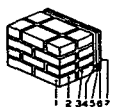
Table 6 .... Coefficients of Transmission (*U*) of Solid Masonry Walls[a]

Coefficients are expressed in Btu per (hour) (square foot) (Fahrenheit degree difference in temperature between the air on the two sides), and are based on an outside wind velocity of 15 mph



Example—Wall G 2		*Example of Substitution*	
Resistances used are given below in this table or in Table 5 or 4		*Resistances used are given below in this table or in Table 5 or 4*	
Construction	Resistance (*R*)	Assume plain wall—no furring or plaster.	
1. Outside surface (15 mph wind)	0.17	Total resistance	5.47
2. Face brick (4 in.)	0.44	Deduct 4. Air space	0.97
3. Common brick (4 in.)	0.80	5. Gypsum lath (⅜ in.)	0.32
4. Air space[b]	0.97	6. Plas. (sand agg.) (½ in.)	0.09 1.38
5. Gypsum lath (⅜ in.)	0.32	Total resistance	2.09
6. Plas. (sand agg.) (½ in.)	0.09	*U* = 1/*R* = 1/2.09 =	0.48
7. Inside surface (still air)	0.68		
Total resistance	3.47		
U = 1/*R* = 1/3.47 =	0.29		

See value 0.29 in boldface type in table below.

To Adjust U Values for Construction with Added Insulation between Furring Strips, See Table 16

Exterior Construction[c]		*Interior Finish* None	Plas. ⅜ in. on Wall (Sand agg.)	Plas. ⅜ in. on Wall (Lt. wt. agg.)	Metal Lath and ¾ in. Plas. on Furring (Sand agg.)	Metal Lath and ¾ in. Plas. on Furring (Lt. wt. agg.)	Gypsum Lath (⅜ in.) and ½ in. Plas. on Furring (No plas.)	Gypsum Lath (⅜ in.) and ½ in. Plas. on Furring (Sand agg.)	Gypsum Lath (⅜ in.) and ½ in. Plas. on Furring (Lt. wt. agg.)	Insul. Bd. Lath (½ in.) and ½ in. Plas. on Furring (No plas.)	Insul. Bd. Lath (½ in.) and ½ in. Plas. on Furring (Sand agg.)	Wood Lath and ½ in. Plas. (Sand agg.)	Number
Resistance →			0.11	0.39	0.13	0.47	0.32	0.41	0.64	1.43	1.52	0.40	
Material	*R*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	
		A	B	C	D	E	F	G	H	I	J	K	
Brick (face and common)[d]													
(6 in.)	0.61	0.68	0.64	0.54	0.39	0.34	0.36	0.35	0.33	0.26	0.25	0.35	1
(8 in.)	1.24	0.48	0.45	0.41	0.31	0.28	0.30	0.29	0.27	0.22	0.22	0.29	2
(12 in.)	2.04	0.35	0.33	0.30	0.25	0.23	0.24	0.23	0.22	0.19	0.19	0.23	3
(16 in.)	2.84	0.27	0.26	0.25	0.21	0.19	0.20	0.20	0.19	0.16	0.16	0.20	4
Brick (common only)													
(8 in.)	1.60	0.41	0.39	0.35	0.28	0.26	0.27	0.26	0.25	0.21	0.20	0.26	5
(12 in.)	2.40	0.31	0.30	0.27	0.23	0.21	0.22	0.22	0.21	0.18	0.17	0.22	6
(16 in.)	3.20	0.25	0.24	0.23	0.19	0.18	0.19	0.18	0.18	0.16	0.15	0.18	7
Stone (lime and sand)													
(8 in.)	0.64	0.67	0.63	0.53	0.39	0.34	0.36	0.35	0.32	0.26	0.25	0.35	8
(12 in.)	0.96	0.55	0.52	0.45	0.34	0.31	0.32	0.31	0.29	0.24	0.23	0.31	9
(16 in.)	1.28	0.47	0.45	0.40	0.31	0.28	0.29	0.28	0.27	0.22	0.22	0.29	10
(24) in.	1.92	0.36	0.35	0.32	0.26	0.24	0.25	0.24	0.23	0.19	0.19	0.24	11
Hollow clay tile													
(8 in.)	1.85	0.36	0.36	0.32	0.26	0.24	0.25	0.25	0.23	0.20	0.19	0.25	12
(10 in.)	2.22	0.33	0.31	0.29	0.24	0.22	0.23	0.22	0.21	0.18	0.18	0.23	13
(12 in.)	2.50	0.30	0.29	0.27	0.22	0.21	0.22	0.21	0.20	0.17	0.17	0.21	14
Poured concrete													
30 lb per cut ft													
(4 in.)	4.44	0.19	0.19	0.18	0.16	0.15	0.15	0.15	0.14	0.13	0.13	0.15	15
(6 in.)	6.66	0.13	0.13	0.13	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.11	16
(8 in.)	8.88	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.09	17
(10 in.)	11.10	0.08	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07	0.08	18
80 lb per cut ft													
(6 in.)	2.40	0.31	0.30	0.27	0.23	0.21	0.22	0.22	0.21	0.18	0.17	0.22	19
(8 in.)	3.20	0.25	0.24	0.23	0.19	0.18	0.19	0.18	0.18	0.16	0.15	0.18	20
(10 in.)	4.00	0.21	0.20	0.19	0.17	0.16	0.16	0.16	0.15	0.14	0.14	0.16	21
(12 in.)	4.80	0.18	0.17	0.17	0.15	0.14	0.14	0.14	0.14	0.12	0.12	0.14	22
140 lb per cut ft													
(6 in.)	0.48	0.75	0.69	0.58	0.41	0.36	0.38	0.37	0.34	0.27	0.26	0.37	23
(8 in.)	0.64	0.67	0.63	0.53	0.39	0.34	0.36	0.35	0.32	0.26	0.25	0.35	24
(10 in.)	0.80	0.61	0.57	0.49	0.36	0.32	0.34	0.33	0.31	0.25	0.24	0.33	25
(12 in.)	0.96	0.55	0.52	0.45	0.34	0.31	0.32	0.31	0.29	0.24	0.23	0.31	26

Table 6 .... Coefficients of Transmission (*U*) of Solid Masonry Walls (*Concluded*)

Exterior Construction[c]		*Interior Finish* None	Plas. ⅜ in. on Wall (Sand agg.)	Plas. ⅜ in. on Wall (Lt. wt. agg.)	Metal Lath and ¾ in. Plas. on Furring (Sand agg.)	Metal Lath and ¾ in. Plas. on Furring (Lt. wt. agg.)	Gypsum Lath (⅜ in.) and ½ in. Plas. on Furring (No plas.)	Gypsum Lath (⅜ in.) and ½ in. Plas. on Furring (Sand agg.)	Gypsum Lath (⅜ in.) and ½ in. Plas. on Furring (Lt. wt. agg.)	Insul. Bd. Lath (½ in.) and ½ in. Plas. on Furring (No plas.)	Insul. Bd. Lath (½ in.) and ½ in. Plas. on Furring (Sand agg.)	Wood Lath and ½ in. Plas. (Sand agg.)	Number
Resistance →			0.11	0.39	0.13	0.47	0.32	0.41	0.64	1.43	1.52	0.40	
Material	*R*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	*U*	
		A	B	C	D	E	F	G	H	I	J	K	
Concrete block (gravel agg.)													
(8 in.)	1.11	0.52	0.48	0.43	0.33	0.29	0.31	0.30	0.28	0.23	0.22	0.30	27
(12 in.)	1.28	0.47	0.45	0.40	0.31	0.28	0.29	0.28	0.27	0.22	0.22	0.29	28
(Cinder agg.)													
(8 in.)	1.72	0.39	0.37	0.34	0.27	0.25	0.26	0.25	0.24	0.20	0.20	0.25	29
(12 in.)	1.89	0.36	0.35	0.32	0.26	0.24	0.25	0.24	0.23	0.19	0.19	0.24	30
(Lt. wt. agg.)													
(8 in.)	2.00	0.35	0.34	0.31	0.26	0.23	0.24	0.24	0.22	0.19	0.19	0.24	31
(12 in.)	2.27	0.32	0.31	0.28	0.24	0.22	0.23	0.22	0.21	0.18	0.18	0.22	32

[a] See text section Calculating Overall Coefficients for basis of calculations.

[b] To adjust *U* values for the effect of added insulation between framing members, see Table 16.

[c] If stucco or structural glass is applied to the exterior, the additional resistance value of 0.10 would have a negligible effect on the *U* value.

[d] Brick, 6 in. (5½ in. actual) is assumed to have no backing. Walls 8, 12 and 16 in. have 4 in. of face brick and balance of common brick.

zontally, there will be $0.00034 \times \frac{1}{3} = 0.00045$ sq ft of tie rod to each square foot of wall area. Then from plane *B* to plane *C*, the conductance C_1 is

$$C_1 = \frac{0.00045}{1.0} \times \frac{400}{1.0} + \frac{0.99955}{1.0} \times \frac{12}{1.0}$$

$$= 0.180 + 11.994 = 12.174$$

2. For tie rod and insulation from plane *C* to plane *D* the conductance C_2 is

$$C_2 = \frac{0.00045}{1.0} \times \frac{400}{2.5} + \frac{0.99955}{1.0} \times \frac{0.30}{2.5}$$

$$= 0.072 + 0.120 = 0.192$$

3. For tie rod and concrete from plane *D* to plane *E* the conductance C_3 is

$$C_3 = \frac{0.00045}{1.0} \times \frac{400}{1.0} + \frac{0.99955}{1.0} \times \frac{12}{1.0}$$

$$= 0.180 + 11.994 = 12.174$$

Series Flow. After the conductance values have been determined, the total resistance and *U* value can be determined as follows;

$$R_T = \frac{1}{f_i} + \frac{x_1}{k_1} + \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \frac{x_2}{k_2} + \frac{1}{f_o}$$

$$R_T = \frac{1}{1.65} + \frac{3.0}{12.0} + \frac{1}{12.174} + \frac{1}{0.192} + \frac{1}{12.174} + \frac{3.0}{12.0} + \frac{1}{6.0}$$

$$R_T = 0.606 + 0.250 + 0.0822 + 5.208$$

$$+ 0.0822 + 0.250 + 0.167 = 6.727$$

$$U = \frac{1}{R_T} = \frac{1}{6.727} = 0.149 \text{ Btu per (hr) (sq ft) (F deg).}$$

The hot box test value, from University of Minnesota, for this wall, corrected for a 15 mph wind velocity, was $U = 0.150$ Btu per (hr) (sq ft) (F deg). The error between the calculated and test values would be

$$\frac{0.150 - 0.149}{0.150} \times 100 = 0.67 \text{ percent.}$$

If the effect of the tie rods were omitted from the calculations, the overall *U* value would be 0.103. Although the percentage of area occupied by the tie rods per square foot of wall area is $0.00045/1.0 \times 100 = 0.045$ percent, the error between the calculated and test values would be

$$\frac{0.150 - 0.103}{0.150} \times 100 = 31 \text{ percent.}$$

Values Used in Calculation of *U* Value Tables

Tables 5 through 15 are based on values given in Table 4. The following conditions have been used:

Equilibrium or steady-state heat transfer, eliminating effects of heat capacity.

Surrounding surfaces at ambient air temperatures.

Exterior wind velocity of 15 mph for winter and 7.5 mph for summer.

Surface emissivity of ordinary building materials $\epsilon = 0.90$.

Stud space in frame construction not insulated. (See Table 16 for method of correcting for added insulation.)

In construction involving air spaces the *U* values shown are calculated for areas between framing. See Fig. 6 in section Correction for Framing if an allowance is to be made for this effect.

Air space resistance values used are those shown in Table 4 under Air Spaces.

Air spaces are ¾ in. or more in width.

Variations of conductivity with mean temperature is neglected.

Corrections for framing to be made on basis of parallel heat

(*Continued on p. 108.*)