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CHAPTER 10

MOISTURE IN BUILDING CONSTRUCTION

Properties of Water in Air; Water in Building Materials; Movement of Moisture in Materials; Vapor Transmission; Permeance and Testing; Visible Condensation; Concealed Condensation in Heated Buildings; Control of Concealed Condensation; Condensation in Cooled Structures

THE behavior of moisture is too often overlooked or given scant attention in the design and construction of buildings. It is present as a vapor in all air and as adsorbed moisture in most building materials. It may be present also at times in the free liquid state or as ice, in the solid state, within the range of temperatures encountered in many buildings. Problems involving moisture may arise from changes in moisture content, from the presence of excessive moisture, or from effects associated with its changes in state.

Of particular interest here is the change from the vapor to the liquid or solid state, known as condensation. This may be associated with a reduction of temperature with time, or may occur as a result of migration of water vapor to regions of lower temperature. Moisture problems involving condensation are therefore most likely to occur in buildings in any climate in which there is a source of water vapor at temperatures above normal, or in cooled structures, and in buildings in cold climates.

Moisture problems in residences occur in winter and become increasingly important as homes are built smaller and tighter. Water vapor originates from such necessary living requirements as cooking, laundering, bathing, and the breathing and perspiration of people. In a typical family of four, the average daily production of water vapor from these sources may be as much as 25 lb, and may be much greater where such appliances as humidifiers, automatic washers, and dryers are used.[1] Another large source of water vapor is sometimes the bare earth in a crawl space or basement. All this water vapor must escape from the dwelling.

PROPERTIES OF WATER VAPOR IN AIR

Water vapor in air is a gas which occupies all the space, along with the air present. In many ways, the water vapor can act independently of the air, since in general its properties do not depend on the presence of the air. It exerts its own vapor pressure, and can move about through air in a space, or move through materials under differences in its own vapor pressure, independently of the air. However, when the air is moved suddenly or is heated or cooled, the water vapor present is similarly affected, so that it is usually necessary to consider it as a part of an air-vapor mixture.

The properties of mixtures of air and water vapor are relatively well known and are dealt with fully in Chapter 3, Thermodynamics. Changes in these properties with heating and cooling can be followed readily with the aid of a psychrometric chart, shown in outline in Fig. 1. The satura-