Electric Motors and Machinery

Motors and the machinery which they drive, if both are located in the room, convert all of the electrical energy supplied into heat. This heat is retained in the room if the product manufactured is not removed until its temperature is the same as the room temperature.

If power is transmitted to the machinery from the outside, then only the heat equivalent of the brake horsepower supplied is used. In some mills this is the chief source of heating, and it is frequently sufficient to overheat the building even in zero weather, thus requiring cooling by ventilation the year round. Table 7 shows the heat output equivalent

TABLE 7. HEAT EQUIVALENTS OF VARIOUS SOURCES[a]

Machinery (Motor in room) = Motor Hp/efficiency x 2544	Btu/hr.
Machinery (Motor outside room) = Motor Hp x 2544	Btu/hr.
Electric Lights = Kilowatts x 3413	Btu/hr.
Gas (Producer = 150) (Manufactured = 535) (Natural = 1000)	Btu/cu ft.

[a] Additional values are given in Chapter 13, Table 26.

of various sources of heat in a factory. For information concerning the heat supplied by persons, refer to data given in Chapter 6, and also Table 25, Chapter 13. For appliances see Table 26, Chapter 13.

INTERMITTENTLY HEATED BUILDINGS

In the case of intermittently heated buildings additional heat is required for raising the temperature of the air, the building materials and the material contents of the building to the specified inside temperature. The rate at which this additional heat must be supplied depends upon the heat capacity of the structure and its material contents, and upon the time in which these are to be heated.[15]

This additional heat may be computed and allowed for as conditions require, but inasmuch as the heating system proportioned for taking care of the heat losses will usually have a capacity about 100 percent greater than that required for average winter weather, and inasmuch as most buildings may either be continuously heated or have more time allowed for heating up during the few minimum temperature days, no allowance usually is made, except in the size of boilers or furnaces. For churches, auditoriums and other intermittently heated buildings, additional capacity should be provided.

RESIDENCE HEAT LOSS PROBLEMS

The following *Examples 6* and *7* will illustrate the procedure for calculating the heat loss of a residence, uninsulated and insulated, in accordance with the recommendations given in this chapter.

Example 6: Calculate the heat loss of the residence shown in Fig. 2 located in the vicinity of Chicago. From Table 1, design outdoor conditions are −10 F and 12 mph wind velocity. Inside temperature from Table 2 is assumed to be 70 F. The attic is unheated. Assume ground temperature to be 50 F (see Fig. 3, Chapter 34) under basement and garage floors and 32 F adjoining basement walls. Estimate infiltration losses by the air change method. No wall, ceiling or roof insulation is to be considered in this problem, but all first and second floor windows, except in the garage,

TABLE 8. HEAT LOSS CALCULATION SHEET FOR UNINSULATED RESIDENCE (FIG. 2)

A	B	C	D	E	F	G
ROOM OR SPACE	PART OF STRUCTURE OR INFILTRATION AIR CHANGES	NET AREA OR AIR VOLUME	COEFFICIENT	TEMP. DIFF.[a]	HEAT LOSS (Btu per hour)	TOTALS (Btu per hour)
Bedroom A and Closet	Walls	238 sq ft	0.29	80	5520	
	Glass	40 sq ft	0.45	80	1440	
	Ceiling	252 sq ft	0.74	39.8[d]	7410	
	Infiltration (¾)[g]	1510 cfh[b]	0.018[c]	80	2180	16,550
Bedroom B and Closet	Walls	156 sq ft	0.29	80	3620	
	Glass	40 sq ft	0.45	80	1440	
	Ceiling	170 sq ft	0.74	39.8[d]	5000	
	Infiltration (¾)[g]	1020 cfh[b]	0.018[c]	80	1470	11,530
Bedroom C and Closet	Walls	114 sq ft	0.29	80	2650	
	Glass	27 sq ft	0.45	80	970	
	Ceiling	129 sq ft	0.74	39.8[d]	3800	
	Infiltration (¾)[g]	874 cfh[b]	0.018[c]	80	1260	8,680
Bedroom D and Closet	Walls	118 sq ft	0.29	80	2740	
	Glass	20 sq ft	0.45	80	720	
	Ceiling	110 sq ft	0.74	39.8[d]	3240	
	Floor over garage	110 sq ft	0.26	35[e]	960[p]	
	Infiltration (¾)[g]	660 cfh[b]	0.018[c]	80	950	8,610
Bathroom 1	Walls	30 sq ft	0.29	80	690	
	Glass	14 sq ft	0.45	80	500	
	Ceiling	55 sq ft	0.74	39.8[d]	1620	
	Infiltration (1)[g]	440 cfh[b]	0.018[c]	80	630	3,440
Bathroom 2	Walls	79 sq ft	0.26	80	1640	
	Glass	9 sq ft	0.45	80	320	
	Ceiling	35 sq ft	0.74	39.8[d]	1060	
	Floor over garage	35 sq ft	0.26	35[e]	320[p]	
	Infiltration (1)[g]	280 cfh[b]	0.018[c]	80	400	3,740
Living Room	Walls	267 sq ft	0.29	80	6200	
	Walls (adjoining garage)	94 sq ft	0.39[f]	35[e]	1280[p]	
	Glass	50 sq ft	0.45	80	1800	
	Floor	294 sq ft				
	Infiltration (1½)[h]	3745 cfh[b]	0.018[c]	80	5400	14,680
Dining Room	Walls	166 sq ft	0.29	80	3850	
	Glass (doors)	35 sq ft	0.85	80	2380	
	Glass (windows)	20 sq ft	0.45	80	720	
	Floor	168 sq ft				
	Infiltration (1½)[i]	2140 cfh[b]	0.018[c]	80	3080	10,030
Kitchen and Entrance to Garage	Walls	96 sq ft	0.29	80	2220	
	Walls (adjoining garage)	51 sq ft	0.39[f]	35[e]	700[p]	
	Glass	18 sq ft	0.45	80	650	
	Door	17 sq ft	0.51	35	300	
	Floor	125 sq ft				
	Infiltration (1½)[j]	1595 cfh[b]	0.018[c]	80	2300	6,170
Lavette and Vestibule	Walls	82 sq ft	0.29	80	1900	
	Walls (adjoining garage)	85 sq ft	0.39[f]	35[e]	1160[p]	
	Glass	9 sq ft	0.45	80	320	
	Door	19 sq ft	0.51	80	780	
	Floor	30 sq ft				
	Infiltration (1½)[k]	383 cfh[b]	0.018[c]	80	550	4,710
Entrance Hall	Walls	39 sq ft	0.29	80	900	
	Door	21 sq ft	0.38	80	640	
	Ceiling[r]	87 sq ft	0.74	39.8[d]	2560	
	Infiltration (2)[l]	1110 cfh[b]	0.018[c]	80	1600	5,700
Garage	Walls	167 sq ft	0.29	45[e]	2180	
	Glass	53 sq ft	1.13	45	2700	
	Doors	44 sq ft	0.51	45	1010	
	Infiltration (1½)[m]	2360 cfh[b]	0.018[c]	45	1910	
	Floor	29 ft[s]	0.81	45	1060	
	Gain adjoining rooms				−4420[p]	4,450
Recreation Room[q]	Walls	220 sq ft	0.10	38	840	
	Glass	8 sq ft	1.13	80	720	
	Floor	287 sq ft	0.10	20	570	
	Infiltration (1)[n]	2010 cfh[b]	0.018[c]	80	2890	5,020
					TOTAL	103,310