(dollars) ÷ 13,000 (Btu) × 2000 (lb) × 0.55 (efficiency) = $0.804. The total cost of heat lost per year = 0.804 × 181.6 (thousand Btu) = $146.00. (A closely approximate solution of such problem may be made quickly by the use of the estimating chart given in Fig. 1.)

HEAT LOSSES FROM INSULATED PIPES

The conductivities of various materials used for insulating steam and hot water systems are given in Table 13. They are given as functions of

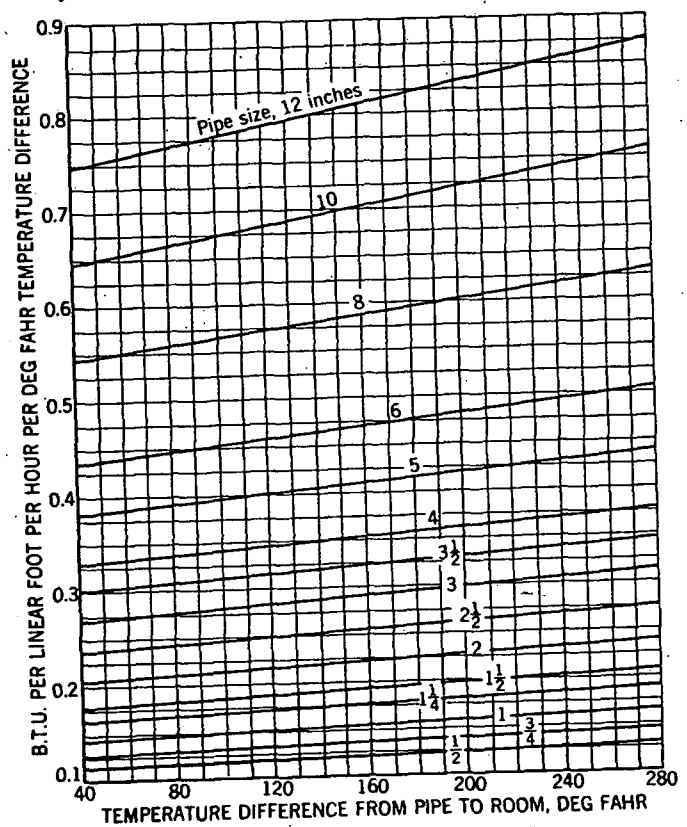


FIG. 3. HEAT LOSS THROUGH 1½ IN. THICK 85 PER CENT MAGNESIA TYPE COVERING

the mean temperatures or the mean of the inner and outer surface temperatures of the insulations. It should be emphasized that they are the average values obtained from a number of tests made on each type of material, also that all variables due to differences in thickness, pipe sizes, and air conditions are eliminated. Individual manufacturer's materials will, of course, vary in conductivity to some extent from these values.

The heat losses through 1, 1½, and 2-in. thick 85 per cent Magnesia

type of insulation for temperature differences between the pipe and the surrounding atmosphere up to 280 F are shown in Figs. 2, 3, and 4. Standard thicknesses of 85 per cent Magnesia pipe covering are not exactly 1 in. However, the loss through any given thickness of insulation can be obtained by interpolation. Also, the losses through any of the insulations given in Table 13 can be obtained by multiplying the losses obtained from Figs. 2, 3, or 4 by the factors given in Table 14.

The rate of heat loss from a surface maintained at constant temperature is greatly increased by air circulation over the surface. In the case of

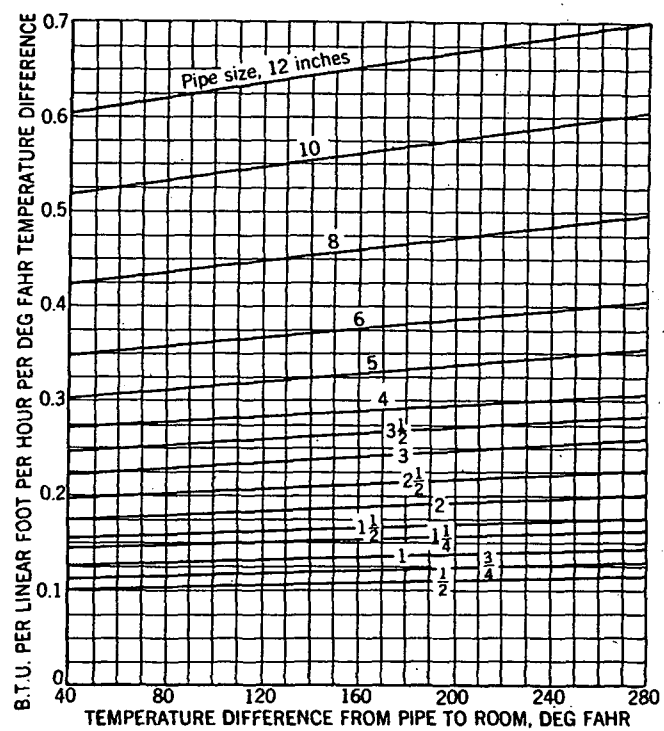


FIG. 4. HEAT LOSS THROUGH 2 IN. THICK 85 PER CENT MAGNESIA TYPE COVERING

well-insulated surfaces, the increases in losses due to air velocity are very small as compared with increases from bare surfaces, which is indicated by Equation 3, because of the fact that air flowing over the surface of the insulation can increase only the rate of heat transfer from surface to air, and cannot change the internal resistance to heat flow inherent in the insulation itself. The maximum increase in heat loss due to air velocity ranges from about 30 per cent in the case of 1-in. thick insulation, to about 10 per cent in the case of 3-in. thick insulation, provided that the insulation is thoroughly sealed so that air can flow only over the surface.