preceding 10 years for the locality in which the heating system is to be installed. The outside temperature assumed and used in the design should always be stated in the heating specifications.

If Weather Bureau reports are not available for the locality in question, then the reports for the station nearest to this locality are to be used, unless some other temperature is specifically stated in the specifications.

In computing the average heat transmission losses for the heating season in the United States the average outside temperature from October 1 to May 1, shall be used. This is to be that reported by the U. S. Weather Bureau during the preceding 10 years, for the locality in question.

Summer

The maximum cooling load in summer may be calculated for an outside dry-bulb temperature not to exceed 95 deg. and a wet-bulb temperature not to exceed 77 deg. While higher outside dry-bulb temperatures are frequently observed they are either of short duration or accompanied by low relative humidities. Weather Bureau reports are frequently misleading in this respect as they report the maximum temperature for the day with the relative humidity, which occurs during a different period and which usually is much higher than the relative humidity occurring at the maximum temperature. Any statement of weather condition which gives a wet-bulb temperature higher than 80 deg. in the United States is questionable.

HEAT LOSSES BY TRANSMISSION

The heat losses of a building are of two kinds: (1) the transmission losses through the walls, floors, roof, ceiling and windows, and (2) the infiltration losses through the cracks, crevices, etc., around doors and windows and through solid materials.

The transmission losses are computed by taking into account the heat transmission coefficients (See par. 5, p. 5) of the walls, roof, etc., of the building. These coefficients may be determined experimentally by test, or they may be computed with sufficient accuracy when certain physical constants are known.

Transmission Coefficients By Test

Hot-Box Method: The standard method of testing built-up wall sections is by means of the guarded hot-box described in the JOURNAL OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Vol. 32, No. 5, May, 1926, which consists of an insulated outer box about 5 ft. x 5 ft. x 5 ft., and an inner box about 3 ft. x 3 ft. x 3 ft., also insulated. The wall specimen is clamped to the open side of the outer box and in this position must come in firm contact with the edges of the open side of the inner box. The air in the inner box is heated by means of a resistance coil wound on a cubical frame, and the temperatures in the two boxes controlled thermostatically to maintain the same temperature in each. Fans are installed to maintain uniform temperatures in these two spaces with a minimum circulation of air.

The heat transferred through the wall specimen is readily estimated

from the heat input of the inner box, and the air-to-air coefficient of the specimen for still-air conditions determined by dividing this heat-loss by the area of the specimen through which the heat passes, the temperature difference of the air on the two sides of the specimen and the number of hours of the test.

Nicholls Heat Meter: The Research Laboratory of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS has developed an apparatus known as the Nicholls heat meter for the determination of the heat transmission coefficient of any type of construction under natural weather conditions. (See JOURNAL OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Vol. 30, No. 1, January, 1924). The Nicholls heat meter consists essentially of a plate of bakelite, 2 ft. square and ⅛ in. thick. This plate is equipped with thermocouples which are so constructed as to operate as differential pyrometers. A difference in temperature between the two surfaces of the plate produces a difference in electrical potential between the thermocouples.

The plate is calibrated so that this difference in potential, when measured, can be converted into terms of heat transmission through the plate. In connection with this plate, it is also necessary to use several other thermocouples to give the temperature of the air within the building, the temperature of the interior surface of the wall or roof, the temperature of the plate itself, the temperature of the exterior of the wall or roof and the temperature of the exterior air.

Tests have been conducted with the Nicholls heat meter on many types of wall construction, and the results obtained are in close agreement with the computed values for these same constructions.

If tests are made to determine heat transmission coefficients, the inside and outside air temperatures should correspond with those actually existing in heating practice, and the amount of air movement, both on the inside and outside of the test wall, should be definitely stated in reporting the coefficients. Since actual temperature differences vary widely in different parts of the country, it is desirable to adopt some standard basis for testing, such as 80 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 coefficients materially. The coefficient increases with the absolute mean temperature.

If the hot-box method is used, 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.

It would be obviously impossible to determine the air-to-air heat transmission coefficients of every type of wall construction in use with the heat meter or the hot-box on account of the great amount of time involved. Hence, the method of computing the coefficients from fundamental constants must be resorted to in most cases, but heat-meter and the hot-box