5 ● Is heat loss by infiltration through walls of importance?

Only in the case of simple walls or poorly constructed compound walls.

6 ● What measurements are required to calculate the heat loss through double-hung wood windows?

Sash crack (equal to the sash perimeter plus the meeting rail) and frame crack (equal to the frame perimeter).

7 ● What is the basis for selecting the wind velocity and outside temperature to be used in making infiltration calculations?

Weather Bureau records. The wind velocity taken is the average during the three coldest months and the temperature used is the lowest on record for the given locality.

8 ● How does the temperature difference influence the heat loss in a tall building?

The chimney effect caused by the temperature difference operates to produce a head that will add to the effect of the wind at lower levels and subtract from it at higher levels.

9 ● For a wind velocity of 15 mph and a building 180 ft high, calculate the effective wind velocity at the ground floor and at a height of 150 ft.

a. At the ground floor the effective wind velocity would be

$$M_e = \sqrt{15^2 + 1.75 \times 90} = 19.6 \text{ mph}$$

b. At a floor 150 ft above the ground

$$M_e = \sqrt{15^2 - 175 \times 60} = 11.0 \text{ mph}$$

10 ● A room contains three 2 ft-8 in. by 5 ft-6 in. plain double-hung wood windows with 1⁄16-in. crack and 3⁄64-in. clearance. Assume a wind velocity of 15 mph and a temperature difference of 75 F. Neglecting chimney effect, what is the maximum heat loss due to infiltration?

From Table 2, infiltration per foot of crack is 39.3 cu ft. Length of crack for the three windows is 57 ft. The maximum heat loss, due to infiltration, is equal to 0.018 $\times$ 39.3 $\times$ 57 $\times$ 75 or 3020 Btu per hour.

11 ● Find the infiltration through a wall with 16-in. shingles on 1 in. by 4 in. boards with 20 mph wind velocity. Give the pressure drop through the wall.

Referring to Curve 3C, Fig. 1, the value on the horizontal scale corresponding to 20 mph is approximately 102 cfh per square foot of wall.

The pressure drop through the wall is 0.193 in. of water (see left hand vertical scale).

12 ● What will be the infiltration through air-dried end and side-matched sheathing for 15 mph wind velocity?

Referring to Curve 10C, Fig. 2, the value on the horizontal scale corresponding to 15 mph is 50 cfh per square foot of wall.

13 ● From Table 2, find the infiltration (cubic feet per hour per foot of crack) for an average double-hung window, not weather stripped, with a 20 mph wind velocity.

59.3 cu ft per foot of crack per hour.

14 ● Using the value found in Question 13, what will be the heat requirement in a building with a total crack (all windows and doors) of 180 ft if the wind velocity is 15 mph, the outside temperature is 0 F, and the inside temperature is 70 F?

Using one half of the total crack, the volume of air is:

$$90 \times 59.3 = 5337 \text{ cu ft}$$

$$H = 0.018 \times 5337 \times (70 - 0) = 6724.6 \text{ Btu.} \quad \text{(See Equation 4.)}$$

Chapter 7

HEATING LOAD

Heat Demand Design Factors, Method of Procedure, Inside and Outside Temperatures, Wind Velocity Effects, Auxiliary Heat Sources, Wall Surface Condensation, Heat Loss Computation Example

TO design any system of heating, the maximum probable heat demand must be accurately estimated in order that the apparatus installed shall be capable of maintaining the desired temperature at all times. The factors which govern this maximum heat demand—most of which are seldom, if ever, in equilibrium—include the following:

1. Outside temperature. 2. Rain or snow. 3. Sunshine or cloudiness. 4. Wind velocity.	*Outside Conditions (The Weather)*
5. Heat transmission of exposed parts of building. 6. Infiltration of air through cracks, crevices and open doors and windows. 7. Heat capacity of materials. 8. Rate of absorption of solar radiation by exposed materials.	*Building Construction*
9. Inside temperatures. 10. Stratification of air. 11. Type of heating system. 12. Ventilation requirements. 13. Period and nature of occupancy. 14. Temperature regulation.	*Inside Conditions*

The *inside conditions* vary from time to time, the physical properties of the *building construction* may change with age, and the *outside conditions* are changing constantly. Just what the worst combination of all of these variable factors is likely to be in any particular case is therefore conjectural. Because of the nature of the problem, extreme precision in estimating heat losses at any time, while desirable, is hard of attainment.

The procedure to be followed in determining the heat loss from any building can be divided into seven consecutive steps, as follows:

1. Determine on the inside air temperature, at the breathing line or the 30-in. line, which is to be maintained in the building during the coldest weather. (See Table 1.)

2. Determine on an outside air temperature for design purposes, based on the minimum temperatures recorded in the locality in question, which will provide for all but the most severe weather conditions. Such conditions as may exist for only a few consecutive hours are readily taken care of by the heat capacity of the building itself. (See Table 2.)