TABLE 6. THERMAL CONDUCTIVITY (k) OF VARIOUS TYPE PIPE INSULATIONS FOR MEDIUM AND HIGH TEMPERATURE PIPE[a]

Expressed in Btu per (hour) (square foot) (Fahrenheit degree temperature difference per inch)

TYPES OF INSULATING MATERIALS	DENSITY LB/CU FT	TEMP. RANGE OF ACCEPTED USE	MEAN TEMPERATURE, F DEG				
			100	200	300	400	500
85% Magnesia—Type	11–14	Up to 600 F	0.39	....	0.45	....	0.51
Corrugated Asbestos—Type							
4 Ply per 1 in.	11–13	Up to 300 F	0.57	0.68	0.80	....	....
6 Ply per 1 in.	15–17	Up to 300 F	0.51	0.59	0.69	....	....
8 Ply per 1 in.	18–20	Up to 300 F	0.49	0.57	0.65	....	....
Laminated Asbestos—Type (35–40 laminations per 1 in.)	30–35	Up to 700 F	0.39	0.44	0.49	0.54	....
Mineral Wool—Type	10–15	Up to 800 F	0.40	0.45	0.50	0.55	....
Diatomaceous Silica—Type	25–30	Up to 1900 F	0.63	0.66	0.69	0.72	0.75
Brown Asbestos Fiber—Type	13–15	Up to 1200 F	0.34	0.39	0.44	0.49	0.54

[a] Average values from laboratories for insulating materials of various manufacturers.

evaluation of pipe insulation cannot be included here. Insulation manufacturers should be consulted in regard to the selection of insulation which is to meet specific requirements.

Elbows and fittings should be covered with an insulation of equal thickness and material which is similar to the pipe covering. Pre-fabricated fittings are available for many types of insulation, such as cork and rock cork. Where asbestos cement or magnesia cement is used to build up the fittings, the material should be applied in layers not exceeding a thickness of $\frac{3}{8}$ in. The final coat should be mixed with 10 percent Portland cement and troweled smooth. After the final coat has thoroughly dried, it is recommended that canvas of the same weight as that used on the pipe covering be pasted over the surface. This procedure will prevent the built up portions of the covering from falling off due to a slight bump or other minor damage.

On permanent installations of high quality, it is recommended that all coverings and fittings be further encased in 8-oz. canvas, drawn tight over rosin-sized paper and sewed in place, using not less than four stitches per inch.

HEAT LOSSES FROM INSULATED PIPES

The conductivities of various materials used for insulating steam and hot water systems are given in Table 6. They are given as functions of the mean temperatures or the arithmetic 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 in the use of *conductivity* all variables due to differences in thickness, pipe sizes, and air conditions, are eliminated.

TABLE 7. PIPE COVERING FACTORS

TYPES OF INSULATING MATERIALS	TEMPERATURE DIFFERENCE, PIPE TO AIR, F DEG				
	100	200	300	400	500
Corrugated Asbestos—Type					
4 Ply per 1 in.	1.30	1.36	1.42	....	....
6 Ply per 1 in.	1.19	1.23	1.27	....	....
8 Ply per 1 in.	1.15	1.19	1.23	....	....
Laminated Asbestos—Type	0.96	0.98	1.00	1.02	1.04
Mineral Wool—Type	0.98	1.00	1.02	1.05	1.07
Diatomaceous Silica—Type	1.37	1.36	1.35	1.35	1.34
Brown Asbestos Fiber—Type	0.86	0.88	0.91	0.93	0.96

Individual manufacturer's materials will, of course, vary in conductivity to some extent from these values.

The heat losses through 1, $1\frac{1}{2}$, and 2-in. thick, 85 percent magnesia type of insulation for temperature differences between the pipe and the surrounding atmosphere up to 280 F, are shown in Figs. 1, 2, and 3.

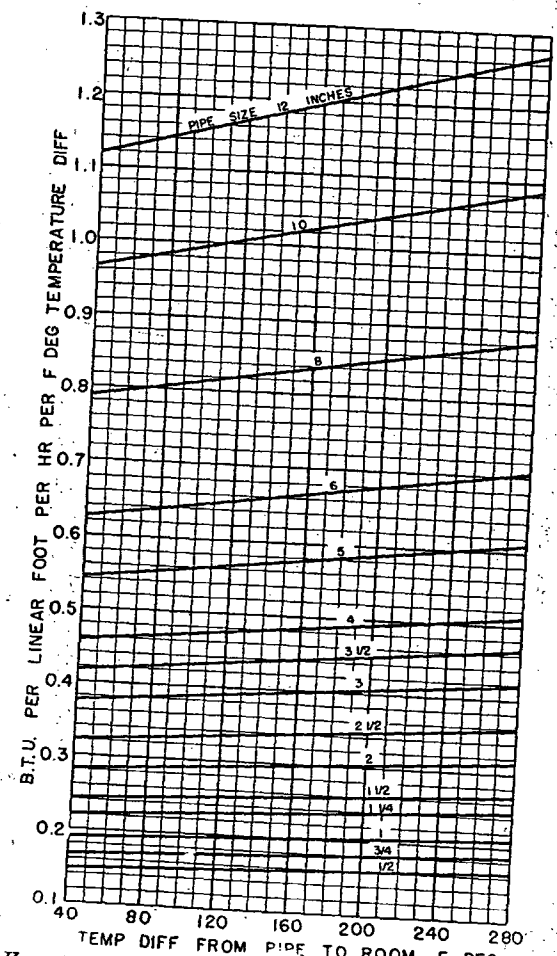

FIG. 1: HEAT LOSS THROUGH 1 IN. THICK 85 PERCENT MAGNESIA TYPE COVERING

Standard thicknesses of 85 percent 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 6 can be obtained by multiplying the losses obtained from Figs. 1, 2, or 3 by the factors given in Table 7.

Pipes operating at high temperatures are frequently insulated to the