

is used to raise the sensible heat factor at least to 0.59. Reheat should be added in the room, in the supply air duct, or in the dehumidifier after the cooling coil or spray section. Reheat is usually supplied by steam coils or by a hot gas interchanger using the hot discharge gas from the refrigerating machine.

Example 1. From a cooling load analysis of the room as determined in Example 12, Chapter 3, the net sensible and latent heat gain of 114,510 Btu per hour would be called room total heat; the net moisture gain of 16.018 lb per hour, multiplied by the approximate value of 1050 Btu per pound of moisture, would be called the room latent heat; namely, 16,820 Btu per hour; and $114,510 - 16,820 = 97,690$ Btu per hour which is

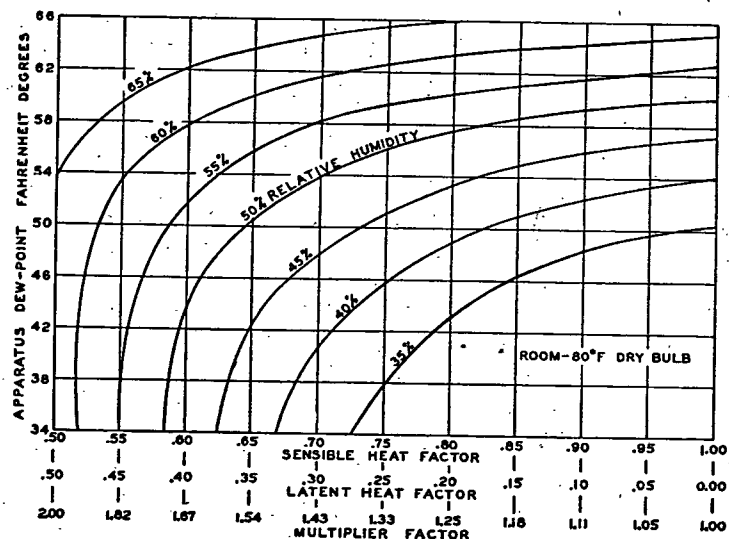


FIG. 14. APPARATUS DEW-POINT REQUIRED FOR VARIOUS SENSIBLE HEAT FACTORS (SHF), LATENT HEAT FACTORS (LHF), AND MULTIPLIER FACTORS (MF) CORRESPONDING TO VARIOUS ROOM RELATIVE HUMIDITIES, FOR ROOM DRY-BULB TEMPERATURE OF 80 F

the room sensible heat. Determine the apparatus dew-point if the room conditions to be maintained are 80 F dry-bulb and 67 F wet-bulb temperature (51.1 per cent relative humidity).

Solution. From Equation 1 the sensible heat factor is $SHF = 97,690 \div 114,510 = 0.853$. Solving Equation 8 by cut and try or by plotting this equation on a curve similar to that in Fig. 13, the apparatus dew-point is 58.6 F. The apparatus dew-point is 58.08 F as determined in Example 12 of Chapter 3. This should be sufficiently accurate for practical applications.

In actual practice, with commercial apparatus, complete saturation is seldom obtained. Four-row finned coils contact approximately 80 per cent of the air, whereas six-row finned coils contact approximately 95 per cent of the air. With spray type dehumidifiers of good design the air leaves the dehumidifier at 1 to 2 deg higher wet-bulb temperature than the spray water leaving the dehumidifier, and the difference between the dry-bulb and wet-bulb temperatures leaving the dehumidifier may

be 1 deg. A spray dehumidifier having sufficient length of spray chamber and density of spray, together with proper arrangement of nozzles, may approach absolute saturation very closely.

The slope of the condition line, or the slope of the line on the psychrometric chart connecting the room condition with the apparatus dew-point on the saturation line, determines the ratio of sensible heat absorbing capacity to the moisture absorbing capacity of the supply air. Therefore the room condition can be maintained as long as the supply air temperature lies on this line, but a greater volume rate of supply air must be used to satisfy the room load if the coil does not contact 100 per cent of the air. For a given room load, the same apparatus dew-point will be required whether the coil contacts all the air or only part of the air.

From the point of view of satisfying the given cooling load requirements, the result of air passing through the apparatus without being contacted produces two effects: (1) It increases the air quantity to be passed through the dehumidifier. Thus, if 20 per cent of the air passing through the coil is contacted, then 25 per cent ($0.20 \div 0.80 \times 100$) more air must be used than would be necessary if all of it were contacted. This is readily seen by examining the heat balance in Equations 6 and 7. (2) It may change the room load which in turn may change the sensible heat factor. If only return air is passed through the dehumidifier or if only room air is by-passed, the room load would not change, but if some outside air is passed through the coil, the room sensible heat gain and room latent heat gain will be changed due to the addition of untreated outside air to the room, which changes the sensible heat factor. When a load calculation is made, it is necessary to know the per cent of air contacted in the cooling coil and calculation made accordingly.

If the ventilation air is drawn through the cooling coil before it goes into the room, only that portion of the air not contacting the coil surface must be included in the room load for the purpose of determining the apparatus dew-point and supply air quantity. It should be noted when evaluating the load added by untreated outside air that the temperature difference between room and outside air should be used and not the difference between outside air and apparatus dew-point, since the rise from the apparatus dew-point to room conditions is charged against the dehumidifier as the cooling and dehumidifying load.

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 air circulation 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 supply may be throttled. If the saturation 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 closed water heaters will be equal to that required to bring the dew-point temperature of the air entering the sprays up to that required before entering the preheater. It is possible, where clean steam is available, to introduce the steam directly into the air stream to produce the desired dew-point temperature of supply air. However, the steam must be exceptionally clean, or objectionable odors will result. This precaution should be observed also where open water heaters or ejector water heaters are used.