

EXAMPLE OF HEAT LOSS COMPUTATIONS

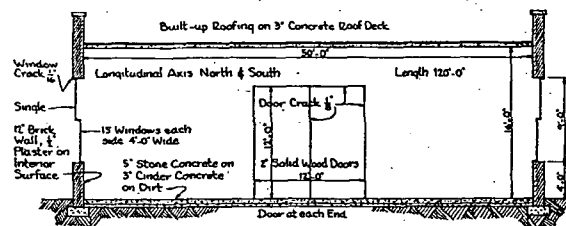


FIG. 1. ELEVATION OF FACTORY BUILDING

1. LOCATION.....Philadelphia, Pa.
2. LOWEST OUTSIDE TEMPERATURE. (Table 2).....-6 F
3. BASE TEMPERATURE: *In this example a design temperature 10 F above lowest on record instead of 15 F is used. Hence the base temperature =*
 $(-6 + 10) = +4 \text{ F.}$

4. DIRECTION OF PREVAILING WIND (during Dec., Jan., Feb.).....Northwest
5. BREATHING-LINE TEMPERATURE (5 ft from floor).....60 F
6. INSIDE AIR TEMPERATURE AT ROOF:

The air temperature just below roof is higher than at the breathing line. Height of roof is 16 ft, or it is $16 - 5 = 11$ ft above breathing line. Allowing 2 per cent per foot above 5 ft, or $2 \times 11 = 22$ per cent, makes the temperature of the air under the roof = $1.22 \times 60 = 73.2 \text{ F.}$

7. INSIDE TEMPERATURE AT WALLS:

The air temperature at the mean height of the walls is greater than at the breathing line. The mean height of the walls is 8 ft and allowing 2 per cent per foot above 5 ft, the average mean temperature of the walls is $1.06 \times 60 = 63.6 \text{ F.}$ By similar assumptions and calculations, the mean temperature of the glass will be found to be 64.2 F and that of the doors 61.2 F.

8. AVERAGE WIND VELOCITY (Table 2).....11.0 mph
9. OVER-ALL DIMENSIONS (See Fig. 1).....120 x 50 x 16 ft
10. CONSTRUCTION:

Walls—12-in. brick, with 1/2-in. plaster applied directly to inside surface.

Roof—3-in. stone concrete and built-up roofing.

Floor—5-in. stone concrete on 3-in. cinder concrete on dirt.

Doors—One 12 ft x 12 ft wood door (2 in. thick) at each end.

Windows—Fifteen, 9 ft x 4 ft single glass double-hung windows on each side.

11. TRANSMISSION COEFFICIENTS:

Walls—(Table 3, Chapter 5, Wall 2B)..... $U = 0.34$

Roof—(Table 11, Chapter 5, Roofs 2A and 3A)..... $U = 0.77$

Floor—(Table 10, Chapter 5, Floors 5A and 6A)..... $U = 0.63$

Doors—(Table 13B, Chapter 5)..... $U = 0.46$

Windows—(Table 13A, Chapter 5)..... $U = 1.13$

12. INFILTRATION COEFFICIENTS:

Windows—Average windows, non-weatherstripped, 1/16-in. crack and 3/4-in. clearance. The leakage per foot of crack for an 11-mile wind velocity is 25.0 cfh. (Determined by interpolation of Table 2, Chapter 6.) The heat equivalent per hour per degree per foot of crack is taken from Chapter 6.

$$25.0 \times 0.018 = 0.45 \text{ Btu per deg Fahr per foot of crack.}$$

Doors—Assume infiltration loss through door crack twice that of windows or $2 \times 0.45 = 0.90$ Btu per deg Fahr per foot of crack.

Walls—As shown by Table 1, Chapter 6, a plastered wall allows so little infiltration that in this problem it may be neglected.

13. CALCULATIONS: See calculation sheet, Table 3.

TABLE 3. CALCULATION SHEET SHOWING METHOD OF ESTIMATING HEAT LOSSES OF BUILDING SHOWN IN FIG. 1

PART OF BUILDING	WIDTH IN FEET	HEIGHT IN FEET	NET SURFACE AREA OR CRACK LENGTH	COEFFICIENT	TEMP. DIFF.	TOTAL BTU
North Wall:						
Brick, 1/2-in. plaster.....	50	16	856	0.34	59.6	13,293
Doors (2-in. wood).....	12	12	144	0.46	57.2	3,789
1/4 in. Crack.....		1 pair doors	60	0.90	57.2	1,544*
West Wall:						
Brick, 1/2-in. plaster.....	120	16	1380	0.34	59.6	27,964
Glass (Single).....	15 x 4	9	540	1.13	60.2	36,734
Double Hung Windows (15).....			450	0.45	60.2	6,095*
1/4 in. Crack.....						
South Wall.....			Same as North Wall			18,626
East Wall.....			Same as West Wall			70,793
Roof, 3-in. concrete and slag-surfaced built-up roofing.....	50	120	6000	0.77	69.2	319,704
Floor, 5-in. stone concrete on 3-in. cinder concrete.....	50	120	6000	0.63	5b	18,900
GRAND TOTAL of heat required for building in Btu per hour.....						517,442

*This building has no partitions and whatever air enters through the cracks on the windward side must leave through the cracks on the leeward side. Therefore, only one-half of the total crack will be used in computing infiltration for each side and each end of building.

bA 5 F temperature differential is commonly assumed to exist between the air on one side of a large floor laid on the ground and the ground.

PROBLEMS IN PRACTICE

1. The dry-bulb temperature and the relative humidity at the ceiling of a mixing room in a bakery are 80 F and 60 per cent, respectively. The roof is a 4-in. concrete deck covered with built-up roofing. If the lowest outside temperature to be expected is -10 F, what thickness of rigid fiber insulation will be required to prevent condensation?

From Table 11, Chapter 5, U for the uninsulated roof = 0.72. From Table 2, Chapter 5, k for rigid fiber insulation = 0.33. From the psychrometric chart, Chapter 1, the dew point of air at 80 F and 60 per cent relative humidity is 65 F. The ceiling temperature, therefore, must not drop below 65 F if condensation is to be prevented.