TABLE 14B. COEFFICIENTS OF TRANSMISSION (U) OF WOOD OR METAL CONSTRUCTION FLAT ROOFS AND CEILINGS[a] (*Concluded*).

DIRECTION OF FLOW →				DOWNWARD FLOW (SUMMER CONDITIONS)										
				TYPE OF CEILING										
TYPE OF DECK BUILT-UP ROOF IN ALL CASES		INSULATION ADDED ON TOP OF DECK[d]		NONE	GYPSUM BD. (⅜ IN.) AND PLAS.			METAL LATH AND PLAS.		INSUL. BD. (½ IN.)	ACOUSTICAL TILE			
		Conductance of Insul.	Resistance		None	Lt. Wt. Agg. ½ in.	Sand Agg. ½ in.	Lt. Wt. Agg. ¾ in.	Sand Agg. ¾ in.	Plain (1.43) or ½ in. Plas. Sand Agg. (1.52)	On Furring ½ in.	On Furring ¾ in.	On Gypsum Bd. (⅜ in.) ½ in.	On Gypsum Bd. (⅜ in.) ¾ in.
RESISTANCE →			↓	→	0.32	0.64	0.41	0.47	0.13	1.47	1.19	1.78	1.51	2.10
MATERIAL	R	C	R	U	U	U	U	U	U	U	U	U	U	U
Preformed slabs—wood fiber and cement binder														
2 in.	5.60	None	—	0.20	0.15[c]	0.14	0.15	0.15	0.15	0.13	0.13	0.12	0.13	0.12
3 in.	5.40	None	—	0.14	0.12	0.11	0.12	0.12	0.12	0.10	0.11	0.10	0.10	0.10
Flat Metal Roof Deck	0	None	—	0.67	0.33	0.30	0.32	0.31	0.35	0.24	0.26	0.22	0.24	0.21
		0.72	1.39	0.35	0.23	0.21	0.22	0.22	0.24	0.18	0.19	0.17	0.18	0.16
		0.36	2.78	0.23	0.17	0.16	0.17	0.17	0.18	0.14	0.15	0.14	0.14	0.13
		0.24	4.17	0.18	0.14	0.13	0.14	0.14	0.14	0.12	0.12	0.12	0.12	0.11
		0.19	5.26	0.15	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.10
		0.15	6.67	0.12	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09
		0.12	8.33	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08

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

[b] To adjust U values see note just above this table.

[c] Wood deck 1, 2, and 3 in. is assumed to be 2⅝₃₂, 1⅝, and 2⅝ in. thick, respectively. The thermal conductivity k is assumed to be 0.80.

[d] If a vapor barrier is used beneath roof insulation it will have a negligible effect on the U value. For information on vapor barrier requirements see Chapter 10, Moisture in Building Construction.

To use Table 16:

1. Find in Column 1 of the appropriate table the value for U obtained from Tables 5 through 15.

2. If there is a column which exactly corresponds to the condition for which you desire the U value, read the answer in this column, opposite the Column 1 value. Interpolate if necessary.

3. If there is no column which fully corresponds to the condition for which you desire the U value, then obtain the answer by means of two or more steps—each time using the value obtained in one step to reenter the same table through Column 1. In this way U values may be obtained for combinations of insulation in the framing space.

EXAMPLES OF THE USE OF TABLE 16

Example 3: Find the coefficient of transmission U_i of the frame wall shown as an example at the top of Table 5:

(a) With 2-inch blanket fibrous insulation between the studs and in contact with the gypsum lath and,

(b) With aluminum-foil-backed gypsum lath.

Solution: According to Table 5, the U value for this construction with no insulation in the air space is 0.24. Referring to Table 16 Part A for walls, it is found that corresponding to the value 0.24 in Column 1, the coefficient for conditions (a) and (b) are:

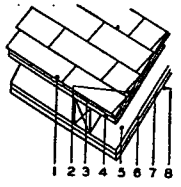
(a) In Column 4, find $U_i = 0.087$. Use 0.09.

(b) From Table 3, Section C, the effective emissivity E of aluminum foil is 0.05. In Column 8 find $U_i = 0.173$. Use 0.17.

(Text continued on p. 208.)

TABLE 15. COEFFICIENTS OF TRANSMISSION (U) OF PITCHED ROOFS[a,b]

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 for heat flow upward and 7.5 mph for heat flow downward.



EXAMPLE

Resistances used are given below in this table or in Table 3 or 4.

Construction (Heat flow up)	Resistance (R)
1. Outside surface (15 mph wind)	0.17
2. Slate shingles (½ in.)	0.05
3. Building paper	0.06
4. Wood sheathing (²⁵⁄₃₂ in.)	0.98
5. Air space[c]	0.90
6. Gypsum lath (⅜ in.)	0.32
7. Plas. (Sand Agg.) ½ in.	0.09
8. Inside surface (still air)	0.62
Total resistance	3.19
$U = 1/R = 1/3.19$	0.31

See value 0.31 in bold face type in table below.

EXAMPLE OF SUBSTITUTION

Resistances used are given below in this table or in Table 3 or 4.

Find U value for same construction with heat flow down (summer conditions)

Total resistance	3.19
Deduct	
1. Outside surface (15 mph wind)	0.17
2. Air space	0.90
8. Inside surface (still air)	0.62
Resistance deducted	1.69
Difference	1.50
Add	
1. Outside surface (7.5 mph wind)	0.25
2. Air space	1.03
8. Inside surface (still air)	0.76
	2.04
Total resistance	3.54
$U = 1/R = 1/3.54$	0.28

[c] TO ADJUST U VALUES FOR CONSTRUCTION WITH ADDED INSULATION BETWEEN FRAMING MEMBERS, SEE TABLE 16.

DIRECTION OF HEAT FLOW →		UPWARD FLOW WINTER CONDITIONS						DOWNWARD FLOW SUMMER CONDITIONS					
		RAFTER SPACE						RAFTER SPACE					
		UNVENTILATED NOT TO BE FURTHER INSULATED					INSULATED	UNVENTILATED NOT TO BE FURTHER INSULATED					INSULATED
TYPE OF CEILING (APPLIED DIRECTLY TO ROOF RAFTERS)		Asphalt Shingles Building Paper						Asphalt Shingles Building Paper					
		On Plywood Sheathing (⅜ in.)	On Wood Sheathing (²⁵⁄₃₂ in.)	Asbestos-Cement Slate, or Tile Shingles, Building Paper on Wood Sheathing (²⁵⁄₃₂ in.)	Wood Shingles on 1 x 4 in. Wood Strips 6-in. Centers	Roof and Sheathing Disregarded[d]		On Plywood Sheathing (⅜ in.)	On Wood Sheathing ²⁵⁄₃₂ in.)	Asbestos-Cement Slate, or the Shingles, Building Paper on Wood Sheathing (²⁵⁄₃₂ in.)	Wood Shingles on 1 x 4 in. Wood Strips on 6 in. Centers	Roof and Sheathing Disregarded[d]	
RESISTANCE →		0.95	1.48	1.09	0.87	—		0.95	1.48	1.09	0.87	—	
MATERIAL	R	U	U	U	U	U	U	U	U	U	U	U	U
None	—	0.57	0.44	0.53	0.60	0.66	0.56	0.51	0.40	0.48	0.53	0.56	0.56
Gypsum bd. (⅜ in.)													
Gypsum lath (⅜ in.) and ½ plas. (lt. wt. agg.)	0.32	0.34	0.29	0.32	0.35	0.54	0.47	0.30	0.26	0.29	0.31	0.47	0.47
Gypsum lath (⅜ in.) and ½ in. plas. (sand agg.)	0.64	0.30	0.26	0.29	0.31	0.46	0.41	0.28	0.24	0.27	0.28	0.41	0.41
Metal lath and ¾ in plas. (lt. wt. agg.)	0.41	0.33	0.28	0.31	0.34	0.52	0.45	0.29	0.25	0.28	0.30	0.45	0.45
Metal lath and ¾ in plas. (sand agg.)	0.47	0.32	0.27	0.31	0.33	0.50	0.44	0.29	0.25	0.28	0.30	0.44	0.44
Insul. bd. (½ in.)	1.32	0.36	0.30	0.34	0.37	0.51	0.52	0.32	0.27	0.31	0.33	0.52	0.52
Insul. bd. lath and ½ in. plas. (sand agg.)	1.43	0.25	0.22	0.24	0.25	0.34	0.31	0.23	0.20	0.22	0.23	0.31	0.31
Acoustical tile	1.58	0.24	0.21	0.23	0.25	0.33	0.30	0.22	0.20	0.22	0.23	0.30	0.30
(½ in.) on gypsum bd. (⅜ in.)	1.61	0.24	0.21	0.23	0.25	0.33	0.30	0.22	0.20	0.22	0.23	0.30	0.30
(½ in.) on furring	1.19	0.26	0.23	0.25	9.27	0.37	0.34	0.24	0.21	0.23	0.24	0.34	0.34
(¾ in.) on gypsum bd. (⅜ in.)	2.10	0.21	0.19	0.20	0.21	0.26	0.24	0.20	0.18	0.19	0.20	0.26	0.26
(¾ in.) on furring	1.78	0.23	0.20	0.22	0.23	0.30	0.28	0.21	0.19	0.20	0.21	0.28	0.28
Wood lath and ½ in. plas. (sand agg.)	0.40	0.33	0.28	0.31	0.34	0.52	0.46	0.29	0.26	0.28	0.30	0.46	0.46

[a] See text section Calculating Overall Coefficients for basis of calculations. [b] Pitch of roof—45 deg.

[c] To adjust U values, see note above table.

[d] When insulation is installed between rafters, the space above should be ventilated and in this case the roof construction is disregarded in calculation of U values. To adjust U values for pitched roof construction with added insulation between framing members, use the average of values for horizontal and vertical heat flow in Table 16A and either 16C or 16D depending on direction of heat flow.