

Table 8 Heat Loss Calculation Sheet for Uninsulated Residence (Fig. 1)

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.*	Heat Loss (Btu per hour)	Totals (Btu per hour)
Bedroom A and Closet	Walls Glass Ceiling Infiltration (3/4)*	238 sq ft 40 sq ft 232 sq ft 1510 cfb*	0.29 0.45 0.74 0.018*	85 85 44.8 ^a 85	5870 1530 8350 2310	18,060
Bedroom B and Closet	Walls Glass Ceiling Infiltration (3/4)*	156 sq ft 40 sq ft 170 sq ft 1020 cfb*	0.29 0.45 0.74 0.018*	85 85 44.8 ^a 85	3840 1530 5630 1560	12,560
Bedroom C and Closet	Walls Glass Ceiling Infiltration (3/4)*	114 sq ft 27 sq ft 129 sq ft 874 cfb*	0.29 0.45 0.74 0.018*	85 85 44.8 ^a 85	2810 1030 4280 1340	9,460
Bedroom D and Closet	Walls Glass Ceiling Floor over garage Infiltration (3/4)*	118 sq ft 20 sq ft 110 sq ft 110 sq ft 660 cfb*	0.29 0.45 0.74 0.26 0.018*	85 85 44.8 ^a 40 ^b 85	2910 770 3640 1140 ^c 1010	9,470
Bathroom 1	Walls Glass Ceiling Infiltration (1)*	30 sq ft 14 sq ft 55 sq ft 440 cfb*	0.29 0.45 0.74 0.018*	85 85 44.8 ^a 85	740 540 1820 670	3,770
Bathroom 2	Walls Glass Ceiling Floor over garage Infiltration (1)*	79 sq ft 9 sq ft 35 sq ft 35 sq ft 280 cfb*	0.26 0.45 0.74 0.26 0.018*	85 ^d 85 44.8 ^a 40 ^b 85	1750 340 ^e 1190 360 430	4,070
Living Room	Walls Walls (adjoining garage) Glass Floor Infiltration (1 1/4)*	267 sq ft 94 sq ft 50 sq ft 294 sq ft 3745 cfb*	0.29 0.39 ^f 0.45 0.45 0.018*	85 40 ^g 85 85 85	6580 1470 1910 1910 5730	15,690
Dining Room	Walls Glass (doors) Glass (windows) Floor Infiltration (1 1/4)*	166 sq ft 35 sq ft 20 sq ft 163 sq ft 2140 cfb*	0.29 0.85 0.45 0.45 0.018*	85 85 85 85 85	4090 2530 770 770 3270	10,660
Kitchen and Entrance to Garage	Walls Walls (adjoining garage) Glass Door Floor Infiltration (1 1/4)*	96 sq ft 51 sq ft 18 sq ft 17 sq ft 125 sq ft 1595 cfb*	0.29 0.39 ^f 0.45 0.51 0.45 0.018*	85 40 ^g 85 85 40 85	2370 800 ^h 690 350 2440	6,650
Lavette and Vestibule	Walls Walls (adjoining garage) Glass Door Floor Infiltration (1 1/4)*	82 sq ft 85 sq ft 9 sq ft 19 sq ft 30 sq ft 383 cfb*	0.29 0.39 ^f 0.45 0.51 0.45 0.018*	85 40 ^g 85 85 85 85	2020 1330 ⁱ 340 820 590	5,100
Entrance Hall	Walls Door Ceiling Infiltration (2)*	39 sq ft 21 sq ft 87 sq ft 1110 cfb*	0.29 0.38 0.74 0.018*	85 85 44.8 ^a 85	960 680 2990 1700	6,330
Garage	Walls Glass Doors Infiltration (1 1/4)* Floor Gain adjoining rooms	167 sq ft 53 sq ft 44 sq ft 2360 cfb* 29 ft ² 29 ft ²	0.29 1.13 0.51 0.018* 0.81	50 ^j 50 50 50 50	2420 3000 1120 2120 1180 -5100 ^k	4,740
Recreation Room*	Walls Glass Floor Infiltration (1)*	220 sq ft 8 sq ft 287 sq ft 2010 cfb*	0.10 1.13 0.10 0.018*	43 85 25 85	950 770 720 3080	5,520
TOTAL					112,080	

Heating Load

Notes for Table 8 Heat Loss Calculation for Uninsulated Residence (Fig. 1)

- * The indoor-outdoor temperature difference is 75 - (-10) or 80 F except where otherwise noted.
- * Volume of infiltration, cfb = (no. air changes) × (floor or ceiling area) × (ceiling height).
- * From Equation 5a.
- * The ceiling heat losses are calculated by estimating the attic temperature and then calculating the loss through the ceiling using the proper temperature difference. This unheated attic is not ventilated during winter months. The attic temperature is estimated from Equation 1 to be 30.2 F when the outdoor temperature is -10 F and room temperature is 70 F. The temperature difference is then 75 - 30.2 or 44.8 deg. For the insulated residence, attic temperature becomes 4.6 F and temperature difference 75 - 4.6 = 70.4 deg.
- * Temperature in garage assumed to be 35 F.
- * Coefficient for wall adjoining garage calculated on basis of metal lath and plaster on both sides of studs (U = 0.39).
- * One-half of value from Table 2, Chapter 25, for storm windows or weatherstripping.
- * Exposed on two sides, weatherstripped windows offset by fireplace. Use 1 1/4.
- * Window on one side weatherstripped but double-doors are hard to close tightly. Hence, conservative value of 1 1/4.
- * Assuming kitchen vent, door to vestibule usually open, allow full table value of 1 1/4.
- * One-half value in Table 2, Chapter 25, increased to 1 1/4 by nearby outside door in vestibule.
- * Full value in Table 2, Chapter 25, to allow for frequent opening of outside door.
- * Two sides exposed, large doors but large volume. Use value 1 1/4 as given in Table 2, Chapter 25.
- * Two small unweatherstripped windows in protected location, but fireplace, indicate 1 change.
- * Heat losses from these rooms into garage are heat gains for garage.
- * Neglect heat loss to basement, as losses from boiler, piping, etc., will probably keep basement near, if not above, 75 F.
- * Upstairs hall ceiling figures with downstairs. Heat should be provided downstairs for both.
- * Linear feet of exposed edge.

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.¹⁴

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. 1 located in the vicinity of Syracuse, N. Y. From Table 1, Column 6, design outdoor conditions are -10 F and 11 mph wind speed. Indoor temperature from Table 2 is assumed to be 75 F. The attic is unheated. Assume ground temperature to be 50 F 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, are to have storm sash. The building is constructed as follows (heat transmission coefficients U are in parentheses):
Walls: Brick veneer, building paper, wood sheathing, studding, metal lath, and plaster (0.29). Walls of dormer over garage are the same, except wood siding is used in place of brick veneer (0.26).

Attic Walls: Brick veneer, building paper, wood sheathing on studding (0.42).

Basement Walls: 10 in. concrete (0.10).

Roof: Asphalt shingles on wood sheathing on rafters (0.44).

Ceiling (Second Floor): Metal lath and plaster (0.74).

Windows: Double-hung wood windows averaging 70 percent glass (0.45; from Chapter 24, Table 18, Section D, the U value for wood windows with storm sash is 0.53 × application factor; by interpolation this factor is 0.85). Steel casement sash in garage and basement (1.13; from Chapter 24, Table 18, U is 1.13 for all glass and the application factor is 1.00). French doors in dining room are 50 percent glass, no storm doors (0.85; from

Chapter 24, Table 18 U is 1.13 for all glass; by interpolation the application factor is 0.75).

Floor (Bedroom D): Maple finish flooring on yellow pine sub-flooring; metal lath and plaster ceiling below (0.26).

Floor (Basement and Garage): 4 in. stone concrete on 3 in. cinder concrete (0.10).

Solution: The calculations for this problem are given in Table 8, and a summary of the results in Table 9. The values in column F of Table 8 were obtained by multiplying together the figures in columns C, D, and E. The heat losses are calculated to the nearest 10 Btu. See reference notes for Table 8 for further explanation of data.

Attention is called to the summary of heat losses (Table 9) for the uninsulated residence. As storm windows are used in this

Table 9 Summary of Heat Losses of Uninsulated Residence (Btu Per Hour)

Room or Space	Walls	Ceiling and Roof	Floor	Glass and Door	Infiltration	Totals
Bedroom A	5870	8350	...	1530	2310	18,060
Bedroom B	3840	5630	...	1530	1560	12,560
Bedroom C	2810	4280	...	1030	1340	9,460
Bedroom D	2910	3640	1140	770	1010	9,470
Bathroom 1	740	1820	...	540	670	3,770
Bathroom 2	1750	1190	360	340	430	4,070
Living Room	6580	8050	...	1910	5730	15,690
Dining Room	4090	...	...	3300	3270	10,660
Kitchen	3170	...	...	1040	2440	6,650
Lavette	3350	...	...	1160	590	5,100
Entrance Hall	960	2990	...	680	1700	6,330
Garage	-1180 ^a	-1600 ^a	1180	4120	2120	4,740
Recreation	950	...	720	770	3080	5,520
Design Totals	37,310	26,400	3,400	18,720	26,250	112,080
Operating Totals	37,310	26,400	3,400	18,720	13,130	98,960
Percentages ^d	37.3	26.7	3.4	18.9	13.3	100.0

* Wall heat loss of 3420 Btu minus wall heat gains of 1470, 820, and 1530 Btu.
* Highest gains of 1140 and 360 Btu.
* Based on 1/4 computed infiltration.
* Based on operating totals.