

TABLE 20. INSTANTANEOUS RATES OF HEAT GAIN DUE TO TRANSMITTED DIRECT AND DIFFUSE SOLAR RADIATION BY UNSHADED WALLS OF 8-IN HOLLOW GLASS BLOCK OF TYPES II, III, IV, IVA AND V PATTERNS

Multiply the Table 19 Values for Type I by These Percentage Factors

For Clear Atmospheres and 18 Deg Declination, North (August 1)

For 30, 40, and 50 Deg North Latitude

Note: To obtain total instantaneous heat gain add adjusted Table 19 values to the Table 21 values.

| INSTANTANEOUS HEAT GAIN DUE TO TRANSMITTED SOLAR RADIATION AS A PERCENTAGE OF TYPE I PATTERN |        |                 |     |     |     |      |                                                                                                                                               |    |    |     |     |
|----------------------------------------------------------------------------------------------|--------|-----------------|-----|-----|-----|------|-----------------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|-----|
| SUN TIME                                                                                     |        | TYPE II PATTERN |     |     |     |      | TYPE III PATTERN                                                                                                                              |    |    |     |     |
| AM →<br>↓                                                                                    |        | N, NW,<br>W, SW | NE  | E   | SE  | S    | N, NW,<br>W, SW                                                                                                                               | NE | E  | SE  | S   |
| 5 a.m.                                                                                       | 7 p.m. | 100             | 100 | 100 | 100 | 100  | 70                                                                                                                                            | 70 | 70 | 70  | 70  |
| 6                                                                                            | 6      | 100             | 95  | 95  | 90  | 100  | 70                                                                                                                                            | 65 | 65 | 70  | 70  |
| 7                                                                                            | 5      | 100             | 90  | 90  | 90  | 100  | 70                                                                                                                                            | 65 | 60 | 65  | 70  |
| 8                                                                                            | 4      | 100             | 95  | 90  | 90  | 100  | 70                                                                                                                                            | 65 | 60 | 65  | 70  |
| 9                                                                                            | 3      | 100             | 95  | 85  | 90  | 90   | 70                                                                                                                                            | 65 | 65 | 70  | 65  |
| 10                                                                                           | 2      | 100             | 95  | 95  | 95  | 95   | 70                                                                                                                                            | 70 | 70 | 75  | 65  |
| 11                                                                                           | 1      | 100             | 100 | 95  | 95  | 100  | 70                                                                                                                                            | 70 | 70 | 80  | 75  |
| 12                                                                                           |        | 100             | 100 | 100 | 100 | 100  | 70                                                                                                                                            | 70 | 70 | 75  | 90  |
| ↑<br>PM →                                                                                    |        | N, NE,<br>E, SE | NW  | W   | SW  | S    | N, NE,<br>E, SE                                                                                                                               | NW | W  | SW  | S   |
| SUN TIME                                                                                     |        | TYPE IV PATTERN |     |     |     |      | TYPE IVA PATTERN                                                                                                                              |    |    |     |     |
| AM →<br>↓                                                                                    |        | N, NW,<br>W, SW | NE  | E   | SE  | S    | N, NW,<br>W, SW                                                                                                                               | NE | E  | SE  | S   |
| 5 a.m.                                                                                       | 7 p.m. | 55              | 45  | 35  | 75  | 55   | 55                                                                                                                                            | 45 | 35 | 30  | 55  |
| 6                                                                                            | 6      | 55              | 45  | 35  | 80  | 55   | 55                                                                                                                                            | 35 | 35 | 30  | 55  |
| 7                                                                                            | 5      | 55              | 45  | 35  | 60  | 55   | 55                                                                                                                                            | 35 | 40 | 35  | 55  |
| 8                                                                                            | 4      | 55              | 45  | 30  | 40  | 55   | 55                                                                                                                                            | 45 | 45 | 45  | 55  |
| 9                                                                                            | 3      | 55              | 50  | 25  | 30  | 60   | 55                                                                                                                                            | 50 | 65 | 65  | 50  |
| 10                                                                                           | 2      | 55              | 55  | 35  | 30  | 50   | 55                                                                                                                                            | 55 | 85 | 90  | 60  |
| 11                                                                                           | 1      | 55              | 55  | 45  | 35  | 40   | 55                                                                                                                                            | 55 | 70 | 105 | 95  |
| 12                                                                                           |        | 55              | 55  | 55  | 50  | 45   | 55                                                                                                                                            | 55 | 55 | 100 | 115 |
| ↑<br>PM →                                                                                    |        | N, NE,<br>E, SE | NW  | W   | SW  | S    | N, NE,<br>E, SE                                                                                                                               | NW | W  | SW  | S   |
| SUN TIME                                                                                     |        | TYPE V PATTERN  |     |     |     |      | Designation of Block Type<br>II—Semi-Light Diffusing<br>III—Light Diffusing<br>IV—Light Diffusing<br>IVA—Light Diffusing<br>V—Light Directing |    |    |     |     |
| AM →<br>↓                                                                                    |        | N, NW,<br>W, SW | NE  | E   | SE  | S    |                                                                                                                                               |    |    |     |     |
| 5 a.m.                                                                                       | 7 p.m. | 60              | 35  | 35  | 30  | 60   |                                                                                                                                               |    |    |     |     |
| 6                                                                                            | 6      | 60              | 35  | 35  | 30  | 60   |                                                                                                                                               |    |    |     |     |
| 7                                                                                            | 5      | 60              | 35  | 40  | 35  | 60   |                                                                                                                                               |    |    |     |     |
| 8                                                                                            | 4      | 60              | 50  | 55  | 50  | 60   |                                                                                                                                               |    |    |     |     |
| 9                                                                                            | 3      | 60              | 80  | 90  | 90  | 60   |                                                                                                                                               |    |    |     |     |
| 10                                                                                           | 2      | 60              | 70  | 105 | 105 | 90*  |                                                                                                                                               |    |    |     |     |
| 11                                                                                           | 1      | 60              | 60  | 80  | 110 | 105* |                                                                                                                                               |    |    |     |     |
| 12                                                                                           |        | 60              | 60  | 60  | 85  | 115* |                                                                                                                                               |    |    |     |     |
| ↑<br>PM →                                                                                    |        | N, NE,<br>E, SE | NW  | W   | SW  | S    |                                                                                                                                               |    |    |     |     |

\* Reduce by 30% for 30 deg N latitude only.

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block in east or west facing walls; 10 percent for south facing flat glass; 5 percent for south facing glass block walls.

### Shading of Glass Areas—Shade Factors

The shade factor is defined as the total gain from a shade-glass combination minus the convection and radiation gain from single unshaded common window glass divided by the total incident solar radiation transmitted by single unshaded common window glass. In equation form,

$$\text{Shade factor} = \frac{\left( \begin{array}{l} \text{Total Gain from} \\ \text{Shade Glass} \\ \text{Combination} \end{array} \right) - \left( \begin{array}{l} \text{Convection \& Radiation} \\ \text{Gain from Single} \\ \text{Unshaded Common Glass} \end{array} \right)}{\text{Total Solar Energy Transmitted by Single Unshaded Common Glass}}$$

TABLE 21. INSTANTANEOUS RATES OF HEAT GAIN BY CONVECTION AND RADIATION FROM UNSHADED WALLS OF 8-IN. HOLLOW GLASS BLOCK OF PATTERNS TYPE I, II, III, IV, IVA AND V\*

For Clear Atmospheres and 18 Deg Declination, North (August 1)

For 80 F Indoor Temperature

Note: For total instantaneous heat gain add these values to values in Table 17, or Table 19 adjusted by Table 20 factors.

| SUN TIME |    | DRY-BULB FAHR.                     | INSTANTANEOUS HEAT GAIN IN BTU PER (HR) (SQ FT) |    |                 |    |    |    |                 |    |
|----------|----|------------------------------------|-------------------------------------------------|----|-----------------|----|----|----|-----------------|----|
|          |    |                                    | N                                               | NE | E               | SE | S  | SW | W               | NW |
| 5 a.m.   | 74 | 40<br>Degrees<br>North<br>Latitude | -3                                              | -3 | -3              | -3 | -3 | -3 | -3              | -3 |
| 6        | 74 |                                    | 0                                               | 3  | 4 <sup>a</sup>  | 3  | -2 | -2 | -2              | -2 |
| 7        | 75 |                                    | 1                                               | 15 | 17 <sup>a</sup> | 13 | -1 | -1 | -1              | -1 |
| 8        | 77 |                                    | 0                                               | 21 | 26 <sup>a</sup> | 21 | 1  | 0  | 0               | 0  |
| 9        | 80 |                                    | 0                                               | 20 | 33              | 27 | 5  | 1  | 2               | 1  |
| 10       | 83 |                                    | 2                                               | 12 | 36              | 32 | 12 | 3  | 3               | 3  |
| 11       | 87 |                                    | 4                                               | 6  | 29              | 32 | 19 | 5  | 6               | 5  |
| 12       | 90 |                                    | 6                                               | 8  | 16              | 26 | 23 | 9  | 8               | 7  |
| 1 p.m.   | 93 |                                    | 8                                               | 10 | 14              | 14 | 26 | 25 | 12              | 9  |
| 2        | 94 |                                    | 9                                               | 10 | 15              | 11 | 25 | 37 | 28              | 11 |
| 3        | 95 |                                    | 11                                              | 11 | 16              | 11 | 21 | 44 | 41              | 17 |
| 4        | 94 |                                    | 11                                              | 11 | 15              | 11 | 16 | 45 | 44              | 30 |
| 5        | 93 |                                    | 11                                              | 10 | 13              | 10 | 13 | 43 | 42 <sup>a</sup> | 35 |
| 6        | 91 |                                    | 13                                              | 9  | 11              | 9  | 11 | 35 | 35 <sup>a</sup> | 29 |
| 7        | 87 |                                    | 11                                              | 7  | 8               | 7  | 8  | 19 | 21 <sup>a</sup> | 15 |
| 8        | 85 |                                    | 7                                               | 4  | 4               | 4  | 4  | 7  | 7               | 4  |
| 9        | 83 | 4                                  | 3                                               | 2  | 3               | 2  | 3  | 4  | 3               |    |

| SUN TIME | DRY-BULB | LATITUDE                                        | SE | S  | SW | LATITUDE                                        | SE | S  | SW |
|----------|----------|-------------------------------------------------|----|----|----|-------------------------------------------------|----|----|----|
| 5 a.m.   | 74       | 30 <sup>b</sup><br>Degrees<br>North<br>Latitude | -3 | -3 | -3 | 50 <sup>b</sup><br>Degrees<br>North<br>Latitude | -3 | -3 | -3 |
| 6        | 74       |                                                 | 1  | -2 | -2 |                                                 | 5  | -2 | -2 |
| 7        | 75       |                                                 | 11 | -1 | -1 |                                                 | 13 | -1 | -1 |
| 8        | 77       |                                                 | 20 | 0  | 0  |                                                 | 21 | 0  | 0  |
| 9        | 80       |                                                 | 26 | 1  | 2  |                                                 | 27 | 6  | 1  |
| 10       | 83       |                                                 | 29 | 4  | 4  |                                                 | 32 | 15 | 2  |
| 11       | 87       |                                                 | 26 | 8  | 5  |                                                 | 35 | 22 | 4  |
| 12       | 90       |                                                 | 18 | 12 | 7  |                                                 | 33 | 28 | 17 |
| 1 p.m.   | 93       |                                                 | 10 | 15 | 16 |                                                 | 23 | 31 | 31 |
| 2        | 94       |                                                 | 11 | 16 | 30 |                                                 | 12 | 32 | 39 |
| 3        | 95       |                                                 | 12 | 14 | 39 |                                                 | 11 | 28 | 43 |
| 4        | 94       |                                                 | 12 | 13 | 43 |                                                 | 11 | 20 | 44 |
| 5        | 93       |                                                 | 11 | 11 | 41 |                                                 | 10 | 12 | 43 |
| 6        | 91       |                                                 | 10 | 9  | 32 |                                                 | 9  | 10 | 36 |
| 7        | 87       |                                                 | 6  | 6  | 15 |                                                 | 7  | 7  | 23 |
| 8        | 85       |                                                 | 4  | 4  | 6  |                                                 | 4  | 4  | 10 |
| 9        | 83       | 3                                               | 3  | 3  | 3  | 3                                               | 3  |    |    |

\* For types III, IV, IVA and V patterns and 30, 40 and 50 deg latitudes, multiply east wall values for 6, 7 and 8 a.m. by 1.40, and west wall values for 5, 6 and 7 p.m. by 1.25.

b For N, NE, E, W and NW use 40 deg North Latitude values.

Design shade factors for a number of combinations are listed in Table 25. The total gain for a shaded window is found by multiplying the values of Table 12 by the appropriate shade factor and adding to these values the corresponding values from Table 13.

The values for sunlit windows are average values based upon calculations for several orientations. Actually the shade factor varies somewhat with orientation and time of day, because the proportion of direct to diffuse incident solar radiation as well as the profile angle varies. Generally these variations may be neglected.

There are a number of variables affecting these ratios such as color, fit, solar altitude, and angle of incidence of the solar radiation. These values, therefore, must be considered as approximate, only, and will have to be used with considerable judgment. An inside shade is effective to the ex-