

large that normal changes in temperature and humidity have relatively little effect on indoor air conditions. The principal object of air conditioning in such places is to remove excessive heat and moisture by supplying a sufficient quantity of properly conditioned air. The indoor air conditions, however, must be varied according to the outside temperature, as already pointed out.

Other Cooling Load Factors

Although the heat and moisture losses from the human body constitute the major portion of the cooling load in most cases where air conditioning

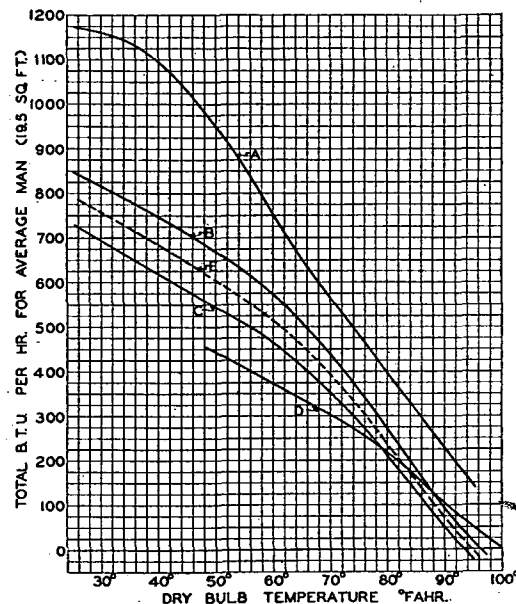


FIG. 6. RELATION BETWEEN SENSIBLE HEAT LOSS FROM THE HUMAN BODY AND DRY-BULB TEMPERATURE FOR STILL AIR*

*Curve A—Men working 66,150 ft-lb per hour. Curve B—Men working 33,075 ft-lb per hour. Curve C—Men working 16,538 ft-lb per hour. Curve D—Men seated at rest. Curves A and C drawn from data at a dry-bulb temperature of 81.3 F only and extrapolating the relation between curves B and D which were drawn from data at many temperatures.

for comfort and health is provided, other factors also must be considered. These include heat from lights, machinery, processes, etc., as well as the transmission and infiltration of heat through the building structure. The computations for these factors may be made in accordance with data given in Chapter 2.

Allowance must also be made in many cases for sun effect on, and heat capacity of, the building structure, studies of which are now in progress at the A.S.H.V.E. Research Laboratory. Another item to be considered is the radiant heat received by the body from high temperature wall and ceiling surfaces.

Examples Involving Heat and Moisture Losses

Example 6. Assume that the design of an air conditioning system for a theater is to be based on an outdoor dry-bulb temperature of 95 F and a wet-bulb temperature of 78 F with an indoor relative humidity of 50 per cent. A dry-bulb temperature midway between 76 F (the probable optimum for continuous exposure) and 95 F, is selected. This is approximately 85 F. Estimate the sensible and latent heat given up per person.

Solution. The sensible heat, and the moisture given up per person per hour under this condition are obtained from Figs. 6 and 7 by following a vertical line from a dry-bulb temperature of 85 F to Curve D, and thence horizontally to the vertical scales. The sensible heat is 165 Btu and the moisture is 1530 grains per person per hour. The latent heat in Btu may be read from Fig. 7 on the vertical scale on the left, or it may be computed by multiplying the moisture loss in pounds by 1040, which is the latent heat of evaporation of water at the temperature of the skin.

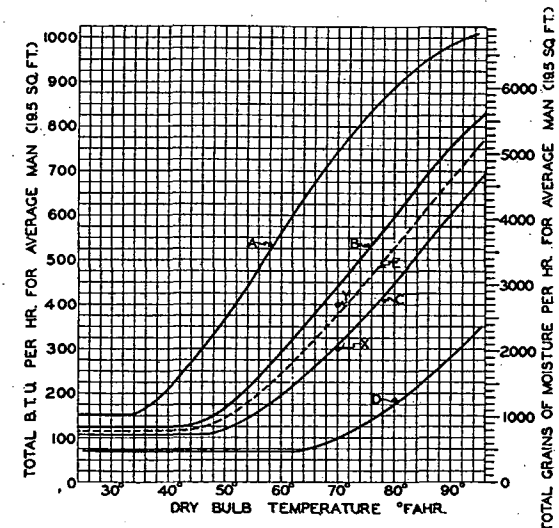


FIG. 7. LATENT HEAT AND MOISTURE LOSS FROM THE HUMAN BODY BY EVAPORATION, IN RELATION TO DRY-BULB TEMPERATURE FOR STILL AIR CONDITIONS*

*Curve A—Men working 66,150 ft-lb per hour. Curve B—Men working 33,075 ft-lb per hour. Curve C—Men working 16,538 ft-lb per hour. Curve D—Men seated at rest. Curves A and C drawn from data at a dry-bulb temperature of 81.3 F only and extrapolating the relation between curves B and D which were drawn from data at many temperatures.

Example 7. How much sensible heat, how much latent heat and how much water vapor will be added per hour to the atmosphere of an auditorium by an audience of 1000 adults, when the dry- and wet-bulb temperatures are 75 F and 63.5 F, respectively?

Solution. From Curve D, Fig. 6, find the sensible heat loss per person for a dry-bulb temperature of 75 F and still air to be 265 Btu per hour. From Fig. 7 find the latent heat loss per person for a dry-bulb temperature of 75 F to be 134 Btu per hour and the moisture added to be 905 grains per hour. Sensible heat = $1,000 \times 265 = 265,000$ Btu. Latent heat = $1,000 \times 134 = 134,000$ Btu. Water vapor added per hour to the air in the auditorium = $1,000 \times 905 = 905,000$ grains or 129 lb.

The sensible and latent heat added to the air may also be found as follows: The effective temperature for dry- and wet-bulb temperatures of 75 F and 63.5 F, respectively, is 70.3 deg. From Curve D, Fig. 5 find 403 Btu as the total heat added to the air by a person for an effective temperature of 70.3 deg. From Fig. 8 find the percentage of sensible and latent heat at a dry-bulb temperature of 75 F to be 66.5 per cent and 33.5