

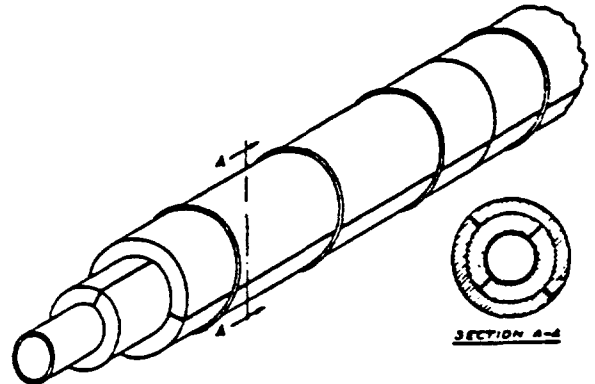
C

Simplified Thicknesses for Pipe Insulation

Johns-Manville molded pipe insulations—85% Magnesia, Superex, and Thermobestos—are manufactured in accordance with Simplified Thicknesses. The purpose of Simplified Thicknesses is to permit the use of double-layer construction in all pipe sizes and thicknesses since the outside diameter of the pipe insulation is approximately the same as that of standard steel pipe.

The table below gives the approximate wall thickness of pipe insulation for each nominal thickness. It also gives the corresponding pipe size of the outer layer for double-layer construction. In specifying, ordering or otherwise referring to these materials, only *nominal* thicknesses should be used. Approximate wall thicknesses are given only for use in determining heat transmission or for other engineering calculations. The 1" nominal thickness is available in pipe sizes up to and including 6". For pipe sizes of 7" and larger, the minimum thickness furnished is nominal 1½". For pipe sizes and thicknesses available, refer to the data sheets on 85% Magnesia, Superex and Thermobestos.

At temperatures above 600 F, pipe expansion is a significant factor. For this reason, pipe insulation



Simplified Thicknesses permit Double-Layer Construction with staggered joints for all temperatures above 600 F

should be applied in double-layer construction with staggered joints for all temperatures above 600 F. This construction prevents excessive heat losses and surface temperatures at the joints, opened by pipe expansion, thus eliminating scorched or burned jackets. The construction also eliminates the potential fire hazard of exposing jackets to higher temperatures at the joints.

Table of Simplified Thicknesses for Pipe Insulation

Nominal Pipe Size, inches	Nominal Thickness, inches																	
	1		1½		2		2½		3		3½		4		4½		5	
	Approximate Thickness and Outer Layer Pipe Size, inches*																	
	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size	Thick- ness	Pipe Size
½	1	2½	1½	3½	2½	4½	2½	6	3½	7	3½	8	4½	4½	5½	5½	5½	5½
¾	1½	2½	1½	3½	2½	4½	2½	6	3½	7	3½	8	4½	4½	5½	5½	5½	5½
1	1½	3	1½	4	2½	5	2½	6	3½	7	3½	8	4½	4½	5½	5½	5½	5½
1¼	1½	3	1½	4½	2½	5	2½	6	3½	7	3½	8	4½	4½	5½	5½	5½	5½
1½	1½	3½	1½	4½	2½	6	2½	7	3½	8	3½	9	4½	4½	5½	5½	5½	5½
2	1½	4	1½	5	2½	6	2½	7	3½	8	3½	9	4½	4½	5½	5½	5½	5½
2½	1½	4½	1½	6	2½	7	2½	8	3½	9	3½	10	4½	4½	5½	5½	5½	5½
3	1½	5	1½	6	2½	7	2½	8	3½	9	3½	10	4½	4½	5½	5½	5½	5½
3½	1½	6	1½	7	2½	8	2½	9	3½	10	3½	11	4½	4½	5½	5½	5½	5½
4	1½	6	1½	7	2½	8	2½	9	3½	10	3½	11	4½	4½	5½	5½	5½	5½
4½	1½	7	1½	8	2½	9	2½	10	3½	11	3½	12	4½	4½	5½	5½	5½	5½
5	1½	7	1½	8	2½	9	2½	10	3½	11	3½	12	4½	4½	5½	5½	5½	5½
6	1	8	1½	9	2½	10	2½	11	3½	12	3½	13	4½	4½	5½	5½	5½	5½
7	—	—	1½	10	2½	11	2½	12	3½	13	3½	14	4½	4½	5½	5½	5½	5½
8	—	—	1½	11	2½	12	2½	13	3½	14	3½	15	4½	4½	5½	5½	5½	5½
9	—	—	1½	12	2½	13	2½	14	3½	15	3½	16	4½	4½	5½	5½	5½	5½
10	—	—	1½	14	2½	15	2½	16	3½	17	3½	18	4½	4½	5½	5½	5½	5½
11	—	—	1½	15	2½	16	2½	17	3½	18	3½	19	4½	4½	5½	5½	5½	5½
12	—	—	1½	16	2½	17	2½	18	3½	19	3½	20	4½	4½	5½	5½	5½	5½
14	—	—	1½	17	2	18	2½	19	3	20	3½	21	4	4½	5	5	5	5
16	—	—	1½	19	2	20	2½	21	3	22	3½	23	4	4½	5	5	5	5
18	—	—	1½	21	2	22	2½	23	3	24	3½	25	4	4½	5	5	5	5

* Subject to manufacturing tolerances.

SIMPLIFIED THICKNESSES FOR PIPE INSULATION

Printed in U.S.A. (846-884)

PRODUCED
JM - 83

DEFENDANT'S
EXHIBIT

OE-57

NY-205

Heat loss from bare surfaces

Losses given in B.t.u. per hour, per linear foot of bare pipe at various temperature differences.

(For finding losses at temperatures between those shown, the B.t.u. increments per degree are given in light-face type between the main columns.)

Nominal pipe size, inches	Sq. ft. of pipe sur- face, per lin. ft.	Temperature differences, degrees F.											
		50°		100°		150°		200°		250°		300°	
1/2	0.220	21.5	.52	47.3	.64	79.2	.76	117.3	.90	162.3	1.06	215.2	1.28
3/4	0.275	26.8	.65	59.2	.80	99.0	.95	146.6	1.13	202.9	1.32	269.0	1.60
1	0.344	33.5	.81	74.0	1.00	123.8	1.19	183.4	1.41	253.8	1.65	336.4	2.01
1 1/4	0.435	42.4	1.02	93.6	1.26	156.6	1.51	231.9	1.78	320.9	2.09	425.4	2.54
1 1/2	0.498	48.6	1.17	107.2	1.44	179.3	1.72	265.4	2.04	367.4	2.39	487.0	2.90
2	0.622	60.7	1.46	133.9	1.80	223.9	2.15	331.5	2.55	458.9	2.99	608.3	3.63
2 1/2	0.753	73.4	1.77	162.1	2.18	271.1	2.61	401.4	3.08	555.6	3.62	736.4	4.39
3	0.917	89.4	2.16	197.3	2.66	330.1	3.17	488.8	3.76	676.6	4.40	896.8	5.34
3 1/2	1.047	102.1	2.46	225.3	3.03	376.9	3.62	558.1	4.29	772.5	5.03	1024.0	6.10
4	1.178	114.9	2.77	253.5	3.41	424.1	4.08	627.9	4.82	869.1	5.66	1152.0	6.88
4 1/2	1.309	127.6	3.08	281.7	3.79	471.2	4.53	697.7	5.35	965.1	6.30	1280.0	7.64
5	1.456	142.0	3.43	313.3	4.22	524.2	5.04	776.1	5.96	1074.0	7.00	1424.0	8.48
6	1.734	169.1	4.08	373.2	5.02	624.2	6.00	924.2	7.10	1279.0	8.34	1696.0	10.10
7	1.996	194.6	4.70	429.5	5.78	718.6	6.91	1064.0	8.18	1473.0	9.58	1952.0	11.64
8	2.257	220.1	5.31	485.7	6.54	812.5	7.81	1203.0	9.24	1665.0	10.84	2207.0	13.16
9	2.519	245.6	5.93	542.1	7.29	906.8	8.72	1343.0	10.32	1859.0	12.10	2464.0	14.68
10	2.817	274.7	6.63	606.2	8.16	1014.0	9.76	1502.0	11.52	2078.0	13.54	2755.0	16.42
11	3.073	299.6	7.23	661.3	8.89	1106.0	10.64	1638.0	12.58	2267.0	14.76	3005.0	17.92
12	3.338	325.5	7.86	718.3	9.67	1202.0	11.54	1779.0	13.68	2463.0	16.04	3265.0	19.46
14 o.d.	3.663	357.1	8.62	788.3	10.61	1319.0	12.66	1952.0	15.02	2703.0	17.58	3582.0	21.36
16 o.d.	4.188	408.3	9.86	901.3	12.13	1508.0	14.48	2232.0	17.16	3090.0	20.12	4096.0	24.42
18 o.d.	4.716	459.8	11.10	1015.0	13.66	1698.0	16.32	2514.0	19.32	3480.0	22.64	4612.0	27.30
20 o.d.	5.235	510.4	12.33	1127.0	15.16	1885.0	18.10	2790.0	21.44	3862.0	25.16	5120.0	30.52
24 o.d.	6.286	612.9	14.80	1353.0	18.20	2263.0	21.74	3350.0	25.76	4638.0	30.20	6148.0	36.64
30 o.d.	7.854	765.8	18.48	1690.0	22.74	2827.0	27.18	4186.0	32.18	5795.0	37.72	7481.0	45.80

Nominal pipe size, inches	Sq. ft. of pipe sur- face, per lin. ft.	Temperature differences, degrees F.											
		350°		400°		450°		500°		550°		600°	
1/2	0.220	279.3	1.52	355.1	1.73	441.7	1.99	541.2	2.17	649.8	2.45	772.2	2.63
3/4	0.275	349.1	1.90	443.9	2.16	552.1	2.49	676.5	2.71	812.2	3.06	963.3	3.29
1	0.344	436.7	2.37	555.2	2.71	690.6	3.11	846.2	3.40	1016.0	3.82	1207.0	4.12
1 1/4	0.435	552.2	3.00	702.1	3.42	873.3	3.93	1070.0	4.30	1285.0	4.84	1527.0	5.20
1 1/2	0.498	632.2	3.43	803.8	3.92	999.7	4.51	1225.0	4.92	1471.0	5.54	1748.0	5.96
2	0.622	789.6	4.29	1004.0	4.90	1249.0	5.62	1530.0	6.14	1837.0	6.92	2183.0	7.44
2 1/2	0.753	955.9	5.18	1215.0	5.94	1512.0	6.80	1852.0	7.44	2224.0	8.38	2643.0	9.00
3	0.917	1164.0	6.32	1480.0	7.22	1841.0	8.30	2256.0	9.04	2708.0	10.22	3219.0	10.96
3 1/2	1.047	1329.0	7.22	1690.0	8.24	2102.0	9.48	2576.0	10.32	3092.0	11.66	3675.0	12.52
4	1.178	1496.0	8.10	1901.0	9.28	2365.0	10.66	2898.0	11.62	3479.0	13.12	4135.0	14.08
4 1/2	1.309	1662.0	9.02	2113.0	10.30	2628.0	11.84	3220.0	12.92	3866.0	14.58	4593.0	15.64
5	1.456	1848.0	10.04	2350.0	11.46	2923.0	13.18	3582.0	14.36	4300.0	16.22	5111.0	17.40
6	1.734	2201.0	11.96	2799.0	13.64	3481.0	15.70	4266.0	17.10	5121.0	19.30	6086.0	20.74
7	1.996	2534.0	13.76	3222.0	15.70	4007.0	18.06	4910.0	19.68	5894.0	22.24	7006.0	23.88
8	2.257	2865.0	15.56	3643.0	17.76	4531.0	20.42	5552.0	22.28	6666.0	25.12	7922.0	27.00
9	2.519	3198.0	17.36	4066.0	19.82	5057.0	22.80	6197.0	24.86	7440.0	28.04	8842.0	30.20
10	2.817	3576.0	19.42	4547.0	22.16	5655.0	25.50	6930.0	27.80	8320.0	31.36	9888.0	33.60
11	3.073	3901.0	21.18	4960.0	24.18	6169.0	27.82	7560.0	30.32	9076.0	34.30	10790.0	36.60
12	3.338	4238.0	23.00	5388.0	26.26	6701.0	30.22	8212.0	32.94	9859.0	37.20	11720.0	39.80
14 o.d.	3.663	4650.0	25.24	5912.0	28.84	7354.0	33.14	9011.0	36.20	10820.0	40.80	12860.0	43.80
16 o.d.	4.188	5317.0	28.84	6759.0	32.96	8407.0	37.90	10300.0	41.40	12370.0	46.60	14700.0	50.00
18 o.d.	4.716	5987.0	32.50	7612.0	37.10	9467.0	40.70	11600.0	46.60	13930.0	52.40	16550.0	56.40
20 o.d.	5.235	6646.0	36.06	8449.0	41.20	10510.0	47.40	12880.0	51.60	15460.0	58.40	18380.0	62.60
24 o.d.	6.286	7980.0	43.40	10150.0	49.40	12620.0	56.80	15460.0	62.20	18570.0	69.80	22060.0	75.20
30 o.d.	7.854	9971.0	54.18	12680.0	61.80	15770.0	71.00	19320.0	77.60	23200.0	87.40	27570.0	93.80

*Example: 2" pipe, 235° temp. diff.; 235° - 200° = 35°; 35° × 2.55 (B.t.u. per deg.) = 89.3 B.t.u.

331.5 + 89.3 = 420.8 B.t.u. loss at 235° temperature difference.

(Continued)

HEAT LOSS FROM BARE SURFACES

June, 1936 (Cancelling sheet dated June, 1931)

IN-3005

Printed in U.S.A.

PRODUCED
JM - 83

HEAT LOSS FROM BARE SURFACES

Losses given in B.t.u. per hour, per linear foot of bare pipe at various temperature differences.

(For finding losses at temperatures between those shown, the B.t.u. increments per degree are given in light-face type between the main columns.)

Nominal pipe size, inches	Sq. ft. of pipe sur- face, per lin. ft.	Temperature difference, degrees F.										
		650°	700°	750°	800°	850°	900°					
1/2	0.220	903.8	2.86	1047	3.06	1200	3.28	1364	3.48	1538	3.70	1723
3/4	0.275	1130.0	3.58	1309	3.84	1501	4.08	1705	4.36	1923	4.60	2153
1	0.344	1413.0	4.48	1637	4.80	1877	5.12	2133	5.44	2405	5.78	2694
1 1/4	0.435	1787.0	5.68	2071	6.06	2374	6.46	2697	6.88	3041	7.30	3406
1 1/2	0.498	2046.0	6.50	2371	6.92	2717	7.42	3088	7.88	3482	8.34	3899
2	0.622	2555.0	8.12	2961	8.66	3394	9.24	3856	9.86	4349	10.42	4870
2 1/2	0.753	3093.0	9.82	3584	10.50	4109	11.20	4669	11.90	5264	12.64	5896
3	0.917	3767.0	11.96	4365	12.76	5003	13.64	5685	14.52	6411	15.38	7180
3 1/2	1.047	4301.0	13.66	4984	14.58	5713	15.56	6491	16.58	7320	17.56	8198
4	1.178	4839.0	15.36	5607	16.42	6428	17.52	7304	18.64	8236	19.76	9221
4 1/2	1.309	5377.0	17.08	6231	18.22	7142	19.48	8116	20.72	9152	21.96	10250
5	1.456	5981.0	19.00	6931	20.26	7944	21.66	9027	23.10	10180	24.40	11400
6	1.734	7123.0	22.62	8254	24.14	9461	25.80	10750	27.40	12120	29.20	13580
7	1.996	8200.0	26.02	9501	27.80	10890	29.80	12380	31.60	13960	33.40	15630
8	2.257	9272.0	29.40	10740	31.60	12320	33.40	13990	35.80	15780	37.80	17670
9	2.519	10350.0	32.80	11990	35.00	13740	37.60	15620	39.80	17610	42.20	19720
10	2.817	11570.0	36.80	13410	39.20	15370	42.00	17470	44.40	19690	47.40	22060
11	3.073	12620.0	40.20	14630	42.80	16770	45.60	19050	48.60	21480	51.60	24060
12	3.338	13710.0	43.60	15890	46.40	18210	49.80	20700	52.80	23340	56.00	26140
14 o.d.	3.663	15050.0	47.80	17440	51.00	19990	54.40	22710	58.00	25610	61.40	28680
16 o.d.	4.188	17200.0	54.80	19940	58.20	22850	62.40	25970	66.20	29280	70.20	32790
18 o.d.	4.716	19370.0	61.60	22450	65.60	25730	70.20	29240	74.60	32970	79.20	36930
20 o.d.	5.235	21510.0	68.20	24920	72.80	28560	78.00	32460	82.80	36600	87.80	40990
24 o.d.	6.286	25820.0	82.00	29920	87.60	34300	93.40	38970	99.60	43950	105.40	49220
30 o.d.	7.854	32260.0	102.60	37390	109.20	42850	117.00	48700	124.20	54910	131.80	61500

Nominal pipe size, inches	Sq. ft. of pipe sur- face, per lin. ft.	Temperature difference, degrees F.			
		650°	700°	750°	1000°
1/2	0.220	3.90	1918	4.10	2123
3/4	0.275	4.88	2397	5.14	2654
1	0.344	6.08	2998	6.44	3320
1 1/4	0.435	7.72	3792	8.12	4198
1 1/2	0.498	8.84	4341	9.30	4806
2	0.622	11.04	5422	11.60	6002
2 1/2	0.753	13.34	6563	14.08	7267
3	0.917	16.26	7993	17.12	8849
3 1/2	1.047	18.56	9126	19.50	10100
4	1.178	20.90	10270	22.00	11370
4 1/2	1.309	23.20	11410	24.40	12630
5	1.456	25.80	12690	27.20	14050
6	1.734	30.60	15110	32.40	16730
7	1.996	35.40	17400	37.20	19260
8	2.257	40.00	19670	42.20	21780
9	2.519	44.80	21960	47.00	24310
10	2.817	49.80	24550	52.60	27180
11	3.073	54.60	26790	57.40	29660
12	3.338	59.20	29100	62.20	32210
14 o.d.	3.663	65.00	31930	68.40	35350
16 o.d.	4.188	74.20	36500	78.20	40410
18 o.d.	4.716	83.60	41110	88.00	45510
20 o.d.	5.235	92.80	45630	97.80	50520
24 o.d.	6.286	111.40	54790	117.40	60660
30 o.d.	7.854	139.20	68460	146.60	75790

Flat, Curved and Cylindrical Surfaces

Heat losses given in B.t.u. per hour, per square foot of bare surface, at various temperature differences.

Temp. difference, degrees F.	Total heat loss at temp. indicated	Increments per degree for total losses	Loss per degree temp. difference
50	97.5	2.35	1.950
100	215.2	2.90	2.152
150	360.0	3.46	2.400
200	533.0	4.10	2.663
250	737.8	4.80	2.951
300	978.0	5.83	3.260
350	1269.5	6.89	3.627
400	1614.0	7.87	4.035
450	2007.5	9.05	4.461
500	2460.0	9.87	4.920
550	2953.5	11.10	5.370
600	3510.0	11.96	5.850
650	4108.0	13.04	6.320
700	4760.0	13.93	6.800
750	5456.3	14.87	7.275
800	6200.0	15.83	7.750
850	6991.3	16.77	8.225
900	7830.0	17.73	8.700
950	8716.3	18.67	9.175
1000	9650.0		9.650