PROBLEMS IN PRACTICE

1 ● What two natural forces cause infiltration?

a. Wind causes pressure to be exerted on one or two sides of a building with consequent movement of air through openings.

b. Temperature difference inside to outside causes a difference in density with consequent entrance of air at lower openings and exit of air at higher openings.

2 ● What is the neutral zone as applied to infiltration in buildings?

Due to temperature difference inside air tends to flow out of openings near the top of the building and is replaced by outside air coming in at lower openings. At some height no flow occurs in or out. This is referred to as the neutral zone and often is taken at the mid-height of the building but may be higher or lower than this depending on several factors.

3 ● In what type of structure is infiltration due to temperature difference of importance?

In tall open buildings, in multi-story buildings inadequately sealed between floors and in stair-wells for multi-story buildings the temperature difference effect is important.

4 ● What procedure is sometimes used to compensate for this temperature or chimney effect in stair-wells?

One rule is to place 50 percent of the calculated radiation in the bottom third, the normal amount in the middle third and the remainder in the top third.

5 ● Why is it customary to apply a correction factor to laboratory values before calculating infiltration in buildings?

Most, if not all, laboratory values have been determined by exerting a certain wind pressure across a single thickness of building construction. In actual building construction the pressure drop due to wind velocity takes place in two steps, one through the windward and the other through the leeward wall. Tests indicate that the leakage in actual construction will be about 80 per cent of laboratory values and therefore this factor has been applied in making up the tables in this chapter. The curves represent laboratory data as taken with no correction applied.

6 ● Is infiltration through walls of importance?

In the case of compound walls of good construction the heat loss due to infiltration is usually negligibly low. In the case of single thickness walls without building paper properly applied, the heat loss due to air leakage may be very high.

7 ● How are the wind velocities and outside temperatures selected for infiltration calculations in heating?

It is common practice to take the average wind velocity for the three coldest months and the temperature as 15 F above the coldest recorded by the Weather Bureau during the preceeding 10 years.

8 ● Show the probable combined effects of infiltration due to temperature difference and wind velocity on the ground floor and on the 15th floor of a 20-story building 200 ft high with a 12 mph wind blowing.

At the ground floor the effective velocity is increased to:

$$M_e = \sqrt{12^2 + 1.75 \times 100} = 17.8 \text{ mph}$$

At the 15th floor level it would be reduced to:

$$M_e = \sqrt{12^2 - 1.75 \times 50} = 7.5 \text{ mph}$$

9 ● What is the value of storm sash in reducing infiltration?

The reduction depends on the relative fit of the window and the storm sash. Fig. 4 indicates for storm sash buttoned on a reduction at 20 mph from about 52 cfh per foot of crack to 42 cfh. Fig. 5 indicates a reduction for a storm sash buttoned over a loosely fitted window from 185 to 90 cfh.

Chapter 7

HEATING LOAD

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

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.)