veniently used to interpolate values for the enthalpy, specific volume, and entropy of moist air from the data of Table 2. Within the estimated precision of the data of Table 2, at temperatures below 150 F, the volume v, enthalpy h, and entropy s, of moist air *per pound of dry air* at any degree of saturation μ may be computed from the simple relations:

$$v = v_a + \mu v_{as} \tag{27}$$

$$h = h_a + \mu h_{as} \tag{28}$$

$$s = s_a + \mu s_{as} \tag{29}$$

Thus, the degree of saturation is used in conjunction with Table 2 in the same manner as the quality is used with tables of the thermodynamic properties of steam.

Correction of Table 2 for Temperatures Above 150 F

The simple relations expressed in Equations 27, 28, and 29 give the properties of unsaturated air with satisfactory precision for most engineering design problems. Above 150 F, when greater precision than obtained by Table 2 is required, these simple relations can be adjusted by the addition of supplementary terms.

To correct the volume, it is necessary to add a correction term $\bar{v}$ which is defined as

$$\bar{v} = \frac{\mu(1 - \mu)A}{1 + aW_s\mu} \tag{30}$$

where a denotes the ratio of the apparent molecular weight of dry air (28.966) to the molecular weight of water (18.016) and is equal to 1.6078. Table 5 gives the values of the coefficient A for several higher temperatures, the value of μ at which the correction term $\bar{v}$ attains its maximum value, and the maximum value of $\bar{v}$ term there attained.

The correction term for the enthalpy is

$$\bar{h} = \frac{\mu(1 - \mu)B}{1 + aW_s\mu} \tag{31}$$

Table 5. Coefficients A, B, C Appearing in Equations 30, 31, 32, Maximum Values of Corrections Defined by Equations 30, 31, 32. Degree of Saturation at Which These Maxima Occur, $\bar{\mu}_m$. Maximum Value of Correction Defined by Equation 33. Degree of Saturation at Which This Maximum Occurs, $\bar{\bar{\mu}}_m$.

(Standard Atmospheric Pressure)

t (F)	A (ft^3/lb_a)	B (Btu/lb_a)	C ($Btu/F/lb_a$)	$\bar{v}_{max}$ (ft^3/lb_a)	$\bar{h}_{max}$ (Btu/lb_a)	$\bar{s}_{max}$ ($Btu/F/lb_a$)	$\bar{\mu}_m$	$\bar{\bar{s}}_{max}$ ($Btu/F/lb_a$)	$\bar{\bar{\mu}}_m$
96	0.0018	0.0268	0.00004	0.0004	0.0069	0.00001	0.4925	0.0015	0.3650
112	0.0042	0.0650	0.00009	0.0010	0.0155	0.00002	0.4878	0.0025	0.3632
128	0.0096	0.1439	0.00020	0.0022	0.0332	0.00005	0.4805	0.0040	0.3602
144	0.0215	0.3149	0.00042	0.0047	0.0693	0.00009	0.4691	0.0065	0.3557
160	0.0487	0.6969	0.00091	0.0099	0.1418	0.00019	0.4511	0.0106	0.3485
176	0.1169	1.636	0.00207	0.0207	0.2903	0.00037	0.4213	0.0179	0.3363
192	0.3363	4.608	0.00567	0.0451	0.6180	0.00076	0.3662	0.0333	0.3129

Table 5 gives the values of the coefficient B and maximum values of $\bar{h}$, the maximum values occurring at the same degree of saturation as $\bar{v}$.

Corrections for the entropy consist of two terms: $\bar{s}$ which is defined as

$$\bar{s} = \frac{\mu(1 - \mu)C}{1 + aW_s\mu} \tag{32}$$

and $\bar{\bar{s}}$, the so-called *mixing entropy*, which contributes the larger part of the error. The *mixing entropy* is defined as

$$\bar{\bar{s}} = 0.1579\,[(1 + \mu aW_s)\log_{10}(1 + \mu aW_s - \mu aW_s \log_{10}(\mu) - \mu(1 + aW_s)\log_{10}(1 + aW_s)] \tag{33}$$

Table 5 lists the values of the coefficient C, the maximum values of $\bar{s}$ and $\bar{\bar{s}}$ and the values of μ at which they occur. The maximum $\bar{s}$ occurs at the same degree of saturation as the maximum values of $\bar{v}$ and $\bar{h}$.

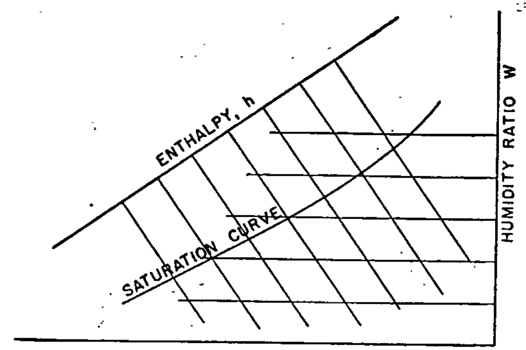

Fig. 3. Basic Coordinates of A.S.H.A.E. Psychrometric Chart

THE ASHAE PSYCHROMETRIC CHART

A psychrometric chart is a graphical representation of the thermodynamic properties of moist air. To be of real value in the solution of engineering problems, it must have distinctive features which aid in problem analysis.

An examination of psychrometric mass and energy balances shows that no properties other than *enthalpy* and *humidity ratio* are required for the solution of problems. It is logical, then, to use these properties as the coordinates of a psychrometric chart. This was initially done by Mollier in 1923,[7, 8] and is the arrangement followed in the chart included with The Guide. The A.S.H.A.E. Psychrometric Chart is based on the best thermodynamic data available today, namely, those of Goff and Gratch, as given in Table 2. The chart is plotted on oblique coordinates of enthalpy and humidity ratio; the enthalpy axis making an angle of approximately 40 deg with the humidity ratio axis. This is shown in Fig. 3.

For practical use, the inclusion of dry-bulb and wet-bulb temperatures, volumes, and indices of the condition of the air in relation to saturation, is necessary for locating and describing states on the chart. The arrange-