RECENT DEVELOPMENTS IN WARM AIR FURNACE HEATING

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Member

SOME years ago the furnace manufacturers formed an organization known as the *National Warm Air Heating & Ventilating Association*. In 1918 this association entered into an agreement with the University of Illinois to have the latter conduct experiments on warm air furnaces. The University has rendered three reports in bulletin form known as Nos. 112, 117 and 120. The last report, which was presented to the meeting of the association at Cleveland, April 19-20, 1922, has not yet been published. The work so far completed at the University has made available a wealth of valuable data which never before was obtainable. With this data in hand it is now possible to calculate the size and performance of a furnace with about the same degree of accuracy as the size and performance of a steam or hot water boiler can be determined. The unfortunate part, however, is that very few of those who have access to the reports know how to make practical use of the data given in them and these reports have been confined almost entirely to the members of the furnace manufacturers association, who have made no effort to see that they are distributed among their agents and dealers so that they could take advantage of their practical value should they be so inclined.

Like our own Society, this association has a Warm Air Furnace Code Committee which has been struggling long and arduously in an endeavor to reconcile all the elements so as to get them to agree on a standard code. This committee submitted a report at the last meeting and a code was adopted. It is not perfect any more than was the first report on the boiler code, which was submitted to our Society, but it is a step in the right direction, is founded on the right principles and can be modified and amended at subsequent meetings. Beyond a doubt it will eventually be perfected when all the members of the association become more familiar with it and understand the benefits to be derived by having a standard which is followed by everybody.

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The formula adopted in the code for determining the size of the leaders, or pipes from the furnace to the various flues and registers was devised by P. J. Dougherty, engineer of the International Heater Co., a member of our Society and also on the Research Committee of the association referred to previously. It is very simple and is based on experimental engineering data taken from the report issued by the University of Illinois. It has been checked by application to certain test problems covering quite a wide range of capacities and it has been found accurate, conservative and reliable.

The rule proposed by Mr. Dougherty is based on the following:

Outside temperature zero deg. fahr.
Inside temperature 70 deg. fahr.

Heat loss per hour per sq. ft. of exposed wall surface of ordinary frame construction ...	25 B.t.u. (0.36 x 70 = 25.2 B.t.u.)
Heat loss per sq. ft. of glass per hour	83 B.t.u. (1.18 x 70 = 82.6 B.t.u.)
Heat loss per cu. ft. air space in a room, allowing one air change per hour	1.25 B.t.u. (0.075 x 0.238 x 70 = 1.25 B.t.u.)

If 1000 is divided by each of the factors, the result will give the square feet of wall surface, the square feet of glass surface, and the cubic feet of space, respectively, to equal 1000 B.t.u. loss per hour.

For example, $\frac{1000}{25}$ = 40 sq. ft. of wall surface per M. B.t.u.

$\frac{1000}{83}$ = 12 sq. ft. of glass surface per M. B.t.u.

$\frac{1000}{1.25}$ = 800 cu. ft. of space in a room per M. B.t.u.

Suppose a room 10 x 12 ft. and 9 ft. high, has 2 windows, each about 16 sq. ft. area. If two of the 10 ft. walls have outside exposure and only one of the 12 ft. walls is so exposed, then the wall exposure will be 10 x 9 x 2 ft., or 180 sq. ft., plus 12 x 9 ft., or 108 sq. ft. which equals 288 sq. ft. Deducting 32 sq. ft. for the 2 windows, leaves a net wall area of 256 sq. ft. A room 10 x 12 x 9 ft. contains 1080 cu. ft. of space.

By dividing each of these quantities by their corresponding factors, as shown above, the result will be the heat units required in thousands; all three should be added together to get the total heat required for the room. This can be stated more clearly as follows:

$$\frac{256}{40} + \frac{32}{12} + \frac{1080}{800} = 10.41 \text{ or } 10{,}410 \text{ B.t.u.}$$

In order to determine what size the leader or pipe should be from the furnace to this room, consult Fig. 1, which is a duplication of the chart