TABLE 5. AREA OF FLANGED FITTINGS, SQUARE FEET[a]

NOMINAL PIPE SIZE (INCHES)	FLANGED COUPLING		90 DEG ELL		LONG RADIUS ELL		TEE		CROSS	
	Standard	Extra Heavy	Standard	Extra Heavy	Standard	Extra Heavy	Standard	Extra Heavy	Standard	Extra Heavy
1	0.320	0.438	0.795	1.015	0.892	1.083	1.235	1.575	1.622	2.07
1¼	0.383	0.510	0.957	1.098	1.084	1.340	1.481	1.925	1.943	2.53
1½	0.477	0.727	1.174	1.332	1.337	1.874	1.815	2.68	2.38	3.54
2	0.672	0.843	1.65	2.01	1.84	2.16	2.54	3.09	3.32	4.06
2½	0.841	1.107	2.09	2.57	2.32	2.76	3.21	4.05	4.19	5.17
3	0.945	1.484	2.38	3.49	2.68	3.74	3.66	5.33	4.77	6.95
3½	1.122	1.644	2.98	3.96	3.28	4.28	4.48	6.04	5.83	7.89
4	1.344	1.914	3.53	4.64	3.96	4.99	5.41	7.07	7.03	9.24
4½	1.474	2.04	3.95	5.02	4.43	5.46	6.07	7.72	7.87	10.07
5	1.622	2.18	4.44	5.47	5.00	6.02	6.81	8.52	8.82	10.97
6	1.82	2.78	5.13	6.99	5.99	7.76	7.84	10.64	10.08	13.75
8	2.41	3.77	6.98	9.76	8.56	11.09	10.55	14.74	13.44	18.97
10	3.43	5.20	10.18	13.58	12.35	15.60	15.41	20.41	19.58	26.26
12	4.41	6.71	13.08	17.73	16.35	18.76	19.67	26.65	24.87	34.11

[a] Including areas of accompanying flanges bolted to the fitting.

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 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

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	12–14	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.

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

best advantage by combining a high temperature insulation near the pipe with a moderate or low temperature insulation around it as an outer layer. By this method an efficient material may be used for each of the two temperature ranges encountered. In calculating the heat loss

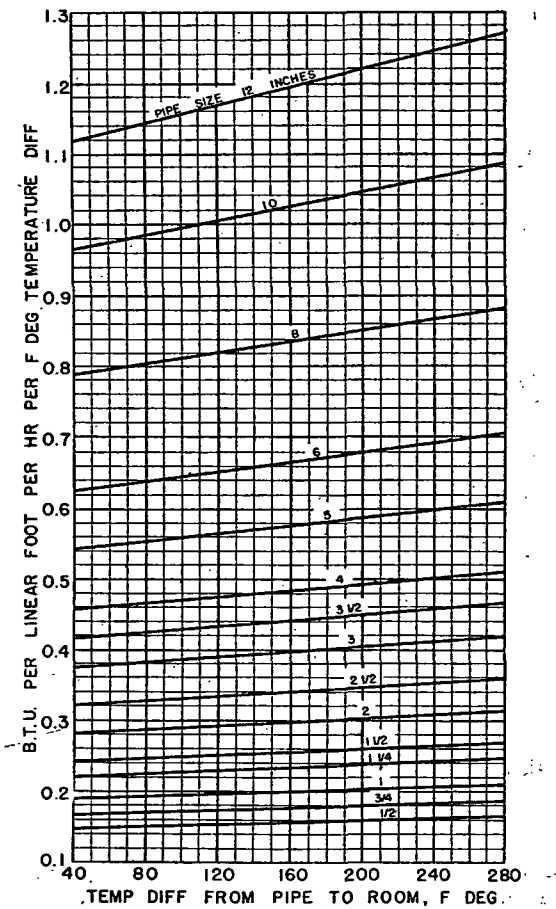


FIG. 1. HEAT LOSS THROUGH 1 IN. THICK 85 PER CENT MAGNESIA TYPE COVERING

through such a combination the mean temperature of each layer must be determined along with the thickness of each. This is readily done in three or four calculations performed as a series of approximations, in which assumptions of thickness and mean temperature are adjusted as indicated in the discussion which follows.

In the case of a single thickness of pipe covering, the quantity of heat