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Chapter 1

FUNDAMENTALS OF HEATING AND AIR CONDITIONING

Dalton's Law, Dry- and Wet-Bulb Temperatures, Properties of Air, Humidity, Relative Humidity, Specific Humidity, Relation of Dew Point to Relative Humidity, Adiabatic Saturation of Air, Total Heat and Heat Content, Enthalpy, Psychrometric Chart, Properties of Steam, Properties of Water, Rate of Evaporation

AIR conditioning has for its objective the supplying and maintaining, in a room or other enclosure, of an atmosphere having a composition, temperature, humidity, and motion which will produce desired effects upon the occupants of the room or upon materials stored or handled in it.

Dry air is a mechanical mixture of gases composed, in percentage of volume, as follows¹: nitrogen 78.03, oxygen 20.99, argon 0.94, carbon dioxide 0.03, and small amounts of hydrogen and other gases.

Atmospheric air at sea level is given in percentage by volume as: N₂ 77.08, O₂ 20.75, water vapor 1.2, A 0.93, CO₂ 0.03 and H₂ 0.01. The amount of water vapor varies greatly under different conditions and is frequently one of the most important constituents since it affects bodily comfort and greatly affects all kinds of hygroscopic materials.

LAW OF PARTIAL PRESSURES

A mixture of dry gases and water vapor, such as atmospheric air, obeys Dalton's Law of Partial Pressures: each gas or vapor in a mixture, at a given temperature, contributes to the observed pressure the same amount that it would have exerted by itself at the same temperature had no other gas or vapor been present. If p = the observed pressure of the mixture and p_1, p_2, p_3 , etc. = the pressure of the gases or vapors corresponding to the observed temperature, then

$$p = p_1 + p_2 + p_3, \text{ etc.} \quad (1)$$

DRY- AND WET-BULB TEMPERATURES

Air is said to be saturated at a given temperature when the water vapor mixed with the air is in the dry saturated condition or, what is the equivalent, when the space occupied by the mixture holds the maximum possible weight of water vapor at that temperature. If the water vapor mixed with the dry air is superheated, i.e., if its temperature is above the temperature of saturation for the actual water vapor partial pressure, the air is not saturated.

¹International Critical Tables.