is passed through the dehumidifier without being contacted by the surface or medium presents a definite sensible and latent cooling load which must be absorbed by the treated air. In accordance with these premises, when room air is bypassed or passed through the cooling surface or medium without being treated, then Equations 2 and 3 can be solved independently without a cut and try or graphical solution, if either the quantity of supply air has been established, or the temperature difference between the room and supply air temperature has been determined.

If the load created by the uncontacted outside air which passes through the dehumidifier is added to sensible and latent heat gain of the space in their proper proportions and the sensible heat factor corrected accordingly, then Equations 2, 3 and 4 will still apply if they are modified as described later.

Assuming that 20 per cent of the air handled by the dehumidifier passes through without contacting the cooling surface or medium, if this air is treated exactly as infiltration and the room sensible and latent heat gains increased accordingly, then Equations 2 and 3 may be modified to give:

$$Q = \frac{h_{sr}}{0.80\,(t_r - t_e)\,1.08} \tag{2a}$$

$$Q = \frac{h_{sl}}{0.80\,(g_r - g_e)\,0.67} \tag{3a}$$

Equation 4 will remain as before if the untreated air load is apportioned as indicated previously. It should be noted that when evaluating the load added by untreated outdoor air that the temperature difference and moisture content difference between room and outdoor air are to be used and not the difference between outdoor air and apparatus dew-point since the rise from apparatus dew-point to room conditions is charged against the dehumidifier as the cooling and dehumidifying load.

Where winter air conditioning is concerned, the determination of supply air temperature and supply air moisture content does not follow the exact procedure as outlined for summer cooling due to the reversal of requirements and other factors. Because of the nature of the loads and their magnitude and the equipment involved, the sensible and latent losses may be handled as if they were entirely separate in their occurrence since the air quantity required by the sensible heat losses will exceed that required by the moisture losses when related to reasonable and practical supply air temperatures and moisture content. Room sensible heat losses, supply air quantity, and supply air temperature will have the relationship (based on standard air as for Equation 2):

$$Q = \frac{h_{sr}}{(t_e - t_r)\,1.08}$$

where

h_s = room sensible heat loss, Btu per hour.
t_e = supply air temperature, degrees Fahrenheit.
t_r = room temperature, degrees Fahrenheit.

Similarly, room latent heat losses or moisture losses and supply air moisture content have the following relationship (based on standard air and saturated conditions of supply air, as for Equation 3):

$$Q = \frac{h_{lr}}{0.67\,(g_e - g_r)} \text{ or } \frac{m_r}{(g_e - g_r)\,4.5}$$

where

h_{lr} = room latent loss, Btu per hour.
m_r = room moisture loss, grains per hour.
g_e = moisture content of entering air, grains per hour.
g_r = moisture content of room air, grains per pound.

As indicated for winter conditions the determination of the apparatus dew-point may resolve into a solution of Equation 3 following the solution of Equation 2.

Since reheaters are normally rated on average leaving air temperatures with the uncontacted air temperature taken into account Equation 2a usually will not apply.

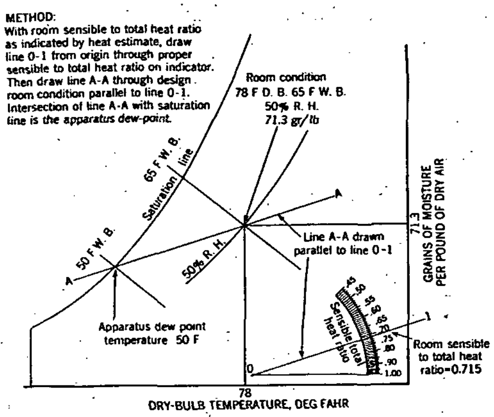

FIG. 13. USE OF PSYCHROMETRIC CHART TO DETERMINE APPARATUS DEW-POINT

If an air washer or humidifying sprays do not saturate, Equation 3a will be modified as (assuming 20 per cent of the air is not contacted by the sprays):

$$Q = \frac{h_r}{0.80\,(g_e - g_r)\,0.67} = \frac{m_r}{0.80\,(g_e - g_r)\,4.5}$$

In winter, room humidities in excess of 30 per cent are seldom required and a low saturating efficiency may be desirable or even necessary where the full summer circulation air through the conditioner is maintained. With a spray type dehumidifier the main sprays may be shut off and an eliminator flooding pump provided which may give sufficient saturation. In other cases, such as where cooling coils are sprayed, the spray water may be throttled.

If the saturating efficiency of the sprays is too low the spray water may be heated. The amount of heat put into the spray water by open or