*Example 3.* What is the probable inleakage of air for a room with three windows on the first floor, if the wind velocity is 15 mph? The building is 90 ft high and is equipped with architectural projected steel windows with two ventilators each with a total perimeter of 24 ft of 3/64-in. crack. Further, find the probable inleakage in similar rooms on the top floor and on the third floor 30 ft from the ground.

*Solution.* On the first floor the equivalent wind velocity is $M_e = \sqrt{15^2 + 1.75 \times 45}$ or 17.5 mph. Leakage for this type of window is given in Table 2 (interpolating) as 102 cu ft per foot of crack per hour. The total leakage rate ($Q$) is equal to $3 \times 24 \times 102$ or 7344 cu ft per hour.

For a similar room on the top floor, with the same exposure, the equivalent wind velocity is $M_e = \sqrt{15^2 - 1.75 \times 45}$ or 12 mph for which the leakage is 66.4 cu ft per ft of crack per hour. The total inleakage of air into the room ($Q$) is equal to $3 \times 24 \times 66.4$ or 4780 cu ft per hour.

For a similar room 30 ft above the ground, $M_e = \sqrt{15^2 + 1.75 \times 15}$ or 16 mph for which the unit crack leakage will be 93.6 cu ft per hour, and the total leakage for the room will be 6740 cu ft per hour.

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## Chapter 7

# THE HEATING LOAD

***Factors Governing Heat Demand, Procedure, Temperatures, Wind Movement, Heat Sources Other Than Heating Plant, Example, Condensation***

IN the design of any type of heating system, the maximum probable heat demand must be accurately estimated in order that the apparatus installed shall be of sufficient capacity to maintain 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.<br>2. Rain or snow.<br>3. Sunshine or cloudiness.<br>4. Wind velocity. | *Outside Conditions (The Weather)* |
| 5. Heat transmission of exposed parts of building.<br>6. Infiltration of air through cracks, crevices and open doors and windows.<br>7. Heat capacity of materials.<br>8. Rate of absorption of solar radiation by exposed materials. | *Building Construction* |
| 9. Inside temperatures.<br>10. Stratification of air.<br>11. Type of heating system.<br>12. Ventilation requirements.<br>13. Period and nature of occupancy.<br>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 is very unlikely.

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).

3. Select or compute the heat transmission coefficients for outside walls and glass;