IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

To Estimate the Cooling Load of a Desire Space with help of C Programming

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Abstract

Cooling load of a desire space is the rate of heat which must be removed from the space to maintain at a specific space air temperature and moisture content. This work provides a procedure for preparing calculation for cooling load require for desire space with help of C programming language. Which is use to calculate cooling require for residential and non-residential buildings. Old way of load estimating for air conditioning systems is done either by manual calculation or based on experience of the air conditioning practitioner, but it is complex and tedious. When C language use to estimate cooling load then this work is simpler and user friendly. This is not a new method for estimating cooling load calculations, a substitute for established methods of estimate cooling load calculations, instructions on how to perform the load calculations. All calculation is done at considering at peak load about 2PM.

Keywords: C Programming.

Introduction

Cooling load estimation is the way to provide a controlled atmosphere to buildings such as homes, offices, halls, and industries for the comfortable zone for human being. It means that control relative humidity, purity and temperature of the air. Cooling loads result from many conduction, convection, and radiation heat transfer processes through the building envelope and from internal sources and system components.

The heat gain or heat loss through a building depends on: (i) heat the desire space by number of power equipments such as oven, washing machine, computers etc. Inside the space. (ii) The surface area of the space. The larger the surface area – the more heat can gain through it. (iii) Orientation with respect to the direction of sun rise and fall will also influence the air conditioner sizing. (iv) The temperature difference between outside temperature and our desired space temperature. (v) The type of construction and the amount of insulation from ceiling and walls. This is because different thermal conductivities (U-value). (f) The no of occupant's activity in desire space. (vi) Activities of equipment in desire space. (vii) Amount of lighting in the room.

Assumptions

Design cooling load takes into account all the loads experienced by a building under a specific set of assumed conditions. The assumptions behind design cooling load are as follows:

1. The solar loads on the building are assumed to be those that would occur on a clear day.
2. The building occupancy is assumed to be at.
3. Latent as well as sensible loads are considered.
4. Lights and appliances are assumed to be operating as full design capacity
5. Heat flow is analyzed assuming dynamic conditions, which means that heat storage in building envelope and interior materials is considered.
6. All building equipment and appliances are considered to be operating at a reasonably capacity.
7. The ventilation rates are either assumed on air changes or based on maximum occupancy expected.
8. The heat transfer due to ventilation is not a load on the building but a load on the system.
9. The latent heat gain is assumed to become cooling load instantly, whereas the sensible heat gain is partially delayed depending on the characteristics of the conditioned space.

ISSN: 2277-9655
Impact Factor: 1.852

Dimension of Space

No. of doors :- 2

- WIDTH :- 0.95 m
- LENGTH :- 2.11 m
- THICKNESS :- 0.032 m
- AREA :- 2.0045 m^2
- THERMAL CONDUCTIVITY :- .09 W/mK

No. of window :- 3

- WIDTH :- 2.33 m
- HEIGHT :- 2.17 m
- AREA :- 5.0561 m^2
- THICKNESS :- 0.005 m
- THERMAL CONDUCTIVITY (GLASS) :- .78 W/mk

Partition .33m (Brick thickness =0.28m

Room space

- WIDTH :- 8.10 m
- LENGTH :- 9.70 m
- HEIGHT :- 3.50 m
- VOLUME OF SPACE :- 274.995 m^3
- THICKNESS OF WALL :- .22m(east , west ; Brick thickness=0.20m)
- Plaster (Inside + Outside) :- 0.05 m
- Roof construction :- 0.20 m (concrete)
- THERMAL CONDUCTIVITY (CONCRETE) :- .73W/mK
- THERMAL CONDUCTIVITY (BRICK) :- 1.32W/mK
- THERMAL CONDUCTIVITY (PLASTER):- .48W/mK
- THERMAL CONDUCTIVITY (WOOD) :- .09W/mK

Film co-efficenct

- F (o) :- 23 W/ m^2K
- F (i) :- 7 W/ m^2K

Internal load factor

NO. OF TUBES	**:-**	**6 (20 W EACH =120 WATT)**
NO. OF FANS	**:-**	**7 (40 W EACH =280 WATT)**
TOTAL	**:-**	**400 WATT**
NO. OF OCCUPANTS	**:-**	**61**

Area of East wall=31.88 m^2
Area of West wall=20.72 m^2
Area of partition =29.97 m^2

Calculation for overall thermal co-efficicent
For outside and inside wall
1/U= 1/23 + .05/0.48 + 0.15/1.73 + 1/7
(OUTER FILM+ PLASTER+ BRICK+ INSIDE FILM)
U=2.47 W/ m^2K
For partition wall
1/U = 1/7 + 0.05/0.48 + 0.28/1.32 + 1/7
(INSIDE + PLASTER + BRICK + INSIDE)
U=1.66 W/ m^2K
For roof and floor
1/U = 1/7 + 0.05/0.48 + 0.20/1.73 + 1/7

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(INSIDE + PLASTER + CONCRETE + INSIDE)
U=1.64W/ m^2K

Window glass

1/U = 1/23 + 0.005/0.78 + 1/7
U = 5.208

Door

1/U = 1/23 + 0.032/0.09 + 1/7
U=1.84

Load calculation (sensible heat)

ITEM	AREA(m^2)	∂T/∂ϕ/Sun Gain	FACTOR	W
WEST GLASS	15.17	232.92	---	3533.48
WEST WALL	20.72	18	2.47	921.21
EAST DOOR	4.009	6	1.84	44.26
EAST WALL	31.88	6	2.47	472.46
NORTH WALL	29.97	12	2.47	888.31
FLOOR	98.57	2.5	1.64	404.14
PARTITION	29.97	0	1.66	0
ROOF	98.57	0	1.97	0
INFILTRATION	19.8cmm	18	20.4	7270

Internal sensible heat gain

SOURCE	QUANTITY	CAPACITY	TOTAL LOAD
PEOPLE	60	75	4500
TUBES	6	20	120
FAN	7	40	280

Latent heat

SOURCE	QUANTITY	HUMIDITY	FACTOR	W
INFILTRATION	19.8cmm	.006	50000	5940
PEOPLE	60	_	55	3300

Total load

Total Load = SHL + LHL
= (18433.48 + 9240) W
= 27673.86 W
= 7.87 TR

Program File For The User Friendly Software For Finding Out The Cooling Load Of Any Given Space Of Known Data

```
#include<stdio.h>
#include<conio.h>
void main()
{
	float
dbt,wbt,wd,ar_roof,tppw,tbpw,inf_fac,power,hd,td,csad,th_cn_d,th_cn_c,th_cn_p,th_cn_b,th_cn_g,ww,hw,tw,csaw,
wrs,hrs,lrs,volr,csa_wal,tbw,tpw,tcr,tpr,watt,u_wall,u_part,u_roof,u_floor,u_wndw,u_door,ar_ewal,ar_wwal,ar_part,
shl_wg,shl_ww,shl_edr,shl_ew,shl_par,shl_roof,shl_floor,shl_inf,shl_ppl,shl_eqp,lhl_inf,lhl_ppl,lhl,shl,thl,tl;

	int doors,tubes,ppl=60,fans,wndws;
	clrscr();
	printf("\n\n\t\tCOOLING LOAD ESTIMATION FOR A SINGLE ROOM");
	printf("\t\n\nEnter the outside dry bulb 3ones3s3ure in degree 3ones3s:");
```

```
scanf("%f",&dbt);
printf("\t\n\nEnter the outside wet bulb 4ones4s4ure in degree 4ones4s:");
scanf("%f",&wbt);
if(wbt>dbt)
{
        printf("\n\n\tDry bulb temp. can never be less than Wet bulb temp.");
}
else
{
printf("\n\nThe inside comfort conditions being used are ::\n\n\tInner Dry Bulb   Temprature(in degree C) = 25\n\n\tRelative Humidity = 50 %");
printf("\n\nThe capacity of the room is taken as 60");
printf("\n\nEnter the details of the Room::");
printf("\n\n\No. of Doors::");
scanf("%d",&doors);
printf("\n\nWidth, Height and Thickness of door(m) ::");
scanf("%f%f%f",&wd,&hd,&td);
csad=wd*hd*doors;
printf("\n\nThe total door area(sq. m) is :: %f",csad);
printf("\n\n\tREFER TO APPENDIX 1 FOR THERMAL CONDUCTIVITY OF MATERIALS");
printf("\n\nEnter the thermal conductivity of door material(W/mK) ::");
scanf("%f",&th_cn_d);
printf("\n\nNo. Of Windows :: ");
scanf("%d",&wndws);
printf("\n\nWidth, Height and Thickness of glass used in windows(m) :: ");
scanf("%f%f%f",&ww,&hw,&tw);
csaw=ww*hw*wndws;
printf("\n\nThe total cross sectional area of the windows(sq. m) is %f",csaw);
printf("\n\nEnter the thermal conductivity of glass used for windows(W/mK) ::");
scanf("%f",&th_cn_g);
printf("\n\nEnter the dimensions of the room space(in m) :: ");
printf("\n\nWidth, Length and Height :: ");
scanf("%f%f%f",&wrs,&lrs,&hrs);
volr=wrs*lrs*hrs;
ar_roof=wrs*lrs;
csa_wal=lrs*hrs;
printf("\n\nThe volume of the room(cu. M) is %f",volr);
printf("\n\nEnter the total thickness of brick material in the wall(m) ::");
scanf("%f",&tbw);
printf("\n\nEnter the thermal conductivity of brick material used(W/mK) ::");
scanf("%f",&th_cn_b);
printf("\n\nEnter the thickness of plaster being used(m) ::");
scanf("%f",tpw);
printf("\n\nEnter the thermal conductivity of plaster used in the wall(W/mK) ::");
scanf("%f",&th_cn_p);
printf("\n\nEnter the total thickness of concrete material used in the roof(m) ::");
scanf("%f",&tcr);
printf("\n\nEnter the thermal conductivity of the concrete material used(W/mK) ::");
scanf("%f",&th_cn_c);
tpr=tpw;
tppw=tpw;
printf("\n\nEnter the total thickness of brick material in the partition wall(m) ::");
scanf("%f",tbpw);
printf("\n\nNo. Of 20W tubelights used in the room ::");
```

 ISSN: 2277-9655
Impact Factor: 1.852

```
        scanf("%f",tubes);
        printf("\n\nNo. Of 40W fans used in the room ::");
        scanf("%d",fans);
        printf("\n\nThe Total Wattage of all the other equipments used in the room ::");
        scanf("%f",&watt);
        power=(20.0*tubes)+(40.0*fans)+watt;
        u_wall=1.0/((1.0/23.0)+(tpw/th_cn_p)+(tbw/th_cn_b)+(1.0/7.0));
        u_part=1.0/((2.0/7.0)+(tppw/th_cn_p)+(tbpw/th_cn_b));
        u_roof=1.0/((2.0/7.0)+(tpr/th_cn_p)+(tcr/th_cn_c));
        u_floor=u_roof;
        u_wndw=1.0/((1.0/23.0)+(1.0/7.0)+(tw/th_cn_g));
        u_door=1.0/((1.0/23.0)+(1.0/7.0)+(td/th_cn_d));
        ar_ewal=csa_wal-csad;
        ar_wwal=csa_wal-csaw;
        ar_part=wrs*hrs;
        shl_wg=csaw*(dbt-25)*u_wndw;
        shl_ww=ar_wwal*(dbt-25)*u_wall;
        shl_edr=csad*6.0*u_door;
        shl_ew=ar_ewal*6.0*u_wall;
        shl_par=2*ar_part*2*u_part;
        shl_roof=ar_roof*2*u_roof;
        shl_floor=shl_roof;
        shl_inf=19.8*(dbt-25)*inf_fac;
        if(doors==1)
        {
                inf_fac=8.1;
        }


        else if(doors==2)
        {
                inf_fac=20.4;
        }
        else
        {
                inf_fac=8.4*doors;
        }
        shl_ppl=ppl*75;
        shl_eqp=power;
        shl=shl_wg+shl_ww+shl_edr+shl_ew+shl_par+shl_roof+shl_floor+shl_inf+shl_ppl+shl_e          qp;
        lhl_inf=19.8*.006*50000;
        lhl_ppl=ppl*55;
        lhl=lhl_inf+lhl_ppl;
        thl=shl+lhl;
        tl=thl/3520;
        printf("\n\nThe Cooling Load Required for the given space is %f tonnes of refriferation(or T R )",tl);
        printf("\n\n\n");
}
        getch();
}
```

ISSN: 2277-9655
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