the average maximum dry- and wet-bulb temperatures for other cities. This study covered a twenty-year record of Weather Bureau temperatures. The design temperatures given are not exceeded more than 5 to 8 per cent of the time during a cooling season of 1200 hours in June, July, August, and September for an average year.

Solar Radiation

Fig. 1 shows the total amount of solar energy in Btu per square foot per hour received during the day by a surface normal to the rays of the sun, by a horizontal surface, and by east, west, and south walls. The curves are drawn from A.S.H.V.E. Laboratory data obtained by pyrheliometer, are based on sun time, and are for a perfectly clear day on August 1 at a north latitude of 40 deg. Data from these curves may be used with little error for most United States latitudes and for all of the hotter months of the year.

The absorption of solar radiation by a surface depends upon the character of the surface and the angle of the surface with respect to the direction of the radiation. The heat absorption by a black oilcloth surface perpendicular to the sun's rays was found to be as high as 273 Btu per square foot per hour, based on tests conducted by the A.S.H.V.E. Research Laboratory in Pittsburgh[1]. Lamp black, red brick dust, and aluminum bronze painted surfaces perpendicular to the sun's rays showed, respectively, 94.0, 63.4, and 28.2 per cent as high a rate of absorption as the black oilcloth.

TABLE 2. ALLOWANCE FOR SOLAR RADIATION ON ROOFS AND WALLS

APPROXIMATE NUMBER OF DEGREES TO ADD TO DRY-BULB TEMPERATURE FOR DIFFERENT TYPES OF SURFACES

TYPE OF SURFACE	BLACK	RED BRICK OR TILE	ALUMINUM PAINT
Roof, horizontal	45	30	15
East or west wall	30	20	10
South wall	15	10	5

Solar radiation is an important factor in the mechanism of heat flow into buildings. Research conducted at the A.S.H.V.E. Research Laboratory[2] has shown that a large error may be introduced into the calculations by failure to consider the periodical character of heat flow resulting from the diurnal movement of the sun and the heat capacity of the structure, which determine the timing and magnitude of the heat wave flowing through the wall into a building on a hot, sunny day.

Unfortunately, the calculations for the transmission of heat from solar radiation through building walls are too complicated to be of much

[1]Absorption of Solar Radiation in Relation to the Temperature, Color, Angle, and Other Characteristics of the Absorbing Surface, by F. C. Houghten and Carl Gutberlet (A.S.H.V.E. TRANSACTIONS, Vol. 36, 1930).

[2]For further information on this subject see following A.S.H.V.E. research papers: Coefficients of Heat Transfer as Measured under Natural Weather Conditions, by F. C. Houghten and C. G. F. Zobel (A.S.H.V.E. TRANSACTIONS, Vol. 34, 1928); Absorption of Solar Radiation in Its Relation to the Temperature, Color, Angle and Other Characteristics of the Absorbing Surface, by F. C. Houghten and Carl Gutberlet (A.S.H.V.E. TRANSACTIONS, Vol. 36, 1930); Heat Transmission as Influenced by Heat Capacity and Solar Radiation, by F. C. Houghten, J. L. Blackshaw, E. M. Pugh and Paul McDermott (A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932).

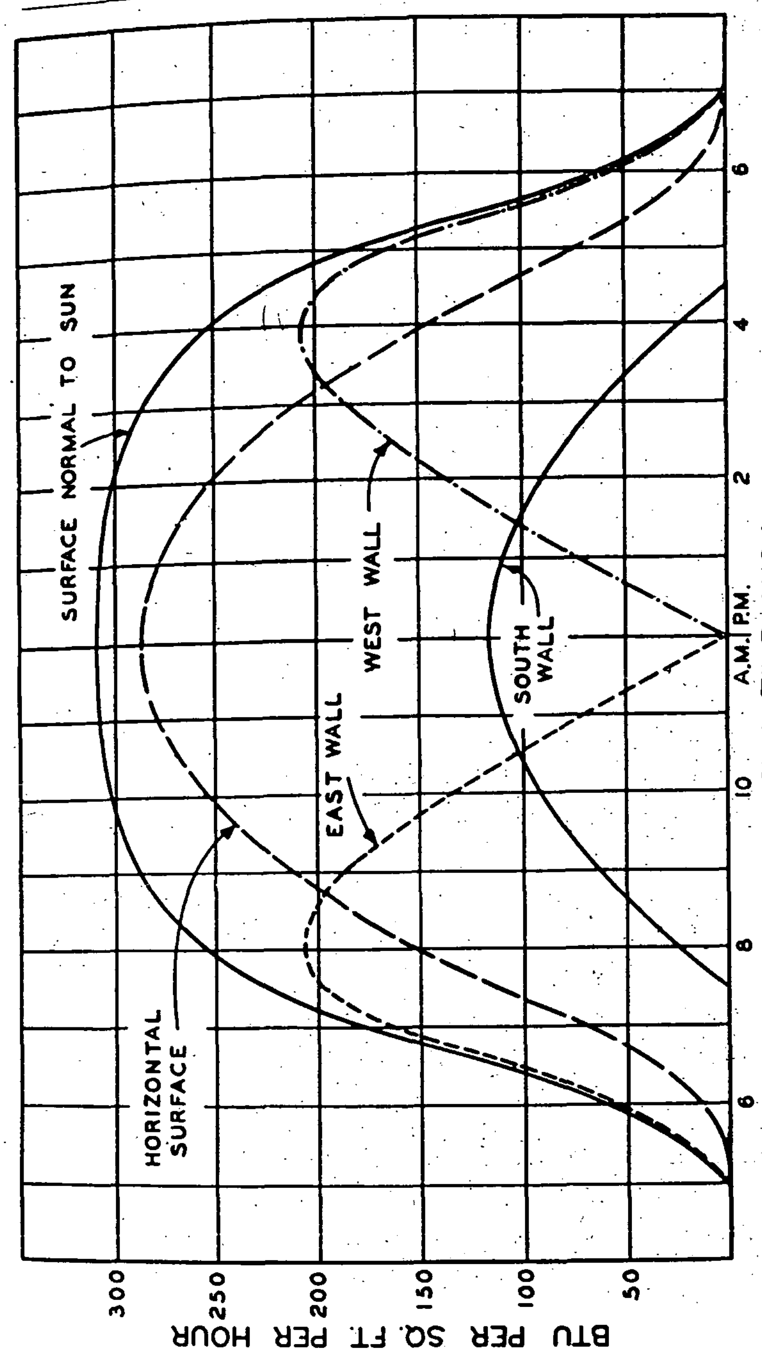

FIG. 1. CURVES GIVING SOLAR INTENSITY NORMAL TO SUN, ON HORIZONTAL SURFACE AND ON WALLS FOR AUGUST 1