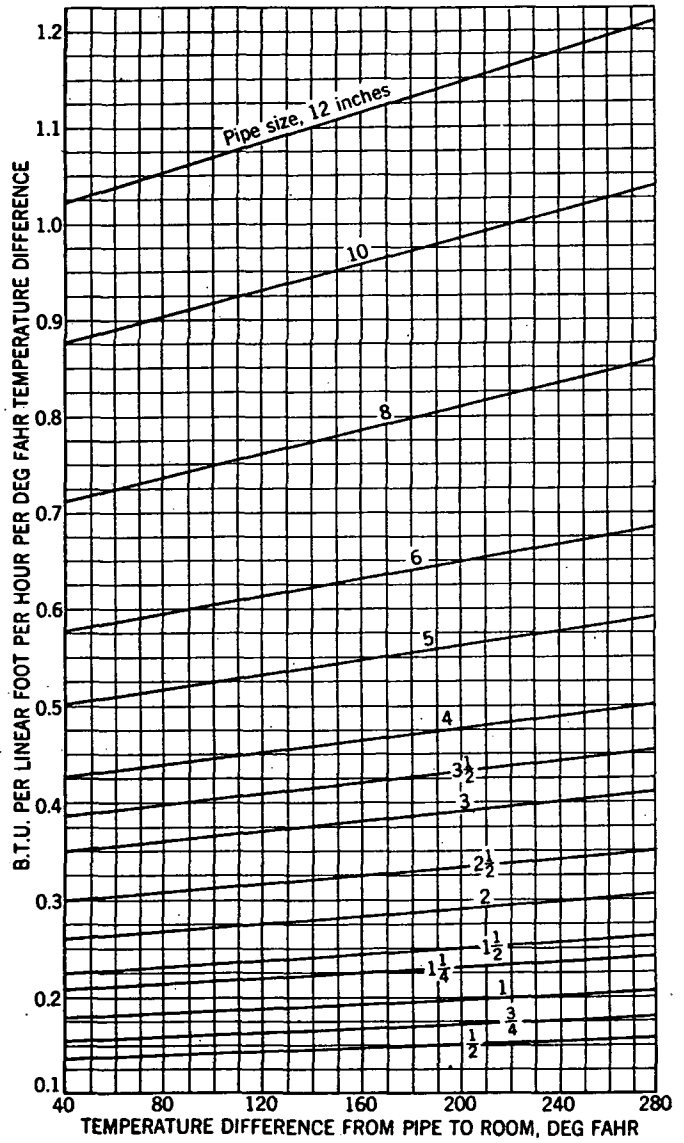

FIG. 2. HEAT LOSS THROUGH 1 IN. THICK 85 PER CENT MAGNESIA TYPE COVERING

TABLE 12. AREAS 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	0.848	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.

Example 1. Compute the total annual heat loss from 165 ft of 2 in. bare pipe in service 4000 hours per year. The pipe is carrying steam at 10 lb pressure and is exposed to an average air temperature of 70 F.

Solution. The pipe temperature is taken as the steam temperature, which is 239.4 F, obtained by interpolation from Table 8 Chapter 1. The temperature difference between the pipe and air = 239.4 − 70 = 169.4 F. By interpolation of Table 6 between temperature differences of 157.1 and 227.7 F, the heat loss from a 2 in. pipe at a temperature difference of 169.4 F is found to be 1.624 Btu per hour per linear foot per degree temperature difference. The total annual heat loss from the entire line = 1.624 × 169.4 × 165 (linear feet) × 4000 (hours) = 181,600 *Mb*.

Example 2. Coal costing $11.50 per ton and having a calorific value of 13,000 Btu per pound is being burned in the furnace supplying steam to the pipe line given in the previous example. If the system is operating at an overall efficiency of 55 per cent, determine the monetary value of the annual heat loss from the line.

Solution. The cost of heat per 1000 *Mb* supplied to the system = 1,000,000 × 11.5

TABLE 13. CONDUCTIVITY (*k*) OF VARIOUS TYPES OF INSULATING MATERIALS FOR MEDIUM AND HIGH TEMPERATURE PIPES[a]

TYPES OF INSULATING MATERIALS	MEAN TEMPERATURE, DEG F				
	100	200	300	400	500
85 per cent Magnesia Type	0.359	0.403	0.448	0.493	0.539
Corrugated Asbestos Type (4 Plies per 1 in. thick)	0.495	0.618	0.741	0.864	.....
Corrugated Asbestos Type (8 Plies per 1 in. thick)	0.505	0.598	0.692	0.786	.....
Laminated Asbestos Type (30-40 Laminations per 1 in. thick)	0.326	0.380	0.434	0.488	0.543
Laminated Asbestos Type (14-20 Laminations per 1 in. thick)	0.374	0.445	0.518	0.589	0.662
Mineral Wool Type	0.350	0.410	0.470	0.530	0.590
High Temperature Type (Diatomaceous Earth and Asbestos)	0.576	0.614	0.652	0.689	0.726
Brown Asbestos Type (Felted Fiber)	0.338	0.396	0.453	0.510	0.568

[a]From tests conducted at *Mellon Institute*.