## *GAS REQUIREMENTS OF BUILDINGS*

### *Residences*

It is a fact, based upon observation, that the user of a gas-fired central-heating appliance in a residence uses more heat during the course of a year than he does when depending upon solid fuel. The extreme ease of starting and operating a gas-burning appliance results in the pilot light being lighted on the first cool day of the season. Thereafter the system generally operates entirely under thermostatic control. It is in operation on many days when very little heat is required, days when it would be impracticable or inconvenient to keep a coal-fire going. On many cold days the gas unit is kept operating continuously at maximum capacity,

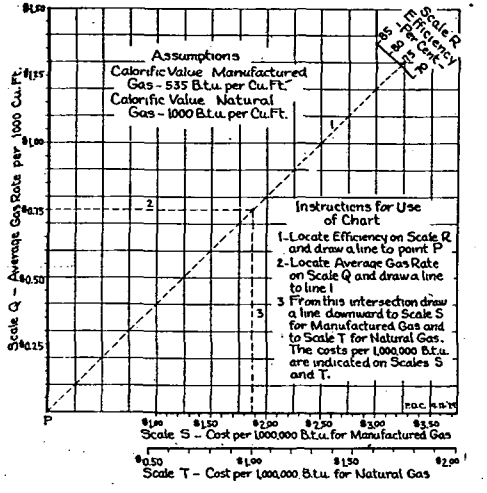


FIG. 1. CHART FOR ESTIMATING THE COST PER 1,000,000 B.T.U. FOR MANUFACTURED AND NATURAL GAS FOR VARIOUS EFFICIENCIES AND AVERAGE GAS RATES

so that the premises are never permitted to cool below the temperature ordinarily maintained.

For a given building maintained at a given temperature, the curve of gas consumption follows the curve of outdoor temperature very closely. The efficiency of the appliance is almost independent of the load, so that the gas consumption is almost proportional to the temperature difference. This property of the gas-burning heating plant makes it relatively easy to estimate the heating costs, once the basic relations have been determined.

In making an estimate of the gas that will be consumed by a gas-fired heating installation during the average heating season, two variables must be taken into account. The first of these is the size of the heating system, usually expressed in terms of square feet of direct cast iron radiation. The other one is the duration and intensity of the heating season. This is easiest expressed in terms of degree-days. A definition of the term *degree-day* may be in order. It has been found that people who





use gas under automatic control for heating their homes, seem to require heat on those days when the mean temperature drops below 65 deg. Thus 65 deg. is taken as the datum line from which to measure the number of degree-days in a month or any other given period. The degree-day can be defined as a day on which the mean temperature is one degree below 65 deg., or 64 deg. Therefore, if the mean temperature for each of the 30 days in a month was 64 deg., we would have accumulated 30 degree-days in that month. By summing up the degree-days for the different days of the heating season, we get the total degree-days for the entire heating season. Studies of weather reports have established the number of degree-days for over 300 cities in the United States and Canada, and it is easy to calculate the heating demands for a particular city. Gas consumption for a given type and size of installation will always be proportional to the number of degree-days in the heating season for the locality in question. Table 3 gives values of degree-days for representative cities.

By averaging the records of a large number of gas-boiler installations, operating under thermostatic control, with a reduced temperature at night, the following equations have been derived:

$$\text{For Steam } G = \frac{110 \times R \times D}{H} \qquad \text{For Water } G = \frac{64 \times R \times D}{H}$$

*where*

$G$ = cubic feet of gas per season.
$R$ = square feet of direct cast iron radiation (as calculated)
$D$ = degree-days per season.
$H$ = B.t.u. (gross) per cubic foot of gas.

*Example:* To estimate the gas consumption for the average heating season for a 200 sq. ft. steam heating system in Chicago.

From Table 3 it is found that the average heating season in Chicago has 6,007 degree-days. The gross heat value of the gas supplied to that city is 535 B.t.u. per cubic foot. Substituting in the equation:

$$G = \frac{110 \times 200 \times 6{,}007}{535} = 247{,}017 \text{ cu. ft.}$$

Observe in the equation that the calculated theoretical amount of radiation is to be used. By this is meant the actual amount of radiation that is required, as determined by accepted methods of heat-loss calculations. Over-radiation will not materially affect the gas consumption, while under-radiation will merely reflect itself in inability to heat in extremely cold weather. The amount of gas consumed for heating a residence during any given heating season may vary decidedly from an estimate according to the method outlined, but the variation will be in almost direct proportion to the difference between the actual degree-days for the season in question and the average degree-days as shown in Table 3.

### *Large Buildings*

In comparing the true cost of heating a large building of a commercial nature with gas, as opposed to other fuels, there are a number of items