

tions next to unheated spaces, (4) ceilings of upper floors, either below a cold attic space or as the underside of a roof slab, and (5) floors of heated rooms above an unheated space. In most cases, only items (1) and (2), outside wall and glass surface, are considered. Failure to take account of the other heat losing surfaces, items (3), (4) and (5), when they exist in a building, has generally resulted in more or less dissatisfaction with the operation of the heating plant, as a result of failure to heat the rooms having such surfaces as indicated by items (3), (4) and (5).

The net outside wall surface is usually determined by reference to the scale plans and elevations of the building concerned. In some cases of course, the actual building may have to be measured. The total area of all outside openings which are occupied by windows and doors is accurately measured and listed as *glass*. The *glass* area is then deducted from the total outside wall area for each room and the difference is the net wall area. The outside wall areas for any floor should be based on the vertical floor to floor heights and the horizontal distance from center to center of partitions separating different rooms. If there are no partitions, measure from inside face of one wall to inside face of next wall. The areas of walls, ceilings and floors next to cold or unheated spaces are found, of course, by taking the inside dimensions of such areas, measured on the heated side.

#### CALCULATIONS FOR HEAT TRANSMISSION LOSSES

The calculations for heat transmission losses are made by multiplying the area *S* in square feet of wall, glass, roof or floor through which the loss takes place, by the proper coefficient *U* for such construction (Tables 6 to 12, or by computation as described under Transmission Coefficients by Computation) and by the temperature difference between the inside air temperature *t* at the proper level (in many cases not the "breathing line") and the outside air temperature *t<sub>o</sub>*. Therefore,

$$H_t = SU (t - t_o) \quad (9)$$

where

*H<sub>t</sub>* = B.t.u. per hr. transmitted through the material of the wall, glass, roof or floor.

*S* = area in sq. ft. of wall, glass, roof or floor, taken from building plans or actually measured. (Use the net inside or heated surface dimensions in all cases.)

*U* = coefficient of heat transmission or B.t.u. per hr. per sq. ft. per 1 deg. fahr. difference between the inside and outside air temperature for air conditions such as exist in the given locality in coldest weather.

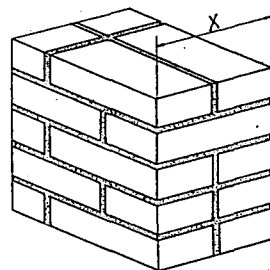
(*t - t<sub>o</sub>*) = temperature difference between inside and outside air, in which *t* must always be taken at the proper level. Note that *t* may not be the "breathing line" temperature in many cases.

For examples showing application of equation (9) to practical examples see *Applications* at the end of this chapter, in which the heat requirements are computed for typical cases.

#### CHAPTER I—CALCULATING THE HEAT LOSSES FROM BUILDINGS

TABLE 6-A. COEFFICIENTS OF TRANSMISSION (*U*) OF VARIOUS TYPES OF MASONRY WALL CONSTRUCTION

Note.—These coefficients are expressed in B.t.u. per hour per square foot per 1 deg. fahr. difference in temperature between the air on the two sides and are based on an outside wind exposure of 15 miles per hour.

| SOLID BRICK WALLS †                                                                                                                           |                                                                     |     |                                                                                     |            |       |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------|------------|-------|-------|
| The values of U in this Table are based on the following Internal Conductivities (C) which are expressed in B.t.u. per Hr. per Sq.Ft. per 1°F |                                                                     |     |  |            |       |       |
|                                                                                                                                               |                                                                     |     |                                                                                     |            |       |       |
| Brick                                                                                                                                         |                                                                     |     | 5.00                                                                                | per 1'     |       |       |
| Cement Mortar                                                                                                                                 |                                                                     |     | 8.00                                                                                | per 1'     |       |       |
| Plaster Board                                                                                                                                 |                                                                     |     | 3.04                                                                                | per 1'     |       |       |
| Plaster (Gypsum)                                                                                                                              |                                                                     |     | 2.32                                                                                | per 1'     |       |       |
| Wood Lath & Plaster                                                                                                                           |                                                                     |     | 2.00                                                                                | as applied |       |       |
| Corkboard                                                                                                                                     |                                                                     |     | 0.30                                                                                | per 1'     |       |       |
| Fiber Insulation (Board form)                                                                                                                 |                                                                     |     | 0.33                                                                                | per 1'     |       |       |
| Cellular Gypsum (18")                                                                                                                         |                                                                     |     | 0.59                                                                                | per 1'     |       |       |
| Powdered Gypsum (26")                                                                                                                         |                                                                     |     | 0.52                                                                                | per 1'     |       |       |
| Y = Thickness of Insulation where specified                                                                                                   |                                                                     |     |                                                                                     |            |       |       |
| Wall Number                                                                                                                                   | Interior Construction                                               | Y   | Thickness of Brick - X                                                              |            |       |       |
|                                                                                                                                               |                                                                     |     | 4"                                                                                  | 13"        | 18"   | 24"   |
|                                                                                                                                               |                                                                     |     | a                                                                                   | b          | c     | d     |
| 1                                                                                                                                             | Plain Walls - No Interior Finish                                    |     | 0.358                                                                               | 0.278      | 0.218 | 0.173 |
| 2                                                                                                                                             | ½" Plaster on Brick                                                 |     | 0.332                                                                               | 0.263      | 0.208 | 0.166 |
| 3                                                                                                                                             | ¾" Plaster on Metal Lath - Furred                                   |     | 0.216                                                                               | 0.185      | 0.156 | 0.131 |
| 4                                                                                                                                             | ½" Plaster on Wood Lath - Furred                                    |     | 0.209                                                                               | 0.179      | 0.152 | 0.128 |
| 5                                                                                                                                             | ½" Plaster on ¾" Plaster Board - Furred                             |     | 0.215                                                                               | 0.184      | 0.155 | 0.131 |
| 6                                                                                                                                             | ½" Plaster on Wood Lath on 2" Furring Strips - Cellular Gypsum Fill | 1½" | 0.165                                                                               | 0.146      | 0.128 | 0.111 |
| 7                                                                                                                                             | ½" Plaster on Wood Lath on 2" Furring Strips - Powdered Gypsum Fill | 1½" | 0.156                                                                               | 0.139      | 0.122 | 0.106 |
| 8                                                                                                                                             | ½" Plaster on Fibre Insulation - (Board form) Furred                | ½"  | 0.166                                                                               | 0.147      | 0.128 | 0.111 |
| 9                                                                                                                                             |                                                                     | 1"  | 0.133                                                                               | 0.120      | 0.107 | 0.095 |
| 10                                                                                                                                            | ½" Plaster on Corkboard set in ½" Cement Mortar                     | 1½" | 0.124                                                                               | 0.113      | 0.102 | 0.090 |
| 11                                                                                                                                            |                                                                     | 2"  | 0.103                                                                               | 0.095      | 0.087 | 0.079 |

\*Based on 1½ in. the actual thickness of 2 in. furring strips.

†The coefficients on this page can also be used with sufficient accuracy for the Ideal Rolok-Bak Wall.