

Water Pressures. Pressures are often stated in feet or inches of water column. At 62 F, with h equal to the head in feet, the pressure of a column of water is $62.383h$ lb per square foot, or $0.433h$ lb per square inch. A column of water 2.309 ft (27.71 in.) high exerts a pressure of one pound per square inch at 62 F.

Boiling Point of Water. The boiling point of water varies with the pressure; it is lower at higher altitudes. A change in pressure will always be accompanied by a change in the boiling point, and there will be a corresponding change in the latent heat of evaporation. These values are given in Table 8.

Specific Heat. The specific heat of water, or the amount of heat (Btu) required to raise the temperature of one pound of water one degree Fahrenheit, varies with the temperature, but it is commonly assumed to be unity at all temperatures. Steam tables are based on exact values, however. The specific heat of ice at 32 F is 0.492 Btu per pound. The amount of heat required to raise one pound of water at 32 F through a known temperature interval depends on the average specific heat for the temperature range.

Sensible and Latent Heat. The heat necessary to raise the temperature of one pound of water from 32 F to the boiling point is known as the *heat of the liquid or sensible heat*. When more heat is added, the water begins to evaporate and expand at constant temperature until the water is entirely changed into steam. The heat thus added is known as the *latent heat of evaporation*.

PROPERTIES OF STEAM

Steam is water vapor which exists in the vaporous condition because sufficient heat has been added to the water to supply the latent heat of evaporation and change the liquid into vapor. This change in state takes place at a definite and constant temperature which is determined solely by the pressure of the steam. The volume of a pound of steam is the *specific volume* which decreases as the pressure increases. The reciprocal of this, or the weight of steam per cubic foot, is the *density*. (See Table 8.)

Steam which is in contact with the water from which it was generated is known as *saturated steam*. If it contains no actual water in the form of mist or priming, it is called *dry saturated steam*. If this be heated and the pressure maintained the same as when it was vaporized, its temperature will increase and it will become *superheated*, that is, its temperature will be higher than that of saturated steam at the same pressure.

REFERENCES

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Chapter 2

REFRIGERANTS AND AIR DRYING AGENTS

Properties of Refrigerant Substances, Selection Factors, Solid Adsorbents, Liquid Absorbents, Nature of Processes, Temperature Pressure Concentration Relations

BOTH cooling and dehumidification of air are usually desirable at certain times. Cooling may be regarded as the extraction of sensible heat while dehumidification necessitates the removal of latent heat. By a suitable selection and combination of methods and equipment these two processes may be accomplished simultaneously or they may be secured independent of each other and at different times as desired. On occasion, the desired result can be secured by extracting sensible heat only while in other cases drying alone will produce the end conditions sought. Suitable substances must be available for use in every particular case.

Generally, when both cooling and dehumidification are sought current practice makes use of artificially produced refrigeration in some form. The substances used as the heat-carrying agents in these applications are called refrigerants. Air drying agents are substances which permit dehumidification of air as a process separate and independent of the extraction of sensible heat from it. Refrigerants and air drying agents are treated separately in this chapter where the aim is to present a statement of the properties of these substances which are of especial importance in air conditioning work. Little mention is made here of methods, systems, or equipment whereby these substances may be applied, which information may be found in Chapter 24.

REFRIGERANTS

Since air cooling and dehumidification are frequently accomplished by evaporating a liquid under circumstances which will permit the heat necessary to be extracted from the air, the refrigerants are substances which are capable of being changed into liquids or vapors within workable temperature and pressure ranges. There are many substances which might be so used but in practice the choice is limited by a wide variety of considerations including availability, cost, safety, chemical stability and adaptability to the type of refrigerating system to be used.

In this chapter detailed consideration is limited to six substances, viz: ammonia, carbon dioxide, dichlorodifluoromethane (F_{12}), methyl