

REFERENCES

A.S.H.V.E. RESEARCH REPORTS:

- No. 852—Effects of Air Velocities on Surface Coefficients, by F. B. Rowley, A. B. Algren and J. L. Blackshaw (A.S.H.V.E. TRANSACTIONS, Vol. 36, 1930, p. 123).
- No. 895—Wind Velocity Gradients Near a Surface and Their Effect on Film Conductance, by F. C. Houghten and Paul McDermott (A.S.H.V.E. TRANSACTIONS, Vol. 37, 1931, p. 301).
- No. 914—Surface Coefficients as Affected by Direction of Wind, by F. B. Rowley and W. A. Eckley (A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932, p. 33).
- No. 915—Conductivity of Concrete, by F. C. Houghten and Carl Gutberlet (A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932, p. 47).
- No. 964—The Heat Conductivity of Wood at Climatic Temperature Differences, by F. B. Rowley (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 329).
- No. 996—Insulating Value of Bright Metallic Surfaces, by F. B. Rowley (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934, p. 413).
- No. 1026—Thermal Properties of Concrete Construction, by F. B. Rowley, A. B. Algren and Clifford Carlson (A.S.H.V.E. TRANSACTIONS, Vol. 42, 1936, p. 33).
- No. 1048—Thermal Properties of Concrete Construction, by F. B. Rowley, A. B. Algren and Robert Lander (A.S.H.V.E. TRANSACTIONS, Vol. 43, 1937, p. 33).
- Insulating Effect of Successive Air Spaces Bounded by Bright Metallic Surfaces, by L. W. Schad (A.S.H.V.E. TRANSACTIONS, Vol. 37, 1931, p. 285).
- Condensation of Moisture and Its Relation to Building Construction and Operation, by F. B. Rowley, A. B. Algren and C. E. Lund (A.S.H.V.E. TRANSACTIONS, Vol. 45, 1939, p. 231).
- A Theory Covering the Transfer of Vapor Through Materials, by F. B. Rowley (A.S.H.V.E. TRANSACTIONS, Vol. 45, 1939, p. 545).
- Thermal Conductivity of Wood, by J. D. MacLean (A.S.H.V.E. TRANSACTIONS, Vol. 47, 1941, p. 323).
- The Specific Heat of Thermal Insulating Materials, by G. B. Wilkes and C. O. Wood (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, June, 1942, p. 370).
- Heat Loss Studies in Four Identical Buildings to Determine the Effect of Insulation, by D. B. Anderson (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, August, 1942, p. 499).
- Simultaneous Heat and Vapor Transfer Characteristics of an Insulating Material, by F. G. Hechler, E. R. McLaughlin and E. R. Queer (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, September, 1942, p. 574).
- Comparative Resistance to Vapor Transmission of Various Building Materials, by L. V. Teesdale (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, December, 1942, p. 736).
- The Diffusion of Water Vapor Through Various Building Materials, by J. D. Babbitt (*Canadian Journal of Research*, Vol. 17, February, 1939, p. 15).
- Effect of Ceiling Insulation upon Summer Comfort, by T. D. Phillips (*National Bureau of Standards*, Report BMS52, July 1, 1940).
- Moisture Condensation in Building Walls, by H. W. Wooley (*National Bureau of Standards*, Report BMS63, December 14, 1940).
- Heat Transmission Through Building Materials, by F. B. Rowley and A. B. Algren, (University of Minnesota *Engineering Experiment Station Bulletin* No. 8).
- Building Insulation, by P. D. Close (*American Technical Society*, Chicago, 1941).

Chapter 5

AIR LEAKAGE

Causes of Infiltration; Infiltration Due to Wind Pressure, Infiltration Through Walls, Window and Door Leakage, Crack Method, Air Change Method, Infiltration Due to Temperature Difference, Sealing of Vertical Openings

THE interchange of air which takes place through various apertures in buildings must be considered in heating and cooling calculations, and properly evaluated. This air leakage, or *infiltration* as it is sometimes designated, takes place through cracks around doors and windows, through solid walls and through fireplaces and chimneys. Although the latter sources of leakage may be considerable, they are often neglected on the assumption that dampers would be closed during periods of extreme cold weather or else that the fireplace will be in use at such times and will therefore contribute to the heat supplied and therefore lessen the heating load.

CAUSES OF INFILTRATION

The displacement of heated air in buildings by unheated outside air is due to two causes, namely, (1) the pressure exerted by the wind and (2) the difference in density of outside and inside air because of differences in temperature. The former is generally referred to as *infiltration* and the latter as *stack* or *chimney effect*.

In either case an exact estimate of the amount of infiltration under design conditions is difficult to make. The complicating factors include (1) variations in building construction particularly as to width of crack or size of openings through which air leakage takes place, (2) the variations in wind velocity and direction, (3) the exposure of the building with respect to air leakage openings and with respect to adjoining buildings, (4) the variations in outside temperatures as influencing the chimney effect, (5) the relative area and resistance of openings on the windward and leeward sides and on the lower floors and on the upper floors, and (6) the influence of a planned air supply and the related outlet vents. Tight construction is essential as otherwise unnecessarily large heat losses due to infiltration will result.

INFILTRATION DUE TO WIND PRESSURE

The wind causes a pressure to be exerted on one or two sides of a building. As a result, air comes into the building on the windward side