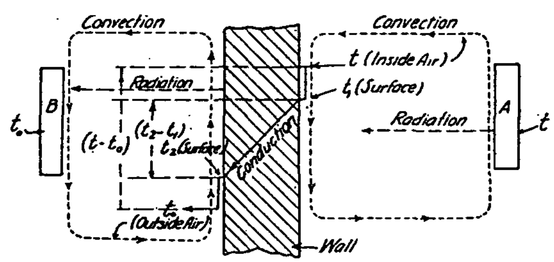
Since actual temperature differences vary widely in different parts of the country, it is desirable to adopt some standard basis for testing, such as 70 deg. inside and 0 deg. outside, and in very precise work make a correction for other temperatures. It has been found that the absolute mean temperature of the wall affects the coefficient materially. The coefficient increases with the absolute mean temperature.

Tests are usually run under still air conditions, which means there was no wind movement, during the test, over the surfaces of the wall. In practice, some wind movement over the exterior surface of the wall should always be allowed for; hence *still air* coefficients cannot be used in actual work as they do not provide for the normal wind movement over the outside of the building in the locality in question during the heating season. Moreover, *still air* transmission coefficients cannot be corrected to provide for moving air conditions by multiplying by a single constant factor.[1]



A represents warm surfaces at temperature *t* of inside air; *B* represents cold surfaces at temperature t_0 of outside air. For an actual temperature gradient curve see Fig. 2.

FIG. 1. TEMPERATURE CURVE OR GRADIENT FROM AIR INSIDE TO AND THROUGH WALL TO AIR OUTSIDE, WALL MATERIAL ASSUMED AIR-TIGHT

The coefficient of heat transmission of various building materials and types of construction as given in Table 6, are for still air and for a wind movement of 15 miles and are generally applicable to heat transmission computations using equation (9). Such heat transmission coefficients are always based on the difference between the air temperatures on the inside and the outside of the wall.

Transmission Coefficients by Computation

If heat transmission coefficients are to be computed, and in many, if not most cases, they should be computed, the following analysis of the transmission of heat through a simple, solid wall is used as the basis for such computations.

The diagram in Fig. 1 exhibits four important temperatures: *First* the air temperature *t* inside of the building; *second*, the temperature t_1 of the inside surface of the wall; *third*, the temperature t_2 of the outside surface of the wall, and *fourth*, the air temperature t_0 outside of the building.

[1] "Effect of Wind on Heat Transmission Coefficients" in Appendix to Section III, Code of Minimum Requirements of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

Heat reaches or enters the inside surface of the wall by radiation and convection, since the air and objects *A* within the building are *always* warmer than the inside surface of the wall, when the inside air temperature *t* is greater than the outside air temperature t_0. This heat must then pass through the material of the wall from inside to outside surface by conduction, and is finally given off from the outside surface by radiation and convection, provided, of course, that equilibrium has been established and all four temperatures are constant.

The amount of heat reaching or entering the wall per hour depends on *t* and t_1 and a coefficient K_1 varying with the character of the wall

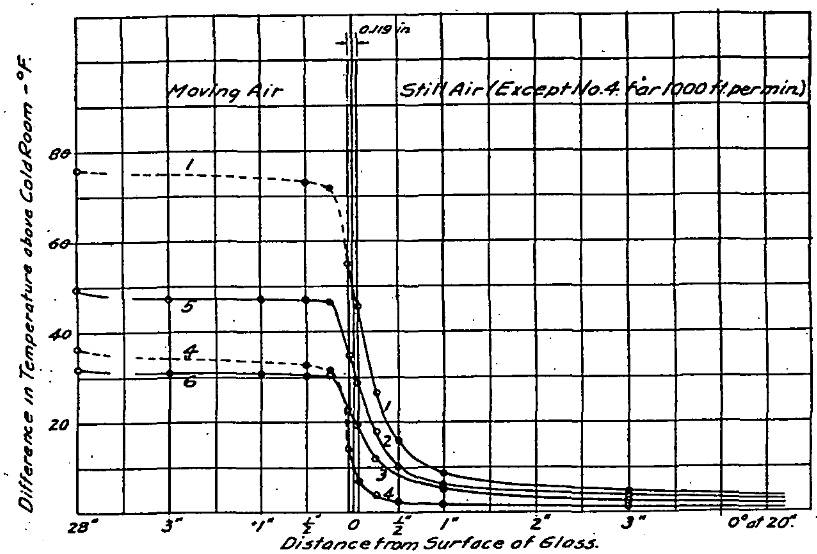


FIG. 2. TEMPERATURE GRADIENT CURVES FOR GLASS (TAKEN FROM BULLETIN NO. 24, ENGRG. EXP. STA., PENNSYLVANIA STATE COLLEGE)

material. K_1 may be defined as the B.t.u. per hour entering each square foot of wall surface per degree difference between the inside air temperature *t* and the inside surface temperature t_1. Hence the heat received by inner surface of the wall per hour by both radiation and convection is

$$H_1 = K_1 (t - t_1) S \qquad (1)$$

where *S* is the inner wall surface area in square feet and the other terms are as heretofore indicated.

Whatever amount of heat H_1 enters the inner wall surface must be given off from the outer wall surface, so that if H_2 represents heat emitted from outer surface

$$H_1 = H_2 = K_2 (t_2 - t_0) S. \qquad (2)$$

Now K_2 may not equal K_1, in which case $(t_2 - t_0)$ will not equal $(t - t_1)$.