HOT WATER SUPPLY

Tables 7, 8, 9 and 10 give the hot-water requirements for several kinds of buildings in terms of gallons per maximum hour and per day. Table 11 gives the total water requirements for hospitals.

Pipe sizes for hot-water systems may be calculated from the foregoing data on cold-water systems, using the same quantities for the gallons of hot water required per minute as is given for the cold water. It should be borne in mind that a column of hot water is lighter than one of cold water, amounting to about 2½ ft. per 100 ft. in the height of columns of equal weight. In case the cold water must first be fed down from roof tanks to heaters in the basement and then back up to the top-floor fixtures, the extra length of run must be taken into consideration. As a check on the total quantity of hot and cold water required per day, this is generally from two to three times the amount of hot water required and from 80 to 100 gal. per occupant of the building.

The return main for circulating systems may be the size of the most distant hot water flow main. It is obvious that no advantage will be gained by making the return any larger than this, but it is equally obvious that with very large circulating systems, it may be desirable upon occasion to make the most distant flow main larger than otherwise would be required, because of provision for the return circuit.

There are available mechanical circulation boosters with small electric motors and loosely-fitted propellers in the hot-water mains. These pumps will create a rapid and positive circulation of the water and are valuable especially in correcting existing sluggish systems.

CHAPTER 24

INSULATION FOR PIPES AND SURFACES

Heat Transfer Through Bare Pipe; Insulation for Hot Pipes and Surfaces; Insulation for Cold Pipes and Surfaces; Economic Thickness; Thickness to Prevent Pipe Sweating.

THE heat resistance of metallic pipes and surfaces is very small. Consequently, they should be adequately insulated to permit the steam or hot or cold liquids to be economically conveyed through them and without undue rise or drop in temperature.

HEAT LOSSES THROUGH BARE PIPE

Fig. 1 shows the loss in B.t.u. per square foot of bare pipe surface per hour per degree fahrenheit temperature difference for pipes of various diameters.

Table 1 gives the B.t.u. loss as well as the loss in dollars and cents and in pounds of coal per 100 lineal feet of bare pipe for temperatures up to 350 deg. fahr. Pounds of coal used are given per 100 lineal feet of pipe per month (assuming continuous use of the apparatus, 70 per cent boiler efficiency, and 13,000 B.t.u. per pound of coal). The *dollars* column represents the money value of the coal used per 100 lineal feet per month (assuming coal at $4.00 per ton and boiler room expense at $1.00 per ton).

The heat loss from bare pipes of various diameters up to 18 in. and at various temperatures can be calculated from the empirical equation:

$$Q = 3320 \frac{77 + t_d - 103\,D^{0.11}}{103\,D^{0.11} - t_d + 1020}$$

where

Q = B.t.u. loss per hour per square foot of bare pipe surface.
D = outer diameter of pipe, in inches.
t_d = temperature difference between pipe surface and air, deg. fahr.

The loss of heat per unit area from flat surfaces varies greatly with the size and position of the heat-losing body. The loss from the surface in a horizontal position is entirely different for the same surface in a vertical position. Also, the loss is different for the same flat surface facing downward or upward. For these reasons a single equation or curve has not yet been obtained that will give accurately the heat loss from flat surfaces in various positions. However, until more experimental work has been conducted, it is suggested that the heat loss from flat bare iron surfaces be taken as equal to 95 per cent of the values given for the 18 in. pipe in Fig. 1.