ecosystem variables by data mining approach and also verified air conditioners become acknowledge. **Kindaichi et.al** [12] observed the energy consumption of RACs under distinct heat-load circumstances and activities. **Matsumoto et.al** [13] calculated the payback period by dividing the capital price to improve the energy effectiveness by every year electrical power cost conserving and found implicit price cut price in Vietnam's Air conditioning unit marketplace. **Moritoa et.al** [14] studied that a greater air flow velocity of disrupted human being rests a lot more than reduce air velocity of airflow.

OBSERVATIONS

Height of my selected room is 10.77 feet, this room has two faces, face 1 is 2.06 meter that is equal to 6.76 feet and face 2 is 2.67 meter that is equal to 8.76 feet. Thickness of wall is 12 cm .total items inside the room i.e., electrical appliances ,people ,chair ,table etc. ,after calculating all their heat gain as per the room walls like plaster ,and calculating densities of the room like brick ,concrete ,plaster .and also the door space. And further on the basis of a particular observation day we have to take out door design conditions, indoor design conditions, daily range, and occupancy.

S.NO	DEVICE	numbers	COMPANY NAME	POWER IN W/Device
1.	FAN	1	BAJAJ	100
2.	TUBELIGHT	1	BAJAJ	60
3.	COMPUTER	1	HP	120
4.	MONITOR	1	HP	150
5.	LAPTOP	1	DELL	50
6.	LAZER PRINTER	1	SAMSUNG	375
7.	PHONE CHARGER	1	SAMSUNG	5

Table 1: Electrical applications

SPECIFICATION OF ROOM DIMENSIONS

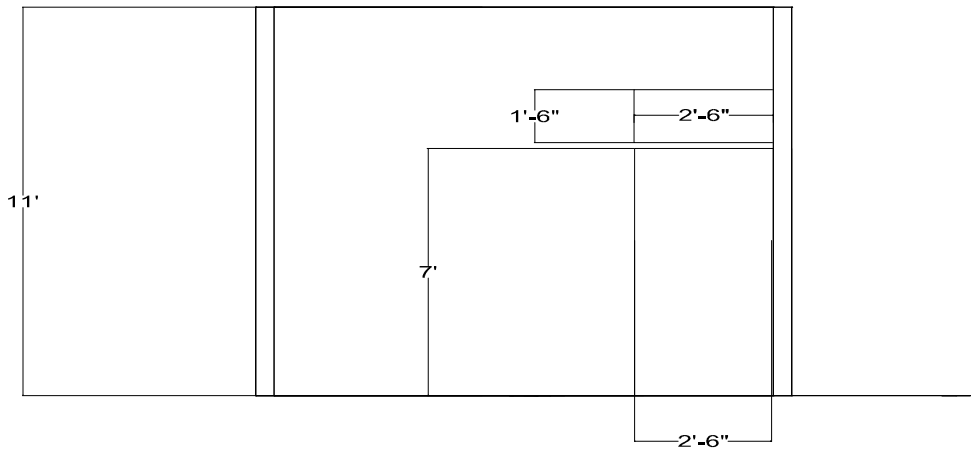

Figure 1. 3-D front view model of room

DETERMINATION OF INTERNAL AND EXTERNAL HEAT GAIN

Dimensions of Room and wind velocity-

Door area = (1) (2) =2 m2

Outside wall areas,

West wall= (3.28) (4) =13.12 m^2

North wall= (2.06) (4)-3(wood) =5.24 m^2

South wall = (2.67) (4) =10.68 m^2

Partition wall areas;

East wall = (3.28) (4) =13.12m^2

North wall= (2.06) (4) =8.24m^2

Assume a wind velocity of 15 kmph ,

$\Delta P=0.00047(15)^2$ =0.11 cm H_2O

Infiltration rate for windows,

For 0.11 cm Wind pressure crack =2.5 m^3/h/m

Length of crack for 1 window=1[2(2+1)] =6 m

Occupancy load;

SHL=75 W/person and LHL=40 W/person

ROOM SENSIBLE HEAT

ITEM	AREA in m^2	TEMPERATURE DIFFERENCE	FACTOR	Heat (W)
DOOR	2	18	0.83	30
ELECRIC APPLICATIONS	-	-	-	2934
PEOPLE	2	-	75	150
SAFETY FACTOR	-	-	5%	950

TABLE 2: ROOM SENSIBLE HEAT INSIDE ROOM

So, ROOM SENSIBLE HEAT =5680 W

ROOM LATENT HEAT

ITEM	AREA in m^2	TEMPERATURE DIFFERENCE	FACTOR	Heat (W)
PEOPLE	2	-	55	110

SAFETY FACTOR	-	-	5%	5

TABLE 3: ROOM LATENT HEAT INSIDE ROOM

So, ROOM LATENT HEAT =105 W

ROOM TOTAL HEAT =ROOM SENIBLE HEAT +ROOM LATENT HEAT

= 5680+115=5795 W

DETERMINATION OF EXTERNAL HEAT GAIN

Outside air sensible heat

ITEM	AREA in m^2	TEMPERATURE DIFFERENCE	FACTOR	Heat (W)
WEST WALL	13.12	16.5	3.5	757.68
WINDOW	70	-	2	140
SAFETY FACTOR	-	-	5%	45

TABLE 4: OUTSIDE AIR SENSIBLE HEAT

So, OUTSIDE AIR SENSIBLE HEAT=945 W

Outside air latent heat

ITEM	AREA in m^2	TEMPERARTURE DIFFERENCE	FACTOR	Heat (W)
WEST WALL	13.12	16.5	3.5	757.68
WINDOW	40	-	2	80
SAFETY FACTOR	-	-	5%	42

TABLE 5: OUTSIDE LATENT HEAT

So, OUTSIDE AIR LATENT HEAT =880 W

VENTILATION LOAD=OALH + OASH

=945+880=1825 W

AIR CONDICTIONING EQUIPMENT LOAD

TOTAL SENSIBLE HEAT=ROOM SENSIBLE HEAT+OUTSIDE AIR SENSIBLE HEAT

=4731+945=5676 W

TOTAL LATENT HEAT=ROOM LATENT HEAT +OUTSIDE AIR LATENT HEAT

=115+880=995 W

GRAND TOTAL HEAT =TOTAL SENSIBLE HEAT+TOTAL LATENT HEAT

=5676+995=6671 W

GRAND SENSIBLE HEAT FACTOR=TOTAL SENSIBLE HEAT/GRAND TOTAL HEAT

=5676/6671=0.85

So, GRAND TOTAL HEAT IS 6671 in W and when it changes into TR (ton of refrigeration) its value is calculated as 1 TR = 3.5 Kw, so 6671 W =1.8 TR

III. RESULTS AND DISCUSSION

The result of present paper after calculation on the basis of thermal conductivities and assumed film coefficient, we observed the final result as, Room total heat is 5795 W, over all sensible heat is 945 W, over all latent heat is 880 W, ventilation load is 1825 W, Total sensible heat is 5676 W, Total latent heat is 995 W, Grand total heat is 6671 W and Grand sensible heat factor is 0.85.

IV. CONCLUSION

On the basis of above experimental setup and experimental investigations, it has been concluded as,

- "Designing and calculation of AC" is an excellent tool to conserve available electrical energy. An attempt is made to set an air conditioning device on basis of room calculation that is used for domestic purpose.
- The Room total heat is 5795 W, outside air sensible heat is 945 W, outside air latent heat is 880 W,

ventilation load is 1825 W, Total sensible heat is 5676 W, Total latent heat is 995 W and Grand total heat is 6671 W.

- The appropriate air conditioner is needed for this particular room is about 1.89 TR.

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