insulation, to about 5 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. If the conditions are such that the air may circulate through cracks and crevices in the insulation, the increases may be far greater than those given. Therefore, it is essential that insulation be

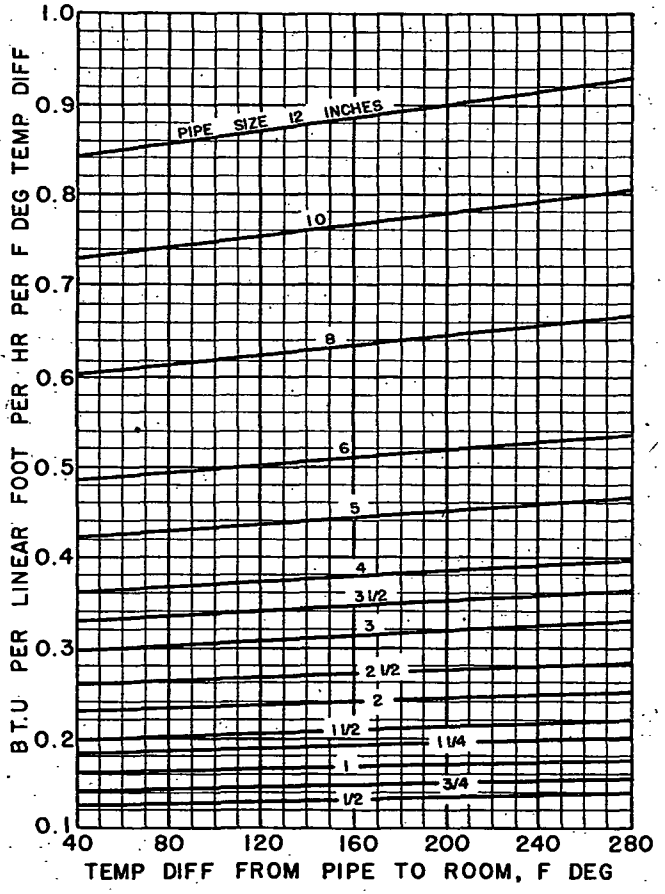

FIG. 2. HEAT LOSS THROUGH 1½ IN. THICK 85 PER CENT MAGNESIA TYPE COVERING

applied in such a manner that air circulation within it or between it and the pipe is avoided.

The transfer of heat from a bare pipe to a highly conducting body in contact with it is far greater than that possible from an insulated pipe to a similar body. When piping is in contact with steel or mortar structures, insulation is of greater value than indicated by tabular data given herein.

The saving due to use of insulation on piping is illustrated in *Example 3*.

Example 3. If the steam line given in *Examples 1* and *2* is covered with 1 in. thick 85 per cent magnesia, determine the resulting total annual loss through the insulation.

Also compute the monetary value of the annual saving and the percentage of saving over the heat loss from the bare pipe.

Solution. By referring to Fig. 1, the coefficient for 1 in. magnesia on a 2-in. pipe is found to be 0.300 Btu per hour per linear foot of pipe per degree temperature difference at a temperature difference of 169.4 F. The total hourly loss per linear foot of pipe will then be 0.300 × 169.4 = 50.8 Btu. The total annual loss through the insulation = 50.8 × 165 (linear feet) × 4000 (hours) = 33,500 *Mb*. The annual bare pipe loss as determined in the solution of *Example 1* was found to be 181,600 *Mb*. The saving due to insulation is then 181,600 − 33,500 = 148,100 *Mb* per year.

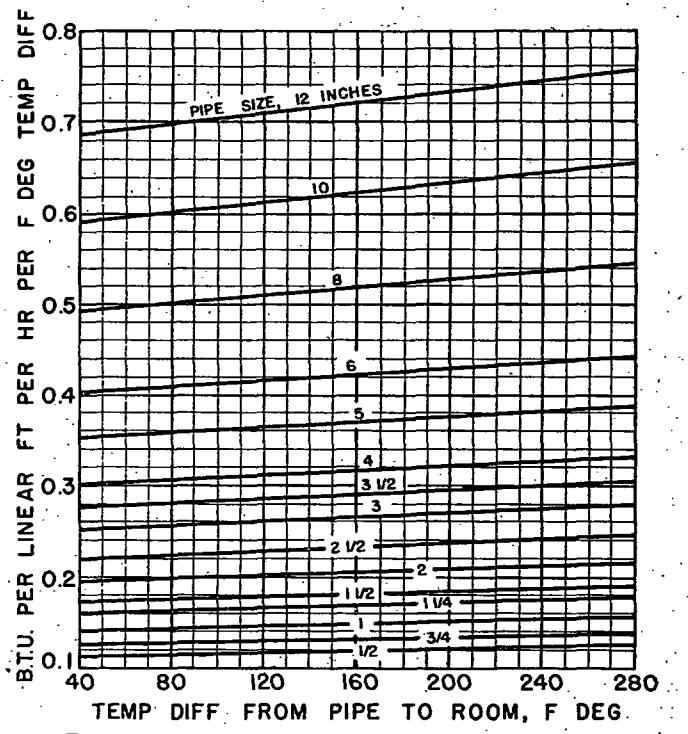

FIG. 3. HEAT LOSS THROUGH 2 IN. THICK 85 PER CENT MAGNESIA TYPE COVERING

From the solution of *Example 2*, it was found that the heat supplied to the system cost $0.804 per thousand *Mb*. Therefore, the monetary value of the saving = 0.804 (dollars) × 148.1 (thousand *Mb*) = $119.07, or 81.5 per cent of the cost when using uninsulated pipe.

LOW TEMPERATURE PIPE INSULATION

Surfaces maintained at temperatures lower than the surrounding air are insulated to reduce the flow of heat and to prevent condensation. The insulating material should absorb a minimum amount of moisture, because the absorption of moisture substantially increases the conductivity of the material. This property is particularly important in the insulation of surfaces that are below the dew-point of the surrounding air. In such cases, due to vapor pressure difference, it is necessary to seal the surface of the insulating material against the penetration of