

TABLE 2. RADIATING SURFACE PER LINEAR FOOT OF PIPE

PIPE SIZE IN.	SURFACE SQ. FT.	PIPE SIZE IN.	SURFACE SQ. FT.	PIPE SIZE IN.	SURFACE SQ. FT.
1/2	0.22	2	0.622	5	1.456
3/4	0.275	2 1/2	0.753	6	1.734
1	0.344	3	0.917	8	2.257
1 1/4	0.435	3 1/2	1.047	10	2.817
1 1/2	0.498	4	1.178	12	3.338

INSULATION OF HOT WATER, LOW AND HIGH PRESSURE
STEAM LINES

The conductivities, in B.t.u. per square foot per hour per inch thick per degree Fahrenheit temperature difference between inner and outer surfaces of the insulation are given in Fig. 4 for various insulations. In this figure the conductivities are plotted as functions of the mean temperatures or the mean of the inner and outer surface temperatures of the insulations.

This method of plotting conductivities, enables one to readily calculate the heat loss through single or compound sections. It should be emphasized that in this figure, the conductivities given for the various insulations are the average values from a number of tests on each type of material, also that all variables due to differences in thickness, different pipe sizes, and different air conditions are eliminated.

The heat losses through any of the insulations shown in Fig. 4 for various thicknesses of covering and for any temperatures generally used

TABLE 3. AREAS OF FLANGED FITTINGS, SQUARE FEET

NOMINAL PIPE SIZE I. D.	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
1 1/4"	0.383	0.510	0.957	1.098	1.084	1.340	1.481	1.925	1.943	2.53
1 1/2"	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
2 1/2"	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
3 1/2"	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
4 1/2"	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
7"	2.17	3.46	6.17	8.62	7.38	9.73	9.37	12.33	12.00	16.83
8"	2.41	3.77	6.98	9.76	8.56	11.09	10.55	14.74	13.44	18.97
9"	3.00	4.44	8.71	11.44	10.57	13.18	13.18	17.23	16.78	22.10
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
14" O. D.	5.39	8.30	16.38	22.31	20.17	25.70	24.81	33.63	31.48	43.15
15" O. D.	6.18	9.52	18.50	25.28	22.92	29.34	27.91	38.04	35.48	48.79
16" O. D.	6.69	10.05	20.17	27.18	25.41	31.73	30.32	40.94	38.34	52.35

in engineering practice can be obtained from Table 5 and Figs. 5 to 7 inclusive.

In these curves the unit loss through 1, 1 1/2 and 2-in. thick covering is given for temperature differences up to 700 deg. fahr. The loss through other thicknesses of covering can be obtained from the curves by interpolation.

Table 5 gives the factor by which the loss from the curves shown in Figs. 5 to 7 must be multiplied to give the loss through any of the coverings whose conductivity values are given in Fig. 4.

TABLE 4. VALUES OF *k* CORRESPONDING TO COMMONLY USED COVERINGS

	<i>k</i>	Per Cent Variation from <i>k</i> = 0.3
Hair Felt.....	0.246	-18%
Keystone Hair.....	0.27	-10%
Wood Felt.....	0.36	+20%
Cork, 6.9 lb. per cu. ft.....	0.27	-10%
Cork, 9.7 lb. per cu. ft.....	0.30	0%
Cork, 16 lb. per cu. ft.....	0.35	+17%

TABLE 5. PIPE-COVERING FACTORS

TYPE OF COVERING	TEMPERATURE DIFFERENCE, PIPE TO AIR, DEG. FAHR.						
	100	200	300	400	500	600	700
85% Magnesia.....	1.234	1.184	1.148	1.111	1.082	1.051	1.025
Laminated Asbestos Type. Approx. 20 laminations per inch.....	1.515	1.474	1.441	1.409	1.383	1.360	1.345
Laminated Asbestos Type. Approx. 30 to 40 laminations per inch.....	1.022	1.019	1.016	1.013	1.010	1.007	1.005
High Temperature.....	1.438	1.358	1.292	1.233	1.190	1.147	1.109
Felted Brown Asbestos Fibre.....	1.665	1.577	1.505	1.436	1.387	1.340	1.300
Rock Wool.....	1.058	1.045	1.035	1.022	1.020	1.014	1.010
Corrugated Asbestos, 8 plies per inch	1.349	1.340	1.333	1.323	-----	-----	-----
Corrugated Asbestos, 4 plies per inch	1.520	1.550	1.580	1.605	-----	-----	-----

TABLE 6. THICKNESSES OF INSULATION ORDINARILY USED

STEAM PRESSURES (LB. GAGE)	STEAM TEMPERATURES (DEG. FAHR.)	THICKNESS OF INSULATION		
		Pipe larger than 4 in.	Pipes 2 in. to 4 in.	Pipes 1/2 in. to 1 1/2 in.
0 to 25	212 to 267	1 in.	1 in.	1 in.
25 to 100	267 to 338	1 1/2 in.	1 in.	1 in.
100 to 200	338 to 388	2 in.	1 1/2 in.	1 in.
Higher Pressure or Superheat	388 to 500	2 1/2 in.	2 in.	1 1/2 in.
Higher Pressure or Superheat	500 to 600	3 in.	2 1/2 in.	2 in.

Example.—Determine the heat flow in B.t.u. per hour per square foot of pipe surface through a magnesia covering 1 in. thick on a 4-in. pipe.

Solution.—The temperature of the pipe is 270 deg. fahr. and the room temperature, 70 deg. fahr. The loss through a covering 1 in. thick on a 4-in. pipe at 200 deg. temperature difference from Fig. 5 = 0.395; the factor for magnesia at 200 deg. temperature difference from Table 5 = 1.184; then the heat loss through the magnesia covering = 0.395 × 1.184 × 200 = 93.5 B.t.u. per square foot of pipe surface per hour.