

multiplied by the appropriate coefficient of X listed in Table 14. Second, Table 15 values are multiplied by the appropriate coefficient of Y listed in Table 14, and added to the first value. All convection and radiation gain values for double glass were computed for a $\frac{1}{2}$ -in. air space. No great error is involved in cooling load estimates if these are used for double glass with other air spaces.

Example 8: Find the total instantaneous heat gain through a single sheet of regular plate glass in a southwest wall at 2 p.m. sun time and 40 deg north latitude on August 1. The maximum dry-bulb temperature for design is 98 F; the atmosphere is clear. The indoor temperature is 80 F.

Solution: From Table 12 the heat gain due to transmitted radiation is 148 Btu per (hr) (sq ft) for common window glass; from Table 14, the factor for regular plate glass is 0.87. The coefficient of X in Table 14 is 1.0, while X is found from Table 13 for common window glass for the same hour, orientation and latitude. The coefficient of Y in Table 14 is 0.25, while the Y value is found from Table 15 for a southwest wall at 2:00 p.m. and 40 deg north latitude. The correction for design dry-bulb temperature is found from Table 24 to be 1.0 Btu per (hr) (sq ft) per degree difference from 95 F design temperature. The total instantaneous heat gain is, from Equation 2a,

$$q = 0.87 \times 148 + 1.0 \times 19 + 0.25 \times 27 + 1.0 (98 - 95) \\ = 157.5 \text{ Btu per (hr) (sq ft).}$$

Design Tables for Rolled Figured Glass

Tables 16 and 17 give design values of instantaneous rates of heat gain for a number of common patterns of single vertical sheets of rolled figured glass. The tables are for a solar declination of 18 deg, which corresponds to a nominal August 1 day, and are based upon the solar intensity values for a clear atmosphere as given in Table 4. The values are given in terms of corrections to apply to Tables 12 and 13. The heat gain due to transmitted solar radiation is found by multiplying the Table 12 values by the approximate percentages given in Table 17. To obtain instantaneous rates of heat gain by convection and radiation, Table 15 values are multiplied by the appropriate value of Y from Table 16 and then added to the corresponding Table 13 values. The total instantaneous heat gain is the sum of the gain due to transmitted solar radiation and the gain by convection and radiation.

The values given in Tables 16 and 17 are based upon an A.S.H.A.E. research paper²³ to which the reader is directed for additional data. The values in Tables 16 and 17 may be used with fair precision for other patterns of similar transmittance and surface characteristics. For example, the data for hammered glass may be used for glass having shallow, closely-spaced ribs or for glass having small, closely-spaced circular indentations. Because some patterns have distinct orientation properties, no attempt has been made to give values for non-vertical glass.

Design Tables for Glass Block Walls

Table 18 describes the glass block patterns discussed in following text. Table 19 gives design values for instantaneous heat gain due to *transmitted direct and diffuse solar radiation* for 8 in. hollow glass block of Type I pattern. For glass blocks of Types II to V the corresponding instantaneous heat gain is found by multiplying the value found for Type I block from Table 19 by the appropriate factor from Table 20.

The instantaneous rate of heat gain due to *convection and radiation* for unshaded 8-in. hollow glass blocks of Types I to V are given in Table 21. The *convection and radiation* gain values for all blocks are so nearly the

TABLE 16. APPLICATION FACTORS TO APPLY TO TABLES 13 AND 15 TO OBTAIN INSTANTANEOUS RATES OF HEAT GAIN FOR VERTICAL SINGLE SHEETS OF ROLLED FIGURED GLASS HAVING NORMAL INCIDENCE TRANSMITTANCES AND LISTED THICKNESSES (SMOOTH SIDE INDOOR, FIGURED SIDE OUTDOOR) (See Table 17 for Factors to Apply to Table 12 Values)

GLASS PATTERN	NORMAL INCIDENCE TRANSMITTANCE	THICKNESS, INCHES	FACTOR TO APPLY TO TABLE 13
Hammered	0.75	$\frac{3}{32}$	$1.0(X)^a + 0.50(Y)^{b,c}$
Hammered, etched both sides	0.67	$\frac{3}{32}$	$1.0(X) + 0.65(Y)^d$
Deep ribs on $\frac{1}{2}$ in. centers	0.77 approx.	$\frac{3}{32}$	$1.0(X) + 0.50(Y)^e$
Hammered heat absorbing	0.21	$\frac{1}{4}$	$1.0(X) + 1.15(Y)^f$
Hammered heat absorbing, etched both sides	0.14	$\frac{1}{4}$	$1.0(X) + 1.40(Y)$

^a X values are Table 13 values

^b Y values are Table 15 values

^c Use 0.40(Y) for east and west glass

^d Use 0.60(Y) for east and west glass

^e Use 0.35(Y) for east and west glass

^f Use 0.95(Y) for south glass

TABLE 17. INSTANTANEOUS RATES OF HEAT GAIN DUE TO TRANSMITTED DIRECT AND DIFFUSE SOLAR RADIATION BY UNSHADED ROLLED FIGURED GLASS

Multiply the Table 12 Values by These Percentage Factors

For Clear Atmospheres and 18 Degrees Declination, North (August 1) For 80, 40, and 50 Degrees North Latitude

Note: To obtain total instantaneous heat gain add adjusted Table 12 values to adjusted Table 13 values

INSTANTANEOUS HEAT GAIN DUE TO TRANSMITTED SOLAR RADIATION AS A PERCENTAGE OF SINGLE SHEET OF COMMON WINDOW GLASS

SUN TIME		HAMMERED					HAMMERED AND ETCHED				
AM ↓		N, NW W, SW	NE	E	SE	S	N, NW W, SW	NE	E	SE	S
5 a.m.	7 p.m.	80	80	85	70	80	60	65	75	55	60
6	6	80	85	85	75	80	60	65	75	50	60
7	5	80	80	85	80	80	60	60	70	55	60
8	4	80	75	85	80	75	60	55	65	55	60
9	3	80	60	80	80	60	60	50	55	65	60
10	2	80	65	75	75	65	60	55	60	55	60
11	1	80	80	60	70	65 ^a	60	60	50	60	50
12		80	80	80	60	65 ^a	60	60	60	50	50
SUN TIME		RIBS ON $\frac{1}{2}$ IN. CENTERS					HAMMERED HEAT ABSORBING				
5 a.m. 7 p.m.		60	75	85	25	60	25	20	25	20	25
6	6	60	80	85	30	60	25	20	25	20	25
7	5	60	65	85	40	60	25	20	25	20	25
8	4	60	40	80	50	55	25	20	20	20	25
9	3	60	30	70	55	35	25	20	20	20	20
10	2	60	40	40	55	35	25	20	20	20	20
11	1	60	60	35	40	35 ^b	25	25	20	20	20
12		60	60	60	35	45 ^b	25	25	25	20	20
↑ PM→		N, NE E, SE	NW	W	SW	S	N, NE E, SE	NW	W	SW	S
SUN TIME		HAMMERED AND ETCHED HEAT ABSORBING									
AM ↓		N, NW W, SW	NE	E	SE	S					
5 a.m.	7 p.m.	20	15	15	10	20					
6	6	20	15	15	10	20					
7	5	20	10	15	10	20					
8	4	20	10	15	10	20					
9	3	20	10	10	10	10					
10	2	20	15	10	10	10					
11	1	20	20	10	10	10					
12		20	20	20	10	10					
↑ PM→		N, NE E, SE	NW	W	SW	S					

^a Decrease values 10 percent for 30 deg latitude; increase 15 percent for 50 deg latitude

^b Increase values 30 percent for 50 deg latitude