

Table 1 can be used for pipe sizing by this method. It provides the designer with a means for quickly assessing the relative effects, economic and otherwise, of various pumps on the system in terms of pipe size.

After sizing the piping on the basis of a preliminary design friction loss the actual friction loss at design rate of flow should be calculated. The friction loss at design flow for all individual sections of pipe and for all fittings in the longest piping circuit should then be summarized.

Table 2 shows the number of elbow equivalents for various fittings. These equivalents can be converted to equivalent feet of pipe by use

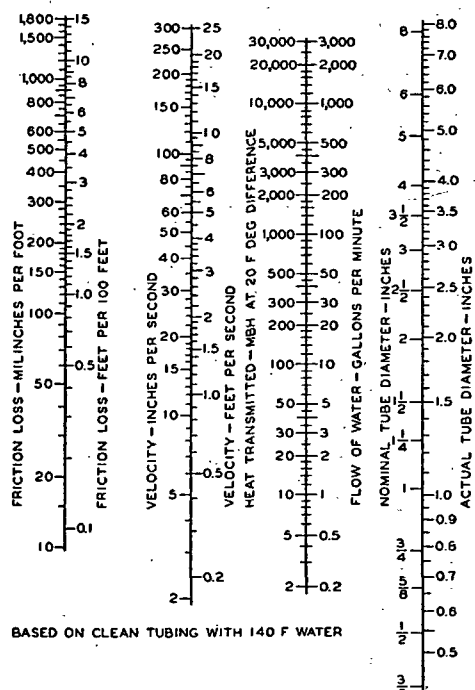


FIG. 4. FRICTION LOSS DUE TO FLOW OF WATER IN TYPE L COPPER TUBE¹
(Based on clean pipe and 140 F water)

of Table 3. Fig. 7 shows the elbow equivalents for determining friction loss in tees. If the pipe size calculation indicates a required pump head different from that of a standard pump, pipe sizes in the system may be changed to establish a closer relationship between the two. The relationship between systems and pump heads is discussed in the section Circulating Pumps.

If there is more than one circuit in a system, the friction loss for the longest circuit should be used to determine the pump head requirement. Piping in the other circuits should be sized to obtain the same total friction loss.

Effects of Antifreeze Fluids. Anti-freeze solutions are sometimes used in heating systems when the danger of freezing exists. They should not be

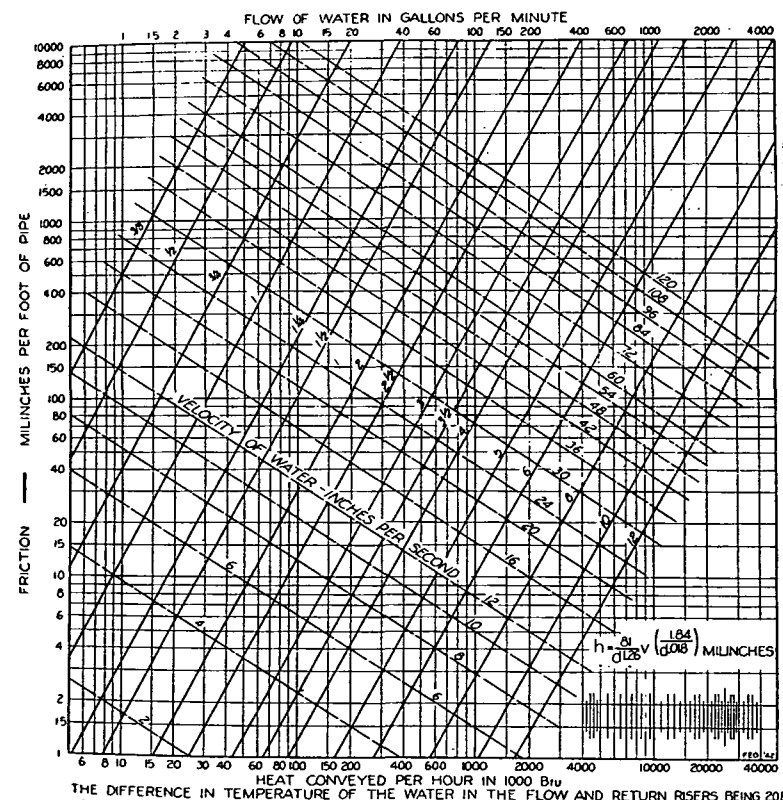


FIG. 5. FRICTION LOSS DUE TO FLOW OF WATER IN IRON PIPE
Lower scale of chart is based on 20 deg temperature difference between flow and return risers. To find friction when temperature drop is other than 20 deg, multiply the actual heat conveyed by $\frac{\text{actual temp. drop}}{20}$ and read the corresponding friction.

	Conversion Ft/(100Ft) to Milinches/Ft				
Ft per 100 ft	0.5	1	2	3	4
Mil inches per ft	60	120	240	360	480

used in direct fired boiler application. Corrections must be made in flow rates, pipe size and pump capacity relative to water when antifreeze solutions are used. See Snow Melting Systems, Chapter 23, Panel Heating.

SELECTION OF PIPING ARRANGEMENT

The type of distribution system selected for any particular building will depend primarily on the structural and architectural characteristics of the building, the need for separate control of different zones, the pressure head due to the height of the building, the space available for piping, and the relative cost of different arrangements of piping. Consequently the location of mains may be considered for basement, for separate floors, or for space above highest heating units.

There are four distinct arrangements of main piping: (1) the two-pipe