TABLE 10. SOLAR RADIATION TRANSMITTED THROUGH SHADED WINDOWS

TYPE OF SHADING	FINISH	PORTION OF THAT TRANSMITTED BY UNSHADED WINDOW
Canvas awning	Dark	0.25–0.35
Inside venetian blind, slats at 45 deg, fully covering window	Aluminum	0.65–0.80
Inside roller shade, half drawn	Dark	0.90–0.95
Outside venetian blind, slats at 45 deg, extended as an awning without sides to cover approximately ⅔ of window	Light	0.35–0.50
Inside roller shade, fully drawn	Aluminum	Approx. 0.45
Inside roller shade, half drawn	Buff	Approx. 0.70
Outside venetian blind, slats at 45 deg, fully covering window	Aluminum	Approx. 0.60

in Tables 4 to 9 were prepared from solar radiation transmission data developed by the A.S.H.V.E. Research Laboratory [6] and direct radiation intensity values of Moon [7]. Included in these values are also an allowance for sky radiation and a reduction factor to take account of the radiation which is prevented from entering the room due to the glass. The notes accompanying the table give suggested factors of modification due to haze, elevation, time of year, etc. Table 10 gives the portion of the solar radiation transmitted to a room by an unshaded window for different indoor and outdoor shading fixtures according to tests [8] at the A.S.H.V.E. Research Laboratory. It is obvious that there are a number of factors which influence the magnitude of the values, including color, fit, elevation and angle of the sun to the wall and so forth. These values, therefore, can be considered approximate only, and will have to be used with considerable judgment.

Table 11 gives factors by which the solar radiation through unshaded glass should be multiplied to take into account the effect of difference from the usual transmissivity of glass (1 minus absorptivity minus reflectivity) for perpendicularly incident radiation. These tables are for use primarily with *heat absorbent glass*. The values given are only approximate, being based upon radiation perpendicular to the glass; and *are for use with single glass only*.

The total heat transmission through sunlit windows may be expressed by the equation:

$$H_g = A_g[fI + U_g(t_o - t_i)] \qquad (2)$$

where

H_g = heat transmitted through a window, Btu per hour.

A_g = net area of glass, square feet.

TABLE 11. MULTIPLYING FACTORS FOR GLASSES HAVING VARIOUS TOTAL ENERGY TRANSMISSIVITIES

TRANSMISSIVITY	FACTOR
0.900	1.02
0.875	1.00
0.800	0.93
0.700	0.85
0.600	0.76
0.500	0.68
0.400	0.60
0.300	0.52
0.200	0.45

f = factor (from Table 10) for adjustment of radiation transmitted through bare windows due to shading or heat absorbent glass (bare window = 1.0).

I = solar heat gain to room through bare glass, Btu per (hour) (square foot) (Tables 5-9).

U_g = coefficient of transmission of glass, Btu per (hour) (square foot) (Fahrenheit degree).

t_o = outside temperature, Fahrenheit degrees.

t_i = inside temperature, Fahrenheit degrees.

The maximum solar intensity on any surface is of limited duration as shown in Fig. 1. In the case of windows the total energy impinging on the glass before and after the time of maximum intensity is further reduced by increased shading of the glass from the frame, or wall. Another point which should be noted is that the maximum solar radiation load on the east wall occurs early in the morning when the outside temperature is low. Tests [9] have shown that where sunlight from bare windows impinges upon floors and walls of high heat capacity, the effect of the radiation is not immediately felt in the room. On the other hand, where shades or blinds are used, the heat may go directly into the air or it may rise to the top of the room and not be immediately reflected in the room load. For these reasons it is customary to assume a load somewhat below the maximum value; the amount of this reduction being largely a matter of individual judgment depending upon the particular problem in hand, but possibly being of the order of 10 to 20 per cent reduction from the maximum.

The direct solar and scattered sky radiation penetration through glass block panels is given in Table 12 for various times of the day for south, east and west exposures for different latitudes on August 1. This table

TABLE 12. HEAT GAIN THROUGH GLASS BLOCKS[a]

		SOLAR RADIATION HEAT GAIN (DIRECT PLUS SKY) BTU PER (SQ FT) (HOUR)						TOTAL HEAT GAIN[b] (SOLAR RADIATION PLUS NORMAL TRANSMISSION) BTU PER (SQ FT) (HOUR)					
SIDE		EAST[c]	WEST[c]	SOUTH				EAST[c]	WEST[c]	SOUTH			
N. LATITUDE DEGREES		40	40	30	35	40	45	40	40	30	35	40	45
Sun Time	Outside Temp F												
7:00	74	65.0		1.0	2.8	3.0	5.0	61.0		−4.5	−2.0	−0.5	1.0
8:00	76	63.0	0.0	3.0	4.4	6.5	11.0	77.5		0.0	2.0	4.0	5.0
9:00	79	40.0	5.0	5.5	7.1	10.2	13.4	73.5	5.0	5.0	7.0	10.0	12.0
10:00	83	24.0	6.0	8.5	11.3	14.7	17.1	57.5	6.5	11.0	15.0	18.0	20.8
11:00	87	15.5	7.0	12.0	15.2	18.7	21.8	45.0	7.5	16.5	22.0	25.5	32.0
12:00	90	10.0	10.0	14.0	17.4	21.0	24.8	36.5	10.5	21.5	28.0	33.8	40.8
1:00	93	7.0	15.5	12.0	15.2	18.7	21.8	30.0	22.0	25.0	31.8	38.5	46.0
2:00	94	6.0	24.0	8.5	11.3	14.7	17.1	24.0	35.0	26.0	32.0	39.0	47.0
3:00	95	5.0	40.0	5.5	7.1	10.2	13.4	19.5	55.0	24.0	29.8	36.5	45.0
4:00	95	4.5	65.0	3.0	4.4	6.5	11.0	15.5	77.0	20.0	25.5	31.5	40.5
5:00	93	4.0	63.0	1.0	2.8	3.0	5.0	12.5	85.5	15.0	20.0	25.2	33.5
6:00	91	2.5	23.5	0.0	0.7	0.7	3.0	10.5	55.0	9.5	13.5	18.0	25.5
7:00	89	1.5	0.0			0.0	0.7	8.0	18.5	3.5	7.0	11.0	18.0

[a] For August 1.

[b] Inside temperature, 78 F.

[c] For east and west walls these values can be applied to all latitudes between 30 and 45 deg N without excessive errors.