A TEST OF THE CONDUCTIVITY OF WINDOW SHADES

By John R. Allen

The tests reported by the author were conducted to determine the relative amounts of heat transmission through a single strength glass window, close fitting with stops on both sides; *first,* without window shades; *second,* with the inner curtain only pulled down; *third,* with curtains on both sides pulled down and *fourth* with the outer curtain only pulled down. The author summarizes his results as follows:

RESULTS

The results from these tests show that the saving in heat transmitted by the use of the single inside curtain was 19.2 per cent.; by the outside curtain, 28.7 per cent. and by both curtains 42.7 per cent. The marked difference in heat transmission between the tests of the inner curtain and the outer curtain, was without doubt due to the fact that the inner curtain did not fit its opening tightly. This allowed currents of warm air to enter at the top and being cooled between the curtain and the window, to fall and go out through the clearances at the sides and bottom. The outer curtain fitted over the smooth sides of the box about 1½ inches and permitted very little movement of air between it and the window.

The author desires to here render acknowledgment to Prof. Frederick Bass for his assistance in conducting these tests.

Results of Window Shade Heat Transmission Tests

Test No	Time Elapsed during Accumulation of 1000 cc. of Melted Water, Minutes	Difference of Temperature Between Inside and Outside Air, deg. fahr.	Values of Heat Transmission Factor "K" as Calculated from First Column	Corrected Percentages of Saving of Heat Over Test No. 1, with Uncovered Glass
1—Both shades up.....	35.55	21.6	1.01	....
2—Inner shade down.....	36.58	26.0	0.817	19.2
3—Both shades down	45.93	29.3	0.578	42.7
4—Outer shade down.....	40.38	28.5	0.720	28.7

CALCULATIONS

In order to calculate the transmission heat loss from a room or building multiply the number of square feet of each kind of surface by its constant and then by the difference in temperature between the air in the room or building and the outside air and add together to obtain the total.

EXPOSURE

A certain allowance must be made for the effect of wind on the exposed sides of buildings. The prevailing wind in the coldest weather varies in different localities, and therefore it is impractical to set a definite rule for all places. Where the prevailing wind in the coldest weather is North it is usual practice to add 10 per cent. to the heat loss determined for Northern exposures. H. W. Whitten and R. C. March, (see Transactions, Vol. 22, p. 195) from observations made, give the equivalent drop in temperature for each mile of wind velocity as follows:

DROP IN TEMPERATURE FOR EACH MILE WIND VELOCITY

Temp. Deg. Fahr.	Wind Velocity	Deg. of Temp. Drop
50 deg. to 40 deg.	1 mile per hour equals	0.75 deg. drop
40 deg. to 30 deg.	1 mile per hour equals	1.0 deg. drop
30 deg. to 20 deg.	1 mile per hour equals	1.1 deg. drop
20 deg. to 10 deg.	1 mile per hour equals	1.2 deg. drop
10 deg. to 0 deg.	1 mile per hour equals	1.3 deg. drop
0 deg. to -10 deg.	1 mile per hour equals	1.4 deg. drop
-10 deg. to -20 deg.	1 mile per hour equals	1.5 deg. drop

In other words a temperature of 5 deg. above zero with a 30-mile wind would be equivalent to 34 deg. below zero with no wind blowing. It will be found, however, that the coefficients for transmission allow for a wind velocity of from 10 to 15 miles per hour.

EXAMPLES OF USE OF DATA IN DETERMINING HEAT LOSSES

Assume a living room 15 x 15 ft. with a 10 ft. ceiling. The space below the room is heated while an unheated space exists above the ceiling. The room is exposed on the North and West and each of these walls have a single window 3 x 6 ft. The walls are frame construction with $^{7}/_{16}$ in. clapboards, paper and ¾ in. sheathing lathed and plastered on the inside. The ceiling is lath and plaster only. It is desired to heat the room to 70 deg. fahr. in zero weather, one air change assumed, as there are no outside doors. The calculations, on basis of infiltration by air change method, would be as follows:

Cubical Contents	10 x 15 x 15	=	2250 cu. ft.
Window Area	3 x 6 x 2	=	36 sq. ft.
Net Wall Area	(10 x 15 x 2) — 36	=	264 sq. ft.
Ceiling Area	15 x 15	=	225 sq. ft.
Infiltration	2250 x 0.02 x 70	=	3150 B. t. u.
Net exposed wall	264 x 0.23 x 70	=	4180 B. t. u.
Plus 10 per cent. for Northern exposure		=	418 B. t. u.
Windows	36 x 1.2 x 70	=	3024 B. t. u.
Ceiling	225 x 0.6 x 35	=	4725 B. t. u.
			15497 B. t. u.

If the infiltration had been estimated by the lineal feet of window crack, assuming poor construction, the loss would have been

Ft. of crack of one window (3 x 3) + (6 x 2) = 21 ft. Infiltration — 21 x 2.4 x 70 = 3528 B. t. u. while for good construction the loss due to infiltration would have been 24 x 1.2 x 70 = 1714 B. t. u.