TABLE 1. CONDUCTANCES (C) FOR SURFACES AND AIR SPACES

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

Section A. Surface Conductances for Still Air[a]

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

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

Mean Temp Deg Fahr	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 with Reflective Insulation[c]

Location and Position of Air Space	Direction of Heat Flow	Temp[d] Diff Deg Fahr: Winter	Summer	Conductance[e] (C), No. of Air Spaces: 1	2	3	Resistance[e] $\left(\frac{1}{C}\right)$, No. of Air Spaces: 1	2	3
Rafter Space (8 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 (3⅝ 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).

largely by the nature of the surface and the temperature difference between the boundary surfaces of the air space. Conduction and convection are controlled largely by the width and shape of the air space and the roughness of the boundary surfaces.

The conductances of vertical air spaces bounded by such materials as paper, wood, plaster, etc., are given in Table 1, **Section B**, having emissivity coefficients of 0.8 or higher, and with extended parallel surfaces perpendicular to the direction of heat flow. A conductance of 1.10 Btu per hour per square foot per degree Fahrenheit temperature difference (resistance = 0.91) based on this table was used for calculating the overall coefficients given in Tables 3 to 12 inclusive for air spaces ¾ in. or more in width. Air space tests[2] reported by Wilkes and Peterson resulted in comparable values. For 3⅝ in. horizontal air spaces having an effective emissivity of 0.83, the conductance for heat flow upward was 1.32 and for heat flow downward, 0.94. The conductance for a similar vertical air space was 1.17, the resistances of course being the reciprocals of these values in each case.

A large part of the heat transferred across air spaces bounded by ordinary materials is by radiation. Therefore, if such air spaces are faced with metallic surfaces such as aluminum foil, coated sheet steel or other low-emissivity, infra-red reflective metal surfaces, the radiant heat transfer will be substantially reduced, thus causing the major portion of the remaining transmitted heat to be by convection. Table 1, **Section C,** gives conductances and resistances for air spaces bounded by one reflective surface having an emissivity of 0.05. It will be noted that the conductance values given in this table are a function of the temperature differences across the space rather than mean temperature, the larger the temperature difference, the larger the conductance. The radiant heat transfer is the same regardless of whether the low emissivity surface is on the high or low temperature surface of the space, and is independent of the width of the space. To minimize the convection transfer the vertical air space should be at least ¾ in. in width. A conductance of 0.46 was used for computing the overall coefficients in Tables 3 to 12 inclusive for air spaces bounded by aluminum foil applied to plasterboard.

When referring to reflective heat-insulating surfaces, the term *brightness* which deals with visible light has no specific meaning and should be avoided[3]. *Emissivity* and *reflectivity* definitely define the radiating and reflecting properties and values may be determined directly for long wavelength radiation corresponding to room temperature. As previously stated, the values in Table 1, **Section C,** are based on an emissivity of the reflective surface of 0.05. Obviously for higher emissivity values the conductances will increase accordingly. For example, non-metallic reflective materials are available having emissivity values approximately midway between those of metallic reflective insulations and ordinary building material surfaces. These materials will have a correspondingly higher radiant heat transfer and where such materials are under consideration, due allowance should be made for the higher emissivity value in arriving at the proper air space conductance.

[2]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).

[3]Some Reflection and Radiation Characteristics of Aluminum, by C. S. Taylor and J. D. Edwards (A.S.H.V.E. TRANSACTIONS, Vol. 45, 1939, p. 179).