

W_1 = the weight of water vapor entering, per pound of dry air.
 W_2 = the weight of water vapor leaving, per pound of dry air.
 h_2 = the heat content of the water supplied at t_2 , Btu per pound.
 $h_2 - h_1$ = the increase in the heat content of the air-water vapor mixture in passing through the apparatus, Btu per pound of dry air
 $= 0.24 (t_2 - t_1) + W_2 (1059.2 + 0.45 t_2) - W_1 (1059.2 + 0.45 t_1)$

The net quantity of heat added to or removed from air-water vapor mixtures in air conditioning work is frequently *approximated* by taking the differences in total heat at exit and entrance.

For example, in Fig. 1, an *approximate* result is

$$E_h - R_c = \Sigma_2 - \Sigma_1 \quad (16)$$

where

Σ_2 = the total heat of the air-vapor mixture at exit, Btu per pound of dry air.
 Σ_1 = the total heat of the air-vapor mixture at entrance, Btu per pound of dry air.

From the definitions of *total heat* and *heat content*, it may be demonstrated that Equation 16 is exactly equivalent to Equation 15, when, and only when, $t'_2 = t'_1 = t_2$; i.e., when the initial and final wet-bulb temperatures and the temperature of the water supplied are equal. The one process that meets these conditions is adiabatic saturation, and either equation will give a result of zero; for other conditions, Equation 16 is approximate but satisfactory for many calculations.

The following problems illustrate the application of these principles:

Example 6. Heating (data from Example 2). Assuming the water to be supplied at 50 F, the net quantity of heat supplied is, from Equation 15,

$$E_h - R_c = 0.24 (70 - 0) + 0.000547 \times 0.45 (70 - 0) + 0.005633$$

or

$$1059.2 + 0.45 \times 70 - (50 - 32) = 22.87 \text{ Btu per pound of dry air.}$$

Example 7. Cooling (data from Example 3). If the condensate is removed at 54 F the quantity of heat removed is found from Equation 15, by proper regard to the arrow direction in Fig. 1,

$$E_h + R_c = 0.24 (84 - 54) + 0.00887 \times 0.45 (84 - 54) + 0.00358$$

or

$$1059.2 + 0.45 \times 84 - (54 - 32) = 11.17 \text{ Btu per pound of dry air.}$$

Using Table 5, the initial total heat of the air-vapor mixture, since the wet-bulb temperature is 70 F, is 33.51 Btu per pound of dry air.

The final total heat is, from Table 5, since the exit air is saturated, 22.45 Btu per pound. Hence, using Equation 16, the quantity of heat removed is, approximately, (33.51 - 22.45) or 11.06 Btu per pound of dry air. The degree of approximation to the correct result is evident in this example.

PSYCHROMETRIC CHART⁴

The Bulkeley Psychrometric Chart⁵, as revised will be found as an insert between pages 18 and 19. It shows graphically the relationships expressed in Equations 9a and 9b. It also gives the grains of moisture per

⁴See A Review of Psychrometric Charts, C. O. Mackey, (*Heating and Ventilating*, June, July, 1931).

⁵The Bulkeley Psychrometric Chart was presented to the Society in 1926. (See A.S.H.V.E. TRANSACTIONS, Vol. 32, 1926.) Single copy of the chart can be furnished at a cost of \$.50.