Table 1. Conductances (C) for Surfaces and Air Spaces

All conductance values expressed in Btu per (hour) (square foot) (Fahrenheit degree temperature difference)

Section A. Surface Conductances for Still Air[a]

Position of Surface	Direction of Heat Flow	Surface Emissivity	
		$\epsilon = 0.83$	$\epsilon = 0.05$
Horizontal	Upward	1.95	1.16
Horizontal	Downward	1.21	0.44
Vertical		1.52[a]	0.74

Section B. Conductance of Vertical Spaces at Various Mean Temperatures[b]

Mean Temp Fahr Deg	Conductances of Air Spaces for Various Widths in Inches						
	0.128	0.250	0.364	0.493	0.713	1.00	1.500
20	2.300	1.370	1.180	1.100	1.040	1.030	1.022
30	2.385	1.425	1.234	1.148	1.080	1.070	1.065
40	2.470	1.480	1.288	1.193	1.125	1.112	1.105
50	2.560	1.535	1.340	1.242	1.168	1.152	1.149
60	2.650	1.590	1.390	1.295	1.210	1.195	1.188
70	2.730	1.648	1.440	1.340	1.250	1.240	1.228
80	2.819	1.702	1.492	1.390	1.295	1.280	1.270
90	2.908	1.757	1.547	1.433	1.340	1.320	1.310
100	2.990	1.813	1.600	1.486	1.380	1.362	1.350
110	3.078	1.870	1.650	1.534	1.425	1.402	1.392
120	3.167	1.928	1.700	1.580	1.467	1.445	1.435
130	3.250	1.980	1.750	1.630	1.510	1.485	1.475
140	3.340	2.035	1.800	1.680	1.550	1.530	1.519
150	3.425	2.090	1.852	1.728	1.592	1.569	1.559

Section C. Conductances and Resistances of Air Spaces Faced on One Surface with Reflective Insulation[c]

Location and Position of Air Space	Direction of Heat Flow	Temp[d] Diff Fahr Deg		Conductance[e] (C)			Resistance[e] $\left(\frac{1}{C}\right)$		
				No. of Air Spaces			No. of Air Spaces		
		Winter	Summer	1	2	3	1	2	3
Rafter Space (6 in.)									
Horizontal	Down	45			0.10	0.07		10.00	14.29
Horizontal	Up	45			0.27	0.17		3.70	5.88
Horizontal	Down		25		0.09	0.06		11.11	16.67
Horizontal	Up		25		0.24	0.16		4.17	6.25
30 deg slope	Down	45			0.15	0.10		6.67	10.00
30 deg slope	Up	45			0.25	0.17		4.00	5.88
30 deg slope	Down		25		0.13	0.09		7.69	11.11
30 deg slope	Up		25		0.23	0.14		4.35	7.14
Stud Space (3½ in.)									
Vertical[f]		30		0.34			2.94		
Vertical		40			0.23	0.13		4.35	7.69
Vertical[f]			15	0.32			3.13		
Vertical			20		0.18	0.11		5.56	9.09
Vertical[g]		30		0.46			2.17		

[a] Radiation and Convection from Surfaces in Various Positions, by G. B. Wilkes and C. M. F. Peterson (A.S.H.V.E. Transactions, Vol. 44, 1938, p. 513.

[b] A.S.H.V.E. Research Report No. 825—Thermal Resistance of Air Spaces, by F. B. Rowley and A. B. Algren (A.S.H.V.E. Transactions, Vol. 35, 1929, p. 165).

[c] Thermal Test Coefficients of Aluminum Insulation for Buildings, by G. B. Wilkes, F. G. Hechler and E. R. Queer (A.S.H.V.E. Transactions, Vol. 46, 1940).

[d] Temperature difference is based on total space between plaster base and sheathing, flooring or roofing.

[e] These air space conductance and resistance values are based on one reflective surface (aluminum) having an emissivity of 0.05 facing each space, and are based on total space between plaster base and sheathing, flooring or roofing. The rafter and stud spaces are divided into equal spaces.

[f] Stud space is lined on plaster base side with loose paper with aluminum on surface facing air space The resistance of the small air space between the plaster base and paper was 0.43.

[g] Radiation and Convection Across Air Spaces in Frame Construction, by G. B. Wilkes and C. M. F. Peterson (A.S.H.V.E. Transactions, Vol. 43, 1937, p. 351).

[a] The recommended surface conductance for calculating heat losses for still air for non-reflective surfaces is 1.65 Btu. For a 15 mph wind velocity, the recommended value is 6.0 Btu. These coefficients were derived from Fig. 4, which was based on tests conducted at the *University of Minnesota*, and apply to vertical surfaces.

Table 2. Conductivities (k) and Conductances (C) of Building and Insulating Materials

These constants are expressed in Btu per (hour) (square foot) (Fahrenheit degree temperature difference). Conductivities (k) are per inch thickness and conductances (C) are for thickness or construction stated, not per inch thickness.

Material	Description	Density (Lb per Cu Ft)	Mean Temp (Fahr Deg)	Conductivity or Conductance		Resistance		Authority
				(k)	(C)	Per Inch Thickness $\left(\frac{1}{k}\right)$	For Thickness Listed $\left(\frac{1}{C}\right)$	
BUILDING BOARDS (Non-Insulating)	Compressed cement and asbestos sheets	118	119	4.1	—	0.24	—	(1)
	Corrugated asbestos board	20.4	110	0.48	—	2.08	—	(2)
	Pressed asbestos mill board	60.5	86	0.84	—	1.19	—	(3)
	Gypsum board—gypsum between layers of heavy paper	62.8	70	1.41	—	0.71	—	(3)
	½ in. gypsum board	—	—	—	3.73	—	0.27	
	¾ in. gypsum board	—	—	—	2.82	—	0.35	
	½ in. gypsum board	53.5	90	—	2.60	—	0.38	(1)
FRAME CONSTRUCTION COMBINATIONS	1 in. fir sheathing and building paper	—	30	—	0.86	—	1.16	(4)
	1 in. fir sheathing, building paper and yellow pine lap siding	—	20	—	0.50	—	2.00	(4)
	1 in. fir sheathing, building paper and stucco	—	20	—	0.82	—	1.22	(4)
	Pine lap siding and building paper, siding 4 in. wide	—	16	—	0.85	—	1.18	(4)
	Yellow pine lap siding	—	—	—	1.28	—	0.78	(4)
MASONRY MATERIALS Brick	Damp or wet	—	—	5.0[a]	—	0.20	—	(2)
	Common yellow clay brick[a]	—	—	4.8	—	0.21	—	(4)
	One tier yellow common clay brick, one tier face brick, approx. 8 in. thick[a]	—	—	—	0.77	—	1.30	(4)
Clay Tile, Hollow	2 in. Tile, ½ in. plaster both sides	120.0	110	—	1.00	—	1.00	(2)
	4 in. Tile, ½ in. plaster both sides	127.0	100	—	0.60	—	1.67	(2)
	6 in. Tile, ½ in. plaster both sides	124.3	105	—	0.47	—	2.13	(2)
	8 in. Tile, average of 8 types (Walls No. 59, 63, 64, 66, 67, 90, 91, 92[a])	—	—	—	0.52	—	1.92	(4)
	12 in. Clay tile wall: 8 in. x 5 in. x 12 in. and 4 in. x 5 in. x 12 in.[a]	—	—	—	0.26	—	3.84	(4)

Authorities:

[1] *National Bureau of Standards*, tests based on samples submitted by manufacturers.

[2] A. C. Willard, L. C. Lichty and L. A. Harding, tests conducted at the *University of Illinois*.

[3] J. C. Peebles, tests conducted at *Armour Institute of Technology*, based on samples submitted by manufacturers.

[4] F. B. Rowley, et al, tests conducted at the *University of Minnesota*.

[5] A.S.H.V.E. Research Laboratory.

[6] E. A. Allcut, tests conducted at the *University of Toronto*.

[a] See Thermal Conductivity of Building Materials, by F. B. Rowley and A. B. Algren (*University of Minnesota Engineering Experiment Station Bulletin* No. 12).

[b] Heat Transmission Through Insulation as Affected by Orientation of Wall, by F. B. Rowley and C. E. Lund (A.S.H.V.E. Transactions, Vol. 49, 1943, p. 331).

[c] The Effect of Convection in Ceiling Insulation, by G. B. Wilkes and L. R. Vianey (A.S.H.V.E. Transactions, Vol. 49, 1943, p. 196).

[d] See A.S.H.V.E. Research Report No. 915—Conductivity of Concrete, by F. C. Houghten and Carl Gutberlet (A.S.H.V.E. Transactions, Vol. 38, 1932, p. 47).

[e] See *Heating, Ventilating and Air Conditioning*, by Harding and Willard, revised edition, 1932.

[f] See BMS13, *U. S. Department of Commerce, National Bureau of Standards*, Washington, D. C.

[g] Roofing, 0.15 in. thick (1.34 lb per square foot), covered with gravel (0.83 lb per square foot), combined thickness assumed 0.25.