

HEATING VENTILATING AIR CONDITIONING GUIDE 1944

TABLE 5. COEFFICIENTS OF TRANSMISSION (*U*) OF FRAME WALLS WITH INSULATION BETWEEN FRAMING^{a, b}

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

COEFFICIENT WITH NO INSULATION BETWEEN FRAMING	COEFFICIENT WITH INSULATION BETWEEN FRAMING				NUMBER
	BLANKET OR BAT INSULATION BETWEEN FRAMING (Thickness below)			3 3/4 IN. LOOSE MINERAL WOOL BETWEEN FRAMING	
	1 IN.	2 IN.	3 IN.		
	A	B	C		
0.11	0.078	0.064	0.055	0.051	33
0.12	0.083	0.067	0.057	0.054	34
0.13	0.088	0.070	0.059	0.056	35
0.14	0.092	0.073	0.061	0.058	36
0.15	0.097	0.075	0.062	0.059	37
0.16	0.10	0.077	0.065	0.060	38
0.17	0.10	0.080	0.066	0.062	39
0.18	0.11	0.082	0.068	0.063	40
0.19	0.11	0.084	0.069	0.064	41
0.20	0.12	0.087	0.070	0.066	42
0.21	0.12	0.088	0.072	0.067	43
0.22	0.12	0.090	0.073	0.069	44
0.23	0.12	0.093	0.074	0.069	45
0.24	0.12	0.094	0.076	0.070	46
0.25	0.13	0.095	0.076	0.072	47
0.26	0.13	0.096	0.077	0.072	48
0.27	0.14	0.097	0.078	0.073	49
0.28	0.14	0.098	0.078	0.073	50
0.29	0.14	0.10	0.080	0.075	51
0.30	0.14	0.10	0.080	0.075	52
0.31	0.14	0.10	0.082	0.076	53
0.32	0.15	0.10	0.082	0.076	54
0.33	0.15	0.11	0.083	0.077	55
0.34	0.15	0.11	0.083	0.078	56
0.35	0.15	0.11	0.085	0.078	57
0.36	0.16	0.11	0.085	0.079	58
0.37	0.16	0.11	0.087	0.080	59
0.38	0.16	0.11	0.087	0.080	60
0.39	0.16	0.11	0.087	0.081	61
0.40	0.16	0.11	0.088	0.082	62
0.41	0.16	0.11	0.088	0.082	63
0.42	0.16	0.11	0.088	0.082	64
0.43	0.17	0.11	0.090	0.083	65
0.44	0.17	0.12	0.090	0.083	66

^aThis table may be used for determining the coefficients of transmission of frame constructions with the types and thicknesses of insulation indicated in Columns A to D inclusive between framing. Columns A, B and C may be used for walls, ceilings or roofs with only one air space between framing but are not applicable to ceilings with no flooring above. (See Table 10.) Column D is applicable to walls only. *Example:* Find the coefficient of transmission of a frame wall consisting of wood siding, 1/4 in. insulating board sheathing, studs, gypsum lath and plaster, with 2 in. blanket insulation between studs. According to Table 4, a wall of this construction with no insulation between studs has a coefficient of 0.19 (Wall No. 4D). Referring to Column B above, it will be found that a wall of this value with 2 in. blanket insulation between the studs has a coefficient of 0.084.

^bCoefficients corrected for 2 x 4 framing, 16 in. o. c.

^cBased on one air space between framing.

CHAPTER 4. HEAT TRANSMISSION COEFFICIENTS

to those shown in *Example 1*, using fundamental Formulas 1, 2 and 3 and the values of *k* (or *C*), *f*, *f*, *f*, and *a* in Table 3.

Actual thicknesses of lumber are used in the computations rather than nominal thicknesses. The computations for wood shingle roofs applied over wood stripping are based on 1 by 4 in. wood strips, spaced 2 in. apart. Since no reliable figures are available concerning the conductivity of Spanish and French clay roofing tile, of which there are many varieties, the figures for such types of roofs were taken the same as for slate roofs, as it is probable that the values of *U* for these two types of roofs will compare favorably.

The thicknesses upon which the coefficients in Tables 4 to 17 inclusive, are based are:

Brick veneer.....	4 in.	1-in. lumber (S-2-S).....	2 1/2 in.
Plaster and metal lath.....	3/4 in.	1 1/2-in. lumber (S-2-S).....	1 1/2 in.
Plaster (on wood lath, gypsum lath or insulating board).....	1/2 in.	2-in. lumber (S-2-S).....	1 1/2 in.
Slate (roofing).....	1/2 in.	2 1/2-in. lumber (S-2-S).....	2 1/2 in.
Stucco on wire mesh reinforcing.....	1/2 in.	3-in. lumber (S-2-S).....	2 3/8 in.
Tar and gravel or slag-surfaced built-up roofing.....	1 in.	4-in. lumber (S-2-S).....	3 5/8 in.
	3/8 in.	Finish flooring (maple or oak).....	1 1/2 in.

Solid brick walls are based on 4 in. hard brick (high density) and the remainder common brick (low density). Stucco is assumed to be 1 in. thick on masonry walls. Where metal lath and plaster are specified, the metal lath is neglected.

The coefficients of transmission of the pitched roofs in Table 15 apply where the roof is over a heated attic or top floor so the heat passes directly through the roof structure including whatever finish is applied to the underside of the roof rafters.

Coefficients for frame construction were corrected for the effect of the framing where such correction would *increase* the coefficients, but not where the correction would *decrease* the coefficient¹. In the latter case, the correction is generally small and the uncorrected coefficient is on the side of safety. Although theoretical coefficients below 0.10 are included in the tables, a minimum coefficient of 0.10 is generally recommended to allow for possible defects in workmanship, poor construction and other factors which would increase the heat loss. The lower the theoretical wall or roof coefficient the greater will be the percentage of error due to construction defects or failure of the insulation to perform as rated.

Combined Coefficients of Transmission

If the attic is unheated, the roof structure and ceiling of the top floor must both be taken into consideration, and the combined coefficient of transmission determined. The formula for calculating the combined coefficient of transmission of a top floor ceiling, unheated attic space, and pitched roof per square foot of ceiling area is:

$$U = \frac{U_r \times U_{ce}}{U_r + \frac{U_{ce}}{n}} \quad (4)$$

¹Effect of Studs and Joists on Heat Flow Through Frame Walls and Ceilings, by Paul D. Close (*Heating, Piping and Air Conditioning*, October, 1943, p. 529).