

to make allowance for the small basement floor heat loss, as may be the case with heated basements. Using this coefficient (0.10) the total heat loss per square foot of floor area will amount to only 2.0 Btu per square foot per hour, based on a temperature difference of 20 F between the air in the basement above the floor and the minimum soil temperature below the basement.

The same coefficient (0.10) may be used for calculating the heat loss through basement walls below grade but a somewhat higher temperature difference should be used for reasons explained in Chapter 6. Thus the total heat loss through basement walls will be greater than that through

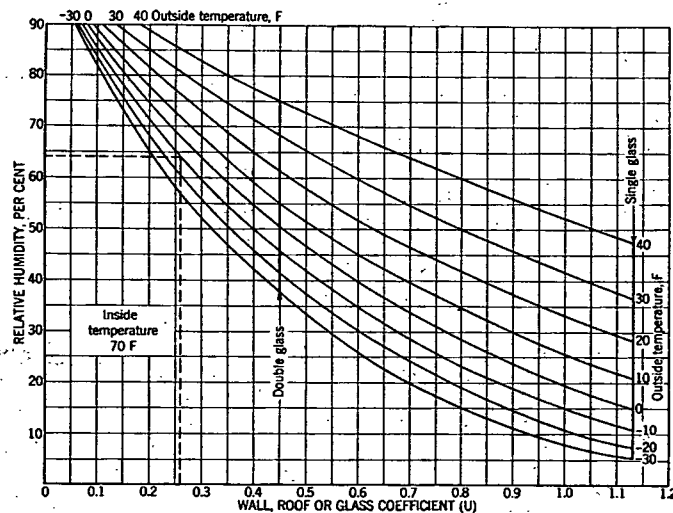


FIG. 2. PERMISSIBLE RELATIVE HUMIDITIES FOR VARIOUS TRANSMISSION COEFFICIENTS

floors. According to present available data the unit wall heat loss will be approximately twice the floor heat loss under average conditions in northern latitudes or about 4.0 Btu per hour per square foot (total, not per degree temperature difference) between the basement air and the ground at a level corresponding to the mid-height of the basement wall. Until further data are available, this value may be used with reasonable accuracy for calculating heat losses through basement walls of heated basements.

CONDENSATION IN BUILDINGS

The water vapor or moisture mixed with the air in buildings will be transmitted through many types of building construction if there is a difference in the vapor pressures on the two sides of the structure⁶. Such

⁶Methods of Moisture Control and Their Application to Building Construction, by F. B. Rowley, A. B. Algren and C. E. Lund. (University of Minnesota Engineering Experiment Station Bulletin No. 17).

water vapor will also condense whenever it comes in contact with surfaces or objects at or below the dew-point temperature. Thus two types of condensation problems are encountered in building practice, namely (1) *Surface condensation* or condensation on the interior building surfaces including the walls, ceiling (or roof) and glass, and (2) *Interstitial condensation* or the transmittance of the vapor through the building materials and condensation of the moisture on surfaces or voids within the materials of construction.

Condensation within the construction as well as condensation on the interior surfaces does not necessarily occur in all buildings but only in isolated cases when conditions conducive to such condensation exist. The probability of condensation increases with the relative humidity or vapor pressure and with the temperature difference and, in the case of interstitial condensation, decreases with the vapor resistance on the warm side of the wall.

Condensation on interior building surfaces⁷ (surface condensation) may be eliminated by either reducing the relative humidity or by maintaining the interior surfaces at or above the dew-point temperature. Permissible relative humidities for various wall, roof or glass coefficients and temperature differences may be determined from Fig. 2. The permissible relative humidity for any specific type of construction may be determined by first ascertaining the coefficient of transmission (U) of the construction and then locating this coefficient on the horizontal scale of Fig. 2. A vertical line drawn to the proper outside temperature curve and then to the left hand scale will indicate the permissible relative humidity for the conditions involved. The dotted line shown in Fig. 2 indicates the permissible relative humidity (64 per cent) if surface condensation is to be avoided, for a frame wall having a coefficient of 0.26 and for an outside temperature of -10 F.

Condensation within the construction may likewise be prevented by eliminating the moisture at the source or by providing a barrier on the warm side of the insulation construction. A good vapor barrier construction may be obtained with a vapor-proof paper properly applied under the plaster or a vapor-proof finish on the interior surface of the wall⁸. Insulating laths with vapor barriers applied to the back surface, are also available. In the case of attics, the greater the heat resistance in the top floor ceiling, the lower the attic temperature and consequently the greater the tendency for condensation to take place on the underside of the roof boards which moisture will drop on to the ceiling. Thus where thick insulations are installed between ceiling joists, it is desirable to allow openings for outside air circulation through attic space as a precaution against condensation on the underside of the roof even though barriers are used in the ceiling below.

⁷Permissible Relative Humidities in Humidified Buildings, by Paul D. Close (A.S.H.V.E. JOURNAL SECTION, Heating, Piping and Air Conditioning, December, 1939, p. 766).

⁸Condensation Within Walls, by F. B. Rowley, A. B. Algren and C. E. Lund (A.S.H.V.E. TRANSACTIONS, Vol. 44, 1938, p. 95).