

HEATING VENTILATING AIR CONDITIONING GUIDE 1944

(dollars) $\div$ 13,000 (Btu) $\times$ 2000 (lb) $\times$ 0.55 (efficiency) = \$0.804. The total cost of heat lost per year = 0.804×181.6 (thousand Btu) = \$146.00.

TABLE 3. HEAT LOSS FROM BRIGHT COPPER PIPE GIVEN ONE THIN COAT OF CLEAR LACQUER

Expressed in Btu per hour per linear foot per degree Fahrenheit between the pipe and surrounding still air at 70 F

NOMINAL PIPE SIZE (INCHES)	HOT WATER (Type K Copper Tube)				STEAM (Standard Pipe Size Pipe)		
	120 F	150 F	180 F	210 F	227.1 F (5 Lb)	297.7 F (50 Lb)	337.9 F (100 Lb)
	TEMPERATURE DIFFERENCE						
	50 F	80 F	110 F	140 F	157.1 F	227.7 F	267.9 F
1/2	0.240	0.265	0.282	0.307	0.401	0.461	0.478
3/4	0.320	0.356	0.373	0.414	0.477	0.571	0.578
1	0.390	0.437	0.463	0.507	0.598	0.681	0.710
1 1/4	0.470	0.537	0.554	0.614	0.700	0.812	0.840
1 1/2	0.540	0.612	0.645	0.714	0.830	0.966	0.990
2	0.690	0.762	0.818	0.892	1.005	1.164	1.201
2 1/2	0.840	0.937	0.991	1.085	1.178	1.361	1.420
3	0.960	1.025	1.135	1.270	1.400	1.625	1.700
3 1/2	1.100	1.250	1.318	1.442	1.580	1.845	1.905
4	1.241	1.400	1.480	1.556	1.750	2.040	2.130
4 1/2	.....	.....	.....	.....	1.910	2.240	2.350
5	1.480	1.685	1.790	1.965	2.130	2.415	2.610
6	1.700	1.936	2.052	2.272	2.450	2.810	2.990
8	2.200	2.500	2.630	2.854	3.120	3.425	3.730

TABLE 4. HEAT LOSS FROM HORIZONTAL TARNISHED COPPER PIPE

Expressed in Btu per hour per linear foot per degree Fahrenheit between the pipe and surrounding still air at 70 F

NOMINAL PIPE SIZE (INCHES)	HOT WATER (Type K Copper Tube)				STEAM (Standard Pipe Size Pipe)		
	120 F	150 F	180 F	210 F	227.1 F (5 Lb)	297.7 F (50 Lb)	337.9 F (100 Lb)
	TEMPERATURE DIFFERENCE						
	50 F	80 F	110 F	140 F	157.1 F	227.7 F	267.9 F
1/2	0.250	0.287	0.300	0.321	0.433	0.500	0.530
3/4	0.340	0.381	0.409	0.429	0.533	0.543	0.654
1	0.440	0.475	0.509	0.536	0.636	0.746	0.803
1 1/4	0.500	0.559	0.618	0.622	0.764	0.878	0.934
1 1/2	0.580	0.656	0.710	0.750	0.904	1.053	1.120
2	0.730	0.825	0.890	0.957	1.101	1.273	1.364
2 1/2	0.880	1.000	1.091	1.143	1.305	1.490	1.605
3	1.040	1.175	1.272	1.343	1.560	1.800	1.940
3 1/2	1.180	1.350	1.454	1.535	1.750	2.020	2.170
4	1.460	1.500	1.635	1.715	1.941	2.240	2.430
4 1/2	.....	.....	.....	.....	2.131	2.465	2.650
5	1.600	1.812	1.980	2.071	2.387	2.770	2.990
6	1.840	2.125	2.270	2.430	2.740	3.210	3.440
8	2.400	2.685	2.910	3.110	3.310	4.050	4.370

CHAPTER 18. PIPE INSULATION

HEAT LOSSES FROM INSULATED PIPES

The conductivities of various materials used for insulating steam and hot water systems are given in Table 8. They are given as functions of the mean temperatures or the mean of the inner and outer surface tem-

TABLE 5. EXTERNAL SURFACE PER LINEAR FOOT OF PIPE

NOMINAL PIPE SIZE (INCHES)	SURFACE AREA (Sq Ft)	NOMINAL PIPE SIZE (INCHES)	SURFACE AREA (Sq Ft)	NOMINAL PIPE SIZE (INCHES)	SURFACE AREA (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

TABLE 6. EXTERNAL SURFACE PER LINEAR FOOT OF COPPER TUBING
Outside diameter 1/8 in. greater than nominal size

TUBE SIZE (INCHES)	SURFACE AREA (Sq Ft)	TUBE SIZE (INCHES)	SURFACE AREA (Sq Ft)	TUBE SIZE (INCHES)	SURFACE AREA (Sq Ft)
1/2	0.164	2	0.556	5	1.342
3/4	0.229	2 1/2	0.687	6	1.604
1	0.295	3	0.818	8	2.128
1 1/4	0.360	3 1/2	0.949	..	.....
1 1/2	0.426	4	1.080	..	.....

TABLE 7. AREAS OF FLANGED FITTINGS, SQUARE FEET*

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
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
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

*Including areas of accompanying flanges bolted to the fitting.

peratures 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 all variables due to differences in thickness, pipe sizes, and air conditions are eliminated. Individual manufacturer's materials will, of course, vary in conductivity to some extent from these values.