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OVERALL HEAT TRANSMISSION COEFFICIENTS OF BUILDING SECTIONS

BY

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OVERALL HEAT TRANSMISSION COEFFICIENTS OF BUILDING SECTIONS

The tables which follow have been prepared to indicate the "overall heat transmission coefficients" of a wide range of wall, floor and ceiling constructions, for home-owners and builders. Following the tables formulae and technical data are provided for the use of architects, engineers and contractors.

The "overall heat transmission coefficient" (U value), indicates the amount of heat passing through 1 square foot of the building section, in 1 hour, when there is a 1 degree temperature difference between one side of the section and the other. The lower the 'U' value, the better is the heat insulating property.

'U' values can indicate directly how quickly a particular building section will conduct heat. Thus they provide a means of comparing its heat insulating property with those of other building sections. The values given in the tables have been calculated on the basis of materials applied in an ideal manner. Thus, if the same values are to be obtained in practice, great care must be taken in the application of the insulation.

A knowledge of the heat insulating properties of building sections enables one to provide for ease and economy of heating, and comfort, by the selection of proper materials. 'U' values will permit the heating contractor to provide for the supply and proper distribution of heat to all parts of a building.

It is not always possible to state definitely what 'U' values should be provided. Climate, and construction and fuel costs vary across the country and these all have a bearing on the selection of an economical 'U' value. However, it is generally recommended that building sections should have 'U' values of 0.15 or less (CMHC Building Standards). In all cases this will require the use of insulating material, in some form, in addition to the materials normally used to provide strength, and inside and outside finish.

The tables provided cover most of the combinations of building materials normally encountered. They do not provide all the data that are required for the calculation of the heat loss from buildings. Heat losses through windows and doors, and by the exchange of inside and outside air through cracks around windows and doors, must also be considered in the calculation of total heat losses from buildings. This is a task which requires experience and special technical knowledge.

HOW TO USE THE TABLES

1. For Walls

Two series of tables are provided for both wood-frame and masonry wall sections.

The first series in each case gives 'U' values for wall sections which have no insulation between the studs or furring strips. Thus these may be used directly where insulation is not placed in air spaces in the walls.

The second series in each case gives 'U' values for walls with varying amounts of insulation between studs or furring strips. To use this series of tables it is first necessary to find the 'U' value provided by the basic materials of the wall, i.e., those materials which provide strength, and interior and exterior finish, from the first series. The value thus found is used as a key to the tables in the second series.

It is important in the use of the tables to follow the procedure outlined in the following example.

Example 1

Problem:

To find the 'U' value of a wall consisting of wood lap-siding, sheathing paper, 3/4" rigid insulation-board sheathing, 2 x 4 studs, and 3/8" gypsum lath and plaster.

Solution:

Refer to tables for frame-walls with no insulation between studs; either table WF1(a) or WF1(b). The type of siding used determines which table applies (in this case wood lap-siding). Thus refer to table WF1(b) as it has, under the heading "exterior finish" a subdivision for wood lap-siding. (See portion of table below).

Beginning in the left-hand column follow across the appropriate horizontal line as indicated by the type of sheathing material in the column headed "sheathing" (in this case 3/4" rigid insulation board). Continue into the column headed "interior finish", and select the type of finish which applies (in this case 3/8" gypsum lath and plaster). The number, 0.19, in the square under the specified interior finish is the 'U' value desired.

OVERALL HEAT TRANSMISSION COEFFICIENTS 'U' — TABLE WF.1 (b)

FRAME WALLS *NO INSULATION BETWEEN STUDS*

EXTERIOR FINISH	SHEATHING	INTERIOR FINISH																
		3/8" GYPSUM BOARD	1/2" GYPSUM BOARD	1/2" RIGID INSULATION BOARD	3/4" RIGID INSULATION BOARD	1" RIGID INSULATION BOARD	1/4" PLYWOOD	3/8" PLYWOOD	3/8" GYPSUM LATH, 1/2" PLASTER	METAL LATH, 3/4" PLASTER	WOOD LATH, 3/4" PLASTER	1/2" INSULATION BOARD LATH, 1/2" PLASTER	3/4" INSULATION BOARD LATH, 1/2" PLASTER	1" INSULATION BOARD LATH, 1/2" PLASTER	FOIL BOARD, REFLECTIVE INTERIOR SIDE	FOIL BOARD, REFLECTIVE BOTH SIDES	INSULATING (om. wood.) 3/8" GYP. LATH 1/2" PLAST.
PLYWOOD SIDING	* WITH ALL SHEATHINGS EXCEPT 25/32" WOOD SHEATHING, HORIZONTAL FURRING STRIPS ARE USED FOR SHINGLE EXTERIOR FINISH. THE AIR SPACE THUS FORMED HAS BEEN INCLUDED IN THE CALCULATION OF "U" VALUES GROUPED BESIDE "WOOD SHINGLES" EXTERIOR FINISH. ⊙ FOR BRICK VENEERS THE AIR SPACE BETWEEN VENEER AND SHEATHING HAS NOT BEEN INCLUDED IN THE CALCULATION OF "U" VALUES.	FOR MASS INSULATION USE TABLE WF.2 (a) (b) or c — COL. 5															
		FOR REFLECTIVE " WF.3 ····· WF 4																
	3/8" PLYWOOD SIDING	.41	.40	.27	.23	.19	.40	.38	.39	.42	.39	.26	.22	.19	.32	.25	.28
	1/2" PLYWOOD SIDING	.39	.37	.26	.22	.19	.38	.36	.36	.39	.37	.25	.21	.18	.31	.24	.27
WOOD LAP SIDING	BUILDING PAPER ONLY	.34	.33	.24	.20	.18	.34	.32	.33	.35	.33	.23	.20	.17	.28	.22	.25
	1/2" GYPSUM BOARD & BUILDING PAPER	.31	.30	.22	.19	.17	.30	.29	.29	.31	.29	.21	.18	.16	.26	.20	.23
	5/16" PLYWOOD & " "	.30	.29	.22	.19	.16	.30	.28	.29	.31	.29	.21	.18	.16	.25	.20	.22
	25/32" WOOD SHEATHING & " "	.26	.25	.19	.17	.15	.25	.24	.25	.26	.25	.19	.17	.15	.22	.18	.20
	1/2" RIGID INSULATION BOARD & BLD'G. PAPER	.23	.22	.18	.16	.14	.22	.21	.23	.23	.22	.17	.15	.14	.20	.16	.18
	3/4" RIGID INSULATION BOARD & " "	.19	.19	.16	.14	.13	.19	.18	.19	.19	.19	.15	.14	.12	.17	.14	.15
	1" RIGID INSULATION BOARD & " "	.17	.17	.14	.13	.11	.17	.16	.16	.17	.16	.14	.12	.11	.15	.13	.14

(.19)

HOW TO USE THE TABLES

Example 2

Problem:

To find the 'U' value of a wall which has the same basic materials as the wall described in Example 1 but, in addition, the wall has 2 inches of insulation having a 'k' value* of 0.27.

Solution:

The first step is to find the 'U' value of the wall without any insulation. This has been done in Example 1 and the 'U' value was found to be 0.19.

The second step is to select one of the tables (WF2(a), (b) or (c)) which apply to wood-frame walls having mass insulation between the studs. In this case the insulation used has a 'k' value of 0.27. Therefore Table WF2(b) applies.

Beginning at the top of the table, select the type of installation which is proposed, as indicated by the sketches. Under the sketch pick out the vertical line of figures which applies to the thickness of insulation to be used. Continue down this column until it intersects the horizontal line which has the 'U' value of the wall without insulation in the extreme left-hand column. In this case the insulation is to be installed as indicated in the first sketch. Then proceed down the column headed 2", to the horizontal line which has .19 in the extreme left-hand column. The figure .08 which occurs at the intersection of these two lines is the 'U' value of the insulated wall. (See portion of table below).

OVERALL HEAT TRANSMISSION COEFFICIENTS "U" — TABLE WF 2(b)

FRAME WALLS *MASS INSULATION BETWEEN STUDS*

THERMAL CONDUCTIVITY of INSULATION k = .27

COEFFICIENT WITH NO INSULATION BETWEEN STUDS.	BLANKETS OR BATTS PLACED AGAINST EITHER SIDE, WITH ONE AIR SPACE AT LEAST ¾" (AIR SPACE, INSULATION, EXTERIOR, INTERIOR)					BLANKETS OR BATTS CENTERED, SEPARATING TWO AIR SPACES, EACH AT LEAST ¾" (INSULATION, AIR SPACES, EXTERIOR, INTERIOR)			BLANKETS BATTS OR FILL; NO AIR SPACE. (INSULATION, EXT., INT.)	FOIL BACKED INTERIOR FINISH. BLANKETS OR BATTS CENTERED, SEPARATING TWO AIR SPACES EACH AT LEAST ¾" (INSULATION, AIR SPACES, EXT., INT.)		
THICKNESS of INSULATION →	1"	1½"	2"	2½"	3"	1"	1½"	2"	3⅜"	1"	1½"	2"
.11	.08	.07	.06	.06	.05	.07	.07	.06	.05	.07	.07	.06
.12	.08	.07	.07	.06	.06	.08	.07	.06	.05	.08	.07	.06
.13	.09	.08	.07	.06	.06	.08	.07	.07	.06	.08	.07	.07
.14	.09	.08	.07	.07	.06	.09	.08	.07	.06	.09	.08	.07
.15	.10	.08	.08	.07	.06	.09	.08	.07	.06	.09	.08	.07
.16	.10	.09	.08	.07	.06	.09	.08	.07	.06	.09	.08	.07
.17	.10	.09	.08	.07	.07	.10	.09	.08	.06	.10	.09	.08
.18	.11	.09	.08	.07	.07	.10	.09	.08	.06	.10	.09	.08
.19	.11	.10	.08	.08	.07	.10	.09	.08	.07	.10	.09	.08
.20	.12	.10	.09	.08	.07	.11	.09	.08	.07	.11	.09	.08

* **Note:** Tables are provided for mass insulation having 'k' values of 0.24, 0.27 and 0.30. The 'k' value is the amount of heat (B.t.u.) which will pass through 1 square foot of a 1-inch thick sample of the insulation in 1 hour, when there is a 1 degree temperature difference between one side of the sample and the other. 'k' values are determined by laboratory test and may be obtained from technical publications, universities and testing laboratories. Tables are also provided for reflective insulations, giving 'U' values based on an emissivity of .05, an inside design temperature of 70°F. and an outside design temperature of -10°F. The 'U' values given in the tables may be applied to outside design temperatures in the range -30°F. to 10°F. without appreciable error.

How to Use the Tables

2. For Floors

Two tables are provided giving 'U' values for various combinations of materials which are commonly used in floor construction. Table F1 covers the case where there is no finish applied below the floor joists and table F2 applies to the case where either $\frac{1}{4}$" plywood or $\frac{1}{2}$" insulation board is used as a finish on the underside of the floor joists. Unlike the tables provided for walls, each of these tables is complete in itself, and 'U' values may be found directly by comparing a particular combination of materials with those given in the tables.

3. For Ceilings

As with floors, two tables are provided. Table C1 covers the case where there is no finish above the ceiling joists, and Table C2 applies to the case where 25/32" wood flooring is applied on the top side of the ceiling joists. 'U' values may be found directly from each table.

Symbols for Reflective Insulation

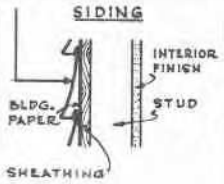
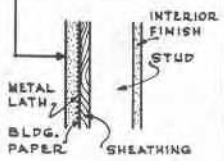
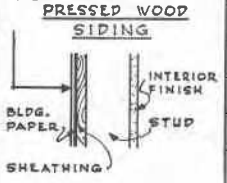
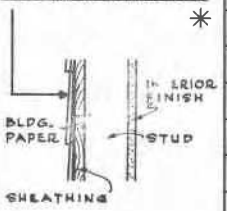
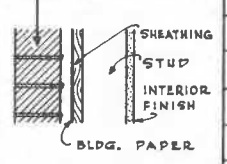
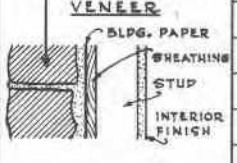
Indicates a curtain having one reflective surface.

Indicates a curtain having both sides reflective.

OVERALL HEAT TRANSMISSION COEFFICIENTS "U"

FRAME WALLS — NO INSULATION BETWEEN STUDS

TABLE WF.1 (a)

EXTERIOR FINISH	SHEATHING	INTERIOR FINISH: 3/8" GYPSUM BOARD	1/2" GYPSUM BOARD	1/2" RIGID INSULATION BOARD	3/4" RIGID INSULATION BOARD	1" RIGID INSULATION BOARD	1/4" PLYWOOD	3/8" PLYWOOD	3/8" GYPSUM LATH, 1/2" PLASTER	METAL LATH, 3/4" PLASTER	WOOD LATH, 3/4" PLASTER	1/2" INSULATION BOARD LATH, 1/2" PLASTER	3/4" INSULATION BOARD LATH, 1/2" PLASTER	1" INSULATION BOARD LATH, 1/2" PLASTER	FOIL BOARD, REFLECTIVE INTERIOR SIDE	FOIL BOARD, REFLECTIVE BOTH SIDES	FOIL BACKED 3/8" GYP. LATH, 1/2" PLASTER
ALUMINUM CLAPBOARD SIDING 	* WITH ALL SHEATHINGS EXCEPT 25/32" WOOD SHEATHING, HORIZONTAL FURRING STRIPS ARE USED FOR SHINGLE EXTERIOR FINISH. THE AIR SPACE THUS FORMED HAS BEEN INCLUDED IN THE CALCULATION of "U" VALUES GROUPED BESIDE "ASBESTOS SHINGLES" EXTERIOR FINISH. ⊙ FOR BRICK AND STONE VENEERS, THE AIR SPACE AND MORTAR BETWEEN VENEER AND SHEATHING HAVE NOT BEEN INCLUDED IN THE CALCULATION of "U" VALUES, SINCE THE ADDITIONAL RESISTANCE IS CONSIDERED UNIMPORTANT.																	
1" STUCCO ON METAL LATH 																	
		FOR MASS INSULATION USE TABLE WF.2 (a), (b), or (c) ····· LAST 3 COLS.															
1/8" TEMPERED PRESSED WOOD SIDING 		FOR REFLECTIVE " " " WF.3 ····· WF 4															
	BUILDING PAPER ONLY	.46	.45	.29	.24	.20	.45	.42	.43	.47	.44	.28	.23	.20	.36	.26	.31
	1/2" GYPSUM BOARD & BUILDING PAPER	.40	.39	.27	.22	.19	.39	.37	.38	.40	.38	.26	.21	.18	.32	.24	.28
	5/16" PLYWOOD & " "	.39	.38	.26	.22	.19	.39	.37	.37	.40	.38	.25	.21	.18	.31	.24	.27
	25/32" WOOD SHEATHING & " "	.32	.31	.23	.19	.17	.31	.30	.30	.32	.31	.22	.19	.17	.26	.21	.23
	1/2" RIGID INSULATION BOARD & BLDG. PAPER	.27	.27	.20	.18	.16	.27	.26	.26	.27	.26	.20	.17	.15	.23	.18	.20
	3/4" RIGID INSULATION BOARD & " "	.23	.22	.18	.16	.14	.22	.22	.22	.23	.22	.17	.15	.14	.20	.16	.18
	1" RIGID INSULATION BOARD & " "	.19	.19	.16	.14	.13	.19	.19	.19	.19	.19	.15	.14	.12	.18	.14	.15
ASBESTOS SHINGLES * 	BUILDING PAPER ONLY	.31	.30	.22	.19	.17	.31	.29	.30	.31	.30	.22	.19	.16	.26	.20	.23
	1/2" GYPSUM BOARD & BUILDING PAPER	.28	.27	.21	.18	.16	.28	.26	.27	.28	.27	.20	.17	.15	.24	.19	.21
	5/16" PLYWOOD & " "	.28	.27	.21	.18	.16	.27	.26	.27	.28	.27	.20	.17	.15	.23	.18	.21
	25/32" WOOD SHEATHING & " "	.30	.30	.22	.19	.17	.30	.29	.29	.31	.29	.21	.18	.16	.25	.20	.22
	1/2" RIGID INSULATION BOARD & BLDG. PAPER	.21	.21	.17	.15	.13	.21	.20	.20	.21	.21	.16	.15	.13	.19	.15	.17
	3/4" RIGID INSULATION BOARD & " "	.18	.18	.15	.13	.12	.18	.18	.18	.18	.18	.15	.13	.12	.16	.14	.15
	1" RIGID INSULATION BOARD & " "	.16	.16	.13	.12	.11	.16	.16	.16	.16	.16	.13	.12	.11	.14	.12	.13
4" FACE BRICK VENEER ⊙ 	BUILDING PAPER ONLY	.39	.38	.26	.22	.19	.38	.36	.37	.40	.37	.25	.21	.18	.31	.24	.27
	1/2" GYPSUM BOARD & BUILDING PAPER	.34	.33	.24	.20	.18	.34	.32	.32	.35	.33	.23	.20	.17	.28	.22	.25
	5/16" PLYWOOD & " "	.34	.33	.24	.20	.17	.33	.32	.32	.34	.32	.23	.20	.17	.28	.21	.24
	25/32" WOOD SHEATHING & " "	.28	.27	.21	.18	.16	.28	.27	.27	.28	.27	.20	.18	.15	.24	.19	.21
	1/2" RIGID INSULATION BOARD & BLDG. PAPER	.24	.24	.19	.16	.15	.24	.23	.24	.25	.24	.18	.16	.14	.21	.17	.19
	3/4" RIGID INSULATION BOARD & " "	.21	.20	.16	.15	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	1" RIGID INSULATION BOARD & " "	.18	.18	.15	.13	.12	.18	.17	.17	.18	.17	.14	.13	.12	.16	.13	.14
6" STONE VENEER ⊙ 	BUILDING PAPER ONLY	.38	.37	.26	.22	.19	.38	.35	.36	.39	.36	.25	.21	.18	.31	.23	.27
	1/2" GYPSUM BOARD & BUILDING PAPER	.34	.33	.24	.20	.17	.33	.32	.32	.34	.32	.23	.20	.17	.28	.22	.24
	5/16" PLYWOOD & " "	.33	.32	.23	.20	.17	.33	.31	.32	.34	.32	.23	.19	.17	.27	.21	.24
	25/32" WOOD SHEATHING & " "	.28	.27	.21	.18	.16	.27	.26	.27	.28	.27	.20	.17	.15	.24	.19	.21
	1/2" RIGID INSULATION BOARD & BLDG. PAPER	.24	.24	.19	.16	.14	.24	.23	.23	.24	.23	.18	.16	.14	.21	.17	.19
	3/4" RIGID INSULATION BOARD & " "	.20	.20	.16	.15	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	1" RIGID INSULATION BOARD & " "	.18	.17	.15	.13	.12	.18	.17	.17	.18	.17	.14	.13	.12	.16	.13	.14

T.N.B. MAY/50

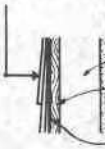
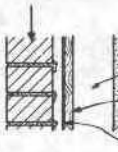
OVERALL HEAT TRANSMISSION COEFFICIENTS "U"

FRAME WALLS — NO INSULATION BETWEEN STUDS

TABLE WF.1 (b)

* WITH ALL SHEATHINGS EXCEPT 25/32" WOOD SHEATHING, HORIZONTAL FURRING STRIPS ARE USED FOR SHINGLE EXTERIOR FINISH. THE AIR SPACE THUS FORMED HAS BEEN INCLUDED IN THE CALCULATION of "U" VALUES GROUPED BESIDE "WOOD SHINGLES" EXTERIOR FINISH.

⊙ FOR BRICK VENEERS THE AIR SPACE BETWEEN VENEER AND SHEATHING HAS NOT BEEN INCLUDED IN THE CALCULATION of "U" VALUES, SINCE THE ADDITIONAL RESISTANCE IS CONSIDERED UNIMPORTANT.

EXTERIOR FINISH	SHEATHING	INTERIOR FINISH: 3/8" GYPSUM BOARD	1/2" GYPSUM BOARD	1/2" RIGID INSULATION BOARD	3/4" RIGID INSULATION BOARD	1" RIGID INSULATION BOARD	1/4" PLYWOOD	3/8" PLYWOOD	3/8" GYPSUM LATH, 1/2" PLASTER	METAL LATH, 3/4" PLASTER	WOOD LATH, 3/4" PLASTER	1/2" INSULATION BOARD LATH, 1/2" PLASTER	3/4" INSULATION BOARD LATH, 1/2" PLASTER	1" INSULATION BOARD LATH, 1/2" PLASTER	FOIL BOARD, REFLECTIVE INTERIOR SIDE	FOIL BOARD, REFLECTIVE BOTH SIDES	FOIL BACKED 3/8" GYP. LATH 1/2" PLASTER
		FOR MASS INSULATION USE TABLE WF.2 (a),(b), or (c)														LAST 3 COL'S.	
		FOR REFLECTIVE " " " WF.3														WF.4	
PLYWOOD SIDING 	3/8" PLYWOOD SIDING & B'LD'G. PAPER	.38	.37	.26	.22	.19	.38	.35	.36	.39	.36	.25	.21	.18	.31	.23	.27
	1/2" PLYWOOD SIDING & B'LD'G. PAPER	.36	.35	.25	.21	.18	.36	.33	.34	.37	.34	.24	.21	.18	.30	.23	.26
WOOD LAP SIDING 	BUILDING PAPER ONLY	.34	.33	.24	.20	.18	.34	.32	.33	.35	.33	.23	.20	.17	.28	.22	.25
	1/2" GYPSUM BOARD & BUILDING PAPER	.31	.30	.22	.19	.17	.30	.29	.29	.31	.29	.21	.18	.16	.26	.20	.23
	5/16" PLYWOOD & " "	.30	.29	.22	.19	.16	.30	.28	.29	.31	.29	.21	.18	.16	.25	.20	.22
	25/32" WOOD SHEATHING & " "	.26	.25	.19	.17	.15	.25	.24	.25	.26	.25	.19	.17	.15	.22	.18	.20
	1/2" RIGID INSULATION BOARD & B'LD'G. PAPER	.23	.22	.18	.16	.14	.22	.22	.22	.23	.22	.17	.15	.14	.20	.16	.18
	3/4" RIGID INSULATION BOARD & " "	.19	.19	.16	.14	.13	.19	.19	.19	.19	.19	.15	.14	.12	.17	.14	.15
	1" RIGID INSULATION BOARD & " "	.17	.17	.14	.13	.11	.17	.16	.16	.17	.16	.14	.12	.11	.15	.13	.14
* WOOD SHINGLES 	BUILDING PAPER ONLY	.26	.26	.20	.17	.15	.26	.25	.25	.26	.25	.19	.17	.15	.22	.18	.20
	1/2" GYPSUM BOARD & BUILDING PAPER	.24	.23	.18	.16	.14	.24	.23	.23	.24	.23	.18	.16	.14	.21	.17	.18
	5/16" PLYWOOD & " "	.24	.23	.18	.16	.14	.23	.23	.23	.24	.23	.18	.16	.14	.21	.17	.18
	25/32" WOOD SHEATHING & " "	.26	.25	.19	.17	.15	.25	.24	.25	.26	.25	.19	.17	.15	.22	.18	.20
	1/2" RIGID INSULATION BOARD & B'LD'G. PAPER	.19	.18	.15	.14	.12	.19	.18	.18	.19	.18	.15	.13	.12	.17	.14	.15
	3/4" RIGID INSULATION BOARD & " "	.16	.16	.14	.12	.11	.16	.16	.16	.17	.16	.13	.12	.11	.15	.12	.13
	1" RIGID INSULATION BOARD & " "	.15	.14	.12	.11	.10	.14	.14	.14	.15	.14	.12	.11	.10	.13	.11	.12
4" COMMON BRICK VENEER ⊙ 	BUILDING PAPER ONLY	.34	.33	.24	.20	.18	.34	.32	.32	.34	.33	.23	.20	.17	.28	.22	.25
	1/2" GYPSUM BOARD & BUILDING PAPER	.30	.30	.22	.19	.17	.30	.29	.29	.31	.29	.21	.18	.16	.25	.20	.22
	5/16" PLYWOOD & " "	.30	.29	.22	.19	.16	.30	.28	.29	.30	.29	.21	.18	.16	.25	.20	.22
	25/32" WOOD SHEATHING & " "	.26	.25	.19	.17	.15	.25	.24	.25	.26	.25	.19	.16	.15	.22	.18	.19
	1/2" RIGID INSULATION BOARD & B'LD'G. PAPER	.22	.22	.18	.15	.14	.22	.21	.22	.23	.22	.17	.15	.14	.20	.16	.18
	3/4" RIGID INSULATION BOARD & " "	.19	.19	.15	.14	.13	.19	.18	.19	.19	.19	.15	.14	.12	.17	.14	.15
	1" RIGID INSULATION BOARD & " "	.17	.17	.14	.13	.11	.17	.16	.16	.17	.16	.14	.12	.11	.15	.13	.14
INSULATED SIDING (IMITATION BRICK) 	BUILDING PAPER ONLY	.29	.29	.21	.18	.16	.29	.28	.28	.30	.28	.21	.18	.16	.25	.19	.22
	1/2" GYPSUM BOARD & BUILDING PAPER	.26	.26	.20	.17	.15	.26	.25	.26	.27	.26	.19	.17	.15	.23	.18	.20
	5/16" PLYWOOD & " "	.26	.26	.20	.17	.15	.26	.25	.25	.26	.25	.19	.17	.15	.22	.18	.20
	25/32" WOOD SHEATHING & " "	.23	.22	.18	.16	.14	.23	.22	.22	.23	.22	.17	.15	.14	.20	.16	.18
	1/2" RIGID INSULATION BOARD & B'LD'G. PAPER	.20	.20	.16	.14	.13	.20	.19	.20	.20	.20	.16	.14	.13	.18	.15	.16
	3/4" RIGID INSULATION BOARD & " "	.18	.17	.14	.13	.12	.17	.17	.17	.18	.17	.14	.13	.12	.16	.13	.14
	1" RIGID INSULATION BOARD & " "	.16	.15	.13	.12	.11	.15	.15	.15	.16	.15	.13	.12	.11	.14	.12	.13

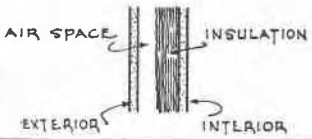
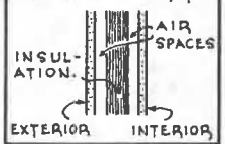
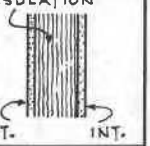
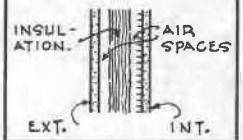
T.N.B. MAY /50

OVERALL HEAT TRANSMISSION COEFFICIENTS "U"

FRAME WALLS — MASS INSULATION BETWEEN STUDS

TABLE WF.2(a)

THERMAL CONDUCTIVITY of INSULATION k = .24

COEFFICIENT WITH NO INSULATION BETWEEN STUDS.	BLANKETS OR BATTS PLACED AGAINST EITHER SIDE, WITH ONE AIR SPACE. 					BLANKETS OR BATTS CENTERED, SEPARATING TWO AIR SPACES, EACH AT LEAST 3/4" 			BLANKETS BATTS OR FILL; NO AIR SPACE. 	FOIL BACKED INTERIOR FINISH BLANKETS OR BATTS CENTERED, SEPARATING TWO AIR SPACES EACH AT LEAST 3/4" 		
THICKNESS of INSULATION →	1"	1½"	2"	2½"	3"	1"	1½"	2"	3⅝"	1"	1½"	2"
.11	.08	.07	.06	.06	.05	.07	.06	.06	.05	.07	.06	.06
.12	.08	.07	.06	.06	.05	.08	.07	.06	.05	.08	.07	.06
.13	.09	.08	.07	.06	.06	.08	.07	.06	.05	.08	.07	.06
.14	.09	.08	.07	.06	.06	.08	.07	.07	.05	.08	.07	.07
.15	.09	.08	.07	.06	.06	.09	.08	.07	.06	.09	.08	.07
.16	.10	.08	.07	.07	.06	.09	.08	.07	.06	.09	.08	.07
.17	.10	.09	.08	.07	.06	.09	.08	.07	.06	.09	.08	.07
.18	.10	.09	.08	.07	.06	.10	.08	.07	.06	.10	.08	.07
.19	.11	.09	.08	.07	.07	.10	.09	.08	.06	.10	.09	.08
.20	.11	.09	.08	.07	.07	.10	.09	.08	.06	.10	.09	.08
.21	.11	.10	.08	.07	.07	.11	.09	.08	.06	.10	.09	.08
.22	.12	.10	.08	.08	.07	.11	.09	.08	.06	.11	.09	.08
.23	.12	.10	.09	.08	.07	.11	.09	.08	.06	.11	.09	.08
.24	.12	.10	.09	.08	.07	.11	.10	.08	.07	.11	.09	.08
.25	.12	.10	.09	.08	.07	.11	.10	.08	.07	.11	.10	.08
.26	.13	.11	.09	.08	.07	.12	.10	.09	.07	.11	.10	.09
.27	.13	.11	.09	.08	.07	.12	.10	.09	.07	.12	.10	.09
.28	.13	.11	.09	.08	.07	.12	.10	.09	.07	.12	.10	.09
.29	.13	.11	.09	.08	.08	.12	.10	.09	.07	.12	.10	.09
.30	.14	.11	.09	.08	.08	.12	.10	.09	.07	.12	.10	.09
.31	.14	.11	.10	.08	.08	.12	.10	.09	.07	.12	.10	.09
.32	.14	.11	.10	.09	.08	.13	.11	.09	.07	.13	.10	.09
.33	.14	.12	.10	.09	.08	.13	.11	.09	.07	.13	.11	.09
.34	.14	.12	.10	.09	.08	.13	.11	.09	.07	.13	.11	.09
.35	.14	.12	.10	.09	.08	.13	.11	.09	.07	.13	.11	.09
.36	.15	.12	.10	.09	.08	.13	.11	.09	.07			
.37	.15	.12	.10	.09	.08	.13	.11	.10	.07			
.38	.15	.12	.10	.09	.08	.13	.11	.10	.07			
.39	.15	.12	.10	.09	.08	.14	.11	.10	.08			
.40	.15	.12	.10	.09	.08	.14	.11	.10	.08			
.41	.15	.12	.10	.09	.08	.14	.11	.10	.08			
.42	.16	.12	.10	.09	.08	.14	.11	.10	.08			
.43	.16	.12	.11	.09	.08	.14	.12	.10	.08			
.44	.16	.13	.11	.09	.08	.14	.12	.10	.08			
.45	.16	.13	.11	.09	.08	.14	.12	.10	.08			
.46	.16	.13	.11	.09	.08	.14	.12	.10	.08			
.47	.16	.13	.11	.09	.08	.14	.12	.10	.08			
.48	.16	.13	.11	.09	.09	.15	.12	.10	.08			
.49	.16	.13	.11	.10	.09	.15	.12	.10	.08			
.50	.17	.13	.11	.10	.09	.15	.12	.10	.08			

NOTE:

USE THIS COLUMN WITH THE LAST TWO COLUMNS of TABLES WF.1 (a) AND (b) ONLY.

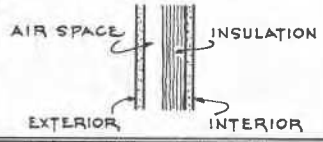
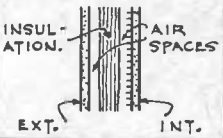
T.N.B. SEPT./50

OVERALL HEAT TRANSMISSION COEFFICIENTS "U"

FRAME WALLS — *MASS INSULATION BETWEEN STUDS*

TABLE WF.2(b)

THERMAL CONDUCTIVITY of INSULATION k = .27

COEFFICIENT WITH NO INSULATION BETWEEN STUDS.	BLANKETS OR BATTS PLACED AGAINST EITHER SIDE, WITH ONE AIR SPACE. 					BLANKETS OR BATTS CENTERED, SEPARATING TWO AIR SPACES, EACH AT LEAST 3/4" 			BLANKETS BATTS OR FILL; NO AIR SPACE. 	FOIL BACKED INTERIOR FINISH BLANKETS OR BATTS CENTERED, SEPARATING TWO AIR SPACES EACH AT LEAST 3/4" 		
THICKNESS of INSULATION →	1"	1½"	2"	2½"	3"	1"	1½"	2"	3⅝"	1"	1½"	2"
.11	.08	.07	.06	.06	.05	.07	.07	.06	.05	.07	.07	.06
.12	.08	.07	.07	.06	.06	.08	.07	.06	.05	.08	.07	.06
.13	.09	.08	.07	.06	.06	.08	.07	.07	.06	.08	.07	.07
.14	.09	.08	.07	.07	.06	.09	.08	.07	.06	.09	.08	.07
.15	.10	.08	.08	.07	.06	.09	.08	.07	.06	.09	.08	.07
.16	.10	.09	.08	.07	.06	.09	.08	.07	.06	.09	.08	.07
.17	.10	.09	.08	.07	.07	.10	.09	.08	.06	.10	.09	.08
.18	.11	.09	.08	.07	.07	.10	.09	.08	.06	.10	.09	.08
.19	.11	.10	.08	.08	.07	.10	.09	.08	.07	.10	.09	.08
.20	.12	.10	.09	.08	.07	.11	.09	.08	.07	.11	.09	.08
.21	.12	.10	.09	.08	.07	.11	.09	.08	.07	.11	.09	.08
.22	.12	.10	.09	.08	.07	.11	.10	.09	.07	.11	.10	.09
.23	.12	.11	.09	.08	.07	.11	.10	.09	.07	.11	.10	.09
.24	.13	.11	.09	.08	.08	.12	.10	.09	.07	.12	.10	.09
.25	.13	.11	.10	.08	.08	.12	.10	.09	.07	.12	.10	.09
.26	.13	.11	.10	.09	.08	.12	.10	.09	.07	.12	.10	.09
.27	.14	.11	.10	.09	.08	.12	.10	.09	.07	.12	.10	.09
.28	.14	.12	.10	.09	.08	.13	.11	.09	.07	.12	.11	.09
.29	.14	.12	.10	.09	.08	.13	.11	.09	.08	.13	.11	.09
.30	.14	.12	.10	.09	.08	.13	.11	.10	.08	.13	.11	.09
.31	.14	.12	.10	.09	.08	.13	.11	.10	.08	.13	.11	.10
.32	.15	.12	.10	.09	.08	.13	.11	.10	.08	.13	.11	.10
.33	.15	.12	.10	.09	.08	.13	.11	.10	.08	.13	.11	.10
.34	.15	.12	.11	.09	.08	.14	.11	.10	.08	.13	.11	.10
.35	.15	.12	.11	.09	.08	.14	.11	.10	.08	.14	.11	.10
.36	.15	.13	.11	.09	.09	.14	.12	.10	.08	NOTE : USE THIS COLUMN WITH THE LAST TWO COLUMNS of TABLES WF.1 (a) AND (b) ONLY.		
.37	.16	.13	.11	.10	.09	.14	.12	.10	.08			
.38	.16	.13	.11	.10	.09	.14	.12	.10	.08			
.39	.16	.13	.11	.10	.09	.14	.12	.10	.08			
.40	.16	.13	.11	.10	.09	.14	.12	.10	.08			
.41	.16	.13	.11	.10	.09	.15	.12	.10	.08			
.42	.16	.13	.11	.10	.09	.15	.12	.11	.08			
.43	.17	.13	.11	.10	.09	.15	.12	.11	.08			
.44	.17	.14	.11	.10	.09	.15	.12	.11	.08			
.45	.17	.14	.11	.10	.09	.15	.12	.11	.08			
.46	.17	.14	.11	.10	.09	.15	.13	.11	.08			
.47	.17	.14	.12	.10	.09	.15	.13	.11	.08			
.48	.17	.14	.12	.10	.09	.15	.13	.11	.09			
.49	.18	.14	.12	.10	.09	.15	.13	.11	.09			
.50	.18	.14	.12	.10	.09	.16	.13	.11	.09			

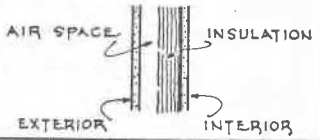
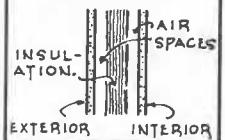
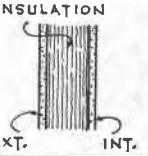
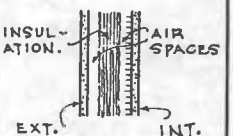
T.N.B. SEPT./50

OVERALL HEAT TRANSMISSION COEFFICIENTS "U"

FRAME WALLS — MASS INSULATION BETWEEN STUDS

TABLE WF. 2 (c)

THERMAL CONDUCTIVITY of INSULATION K = .30

COEFFICIENT WITH NO INSULATION BETWEEN STUDS.	BLANKETS OR BATTS PLACED AGAINST EITHER SIDE, WITH ONE AIR SPACE. 					BLANKETS OR BATTS CENTERED, SEPARATING TWO AIR SPACES, EACH AT LEAST 3/4" 			BLANKETS BATTS OR FILL; NO AIR SPACE. 	FOIL BACKED INTERIOR FINISH BLANKETS OR BATTS CENTERED, SEPARATING TWO AIR SPACES EACH AT LEAST 3/4" 		
THICKNESS of INSULATION →	1"	1½"	2"	2½"	3"	1"	1½"	2"	3⅝"	1"	1½"	2"
.11	.08	.07	.07	.06	.06	.08	.07	.06	.05	.08	.07	.06
.12	.09	.08	.07	.06	.06	.08	.07	.07	.06	.08	.07	.07
.13	.09	.08	.07	.07	.06	.09	.08	.07	.06	.09	.08	.07
.14	.10	.08	.08	.07	.06	.09	.08	.07	.06	.09	.08	.07
.15	.10	.09	.08	.07	.07	.09	.08	.08	.06	.09	.08	.08
.16	.10	.09	.08	.07	.07	.10	.09	.08	.06	.10	.09	.08
.17	.11	.09	.08	.08	.07	.10	.09	.08	.07	.10	.09	.08
.18	.11	.10	.09	.08	.07	.10	.09	.08	.07	.10	.09	.08
.19	.12	.10	.09	.08	.07	.11	.09	.08	.07	.11	.09	.08
.20	.12	.10	.09	.08	.07	.11	.10	.09	.07	.11	.10	.09
.21	.12	.11	.09	.08	.08	.11	.10	.09	.07	.11	.10	.09
.22	.13	.11	.09	.08	.08	.12	.10	.09	.07	.11	.10	.09
.23	.13	.11	.10	.09	.08	.12	.10	.09	.07	.12	.10	.09
.24	.13	.11	.10	.09	.08	.12	.10	.09	.07	.12	.10	.09
.25	.14	.11	.10	.09	.08	.12	.11	.09	.08	.12	.11	.09
.26	.14	.12	.10	.09	.08	.13	.11	.10	.08	.12	.11	.10
.27	.14	.12	.10	.09	.08	.13	.11	.10	.08	.13	.11	.10
.28	.14	.12	.10	.09	.08	.13	.11	.10	.08	.13	.11	.10
.29	.15	.12	.11	.09	.09	.13	.11	.10	.08	.13	.11	.10
.30	.15	.12	.11	.10	.09	.13	.11	.10	.08	.13	.11	.10
.31	.15	.13	.11	.10	.09	.14	.12	.10	.08	.13	.11	.10
.32	.15	.13	.11	.10	.09	.14	.12	.10	.08	.14	.12	.10
.33	.16	.13	.11	.10	.09	.14	.12	.10	.08	.14	.12	.10
.34	.16	.13	.11	.10	.09	.14	.12	.10	.08	.14	.12	.10
.35	.16	.13	.11	.10	.09	.14	.12	.11	.08	.14	.12	.10
.36	.16	.13	.11	.10	.09	.15	.12	.11	.08	NOTE:		
.37	.16	.13	.11	.10	.09	.15	.12	.11	.09			
.38	.17	.14	.12	.10	.09	.15	.12	.11	.09	USE THIS COLUMN WITH THE LAST TWO COLUMNS of TABLES WF. 1 (a) AND (b) ONLY.		
.39	.17	.14	.12	.10	.09	.15	.12	.11	.09			
.40	.17	.14	.12	.10	.09	.15	.13	.11	.09			
.41	.17	.14	.12	.10	.09	.15	.13	.11	.09			
.42	.17	.14	.12	.10	.09	.15	.13	.11	.09			
.43	.18	.14	.12	.11	.10	.16	.13	.11	.09			
.44	.18	.14	.12	.11	.10	.16	.13	.11	.09			
.45	.18	.14	.12	.11	.10	.16	.13	.11	.09			
.46	.18	.15	.12	.11	.10	.16	.13	.11	.09			
.47	.18	.15	.12	.11	.10	.16	.13	.11	.09			
.48	.18	.15	.12	.11	.10	.16	.13	.11	.09			
.49	.19	.15	.13	.11	.10	.16	.13	.12	.09			
.50	.19	.15	.13	.11	.10	.16	.14	.12	.09			

T.N.B. SEPT./50

OVERALL HEAT TRANSMISSION COEFFICIENTS "U"

FRAME WALLS *REFLECTIVE INSULATION BETWEEN STUDS*

TABLE WF. 3

INSIDE DESIGN TEMP. 70°, OUTSIDE DESIGN TEMP. -10°, EMISSIVITY of REFLECTIVE SURFACES .05

COEFFICIENT WITH NO INSULATION BETWEEN STUDS	FOILS REFLECTIVE TWO SIDES			FOILS REFLECTIVE ONE SIDE		
	TWO AIR SPACES EACH FACED ONE SIDE WITH REFLECTIVE MATERIAL.	THREE AIR SPACES TWO FACED ONE SIDE AND ONE FACED BOTH SIDES WITH REFLECTIVE MATERIAL.	FOUR AIR SPACES TWO FACED ONE SIDE AND TWO FACED BOTH SIDES WITH REFLECTIVE MATERIAL.	TWO AIR SPACES ONE FACED ONE SIDE WITH REFLECTIVE MATERIAL.	THREE AIR SPACES TWO FACED ONE SIDE WITH REFLECTIVE MATERIAL.	FOUR AIR SPACES THREE FACED ONE SIDE WITH REFLECTIVE MATERIAL.
	 EXTERIOR INTERIOR	 EXTERIOR INTERIOR	 EXTERIOR INTERIOR	 EXTERIOR INTERIOR	 EXTERIOR INTERIOR	 EXTERIOR INTERIOR
.11	.08	.07	.06	.09	.07	.06
.12	.08	.07	.06	.09	.08	.07
.13	.09	.07	.06	.10	.08	.07
.14	.09	.08	.06	.10	.08	.07
.15	.10	.08	.07	.11	.09	.07
.16	.10	.08	.07	.11	.09	.08
.17	.10	.08	.07	.12	.10	.08
.18	.11	.09	.07	.12	.10	.08
.19	.11	.09	.08	.13	.10	.08
.20	.12	.09	.08	.13	.10	.09
.21	.12	.09	.08	.14	.11	.09
.22	.12	.10	.08	.14	.11	.09
.23	.13	.10	.08	.15	.11	.09
.24	.13	.10	.08	.15	.12	.09
.25	.13	.10	.08	.16	.12	.10
.26	.14	.10	.09	.16	.12	.10
.27	.14	.11	.09	.17	.12	.10
.28	.14	.11	.09	.17	.13	.10
.29	.14	.11	.09	.18	.13	.10
.30	.15	.11	.09	.18	.13	.10
.31	.15	.11	.09	.18	.13	.10
.32	.15	.11	.09	.19	.13	.11
.33	.16	.12	.09	.19	.14	.11
.34	.16	.12	.09	.19	.14	.11
.35	.16	.12	.09	.20	.14	.11
.36	.16	.12	.10	.20	.14	.11
.37	.16	.12	.10	.21	.14	.11
.38	.17	.12	.10	.21	.14	.11
.39	.17	.12	.10	.21	.15	.11
.40	.17	.12	.10	.21	.15	.11
.41	.17	.13	.10	.22	.15	.11
.42	.17	.13	.10	.22	.15	.12
.43	.18	.13	.10	.22	.15	.12
.44	.18	.13	.10	.23	.15	.12
.45	.18	.13	.10	.23	.16	.12
.46	.18	.13	.10	.23	.16	.12
.47	.18	.13	.10	.23	.16	.12
.48	.18	.13	.10	.24	.16	.12
.49	.19	.13	.10	.24	.16	.12
.50	.19	.13	.11	.24	.16	.12

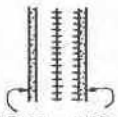
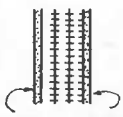
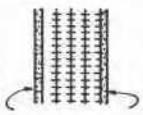
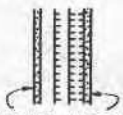
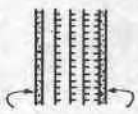
T·N·B· JAN./51

FRAME WALLS

OVERALL HEAT TRANSMISSION COEFFICIENTS "U"
USING FOIL BACKED INTERIOR FINISH WITH REFLECTIVE INSULATION BETWEEN STUDS

TABLE WF.4

INSIDE DESIGN TEMP. 70°, OUTSIDE DESIGN TEMP. -10° EMISSIVITY of REFLECTIVE SURFACES .05

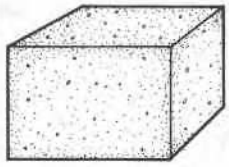
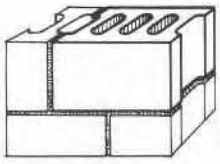
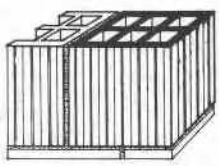
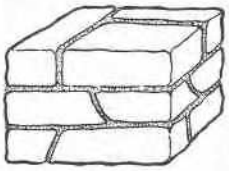
COEFICIENT WITH NO INSULATION BETWEEN STUDS.	FOILS REFLECTIVE TWO SIDES						FOILS REFLECTIVE ONE SIDE					
	TWO AIR SPACES ONE FACED ONE SIDE AND ONE FACED BOTH SIDES WITH REFLECTIVE MATERIAL.		THREE AIR SPACES ONE FACED ONE SIDE AND TWO FACED BOTH SIDES WITH REFLECTIVE MATERIAL.		FOUR AIR SPACES ONE FACED ONE SIDE AND THREE FACED BOTH SIDES WITH REFLECTIVE MATERIAL.		TWO AIR SPACES ONE FACED BOTH SIDES WITH REFLECTIVE MATERIAL.		THREE AIR SPACES ONE FACED ONE SIDE AND ONE FACED BOTH SIDES WITH REFLECTIVE MATERIAL.		FOUR AIR SPACES TWO FACED ONE SIDE AND ONE FACED BOTH SIDES WITH REFLECTIVE MATERIAL.	
	 EXTERIOR INTERIOR		 EXTERIOR INTERIOR		 EXTERIOR INTERIOR		 EXTERIOR INTERIOR		 EXTERIOR INTERIOR		 EXTERIOR INTERIOR	
.11	.09		.07		.06		.10		.08		.07	
.12	.09		.07		.06		.10		.08		.07	
.13	.10		.08		.07		.11		.09		.07	
.14	.10		.08		.07		.12		.09		.08	
.15	.11		.09		.07		.13		.10		.08	
.16	.11		.09		.08		.13		.10		.08	
.17	.12		.09		.08		.14		.11		.09	
.18	.12		.10		.08		.15		.11		.09	
.19	.13		.10		.08		.15		.12		.09	
.20	.13		.10		.08		.16		.12		.10	
.21	.14		.11		.09		.16		.12		.10	
.22	.14		.11		.09		.17		.13		.10	
.23	.15		.11		.09		.18		.13		.10	
.24	.15		.11		.09		.18		.13		.10	
.25	.15		.11		.09		.19		.14		.11	
.26	.16		.12		.09		.19		.14		.11	
.27	.16		.12		.10		.20		.14		.11	
.28	.16		.12		.10		.21		.14		.11	
.29	.17		.12		.10		.21		.15		.11	
.30	.17		.13		.10		.22		.15		.11	
.31	.18		.13		.10		.22		.15		.12	
.32	.18		.13		.10		.23		.15		.12	
.33	.18		.13		.10		.23		.16		.12	
.34	.18		.13		.10		.24		.16		.12	
.35	.19		.14		.11		.24		.16		.12	

T.N.B. JAN./51

SOLID MASONRY WALLS

OVERALL HEAT TRANSMISSION COEFFICIENTS "U" — NO INSULATION

TABLE WM.1

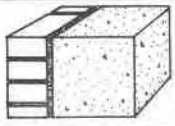
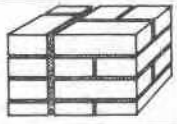
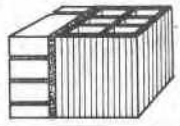
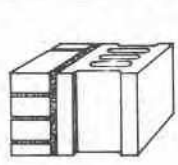
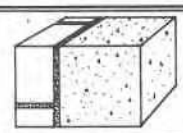
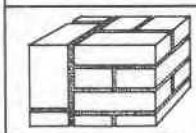
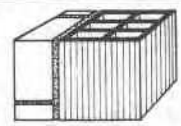
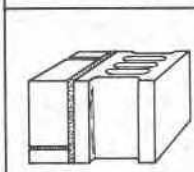
EXTERIOR FINISH	MAIN WALL	INTERIOR FINISH																		
				¾" TO 2" FURRING STRIPS, AS REQUIRED FOR INSULATION																
EITHER NO EXTERIOR FINISH OR 1" STUCCO*	* THE ADDITION of STUCCO EXTERIOR INCREASES THE THERMAL RESISTANCE SO SLIGHTLY THAT FIGURES FOR "NO EXTERIOR FINISH" MAY BE USED WITH NO APPRECIABLE ERROR.	PLAIN WALL NO INTERIOR FINISH	½" PLASTER, DIRECT ON WALL	⅜" GYPSUM BOARD	½" GYPSUM BOARD	½" RIGID INSULATION BOARD	¾" RIGID INSULATION BOARD	1" RIGID INSULATION BOARD	¼" PLYWOOD	⅜" PLYWOOD	⅜" GYPSUM LATH, ½" PLASTER	METAL LATH, ¾" PLASTER	WOOD LATH, ¾" PLASTER	½" INSULATION BOARD LATH, ½" PLASTER	¾" INSULATION BOARD LATH, ½" PLASTER	1" INSULATION BOARD LATH, ½" PLASTER	FOIL BOARD, REFLECTIVE INTERIOR SIDE	FOIL BOARD, REFLECTIVE BOTH SIDES	FOIL BACKED ⅜" GYPSUM LATH, ½" PLASTER
SOLID CONCRETE		FOR MASS INSUL. USE TABLE WM.4 FOR REFLECTIVE INSUL. USE TABLE WM.4 ---------- LAST COLUMN.																		
	6" SOLID CONCRETE, *SAND & GRAVEL AGGREGATE*	.79	.71	.41	.40	.27	.23	.19	.40	.38	.39	.42	.39	.26	.22	.19	.32	.25	.28
	8" SOLID CONCRETE, " " " "	.70	.64	.38	.37	.26	.22	.19	.38	.36	.36	.39	.37	.25	.21	.18	.31	.24	.27
	10" SOLID CONCRETE, " " " "	.63	.58	.36	.35	.25	.21	.18	.36	.34	.34	.37	.35	.24	.20	.18	.29	.23	.26
HOLLOW CONCRETE BLOCK																				
	8" HOLLOW CONCRETE BLOCK *SAND & GRAVEL AGGREGATE*	.56	.52	.34	.33	.24	.20	.17	.33	.32	.32	.34	.32	.23	.20	.17	.28	.22	.24
	12" HOLLOW CONCRETE BLOCK " "	.49	.46	.31	.30	.22	.19	.17	.31	.29	.30	.32	.30	.22	.19	.16	.26	.20	.23
	8" HOLLOW CONCRETE BLOCK *CINDER AGGREGATE*	.41	.39	.28	.27	.21	.18	.16	.27	.26	.26	.28	.27	.20	.17	.15	.23	.19	.21
	12" HOLLOW CONCRETE BLOCK " "	.38	.36	.26	.26	.20	.17	.15	.26	.25	.25	.26	.25	.19	.17	.15	.22	.18	.20
	8" HOLLOW CONCRETE BLOCK *BURNED CLAY or SLAG AGGREGATE*	.36	.34	.25	.25	.19	.17	.15	.25	.24	.24	.26	.24	.19	.16	.15	.22	.17	.19
	12" HOLLOW CONCRETE BLOCK " "	.34	.33	.24	.24	.19	.16	.15	.24	.23	.24	.25	.24	.18	.16	.14	.21	.17	.19
HOLLOW CLAY TILE																				
	8" HOLLOW CLAY TILE *2 CELLS THICK*	.41	.39	.28	.27	.21	.18	.16	.27	.26	.26	.28	.27	.20	.17	.15	.23	.19	.21
	10" HOLLOW CLAY TILE 2 " "	.40	.38	.27	.27	.20	.18	.16	.27	.26	.26	.27	.26	.20	.17	.15	.23	.18	.20
	12" HOLLOW CLAY TILE 3 " "	.31	.29	.22	.22	.18	.15	.14	.22	.21	.22	.23	.22	.17	.15	.14	.20	.16	.17
SOLID STONE																				
	8" SOLID STONE	.70	.64	.38	.37	.26	.22	.19	.38	.36	.36	.39	.37	.25	.21	.18	.31	.24	.27
	12" SOLID STONE	.57	.53	.34	.33	.24	.20	.18	.34	.32	.33	.35	.33	.23	.20	.17	.28	.22	.25
	16" SOLID STONE	.49	.45	.31	.30	.22	.19	.17	.30	.29	.29	.31	.30	.22	.19	.16	.26	.20	.23

T.N.B. JULY 1950

VENEER MASONRY WALLS

OVERALL HEAT TRANSMISSION COEFFICIENTS "U" — NO INSULATION

TABLE WM. 2

EXTERIOR FINISH	MAIN WALL	INTERIOR FINISH																	
				¾" TO 2" FURRING STRIPS, AS REQUIRED FOR INSULATION															
		PLAIN WALL, NO INTERIOR FINISH	½" PLASTER, DIRECT ON WALL	⅜" GYPSUM BOARD	½" GYPSUM BOARD	½" RIGID INSULATION BOARD	¾" RIGID INSULATION BOARD	1" RIGID INSULATION BOARD	¼" PLYWOOD	⅜" PLYWOOD	⅜" GYPSUM LATH, ½" PLASTER	METAL LATH, ¾" PLASTER	WOOD LATH, ¾" PLASTER	½" INSULATION BOARD LATH, ½" PLASTER	¾" INSULATION BOARD LATH, ½" PLASTER	1" INSULATION BOARD LATH, ½" PLASTER	FOIL BOARD, REFLECTIVE INTERIOR SIDE	FOIL BACKED ⅜" GYPSUM LATH, ½" PLASTER	FOIL BOARD, REFLECTIVE BOTH SIDES
VENEER FACING*	*FOR VENEER MASONRY WALLS THE MORTAR BETWEEN BACKING AND FACING HAS NOT BEEN INCLUDED IN THE CALCULATION of "U" VALUES, SINCE THE ADDITIONAL RESISTANCE IS CONSIDERED UNIMPORTANT.																		
4" FACE BRICK VENEER		FOR MASS INSULATION USE TABLE WM.4 — FOR REFLECTIVE INSULATION USE TABLE WM.4 ---- LAST COLUMN																	
	6" SOLID CONCRETE, SAND & GRAVEL AGGREGATE	.59	.54	.35	.34	.24	.20	.18	.34	.32	.33	.35	.33	.23	.20	.17	.28	.22	.25
	8" SOLID CONCRETE, " " " "	.54	.50	.33	.32	.23	.20	.17	.32	.31	.31	.33	.32	.23	.19	.17	.27	.21	.24
	4" COMMON BRICK	.50	.46	.31	.30	.22	.19	.17	.31	.29	.30	.32	.30	.22	.19	.16	.26	.20	.23
	8" COMMON BRICK	.35	.34	.25	.25	.19	.17	.15	.25	.24	.24	.25	.24	.19	.16	.14	.22	.17	.19
	12" COMMON BRICK	.28	.26	.21	.20	.17	.15	.13	.21	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	4" HOLLOW CLAY TILE 1 CELL THICK	.45	.42	.29	.29	.22	.19	.16	.29	.28	.28	.30	.28	.21	.18	.16	.25	.20	.22
	6" HOLLOW CLAY TILE 2 CELLS THICK	.36	.34	.25	.25	.19	.17	.15	.25	.24	.24	.25	.24	.19	.16	.15	.22	.17	.19
	8" HOLLOW CLAY TILE 2 " "	.35	.33	.25	.24	.19	.16	.15	.24	.23	.24	.25	.24	.18	.16	.14	.21	.17	.19
	10" HOLLOW CLAY TILE 2 " "	.34	.32	.24	.24	.19	.16	.15	.24	.23	.23	.25	.24	.18	.16	.14	.21	.17	.19
	4" HOLLOW CONCRETE BLOCK SAND & GRAVEL AGGREGATE	.52	.48	.32	.31	.23	.19	.17	.32	.30	.31	.33	.31	.22	.19	.17	.27	.21	.24
	8" HOLLOW CONCRETE BLOCK " "	.45	.42	.29	.29	.22	.19	.16	.29	.28	.28	.30	.28	.21	.18	.16	.25	.20	.22
	12" HOLLOW CONCRETE BLOCK " "	.40	.38	.27	.27	.20	.18	.16	.27	.26	.26	.28	.26	.20	.17	.15	.23	.19	.21
	4" HOLLOW CONCRETE BLOCK CINDER AGGREGATE	.45	.42	.29	.29	.22	.19	.16	.29	.28	.28	.30	.28	.21	.18	.16	.25	.20	.22
	8" HOLLOW CONCRETE BLOCK " "	.35	.33	.25	.24	.19	.16	.15	.24	.23	.24	.25	.24	.18	.16	.14	.21	.17	.19
	12" HOLLOW CONCRETE BLOCK " "	.32	.31	.23	.23	.18	.16	.14	.23	.22	.23	.24	.23	.18	.16	.14	.20	.17	.18
	8" HOLLOW CONCRETE BLOCK BURNED CLAY OR SLAG AGGREGATE	.31	.30	.23	.22	.18	.16	.14	.23	.22	.22	.23	.22	.17	.15	.14	.20	.16	.18
	12" HOLLOW CONCRETE BLOCK " "	.30	.29	.22	.22	.17	.15	.14	.22	.21	.21	.22	.21	.17	.15	.13	.19	.16	.17
4" STONE VENEER		FOR MASS INSULATION USE TABLE WM.4 — FOR REFLECTIVE INSULATION USE TABLE WM.4 ---- LAST COLUMN																	
	6" SOLID CONCRETE, SAND & GRAVEL AGGREGATE	.63	.58	.36	.35	.25	.21	.18	.36	.34	.34	.37	.35	.24	.20	.18	.29	.23	.26
	8" SOLID CONCRETE, " " " "	.57	.53	.34	.33	.24	.20	.18	.34	.32	.33	.35	.33	.23	.20	.17	.28	.22	.25
	4" COMMON BRICK	.53	.49	.32	.32	.23	.20	.17	.32	.30	.31	.33	.31	.22	.19	.17	.27	.21	.24
	8" COMMON BRICK	.37	.35	.26	.25	.19	.17	.15	.26	.25	.25	.26	.25	.19	.17	.15	.22	.18	.20
	12" COMMON BRICK	.29	.27	.21	.21	.17	.15	.13	.21	.20	.21	.22	.21	.16	.15	.13	.19	.15	.17
	4" HOLLOW CLAY TILE 1 CELL THICK	.48	.44	.30	.30	.22	.19	.17	.30	.29	.29	.31	.29	.21	.18	.16	.25	.20	.22
	6" HOLLOW CLAY TILE 2 CELLS THICK	.37	.35	.26	.25	.20	.17	.15	.26	.25	.25	.26	.25	.19	.17	.15	.22	.18	.20
	8" HOLLOW CLAY TILE 2 " "	.36	.34	.25	.25	.19	.17	.15	.25	.24	.24	.26	.25	.19	.16	.15	.22	.18	.19
	10" HOLLOW CLAY TILE 2 " "	.35	.34	.25	.25	.19	.17	.15	.25	.24	.24	.25	.24	.19	.16	.14	.22	.17	.19
	4" HOLLOW CONCRETE BLOCK SAND & GRAVEL AGGREGATE	.56	.51	.34	.33	.24	.20	.17	.33	.31	.32	.34	.32	.23	.19	.17	.28	.21	.24
	8" HOLLOW CONCRETE BLOCK " "	.48	.44	.30	.30	.22	.19	.17	.30	.29	.29	.31	.29	.21	.18	.16	.25	.20	.22
	12" HOLLOW CONCRETE BLOCK " "	.43	.40	.28	.28	.21	.18	.16	.28	.27	.27	.29	.27	.20	.18	.16	.24	.19	.21
	4" HOLLOW CONCRETE BLOCK CINDER AGGREGATE	.48	.44	.30	.30	.22	.19	.17	.30	.29	.29	.31	.29	.21	.18	.16	.25	.20	.22
	8" HOLLOW CONCRETE BLOCK " "	.36	.34	.25	.25	.19	.17	.15	.25	.24	.24	.26	.25	.19	.16	.15	.22	.18	.19
	12" HOLLOW CONCRETE BLOCK " "	.34	.32	.24	.24	.18	.16	.14	.24	.23	.23	.24	.23	.18	.16	.14	.21	.17	.19
	8" HOLLOW CONCRETE BLOCK BURNED CLAY OR SLAG AGGREGATE	.32	.31	.23	.23	.18	.16	.14	.23	.22	.23	.24	.23	.18	.16	.14	.20	.17	.18
	12" HOLLOW CONCRETE BLOCK " "	.31	.30	.23	.22	.18	.16	.14	.22	.22	.22	.23	.22	.17	.15	.14	.20	.16	.18

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CAVITY MASONRY WALLS

OVERALL HEAT TRANSMISSION COEFFICIENTS "U" — NO INSULATION

TABLE WM. 3

NO EXTERIOR FINISH OR 1" STUCCO*

IN CALCULATIONS of "U" VALUES FOR THE CAVITY WALLS, THE THERMAL TRANSMISSION of THE TIES BETWEEN EXTERIOR AND INTERIOR WALLS HAS NOT BEEN INCLUDED SINCE IT HAS LITTLE EFFECT UPON THE "U" VALUE of THE WALLS SHOWN.

* THE ADDITION of STUCCO EXTERIOR INCREASES THE THERMAL RESISTANCE SO SLIGHTLY THAT FIGURES FOR "NO EXTERIOR FINISH" MAY BE USED WITH NO APPRECIABLE ERROR.

EXTERIOR WALL	INTERIOR WALL	INTERIOR FINISH																	
				3/4" TO 2" FURRING STRIPS, AS REQUIRED FOR INSULATION															
		PLAIN WALL, NO INTERIOR FINISH	½" PLASTER, DIRECT ON WALL	3/8" GYPSUM BOARD	½" GYPSUM BOARD	½" RIGID INSULATION BOARD	¾" RIGID INSULATION BOARD	1" RIGID INSULATION BOARD	¼" PLYWOOD	3/8" PLYWOOD	3/8" GYPSUM LATH, ½" PLASTER	METAL LATH, ¾" PLASTER	WOOD LATH, ¾" PLASTER	½" INSULATION BOARD LATH, ½" PLASTER	¾" INSULATION BOARD LATH, ½" PLASTER	1" INSULATION BOARD LATH, ½" PLASTER	FOIL BOARD, REFLECTIVE INTERIOR SIDE	FOIL BOARD, REFLECTIVE BOTH SIDES	FOIL BACKED 3/8" GYPSUM LATH, ½" PLASTER
		FOR MASS INSUL. USE TABLE WM.4																	LAST COLUMN
		FOR REFLECTIVE INSUL. USE TABLE WM.4 ----------																	
4" FACE BRICK	4" COMMON BRICK	.34	.32	.24	.24	.19	.16	.15	.24	.23	.23	.25	.24	.18	.16	.14	.21	.17	.19
	8" COMMON BRICK	.27	.26	.20	.20	.16	.14	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	4" HOLLOW CLAY TILE 1 CELL THICK	.32	.30	.23	.23	.18	.16	.14	.23	.22	.22	.23	.23	.18	.15	.14	.20	.16	.18
	6" HOLLOW CLAY TILE 2 CELLS THICK	.27	.26	.20	.20	.16	.15	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	8" HOLLOW CLAY TILE " " "	.26	.25	.20	.20	.16	.14	.13	.20	.19	.19	.20	.20	.16	.14	.13	.18	.15	.16
	4" HOLLOW CONCRETE BLOCK SAND & GRAVEL AGGREGATE	.35	.34	.25	.24	.19	.17	.15	.25	.24	.24	.25	.24	.18	.16	.14	.21	.17	.19
	8" HOLLOW CONCRETE BLOCK " "	.32	.30	.23	.23	.18	.16	.14	.23	.22	.22	.23	.23	.18	.15	.14	.20	.16	.18
	4" HOLLOW CONCRETE BLOCK CINDER AGGREGATE	.32	.30	.23	.23	.18	.16	.14	.23	.22	.22	.23	.23	.18	.15	.14	.20	.16	.18
	8" HOLLOW CONCRETE BLOCK " "	.26	.25	.20	.20	.16	.14	.13	.20	.19	.19	.20	.20	.16	.14	.13	.18	.15	.16
	8" HOLLOW CONCRETE BLOCK BURNED CLAY OR SLAG AGGREGATE	.24	.23	.19	.19	.15	.14	.12	.19	.18	.18	.19	.18	.15	.13	.12	.17	.14	.15
4" HOLLOW CONCRETE BLOCK SAND & GRAVEL AGGREGATE	4" HOLLOW CLAY TILE 1 CELL THICK	.29	.28	.22	.22	.17	.15	.14	.22	.21	.21	.22	.21	.17	.15	.13	.19	.16	.17
	6" HOLLOW CLAY TILE 2 CELLS THICK	.25	.24	.19	.19	.16	.14	.13	.19	.19	.19	.20	.19	.15	.14	.12	.17	.14	.16
	8" HOLLOW CLAY TILE " " "	.25	.24	.19	.19	.15	.14	.13	.19	.18	.19	.19	.19	.15	.14	.12	.17	.14	.15
	4" HOLLOW CONCRETE BLOCK SAND & GRAVEL AGGREGATE	.32	.31	.23	.23	.18	.16	.14	.23	.22	.23	.24	.23	.18	.16	.14	.20	.17	.18
	8" HOLLOW CONCRETE BLOCK " "	.29	.28	.22	.22	.17	.15	.14	.22	.21	.21	.22	.21	.17	.15	.13	.19	.16	.17
	4" HOLLOW CONCRETE BLOCK CINDER AGGREGATE	.29	.28	.22	.22	.17	.15	.14	.22	.21	.21	.22	.21	.17	.15	.13	.19	.16	.17
	8" HOLLOW CONCRETE BLOCK " "	.25	.24	.19	.19	.15	.14	.13	.19	.18	.19	.19	.19	.15	.14	.12	.17	.14	.15
	8" HOLLOW CONCRETE BLOCK BURNED CLAY OR SLAG AGGREGATE	.23	.22	.18	.18	.15	.13	.12	.18	.17	.17	.18	.18	.14	.13	.12	.16	.13	.14
4" HOLLOW CONCRETE BLOCK CINDER AGGREGATE	4" HOLLOW CLAY TILE 1 CELL THICK	.27	.26	.20	.20	.16	.15	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	6" HOLLOW CLAY TILE 2 CELLS THICK	.23	.23	.18	.18	.15	.13	.12	.18	.18	.18	.19	.18	.15	.13	.12	.16	.14	.15
	8" HOLLOW CLAY TILE " " "	.23	.22	.18	.18	.15	.13	.12	.18	.17	.18	.18	.18	.14	.13	.12	.16	.13	.15
	4" HOLLOW CONCRETE BLOCK SAND & GRAVEL AGGREGATE	.29	.28	.22	.22	.17	.15	.14	.22	.21	.21	.22	.21	.17	.15	.13	.19	.16	.17
	8" HOLLOW CONCRETE BLOCK " "	.27	.26	.20	.20	.16	.15	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	4" HOLLOW CONCRETE BLOCK CINDER AGGREGATE	.27	.26	.20	.20	.16	.15	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	8" HOLLOW CONCRETE BLOCK " "	.23	.22	.18	.18	.15	.13	.12	.18	.17	.18	.18	.18	.14	.13	.12	.16	.13	.15
	8" HOLLOW CONCRETE BLOCK BURNED CLAY OR SLAG AGGREGATE	.21	.21	.17	.17	.14	.13	.12	.17	.16	.17	.17	.17	.14	.12	.11	.15	.13	.14
4" HOLLOW CLAY TILE	4" HOLLOW CLAY TILE 1 CELL THICK	.27	.26	.20	.20	.16	.15	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	6" HOLLOW CLAY TILE 2 CELLS THICK	.23	.23	.18	.18	.15	.13	.12	.18	.18	.18	.19	.18	.15	.13	.12	.16	.14	.15
	8" HOLLOW CLAY TILE " " "	.23	.22	.18	.18	.15	.13	.12	.18	.17	.18	.18	.18	.14	.13	.12	.16	.13	.15
	4" HOLLOW CONCRETE BLOCK SAND & GRAVEL AGGREGATE	.29	.28	.22	.22	.17	.15	.14	.22	.21	.21	.22	.21	.17	.15	.13	.19	.16	.17
	8" HOLLOW CONCRETE BLOCK " "	.27	.26	.20	.20	.16	.15	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	4" HOLLOW CONCRETE BLOCK CINDER AGGREGATE	.27	.26	.20	.20	.16	.15	.13	.20	.20	.20	.21	.20	.16	.14	.13	.18	.15	.16
	8" HOLLOW CONCRETE BLOCK " "	.23	.22	.18	.18	.15	.13	.12	.18	.17	.18	.18	.18	.14	.13	.12	.16	.13	.15
	8" HOLLOW CONCRETE BLOCK BURNED CLAY OR SLAG AGGREGATE	.21	.21	.17	.17	.14	.13	.12	.17	.16	.17	.17	.17	.14	.12	.11	.15	.13	.14

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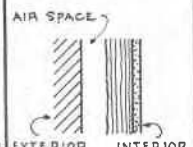
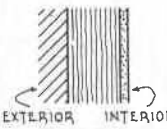
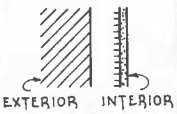
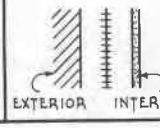
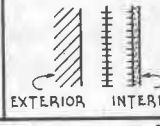
MASONRY WALLS

OVERALL HEAT TRANSMISSION COEFFICIENTS "U" *WITH INSULATION BETWEEN FURRING STRIPS.*

TABLE WM.4

COEFFICIENT WITH NO INSULATION IN FURRING SPACE	MASS INSULATION						REFLECTIVE INSULATION EACH AIR SPACE AT LEAST 3/4" EMISSIVITY .05					
	1" (NOMINAL) FURRING. SPACE 3/4"			2" NOMINAL FURRING. SPACE 1 5/8"						REFLECTIVE INTERIOR FINISH		
	1" BATT, OR BLANKET, (COMPRESSED)			1" BATT OR BLANKET			2" BATT OR BLANKET, (COMPRESSED)			ONE AIR SPACE FACED ONE SIDE WITH REFLECTIVE MATERIAL.	TWO AIR SPACES EACH FACED ONE SIDE WITH REFLECTIVE MATERIAL.	TWO AIR SPACES ONE FACED ONE SIDE, AND ONE FACED BOTH SIDES WITH REFLECTIVE MATERIAL.
												
k VALUE →	k·24	k·27	k·30	k·24	k·27	k·30	k·24	k·27	k·30	OUTSIDE DESIGN TEMPERATURE - 10°		
.11	.09	.09	.09	.08	.08	.08	.06	.07	.07	.09	.08	.08
.12	.09	.10	.10	.08	.08	.09	.07	.07	.07	.10	.08	.09
.13	.10	.10	.11	.08	.09	.09	.07	.07	.08	.11	.09	.10
.14	.11	.11	.11	.09	.09	.10	.07	.08	.08	.12	.09	.10
.15	.11	.12	.12	.09	.10	.10	.07	.08	.08	.13	.10	.11
.16	.12	.12	.13	.10	.10	.10	.08	.08	.09	.13	.10	.11
.17	.12	.13	.13	.10	.10	.11	.08	.08	.09	.14	.10	.12
.18	.13	.13	.14	.10	.11	.11	.08	.09	.09	.15	.11	.12
.19	.13	.14	.15	.11	.11	.12	.08	.09	.09	.15	.11	.13
.20	.14	.15	.15	.11	.11	.12	.08	.09	.10	.16	.12	.13
.21	.14	.15	.16	.11	.12	.12	.09	.09	.10	.17	.12	.14
.22	.15	.16	.16	.11	.12	.13	.09	.09	.10	.18	.12	.14
.23	.15	.16	.17	.12	.12	.13	.09	.10	.10	.18	.13	.15
.24	.16	.17	.17	.12	.13	.13	.09	.10	.10	.19	.13	.15
.25	.16	.17	.18	.12	.13	.14	.09	.10	.11	.20	.13	.15
.26	.16	.17	.18	.12	.13	.14	.09	.10	.11	.20	.14	.16
.27	.17	.18	.19	.13	.14	.14	.10	.10	.11	.21	.14	.16
.28	.17	.18	.19	.13	.14	.14	.10	.10	.11	.22	.14	.17
.29	.18	.19	.20	.13	.14	.15	.10	.11	.11	.22	.14	.17
.30	.18	.19	.20	.13	.14	.15	.10	.11	.11	.23	.15	.17
.31	.18	.20	.21	.14	.14	.15	.10	.11	.12	.23	.15	.18
.32	.19	.20	.21	.14	.15	.16	.10	.11	.12	.24	.15	.18
.33	.19	.20	.22	.14	.15	.16	.10	.11	.12	.25	.16	.18
.34	.19	.21	.22	.14	.15	.16	.10	.11	.12	.25	.16	.19
.35	.20	.21	.22	.14	.15	.16	.10	.11	.12	.26	.16	.19
.36	.20	.22	.23	.14	.15	.16	.10	.11	.12			
.37	.20	.22	.23	.15	.16	.17	.11	.11	.12			
.38	.21	.22	.24	.15	.16	.17	.11	.12	.12			
.39	.21	.23	.24	.15	.16	.17	.11	.12	.13			
.40	.21	.23	.24	.15	.16	.17	.11	.12	.13			
.41	.21	.23	.25	.15	.16	.17	.11	.12	.13			
.42	.22	.24	.25	.15	.16	.18	.11	.12	.13			
.43	.22	.24	.26	.15	.17	.18	.11	.12	.13			
.44	.22	.24	.26	.16	.17	.18	.11	.12	.13			
.45	.23	.24	.26	.16	.17	.18	.11	.12	.13			
.46	.23	.25	.27	.16	.17	.18	.11	.12	.13			
.47	.23	.25	.27	.16	.17	.18	.11	.12	.13			
.48	.23	.25	.27	.16	.17	.19	.11	.12	.13			
.49	.23	.26	.28	.16	.17	.19	.11	.12	.13			
.50	.24	.26	.28	.16	.18	.19	.11	.12	.13			

NOTE:

USE THIS COLUMN WITH LAST TWO COLUMNS OF WM.1, WM.2 AND WM.3

T.N.B. JAN./51

OVERALL HEAT TRANSMISSION COEFFICIENTS "U"

FLOORS — NO FINISH BELOW FLOOR JOISTS

TABLE F.1

NOTE: FIGURES BELOW ARE BASED ON VENTILATED CRAWL SPACE BELOW FLOOR JOISTS, AND ARE CORRECTED FOR 2" x 8" JOISTS @ 16" O.C.

INSULATION		INTERIOR FINISH							
		13/16" HARDWOOD	1/2" PLYWOOD	25/32" SOFTWOOD	HARDWOOD, BUILDING PAPER AND SOFTWOOD.	1/8" LINOLEUM, BUILDING PAPER AND SOFTWOOD.	1/8" ASPHALT TILE, BUILDING PAPER AND SOFTWOOD.	1/8" LINOLEUM, BUILDING PAPER AND 1/2" PLYWOOD.	1/8" ASPHALT TILE, BUILDING PAPER AND 1/2" PLYWOOD.
NO INSULATION		.37	.39	.34	.25	.31	.31	.35	.35
MASS INSULATION									
2" MASS INSULATION	K = .24	.10	.10	.09	.09	.09	.09	.09	.09
	K = .27	.10	.10	.10	.09	.10	.10	.10	.10
	K = .30	.11	.11	.11	.10	.10	.10	.11	.11
3" MASS INSULATION	K = .24	.07	.07	.07	.07	.07	.07	.07	.07
	K = .27	.08	.08	.08	.07	.08	.08	.08	.08
	K = .30	.08	.09	.08	.08	.08	.08	.08	.08
4" MASS INSULATION	K = .24	.06	.06	.06	.06	.06	.06	.06	.06
	K = .27	.07	.07	.06	.06	.06	.06	.07	.07
	K = .30	.07	.07	.07	.07	.07	.07	.07	.07

VAPOUR BARRIER

MESH SUPPORT

REFLECTIVE INSULATION

EMISSIVITY of REFLECTIVE SURFACES .05
INSIDE DESIGN TEMP. 70°
OUTSIDE DESIGN TEMP. -10°

FOILS REFLECTIVE ONE SIDE	FOILS REFLECTIVE BOTH SIDES									
		FOILS REFLECTIVE ONE SIDE	ONE AIR SPACE, FACED ONE SIDE	.14	.15	.14	.12	.13	.13	.14	.14
		FOILS REFLECTIVE BOTH SIDES	" " " " " "	.12	.12	.11	.10	.11	.11	.12	.12
		FOILS REFLECTIVE ONE SIDE	" " " FACED BOTH SIDES.	.14	.14	.13	.12	.13	.13	.14	.14
		FOILS REFLECTIVE BOTH SIDES	" " " " " "	.12	.12	.11	.10	.11	.11	.11	.11
		FOILS REFLECTIVE ONE SIDE	TWO AIR SPACES, EACH FACED ONE SIDE.	.09	.09	.08	.08	.08	.08	.08	.08
		FOILS REFLECTIVE BOTH SIDES	" " " ONE FACED ONE SIDE & ONE FACED BOTH.	.08	.08	.07	.07	.07	.07	.07	.07
		FOILS REFLECTIVE ONE SIDE	" " " ONE FACED ONE SIDE & ONE FACED BOTH	.08	.08	.08	.08	.08	.08	.08	.08
		FOILS REFLECTIVE BOTH SIDES	" " " EACH FACED BOTH SIDES	.07	.07	.07	.07	.07	.07	.07	.07
		FOILS REFLECTIVE ONE SIDE	THREE AIR SPACES, EACH FACED ONE SIDE.	.06	.06	.06	.06	.06	.06	.06	.06
		FOILS REFLECTIVE BOTH SIDES	" " " ONE FACED ONE SIDE & TWO FACED BOTH	.06	.06	.06	.05	.05	.05	.06	.06
		FOILS REFLECTIVE ONE SIDE	" " " TWO FACED ONE SIDE & ONE FACED BOTH	.06	.06	.06	.06	.06	.06	.06	.06
		FOILS REFLECTIVE BOTH SIDES	" " " EACH FACED BOTH SIDES	.06	.06	.05	.05	.05	.05	.05	.05

T.N.B. JAN./51

OVERALL HEAT TRANSMISSION COEFFICIENTS "U"

FLOORS *WITH FINISH ON UNDER SIDE of FLOOR JOISTS*

TABLE F.2

NOTE: FIGURES BELOW ARE BASED ON A VENTILATED CRAWL SPACE BELOW FLOOR, AND ARE CORRECTED FOR 2"x8" JOISTS @ 16" O.C.

INSULATION		¼" PLYWOOD FINISH ON UNDER SIDE of FL. JOISTS — INTERIOR FINISH								½" INSULATION BOARD FINISH ON UNDER SIDE of FL. JOISTS — INTERIOR FINISH							
		13/16" HARDWOOD	½" PLYWOOD	25/32" SOFTWOOD	HARDWOOD, BUILDING PAPER AND SOFTWOOD.	⅛" LINOLEUM, BUILDING PAPER AND SOFTWOOD.	⅛" ASPHALT TILE, BUILDING PAPER AND SOFTWOOD.	⅛" LINOLEUM, BUILDING PAPER AND ½" PLYWOOD.	⅛" ASPHALT TILE, BUILDING PAPER AND ½" PLYWOOD.	13/16" HARDWOOD	½" PLYWOOD	25/32" SOFTWOOD	HARDWOOD, BUILDING PAPER AND SOFTWOOD.	⅛" LINOLEUM, BUILDING PAPER AND SOFTWOOD.	⅛" ASPHALT TILE, BUILDING PAPER AND SOFTWOOD.	⅛" LINOLEUM, BUILDING PAPER AND ½" PLYWOOD.	⅛" ASPHALT TILE, BUILDING PAPER AND ½" PLYWOOD.
NO INSULATION		.24	.25	.23	.19	.21	.22	.23	.23	.18	.19	.18	.15	.17	.17	.18	.18
MASS INSULATION																	
2" MASS INSULATION	k = .24	.09	.09	.08	.08	.08	.08	.08	.08	.08	.08	.08	.07	.07	.07	.08	.08
	k = .27	.09	.09	.09	.08	.09	.09	.09	.09	.08	.08	.08	.07	.08	.08	.08	.08
	k = .30	.09	.10	.09	.09	.09	.09	.10	.10	.09	.09	.08	.08	.08	.08	.09	.09
3" MASS INSULATION	k = .24	.07	.07	.07	.06	.07	.07	.07	.07	.06	.06	.06	.06	.06	.06	.06	.06
	k = .27	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	.06	.06	.06	.06	.07	.07
	k = .30	.08	.08	.08	.07	.07	.07	.08	.08	.07	.07	.07	.06	.07	.07	.07	.07
4" MASS INSULATION	k = .24	.06	.06	.06	.05	.05	.06	.06	.06	.05	.05	.05	.05	.05	.05	.05	.05
	k = .27	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06	.05	.06	.06	.06	.06
	k = .30	.07	.07	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06
2" EXPANDED VERMICULITE	k = .48	.12	.12	.12	.11	.12	.12	.12	.12	.11	.11	.10	.09	.10	.10	.10	.10
3" EXPANDED VERMICULITE	k = .48	.10	.10	.10	.09	.09	.10	.10	.10	.09	.09	.09	.08	.09	.09	.09	.09
4" EXPANDED VERMICULITE	k = .48	.09	.09	.08	.08	.08	.08	.08	.08	.08	.08	.08	.07	.07	.08	.08	.08

REFLECTIVE INSULATION

EMISSIVITY of REFLECTIVE SURFACES .05
INSIDE DESIGN TEMP. 70°
OUTSIDE DESIGN TEMP. -10°

FOILS REFLECTIVE ONE SIDE	FOILS REFLECTIVE BOTH SIDES		13/16" HARDWOOD	½" PLYWOOD	25/32" SOFTWOOD	HARDWOOD, BUILDING PAPER AND SOFTWOOD.	⅛" LINOLEUM, BUILDING PAPER AND SOFTWOOD.	⅛" ASPHALT TILE, BUILDING PAPER AND SOFTWOOD.	⅛" LINOLEUM, BUILDING PAPER AND ½" PLYWOOD.	⅛" ASPHALT TILE, BUILDING PAPER AND ½" PLYWOOD.	13/16" HARDWOOD	½" PLYWOOD	25/32" SOFTWOOD	HARDWOOD, BUILDING PAPER AND SOFTWOOD.	⅛" LINOLEUM, BUILDING PAPER AND SOFTWOOD.	⅛" ASPHALT TILE, BUILDING PAPER AND SOFTWOOD.	⅛" LINOLEUM, BUILDING PAPER AND ½" PLYWOOD.	⅛" ASPHALT TILE, BUILDING PAPER AND ½" PLYWOOD.
		FOILS REFLECTIVE ONE SIDE	.12	.12	.12	.10	.11	.11	.12	.12	.10	.10	.10	.09	.10	.10	.10	.10
		FOILS REFLECTIVE ONE SIDE	.11	.11	.10	.09	.10	.10	.10	.10	.09	.09	.09	.08	.09	.09	.09	.09
		FOILS REFLECTIVE BOTH SIDES	.09	.09	.08	.07	.07	.07	.08	.08	.07	.07	.07	.06	.07	.07	.07	.07
		FOILS REFLECTIVE ONE SIDE	.10	.10	.10	.09	.10	.10	.10	.10	.09	.09	.09	.08	.10	.10	.09	.09
		FOILS REFLECTIVE BOTH SIDES	.08	.08	.07	.07	.07	.07	.07	.07	.07	.07	.07	.06	.07	.07	.07	.07
		FOILS REFLECTIVE ONE SIDE	.07	.07	.07	.07	.07	.07	.07	.07	.06	.06	.06	.06	.06	.06	.06	.06
		FOILS REFLECTIVE BOTH SIDES	.06	.06	.06	.05	.05	.06	.06	.06	.05	.05	.05	.05	.05	.05	.05	.05
		FOILS REFLECTIVE ONE SIDE	.07	.07	.07	.06	.07	.07	.07	.07	.06	.07	.06	.06	.06	.06	.06	.06
		FOILS REFLECTIVE BOTH SIDES	.06	.06	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05

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OVERALL HEAT TRANSMISSION COEFFICIENTS "U"

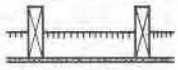
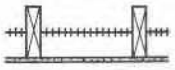
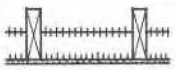
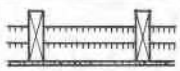
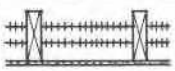
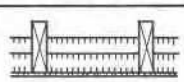
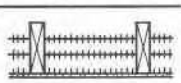
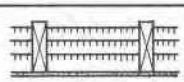
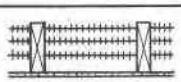
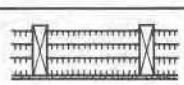
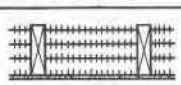
CEILINGS — NO FLOORING ABOVE CEILING JOISTS

TABLE C.1

	INSULATION	INTERIOR FINISH																
	NOTE: FIGURES BELOW ARE BASED ON VENTILATED ATTIC SPACE BETWEEN CEILING & ROOF AND ARE CORRECTED FOR 2"x6" JOISTS @ 16" O.C.	3/8" GYPSUM BOARD	1/2" GYPSUM BOARD	1/2" RIGID INSULATION BOARD	3/4" RIGID INSULATION BOARD	1" RIGID INSULATION BOARD	1/4" PLYWOOD	3/8" PLYWOOD	3/8" GYPSUM LATH, 1/2" PLASTER	METAL LATH, 3/4" PLASTER	WOOD LATH, 3/4" PLASTER	1/2" INSULATION BOARD LATH, 1/2" PLASTER	3/4" INSULATION BOARD LATH, 1/2" PLASTER	1" INSULATION BOARD LATH, 1/2" PLASTER	FOIL BOARD, REFLECTIVE INTERIOR SIDE	FOIL BOARD, REFLECTIVE BOTH SIDES	FOIL BACKED 3/8" GYPSUM LATH, 1/2" PLASTER
	NO INSULATION	.68	.64	.35	.27	.22	.66	.59	.61	.70	.62	.33	.26	.22	.56	.46	.49
MASS INSULATION	2" MASS INSULATION k = .24	.11	.11	.09	.09	.08	.11	.10	.10	.11	.10	.09	.09	.08	.10	.10	.10
	2" MASS INSULATION k = .27	.12	.11	.10	.09	.09	.12	.11	.11	.12	.11	.10	.09	.09	.11	.11	.11
	2" MASS INSULATION k = .30	.13	.12	.11	.10	.09	.12	.12	.12	.13	.12	.11	.10	.09	.12	.12	.12
	3" MASS INSULATION k = .24	.08	.08	.07	.07	.07	.08	.08	.08	.08	.08	.07	.07	.06	.08	.08	.08
	3" MASS INSULATION k = .27	.09	.09	.08	.07	.07	.09	.08	.09	.09	.09	.08	.07	.07	.08	.08	.09
	3" MASS INSULATION k = .30	.09	.09	.08	.08	.07	.09	.09	.09	.09	.09	.08	.08	.07	.09	.09	.09
	4" MASS INSULATION k = .24	.07	.06	.06	.06	.05	.07	.06	.06	.07	.06	.06	.06	.05	.06	.06	.06
	4" MASS INSULATION k = .27	.07	.07	.06	.06	.06	.07	.07	.07	.07	.07	.06	.06	.06	.07	.07	.07
	4" MASS INSULATION k = .30	.08	.08	.07	.06	.06	.08	.07	.08	.08	.08	.07	.06	.06	.07	.07	.07
	2" EXPANDED VERMICULITE k = .48	.17	.17	.14	.13	.12	.17	.17	.17	.17	.17	.14	.13	.12	.16	.16	.17
	3" EXPANDED VERMICULITE k = .48	.13	.13	.11	.10	.10	.13	.13	.13	.13	.13	.11	.10	.09	.13	.13	.13
	4" EXPANDED VERMICULITE k = .48	.11	.11	.09	.09	.08	.11	.10	.10	.11	.10	.09	.09	.08	.10	.10	.10
	1/2" RIGID INSULATION BOARD, ON TOP OF JOISTS	.25	.25	.19	.17	.15	.25	.24	.24	.26	.24	.18	.16	.14	.24	.20	.21
	1" RIGID INSULATION BOARD, ON TOP OF JOISTS.	.18	.18	.15	.13	.12	.18	.17	.18	.18	.18	.14	.13	.12	.17	.15	.15

REFLECTIVE INSULATION

EMISSIVITY of REFLECTIVE SURFACES .05
INSIDE DESIGN TEMPERATURE 70°
OUTSIDE DESIGN TEMPERATURE -10°

FOILS REFLECTIVE ONE SIDE	FOILS REFLECTIVE BOTH SIDES.																
		FOILS REFLECTIVE ONE SIDE	.33	.32	.23	.19	.17	.33	.31	.32	.34	.32	.22	.18	.16	.31	.30	.31
		FOILS REFLECTIVE BOTH SIDES	.30	.29	.21	.18	.16	.29	.28	.28	.30	.28	.20	.17	.15	.27	.27	.28
		FOILS REFLECTIVE ONE SIDE	.33	.32	.23	.19	.16	.33	.31	.31	.34	.31	.22	.18	.16	.30	.30	.31
		FOILS REFLECTIVE BOTH SIDES	.29	.28	.21	.18	.15	.29	.27	.28	.30	.28	.20	.17	.15	.27	.27	.28
		FOILS REFLECTIVE ONE SIDE	.21	.21	.16	.14	.13	.21	.20	.20	.21	.21	.16	.14	.12	.20	.20	.20
		FOILS REFLECTIVE BOTH SIDES	.19	.19	.15	.13	.12	.19	.18	.19	.20	.19	.15	.13	.12	.18	.18	.19
		FOILS REFLECTIVE ONE SIDE	.21	.21	.16	.14	.13	.21	.20	.20	.21	.20	.16	.14	.12	.20	.20	.20
		FOILS REFLECTIVE BOTH SIDES	.19	.19	.15	.13	.12	.19	.18	.19	.19	.19	.15	.13	.12	.18	.18	.19
		FOILS REFLECTIVE ONE SIDE	.15	.15	.13	.11	.10	.15	.15	.15	.15	.15	.12	.11	.10	.15	.14	.15
		FOILS REFLECTIVE BOTH SIDES	.14	.14	.12	.11	.10	.14	.14	.14	.14	.14	.11	.11	.10	.14	.14	.14
		FOILS REFLECTIVE ONE SIDE	.15	.15	.13	.11	.10	.15	.15	.15	.15	.15	.12	.11	.10	.14	.14	.15
		FOILS REFLECTIVE BOTH SIDES	.14	.14	.12	.11	.10	.14	.14	.14	.14	.14	.12	.11	.10	.14	.14	.14

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CEILINGS

OVERALL HEAT TRANSMISSION COEFFICIENTS "U"
25/32" WOOD FLOORING, ABOVE CEILING JOISTS.

TABLE C.2

NOTE: FIGURES BELOW ARE BASED ON VENTILATED ATTIC SPACE BETWEEN CEILING & ROOF AND ARE CORRECTED FOR 2"x6" JOISTS @ 16" O.C.

INSULATION		INTERIOR FINISH																
		3/8" GYPSUM BOARD	1/2" GYPSUM BOARD	1/2" RIGID INSULATION BOARD	3/4" RIGID INSULATION BOARD	1" RIGID INSULATION BOARD	1/4" PLYWOOD	3/8" PLYWOOD	3/8" GYPSUM LATH, 1/2" PLASTER	METAL LATH, 3/4" PLASTER	WOOD LATH, 3/4" PLASTER	1/2" INSULATION BOARD LATH, 1/2" PLASTER	3/4" INSULATION BOARD LATH, 1/2" PLASTER	1" INSULATION BOARD LATH, 1/2" PLASTER	FOIL BOARD, REFLECTIVE INTERIOR SIDE	FOIL BOARD, REFLECTIVE BOTH SIDES	FOIL BACKED 3/8" GYPSUM LATH, 1/2" PLASTER
NO INSULATION		.30	.29	.21	.18	.16	.29	.28	.28	.30	.28	.21	.18	.16	.27	.23	.23
MASS INSULATION																	
2" MASS INSULATION	K = .24	.09	.09	.08	.08	.07	.09	.09	.09	.09	.09	.08	.08	.07	.09	.09	.09
	K = .27	.10	.09	.09	.08	.08	.10	.09	.09	.10	.09	.09	.08	.08	.09	.09	.09
	K = .30	.10	.10	.09	.09	.08	.10	.10	.10	.10	.10	.09	.08	.08	.10	.10	.10
3" MASS INSULATION	K = .24	.07	.07	.07	.06	.06	.07	.07	.07	.07	.07	.06	.06	.06	.07	.07	.07
	K = .27	.08	.08	.07	.07	.06	.08	.08	.08	.08	.08	.07	.06	.06	.07	.07	.08
	K = .30	.08	.08	.07	.07	.07	.08	.08	.08	.08	.08	.07	.07	.07	.08	.08	.08
4" MASS INSULATION	K = .24	.06	.06	.05	.05	.05	.06	.06	.06	.06	.06	.05	.05	.05	.06	.06	.06
	K = .27	.06	.06	.06	.06	.05	.06	.06	.06	.06	.06	.06	.06	.05	.06	.06	.06
	K = .30	.07	.07	.06	.06	.06	.07	.07	.07	.07	.07	.06	.06	.06	.07	.07	.07
2" EXPANDED VERMICULITE	K = .48	.13	.13	.11	.11	.10	.13	.13	.13	.14	.13	.11	.10	.10	.13	.13	.13
3" EXPANDED VERMICULITE	K = .48	.11	.11	.09	.09	.08	.11	.11	.11	.11	.11	.09	.08	.08	.10	.10	.11
4" EXPANDED VERMICULITE	K = .48	.09	.09	.08	.08	.07	.09	.09	.09	.09	.09	.08	.08	.07	.09	.09	.09

REFLECTIVE INSULATION

EMISSIVITY of REFLECTIVE SURFACES .05
INSIDE DESIGN TEMPERATURE 70°
OUTSIDE DESIGN TEMPERATURE -10°

FOILS REFLECTIVE ONE SIDE	FOILS REFLECTIVE BOTH SIDES																
		FOILS REFLECTIVE ONE SIDE	.24	.24	.18	.16	.14	.24	.23	.24	.25	.24	.18	.15	.14	.23	.23	.23
		FOILS REFLECTIVE ONE SIDE	.20	.20	.16	.14	.13	.20	.20	.20	.20	.20	.16	.14	.12	.19	.19	.20
		FOILS REFLECTIVE BOTH SIDES	.17	.17	.14	.12	.11	.17	.17	.17	.17	.17	.13	.12	.11	.16	.16	.16
		FOILS REFLECTIVE ONE SIDE	.20	.20	.16	.14	.13	.20	.19	.20	.20	.20	.15	.14	.12	.19	.19	.20
		FOILS REFLECTIVE BOTH SIDES	.17	.17	.14	.12	.11	.17	.16	.16	.17	.17	.13	.12	.11	.16	.16	.16
		FOILS REFLECTIVE ONE SIDE	.15	.15	.12	.11	.10	.15	.15	.15	.15	.15	.12	.11	.10	.14	.14	.15
		FOILS REFLECTIVE BOTH SIDES	.13	.13	.11	.10	.09	.13	.13	.13	.13	.13	.11	.10	.09	.12	.12	.13
		FOILS REFLECTIVE ONE SIDE	.15	.15	.12	.11	.10	.15	.15	.15	.15	.15	.12	.11	.10	.14	.14	.15
		FOILS REFLECTIVE BOTH SIDES	.13	.13	.11	.10	.09	.13	.13	.13	.13	.13	.11	.10	.09	.12	.12	.13

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APPENDIX A

CALCULATIONS

General

The tables on the preceding pages contain the overall heat transmission coefficients recommended for use in the computation of heat losses through building sections. In the tables covering building sections having no air spaces, or having air spaces bounded by ordinary materials, the coefficients have been calculated according to the procedure and formula recommended in the Heating, Ventilating and Air Conditioning Guide*. In the tables for building sections containing air spaces faced one or both sides with reflective material, the calculations have been made according to the procedure outlined in Appendix D, "Calculation of Building Section Heat Transmission Coefficients", Technical Circular No. 7, Revised January 1947, published by the Federal Housing Administration, Washington, D. C.

The following notes apply to all tables:

1. No allowance has been made for the resistance to heat flow provided by vapour barrier materials, since it is so small when compared with the total resistance of the whole wall section.

2. The inside surface conductance used is that for still air. The outside surface conductance used is that for a wind velocity of 15 miles per hour in tables for frame and masonry walls, and for ceilings and floors is that for still air.

3. With all types of insulation, the coefficients have been corrected for the influence of 2 by 4 studs on 16-inch centres. Corrections applied to floors and ceilings are noted in the tables.

4. For frame and masonry walls with foil-backed interior finish and reflective insulation, the foil-backed interior finish has been considered as one of the reflecting surfaces.

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* Published yearly by the American Society of Heating and Ventilating Engineers, New York.

Overall Heat Transmission Coefficients of Building Sections

In the determination of the theoretical heat loss of buildings, the overall heat transmission of any building section, such as a wall, ceiling or floor, is expressed by the equation:

$$H = U \times A \times (t_1 - t_2)$$

where:

H = Heat loss, in B.t.u./ hour

U = Overall heat transmission coefficient, in B.t.u./ hour / sq. ft./ °F. difference between air temperatures inside and outside.

A = Area of section, in square feet.

t_1 = Average air temperature, inside, in °F.

t_2 = Average air temperature, outside, in °F.

The surface area (A) of the building section, and the average air temperature inside and outside the section (t_1 and t_2) may be measured.

The determination of the theoretical overall heat transmission coefficient (U) however, is generally more difficult, especially for the more complex building sections. The calculation involves the use of a formula (see Page 22), and usually a reference to tables to ascertain the thermal conductivities of the materials involved, the thermal conductances of air spaces, and the interior and exterior surface conductance coefficients.

Symbols Used in Calculation of Overall Heat Transmission Coefficient

k = thermal conductivity; the amount of heat transmitted in one hour through a one square foot area of homogeneous material one inch thick, for each degree F. temperature difference between the two surfaces of the material. Unit expressed in B.t.u./hour/ square foot/°F./inch of thickness.

$\frac{1}{k}$ = Resistivity; the reciprocal of thermal conductivity of a homogeneous material one inch thick.

$\frac{x}{k}$ = Resistance; the reciprocal of thermal conductance of a homogeneous material "x" inches thick.

C = Thermal conductance; the amount of heat transmitted in one hour through a one square foot area of material, or combination of materials of given thickness, for each degree F. temperature difference between the two surfaces. Unit expressed in B.t.u./hour /square foot/°F.

$\frac{1}{C}$ = Resistance; the reciprocal of thermal conductance.

f = Film or surface conductance; the amount of heat transmitted in one hour from one square foot surface to the air immediately adjacent to it (or from the air to the surface) for each degree F. temperature difference between the surface and the adjacent air. Unit expressed in B.t.u./hour/square foot/°F.
Inside surface conductance is denoted by f_1 and outside surface conductance by f_0.

$\frac{1}{f}$ = Film or surface resistance; the reciprocal of film or surface conductance.

a = Thermal conductance of an air space; the amount of heat transmitted in one hour from one square foot of surface bounding one side of an air space to one square foot of surface bounding the opposite side of the air space for each degree F. temperature difference between the two surfaces.
Unit expressed in B.t.u./hour/square foot/°F.

$\frac{1}{a}$ = Resistance of an air space; the reciprocal of thermal conductance of an air space.

U = Overall Heat Transmission Coefficient; the amount of heat transmitted in one hour through one square foot of a building section (wall, ceiling or floor) for each degree F. temperature difference between air on the inside and air on the outside of the building section.
Unit expressed in B.t.u./hour/square foot/°F.

$\frac{1}{U}$ = Overall Resistance; the reciprocal of the overall heat transmission coefficient.

Calculation of Overall Heat Transmission Coefficient

The overall heat transmission coefficient 'U' of a building section is equal to the reciprocal of the sum of the resistances of the individual materials, air spaces and surface films, comprising the building section. This is expressed by the equation:

$$U = \frac{1}{f_0} + \frac{x_1}{k_1} + \frac{x_2}{k_2} + \cdots \frac{1}{C_1} + \frac{1}{C_2} + \cdots \frac{1}{a_1} + \frac{1}{a_2} + \cdots \frac{1}{f_i}$$

Where: $\frac{1}{f_o}$ = Resistance of outside surface film.

$\frac{x_1}{k_1}, \frac{x_2}{k_2}$, etc. = Resistances of the materials having thickness x inches and thermal conductivity k.

$\frac{1}{C_1}, \frac{1}{C_2}$, etc. = Resistances of the materials having thermal conductance C.

$\frac{1}{a_1}, \frac{1}{a_2}$, etc. = Resistances of air spaces.

$\frac{1}{f_i}$ = Resistance of inside surface film.

APPENDIX B

Conductance of Air Spaces, Faced Both Sides with Non-Reflective Materials

The amount of heat transferred across an enclosed air space depends upon several factors. Among these, the emissivity of the surfaces enclosing the air space, the difference in temperature across the air space, and the direction of heat flow, are the most important. The shape and width of an air space also affect the heat transfer but it has been found by experience that increasing the width beyond $\frac{3}{4}$ inches has a negligible effect upon the conductance of the air space.

In the following table, average conductance values are given for air spaces faced with ordinary materials, for the three directions of heat flow, viz., horizontal or lateral flow across a vertical air space, upward flow across a horizontal air space and downward flow across a horizontal air space. These figures are average values for air spaces having approximately parallel surfaces.

Average Conductance of Air Spaces Bounded by Approximately Parallel Surfaces of Ordinary Materials.

Direction of Heat Flow	Average Conductance (a)
Horizontal (wall)	1.10
Upward (ceiling)	1.32
Downward (floor)	.94

APPENDIX C

Conductance of Air Spaces Faced One or Both Sides with Reflective Material

In order to function as insulation, reflective materials must always be accompanied by air spaces adjacent to the reflective surfaces. The width of air space generally recommended is from $\frac{1}{2}$ inch to $\frac{3}{4}$ inch and experience has shown that increasing the width beyond $\frac{3}{4}$ inches will have little or no effect on the insulating value. If this air space is not provided adjacent to the reflective surface the insulating value depends solely upon the thermal resistance of the reflective material itself, which, in practically all cases, is extremely low.

The reflective insulation tables in this booklet have been based on reflective material having an emissivity of .05. Should the surface become covered with dust, etc. to a degree which will raise its emissivity the insulating value will decrease in proportion. Should the emissivity approach .90, which is approximately the value for ordinary non-reflecting surfaces, the reflective materials would function, as insulation, simply as an air space bounded by ordinary materials.

The amount of heat transferred across an enclosed air space faced one or both sides with reflective material, as in the case of air spaces bounded by ordinary materials, depends upon the emissivity of the surfaces enclosing the air space, the difference in temperature across the air space, the mean temperature of the air space, the direction of heat flow and the width and shape of the air space.

A procedure for the calculation of the overall heat transmission coefficient of building sections containing air spaces faced one or both sides with reflective material has been evolved (2) based on the average effective emissivity of the air spaces faced with reflective material, the average temperature difference across the individual air spaces, and the sum of the resistances of the building section components other than the air spaces faced with reflective material. This procedure has been followed in this booklet in the computation of the overall heat transmission coefficients for building sections containing air spaces faced with reflective material, assuming an emissivity of .05 for the reflective material and an emissivity of .90 for the ordinary non-reflective surfaces.

In cases where it is desired to compute the overall heat transmission coefficient of building sections other than those given in this booklet without going through this detailed procedure, it may be sufficiently accurate to use the approximate figures given in the following table. These figures are based on the mean temperature of the air space, the temperature difference across the air space, and the resistance of the components other than the air spaces faced with reflective material which are to be found in "typical" frame wall, ceiling and floor constructions.

Approximate Conductances of Air Spaces Faced one or Both Sides With Reflective Material (emissivity = .05)

	Design Temperature -20°F.	0°F.	20°F.
Horizontal Heat Flow (Walls)			
1 space faced 1 side	.49	.46	.43
1 space faced both sides	.48	.45	.42
2 spaces each faced 1 side	.23	.22	.20
2 spaces (1 faced 1 side) (1 faced both sides)	.22	.21	.20
3 spaces (2 faced 1 side) (1 faced both sides)	.14	.13	.12
3 spaces (1 faced 1 side) (2 faced both sides)	.14	.13	.12
4 spaces each faced one side	.10	.10	.09
Upward Heat Flow (Ceilings) (Attic space not considered as air space)			
1 space faced 1 side	.68	.65	.60
2 spaces (1 faced 1 side) (1 faced both sides)	.31	.29	.27
3 spaces each faced 1 side	.20	.19	.17
3 spaces (2 faced 1 side) (1 faced both sides)	.19	.18	.16
4 spaces each faced 1 side	.14	.13	.12
Downward Heat Flow (Floors) (Crawl space not considered as air space)			
1 space faced 1 side	.22	.21	.19
2 spaces each faced 1 side	.10	.09	.09
2 spaces (1 faced 1 side) (1 faced both sides)	.09	.09	.08
3 spaces each faced one side	.06	.06	.06

APPENDIX D

Film or Surface Conductance Values

The film of air in immediate contact with the surface of any material offers resistance to the passage of heat from the surface to the surrounding air, or vice versa. The thermal conductance of this air film is known as film or surface conductance, and its value depends upon various factors such as the physical nature of the surface, the direction of heat flow, the temperature of the surface, the temperature difference between the surface and surrounding air and the velocity of air passing over it. The surface conductance values given in this appendix are average values and are considered sufficiently accurate for all practical purposes.

Inside surface conductance values (f_i) are given for interior surfaces of average texture, and are based on still air. Where the interior finish has a highly reflective surface, the values given for the outside surface conductance of a highly reflective surface in still air may be used.

Outside surface conductance values (f_o) for moving air are given for four types of surfaces, viz. "rough", such as stucco; "average" such as wood or brick; "smooth", such as glass; and "highly reflective", such as unpainted aluminum. The wind velocity is assumed to be 15 m.p.h. These values are used when the outside surface of the building section is exposed to the weather or, in the case of heat flow downward, when the floor section faces an unheated air space which is completely open; for example, the crawl space of a basementless structure not provided with foundation or curtain walls.

Outside surface conductance values (f_o) for still air are given for average, smooth and highly reflective surfaces. These are used when the outside surface of the building section faces an unheated and vented air space in which the air temperature is assumed to be virtually the same as outside air temperature and the air movement is low enough to be considered as still air; for example, a vented attic space between roof and ceiling, or a vented crawl space of a basementless structure.

Inside Surface Conductance f_i

Direction of Heat Flow	Average Conductance
Horizontal (wall)	1.65
Upward (ceiling)	1.95
Downward (floor)	1.20

Outside Surface Conductance f_o

Direction of Heat Flow	Moving Air (15 m.p.h. Wind)			
	Rough Surface	Average Surface	Smooth Surface	Reflective Surface
Horizontal (wall)	9.09	6.00	4.50	5.25
Upward (roof)	9.09	6.00		5.25
Downward (floor)	9.09	6.00		5.25

Direction of Heat Flow	Still Air		
	Average Surface	Smooth Surface	Reflective Surface
Horizontal (wall)	1.65	1.50	.74
Upward (ceiling)	1.95		1.16
Downward (floor)	1.20		.44

APPENDIX E

Values for Thermal Conductivity (k) and Thermal Conductance (C) of Common Building Materials

Conductivity (k) expressed in B.t.u./square foot/deg. F. /inch of thickness.

Conductance (C) expressed in B.t.u./square foot/deg. F. for the thickness stated or commonly used.

The following figures indicate values, or the range of values, of "k" and "C" which are generally accepted for the calculation of heat losses.

	'k'	'C'
Exterior Finish		
Aluminum Clapboard	1475	-
Asbestos Shingles		6.00
Asphalt Shingles		6.66
Brick - common - 4" thick	5.00	-
- face - 4" thick	9.00	-
Building Paper		5.50
Insulated Siding (Imitation Brick)		.78
Stone	12.50	-
Stucco	12.50	-
Wood Shingles		1.28
Wood Siding		1.28
1/8" Tempered Pressed Wood		12.50
3/8" Plywood		2.12
1/2" Plywood		1.59
1" Stucco on Metal Lath		12.50
Masonry Material		
(Brick - common	5.00	-
(- face	9.00	-
Cement Mortar	12.50	-
Stone	12.50	-
Solid Gypsum Tile	2.96	-
Concrete - burned clay aggregate	4.00	-
- cinder aggregate	4.55	-
- pumice aggregate	2.44	-
- sand-gravel aggregate	12.50	-
- slag aggregate	1.60	-
- vermiculite aggregate (density - 30 lbs./cu.ft.)	.95	-

	'k'	'C'
Hollow Clay Tile - 3"		1.28
4"		1.00
6"		.64
8"		.60
10"		.58
12"		.40
16"		.31
Hollow Concrete Blocks		
Cinder Aggregate - 3"		1.28
4"		1.00
8"		.60
12"		.53
Clay or Slag Aggregate - 8"		.50
12"		.47
Sand and Gravel Aggregate - 4"		1.43
8"		1.00
12"		.80
Hollow Gypsum Tile - 3"		.61
4"		.46
Roofing Material		
Asbestos Shingles		6.00
Asphalt Shingles		6.66
Asphalt Roll Roofing		6.66
Slate	10.00	-
Wood Shingles		1.28
Sheathing		
Building Paper		5.50
Insulating Board	.33	-
5/16" Plywood		2.56
1/2" Gypsum Board		2.82
25/32" Wood Sheathing		1.02
25/32" Wood Sheathing and Building Paper		.86
Insulating Materials - Batts, Blankets or Fill		
Cotton	.24 to .30	-
Eel Grass	.25 to .26	-
Expanded Vermiculite	.48	-
Mineral Wool	.27 to .33	-
Redwood Bark	.26 to .31	-
Sawdust or Shavings	.41	-

Insulating Materials Rigid Insulation	'k'	'C'
Corkboard	.25 to .34	-
Cellular Glass	.40	-
Cellular Plastic	.27	-
Cellular Rubber	.23	-
Insulating Board	.33	-
Shredded Wood and Cement	.46 to .77	-
Interior Finish		
Gypsum Plaster	3.30	-
Insulating Board	.33	-
Plywood	.80	-
1/4" Plywood		3.23
3/8" Plywood		2.12
3/8" Gypsum Board		3.70
1/2" Gypsum Board		2.82
1/2" Gypsum Plaster on 3/8" Gypsum Lath		2.40
3/4" Gypsum Plaster on Metal Lath		4.40
3/4" Gypsum Plaster on Wood Lath		2.50
Flooring Materials		
Maple or Oak	1.15	-
Pine or Fir	.80	-
Plywood	.80	-
Vitreous Tile or Terrazzo	12.50	-
1/4" Linoleum		1.35
1/2" Plywood		1.59
25/32" Pine or Fir		1.02
13/16" Maple or Oak		1.40
Asphalt Tile	6.50	-

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