The variation in solar intensity is given in Fig. 1. The curves are drawn from A.S.H.V.E. Laboratory data obtained by pyrheliometer, are based on sun time, and apply for a perfectly clear day on August 1 at a north latitude of 40 deg. A study of these curves discloses the periodic relationship and wide variation in solar intensity on various surfaces. It will be observed that both the roof (horizontal surface) and south wall radiation curves are in exact phase relationship with each other and that whereas the east and west wall radiation curves overlap those for roof and south wall, they do not overlap each other. This phase relationship has an important bearing on the cooling load. Failure to consider the periodic character of heat flow resulting from diurnal movement of the sun and the lag due to heat capacity of the structure, which determine the timing and magnitude of the heat wave flowing through the wall, may result in a large error in load calculations.

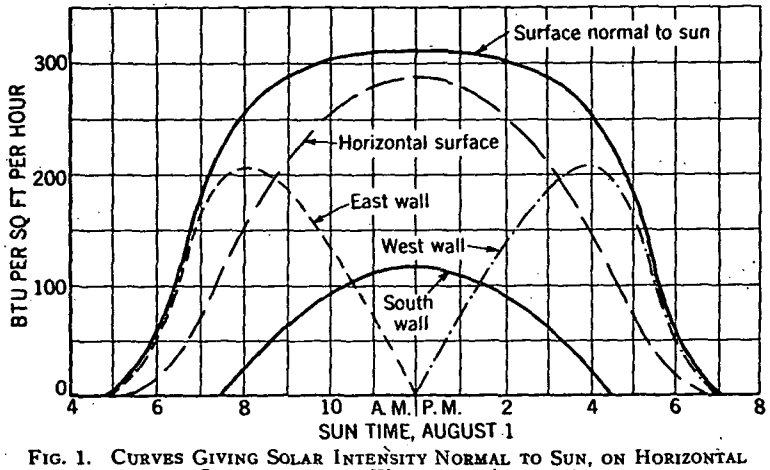

FIG. 1. CURVES GIVING SOLAR INTENSITY NORMAL TO SUN, ON HORIZONTAL SURFACE AND ON WALLS FOR AUGUST 1

The values of solar intensity appearing in Fig. 1 must not be confused with the actual heat transmission through the wall for much of the solar radiation impinging against the outer surface fails to pass through the wall. Instead it is delivered to the outside air by reflection, radiation, convection and conduction. A mathematical solution for the determination of solar heat transmission has been developed but the equations involved are too complex for practical application.[1] From results of this investigation and earlier studies,[2] the Research Laboratory has prepared Tables 2, 3, 4 and 5 which give the solar intensity (I) for various hours of the day on walls of various orientations and horizontal surfaces. These values are shown for north latitudes from 30 to 45 deg.

[1]A.S.H.V.E. RESEARCH REPORT No. 923—Heat Transmission as Influenced by Heat Capacity and Solar Radiation, by F. C. Houghten, J. L. Blackshaw, E. W. Pugh and Paul McDermott(A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932, p. 231).

[2]A.S.H.V.E. RESEARCH REPORT No. 853—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, p. 137).

TABLE 2. SOLAR RADIATION IMPINGING AGAINST WALLS HAVING SEVERAL ORIENTATIONS, AND A HORIZONTAL SURFACE.

For 30 Deg Latitude on the twenty-first of July.

SUN TIME	INTENSITY OF SOLAR RADIATION, BTU PER SQ FT PER HOUR							
	NORTHEAST	EAST	SOUTHEAST	SOUTH	SOUTHWEST	WEST	NORTHWEST	HORIZONTAL SURFACE
4:59	0	0	0					0
5:00	1	1	0.3					0.01
6:00	47	51	24					9
7:00	136	160	90					68
8:00	151	205	136					147
9:00	127	189	140	8				214
10:00	79	141	122	31				265
11:00	21	78	85	45				296
12:00			36	50	36			305
1:00				45	85	78	21	296
2:00				31	122	141	79	265
3:00				8	140	189	127	214
4:00					136	205	151	147
5:00					90	160	136	68
6:00					24	51	47	9
7:00					0.3	1	1	0.01
7:01					0	0	0	0

TABLE 3. SOLAR RADIATION IMPINGING AGAINST WALLS HAVING SEVERAL ORIENTATIONS, AND A HORIZONTAL SURFACE.

For 35 Deg Latitude on the twenty-first of July.

SUN TIME	INTENSITY OF SOLAR RADIATION, BTU PER SQ FT PER HOUR							
	NORTHEAST	EAST	SOUTHEAST	SOUTH	SOUTHWEST	WEST	NORTHWEST	HORIZONTAL SURFACE
4:46	0	0	0					0
5:00	9	9	3					0.01
6:00	67	72	35					15
7:00	142	174	103					77
8:00	150	209	145					151
9:00	118	191	154	26				214
10:00	60	143	139	55				264
11:00	2	75	103	72				291
12:00			55	78	55			300
1:00				72	103	75	2	291
2:00				55	139	143	60	264
3:00				26	154	191	118	214
4:00					145	209	150	151
5:00					103	174	142	77
6:00					35	72	67	15
7:00					3	9	9	0.01
7:14					0	0	0	0