Usually, in an actual wall exposed to wind on the outside, K_2 (Table 5) is greater than K_1 and (t_2-t_0) must be less than $(t-t_1)$. Moreover, the heat H_c passing through the wall by conduction is equal to H_1 and H_2, and if C is the coefficient of conduction = B.t.u. transmitted per hour per square foot of material per 1 in. thickness per degree difference between the surface temperatures, then

$$H_1 = H_2 = H_c = \frac{C}{x}(t_1 - t_2)\,S \qquad (3)$$

where x = wall thickness in inches.

These equations (1), (2) and (3) are fundamental and are used for determining values for K_1, K_2 and C for actual wall materials by test. They cannot be used for computing heat losses in an actual building, since the surface temperatures t_1 and t_2 are seldom known, although these surface temperatures can be determined in a test by means of thermocouples. Hence, for actual conditions where the only temperatures known are the inside and outside air temperatures t and t_0, it is necessary to use a transmission coefficient U = B.t.u. transmitted per hour per square foot of wall surface per degree difference between the inside and outside air temperatures. Values of U for a limited number of walls are given in Tables 6-12. The heat H transmitted per hour from air inside to air outside is then computed as follows:

$$H = U\,(t - t_0)\,S \qquad (4)$$

and since $H = H_1 = H_2 = H_c$, the right hand members of equations (1), (2), (3) and (4) are all equal.

The coefficient U may be determined by test, or it may be computed for any wall provided values for K_1, K_2 and C are known. By proper substitution in the four equations, the unknown temperatures t_1 and t_2 can be eliminated and the value of the transmission coefficient for a simple wall x inches thick is

$$U = \frac{1}{\frac{1}{K_1} + \frac{1}{K_2} + \frac{x}{C}} \qquad (5)$$

and for a compound wall of several materials having thickness in inches of x_1, x_2, x_3, etc., the coefficient is

$$U = \frac{1}{\frac{1}{K_1} + \frac{1}{K_2} + \frac{x_1}{C_1} + \frac{x_2}{C_2} + \frac{x_3}{C_3} + \text{etc.}} \qquad (6)$$

As in the case of the simple wall, K_1 and K_2 are always the inside and outside surface coefficients for the two materials in contact with air. If the air is still (no wind), then for the same material K_1 and K_2 are the same, and $K_1 = K_2$; but if the outside air is in motion then K_2 is always greater than K_1 and will increase as the wind velocity increases. Values

TABLE 3. SURFACE COEFFICIENTS (K_1) FOR VARIOUS BUILDING MATERIALS UNDER STILL AIR (NO WIND) CONDITIONS

The values in the table are in B.t.u. per square feet of wall surface per hour per 1 deg. fahr. difference between the mean air temperature in the room and the inside surface temperature of the wall.

Building Material	Surface Coefficient K_1 (Still Air) Harding and Willard	Wood
Asbestos (sheet)	1.40	....
Brickwork (ordinary)	1.40	....
Cement Plaster (finished)	0.93	....
Concrete	1.30	....
Corkboard	1.25	1.20
Glass (window)	1.50	1.90*
Magnesia (blocks)	1.45	....
Wood (finished surface)	1.40	....
Building paper	....	1.40
Average of all values	1.34	....

*Average of both sides of glass 0.12 in. thick and for 70 deg. fahr. total temperature difference from air to air with moving air on one side. Probable value for still air on both sides 1.60.

for K_1 in still air as determined by various investigators are given in Table 3. Values for C, the conductivity of building materials, are given in Table 4, and are taken from the published values of various investigators. It should be noted that values of C as well as U are dependent on the temperature range, and it is therefore desirable that the investigator determine conductivity values when the wall is subjected to an air temperature of about 70 deg. fahr. on the inside and about zero on the outside.

In the case of air space construction, two additional surface coefficients for each air space must be inserted in either equation (5) or (6). These surface coefficients may be taken the same as the K_1 (still air) values for the materials forming the sides of the air spaces; thus for a simple wall with one air space,

$$U = \frac{1}{\frac{1}{K_1} + \frac{1}{K_2} + \frac{1}{K_1} + \frac{1}{K_1} + \frac{x}{C}} \qquad (7)$$

or

$$= \frac{1}{\frac{3}{K_1} + \frac{1}{K_2} + \frac{x}{C}} \qquad (8)$$

With certain very special forms of construction which have irregular air spaces, it is necessary to use the conductivity for the unit construction as actually assembled in the wall. This condition exists when hollow tile is used as furring, in which case $\frac{x_1}{C_1}$ is replaced by $\frac{1}{C_u}$, where C_u is the unit conductivity. (*See second footnote of Table 4.*)