

THERMODYNAMIC PROPERTIES OF WATER AND STEAM

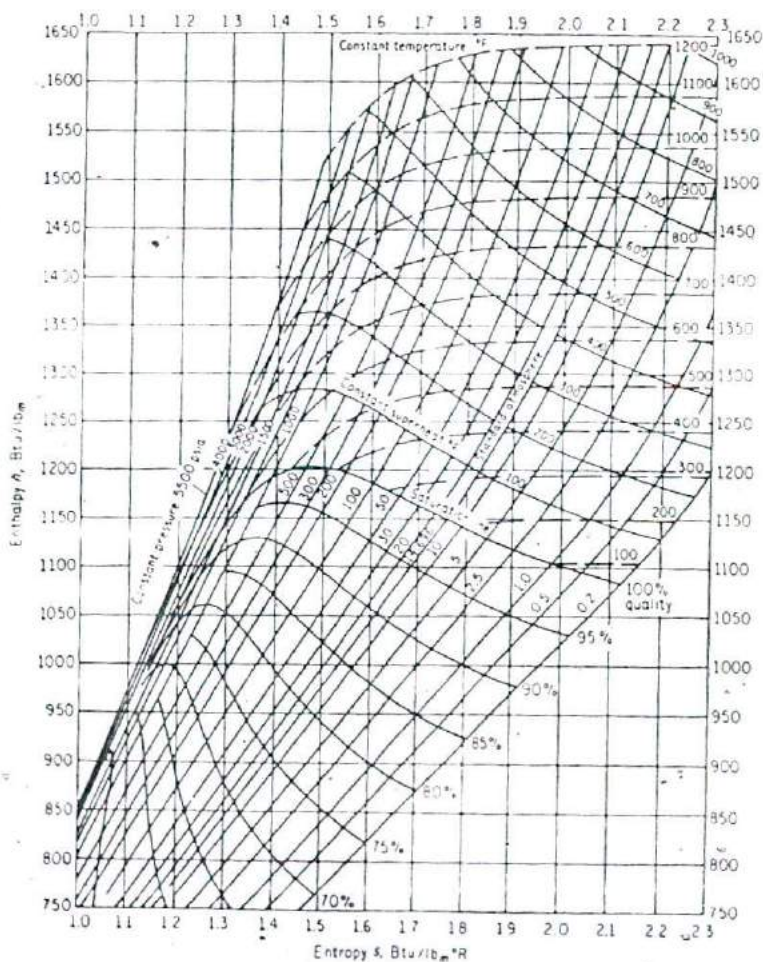


Figure A-1 Mollier diagram for steam. (Based on data in Ref. 6.)

Table A-1 Saturated steam: pressure table (English units)*

Pressure, psia	Temperature, °F	Specific volume, ft ³ /lb _m			Specific enthalpy, Btu/lb _m			Specific entropy, Btu/lb _m ·°F		
		v_f	v_g	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
0.0886	32.018	0.01602	3302.4	3302.4	0.00	1075.5	1075.5	0	2.1872	2.1872
0.10	35.023	0.01602	2945.5	2945.5	3.03	1073.8	1076.8	0.0061	2.1705	2.1766
0.15	45.453	0.01602	2004.7	2004.7	13.50	1067.9	1081.4	0.0271	2.1140	2.1411
0.20	53.160	0.01603	1526.3	1526.3	21.22	1063.5	1084.7	0.0422	2.0738	2.1160
0.30	64.484	0.01604	1039.7	1039.7	32.54	1057.1	1089.7	0.0641	2.0168	2.0809
0.40	72.869	0.01606	792.0	792.0	40.92	1052.4	1093.3	0.0799	1.9762	2.0562
0.5	79.586	0.01607	641.5	641.5	47.62	1048.6	1096.3	0.0925	1.9446	2.0370
0.6	85.218	0.01609	540.0	540.1	53.25	1045.5	1098.7	0.1028	1.9186	2.0215
0.7	90.09	0.01610	466.93	466.94	58.10	1042.7	1100.8	0.3	1.8966	2.0083
0.8	94.38	0.01611	411.67	411.69	62.39	1040.3	1102.6	0.1117	1.8775	1.9970
0.9	98.24	0.01612	368.41	368.43	66.24	1038.1	1104.3	0.1264	1.8606	1.9870
1.0	101.74	0.01614	333.59	333.60	69.73	1036.1	1105.8	0.1326	1.8455	1.9781
2.0	126.07	0.01623	173.74	173.76	94.03	1022.1	1116.2	0.1750	1.7450	1.9200
3.0	141.47	0.01630	118.71	118.73	109.42	1013.2	1122.6	0.2009	1.6854	1.8864
4.0	152.96	0.01636	90.63	90.64	120.92	1006.4	1127.3	0.2199	1.6428	1.8626
5.0	162.24	0.01641	73.515	73.53	130.20	1000.9	1131.1	0.2349	1.6094	1.8443
6.0	170.05	0.01645	61.967	61.98	138.03	996.2	1134.2	0.2474	1.5820	1.8294
7.0	176.84	0.01649	53.634	53.65	144.83	992.1	1136.9	0.2581	1.5587	1.8168
8.0	182.86	0.01653	47.328	47.35	150.87	988.5	1139.3	0.2676	1.5384	1.8060
9.0	188.27	0.01656	42.385	42.40	156.30	985.1	1141.4	0.2760	1.5204	1.7964
10	193.21	0.01659	38.404	38.42	161.26	982.1	1143.3	0.2836	1.5043	1.7879
14.696	212.00	0.01672	26.782	26.80	180.17	970.3	1150.5	0.3121	1.4447	1.7568
15.0	213.03	0.016726	26.274	26.290	181.21	969.7	1150.9	0.3137	1.4415	1.7552
20.0	227.96	0.016834	20.070	20.087	196.27	960.1	1156.3	0.3358	1.3962	1.7320

30.0	250.34	0.017009	13.7266	13.7436	218.9	945.2	1164.1	0.3682	1.3313	1.6095
40.0	267.25	0.017151	10.4794	10.4965	236.1	933.6	1169.8	0.3921	1.2844	1.6765
50.0	281.02	0.017274	8.4967	8.5140	250.2	923.9	1174.1	0.4112	1.2474	1.6886
60.0	292.71	0.017383	7.1562	7.1736	262.2	915.4	1177.6	0.4273	1.2167	1.6440
70.0	302.93	0.017482	6.1875	6.2050	272.7	907.8	1180.6	0.4411	1.1905	1.6316
80.0	312.04	0.017573	5.4536	5.4711	282.1	900.9	1183.1	0.4534	1.1675	1.6208
90.0	320.28	0.017659	4.8779	4.8953	290.7	894.6	1185.3	0.4643	1.1470	1.6113
100.0	327.82	0.017740	4.4133	4.4310	298.5	888.6	1187.2	0.4743	1.1284	1.6027
110.0	334.79	0.01782	4.0306	4.0484	305.8	883.1	1188.9	0.4834	1.1115	1.5950
120.0	341.27	0.01789	3.7097	3.7275	312.6	877.8	1190.4	0.4919	1.0960	1.5879
130.0	347.33	0.01796	3.4364	3.4544	319.0	872.8	1191.7	0.4998	1.0815	1.5813
140.0	353.04	0.01803	3.2010	3.2190	325.0	868.0	1193.0	0.5071	1.0681	1.5752
150.0	358.43	0.01809	2.9958	3.0139	330.6	863.4	1194.1	0.5141	1.0554	1.5695
160.0	363.55	0.01815	2.8155	2.8336	336.1	859.0	1195.1	0.5206	1.0435	1.5641
170.0	368.42	0.01821	2.6586	2.6738	341.2	854.8	1196.0	0.5269	1.0322	1.5591
180.0	373.08	0.01827	2.5129	2.5312	346.2	850.7	1196.9	0.5328	1.0215	1.5543
190.0	377.53	0.01833	2.3847	2.4030	350.9	846.7	1197.6	0.5384	1.0113	1.5498
200.0	381.80	0.01839	2.2689	2.2873	355.5	842.8	1198.3	0.5438	1.0016	1.5454
210.0	385.91	0.01844	2.16373	2.18217	359.9	839.1	1199.0	0.5490	0.9923	1.5413
220.0	389.88	0.01850	2.06779	2.08629	364.2	835.4	1199.6	0.5540	0.9834	1.5374
230.0	393.70	0.01855	1.97991	1.99846	368.3	831.8	1200.1	0.5588	0.9748	1.5336
240.0	397.39	0.01860	1.89909	1.91769	372.3	828.4	1200.6	0.5634	0.9665	1.5299
250.0	400.97	0.01865	1.82452	1.84317	376.1	825.0	1201.1	0.5679	0.9585	1.5264
260.0	404.44	0.01870	1.75548	1.77418	379.9	821.6	1201.5	0.5722	0.9508	1.5230
270.0	407.80	0.01875	1.69137	1.71013	383.6	818.3	1201.9	0.5764	0.9433	1.5197
280.0	411.07	0.01880	1.63169	1.65049	387.1	815.1	1202.3	0.5805	0.9361	1.5166
290.0	414.25	0.01885	1.57597	1.59482	390.6	812.0	1202.6	0.5844	0.9291	1.5135
300.0	417.35	0.01889	1.52384	1.54274	394.0	808.9	1202.9	0.5882	0.9223	1.5105
350.0	431.73	0.01912	1.30642	1.32554	409.8	794.2	1204.0	0.6059	0.8909	1.4968
400.0	444.60	0.01934	1.14162	1.16095	424.2	780.4	1204.6	0.6217	0.8630	1.4847
450.0	456.28	0.01954	1.01224	1.03179	437.3	767.5	1204.8	0.6360	0.8378	1.4738

(continued)

Table A-1 Saturated steam: pressure table (English units)* (Continued)

Pressure, psia	Temperature, °F	Specific volume, ft ³ /lb _m			Specific enthalpy, Btu/lb _m			Specific entropy, Btu/lb _m ·°F		
		v_g	v_{fg}	v_f	h_{fg}	h_f	h_g	s_f	s_g	$s_g - s_f$
500.0	467.01	0.01975	0.90787	0.92762	449.5	755.1	1204.7	0.6490	0.8148	1.4639
550.0	476.94	0.01984	0.82183	0.84177	461.9	743.3	1204.3	0.6611	0.7936	1.4547
600.0	486.20	0.02013	0.74962	0.76975	471.7	732.0	1203.7	0.6723	0.7738	1.4461
650.0	494.89	0.02032	0.68811	0.70843	481.9	720.9	1202.8	0.6828	0.7552	1.4381
700.0	503.08	0.02050	0.63505	0.65556	491.6	710.2	1201.8	0.6928	0.7377	1.4304
750.0	510.84	0.02069	0.58880	0.60949	500.9	699.8	1200.7	0.7022	0.7210	1.4232
800.0	518.21	0.02087	0.54809	0.56896	509.8	689.6	1199.4	0.7111	0.7051	1.4163
850.0	525.34	0.02105	0.51197	0.53302	518.4	679.5	1198.0	0.7197	0.6899	1.4096
900.0	531.95	0.02123	0.47968	0.50091	526.7	669.7	1196.4	0.7279	0.6753	1.4032
950.0	538.39	0.02141	0.45064	0.47205	534.7	660.0	1194.7	0.7358	0.6612	1.3970
1000.0	544.58	0.02159	0.42436	0.44596	542.6	650.4	1192.9	0.7434	0.6476	1.3910
1050.0	550.53	0.02177	0.40047	0.42224	550.1	640.9	1191.0	0.7507	0.6344	1.3851
1100.0	556.28	0.02195	0.37863	0.40058	557.5	631.5	1189.1	0.7578	0.6216	1.3794
1150.0	561.82	0.02214	0.35859	0.38073	564.8	622.2	1187.0	0.7647	0.6091	1.3738
1200.0	567.19	0.02232	0.34013	0.36245	571.9	613.0	1184.8	0.7714	0.5969	1.3683
1250.0	572.38	0.02250	0.32306	0.34556	578.8	603.8	1182.6	0.7780	0.5850	1.3630
1300.0	577.42	0.02269	0.30722	0.32991	585.6	594.6	1180.2	0.7843	0.5733	1.3577
1350.0	582.32	0.02288	0.29250	0.31537	592.3	585.4	1177.8	0.7906	0.5620	1.3525
1400.0	587.07	0.02307	0.27871	0.30178	598.8	576.5	1175.3	0.7966	0.5507	1.3474
1450.0	591.70	0.02327	0.26584	0.28911	605.3	567.4	1172.8	0.8026	0.5397	1.3423
1500.0	596.20	0.02346	0.25372	0.27719	611.7	558.4	1170.1	0.8085	0.5288	1.3373
1550.0	600.59	0.02366	0.24235	0.26601	618.0	549.4	1167.4	0.8142	0.5182	1.3324
1600.0	604.87	0.02387	0.23159	0.25545	624.2	540.3	1164.5	0.8199	0.5076	1.3274
1650.0	609.05	0.02407	0.22143	0.24551	630.4	531.3	1161.6	0.8254	0.4971	1.3225
1700.0	613.13	0.02428	0.21178	0.23607	636.5	522.2	1158.6	0.8309	0.4867	1.3176

1750.0	617.12	0.02450	0.20263	0.22713	642.5	513.1	1155.6	0.8463	0.4765	1.3128
1800.0	621.02	0.02472	0.19390	0.21861	648.5	503.8	1152.3	0.8417	0.4662	1.3079
1850.0	624.83	0.02495	0.18558	0.21052	654.5	494.6	1149.0	0.8470	0.4561	1.3030
1900.0	628.56	0.02517	0.17761	0.20278	660.4	485.2	1145.6	0.8522	0.4459	1.2981
1950.0	632.22	0.02541	0.16999	0.19540	666.3	475.8	1142.0	0.8574	0.4358	1.2931
2000.0	635.80	0.02565	0.16266	0.18831	672.1	466.2	1138.3	0.8625	0.4256	1.2881
2100.0	642.76	0.02615	0.14885	0.17501	683.8	446.7	1130.5	0.8727	0.4053	1.2780
2200.0	649.45	0.02669	0.13603	0.16272	695.5	426.7	1122.2	0.8828	0.3848	1.2676
2300.0	655.89	0.02727	0.12406	0.15133	707.2	406.0	1113.2	0.8929	0.3640	1.2569
2400.0	662.11	0.02790	0.11287	0.14076	719.0	384.8	1103.7	0.9031	0.3430	1.2460
2500.0	668.11	0.02859	0.10209	0.13068	731.7	361.6	1093.3	0.9139	0.3206	1.2345
2600.0	673.91	0.02938	0.09172	0.12110	744.5	337.6	1082.0	0.9247	0.2977	1.2225
2700.0	679.53	0.03029	0.08165	0.11194	757.3	312.3	1069.7	0.9356	0.2741	1.2097
2800.0	684.96	0.03134	0.07171	0.10305	770.7	285.1	1055.8	0.9468	0.2491	1.1958
2900.0	690.22	0.03262	0.06158	0.09420	785.1	254.7	1039.8	0.9588	0.2215	1.1803
3000.0	695.33	0.03428	0.05073	0.08500	801.8	218.4	1020.3	0.9728	0.1891	1.1619
3100.0	700.28	0.03681	0.03771	0.07452	824.0	160.3	993.3	0.9914	0.1460	1.1373
3200.0	705.08	0.04472	0.01191	0.05663	875.5	56.1	931.6	1.0351	0.0482	1.0832
3208.2†	705.47	0.05078	0.00000	0.05078	906.0	0.0	906.0	1.0612	0.0000	1.0612

* Tables A-1 through A-5 are abstracted from the ASME *Thermodynamic and Transport Properties of Steam*, Ref. 6.

† Critical point.

Table A-2 Saturated steam: temperature table (English units)

Temperature, °F	Pressure, psia	Specific volume, ft ³ /lb _m			Specific enthalpy, Btu/lb _m			Specific entropy, Btu/(lb _m ·°F)		
		v _g	v _f	v _{fg}	h _g	h _f	h _{fg}	s _g	s _f	s _{fg}
32.018	0.08865	3502.4	0.016022	3302.4	0.0003	1075.5	1075.5	0.0000	2.1872	2.1872
33.0	0.09223	3180.7	0.016021	3180.7	0.989	1075.9	1075.9	0.0020	2.1817	2.1837
34.0	0.09600	3061.9	0.016021	3061.9	1.986	1076.4	1076.4	0.0041	2.1762	2.1802
35.0	0.09991	2948.1	0.016020	2948.1	3.002	1076.8	1076.8	0.0061	2.1706	2.1767
36.0	0.10395	2839.0	0.016020	2839.0	4.008	1077.2	1077.2	0.0081	2.1651	2.1732
37.0	0.10815	2734.4	0.016019	2734.4	5.013	1077.7	1077.7	0.0101	2.1596	2.1697
38.0	0.11249	2634.1	0.016019	2634.2	6.018	1078.1	1078.1	0.0122	2.1541	2.1663
39.0	0.11698	2538.0	0.016019	2538.0	7.023	1078.5	1078.5	0.0142	2.1487	2.1629
40.0	0.12163	2445.8	0.016019	2445.8	8.027	1079.0	1079.0	0.0162	2.1432	2.1594
41.0	0.12645	2357.3	0.016019	2357.3	9.031	1079.4	1079.4	0.0182	2.1375	2.1560
42.0	0.13143	2272.4	0.016019	2272.4	10.035	1099.8	1079.9	0.0202	2.1271	2.1527
43.0	0.13659	2191.0	0.016019	2191.0	11.038	1099.3	1080.3	0.0222	2.1217	2.1493
44.0	0.14192	2112.8	0.016019	2112.8	12.041	1068.7	1080.7	0.0242	2.1164	2.1459
45.0	0.14744	2037.7	0.016020	2037.7	13.044	1068.1	1081.2	0.0262	2.1111	2.1426
46.0	0.15314	1965.7	0.016020	1965.7	14.047	1067.6	1081.6	0.0282	2.1058	2.1493
47.0	0.15904	1896.5	0.016021	1896.5	15.049	1067.0	1082.1	0.0301	2.1006	2.1460
48.0	0.16514	1830.0	0.016021	1830.0	16.051	1066.4	1082.5	0.0321	2.0953	2.1327
49.0	0.17144	1766.2	0.016022	1766.2	17.053	1065.9	1082.9	0.0341	2.0901	2.1294
50.0	0.17796	1704.8	0.016023	1704.8	18.054	1065.3	1083.4	0.0361	2.0849	2.1262
51.0	0.18469	1646.9	0.016023	1646.9	19.056	1064.7	1083.8	0.0380	2.0798	2.1230
52.0	0.19165	1589.2	0.016024	1589.2	20.057	1064.2	1084.2	0.0400	2.0746	2.1197
53.0	0.19883	1534.7	0.016025	1534.7	21.058	1063.6	1084.7	0.0419	2.0695	2.1165
54.0	0.20625	1482.4	0.016026	1482.4	22.058	1063.1	1085.1	0.0439	2.0644	2.1134
55.0	0.21392	1432.0	0.016027	1432.0	23.059	1062.5	1085.6	0.0458	2.0593	2.1102
56.0	0.22183	1383.6	0.016028	1383.6	24.059	1061.9	1086.0	0.0478	2.0542	2.1070
57.0	0.23000	1337.0	0.016029	1337.0	25.060	1061.4	1086.4	0.0497	2.0542	2.1039
58.0	0.23843	1292.2	0.016031	1292.2	26.060	1060.8	1086.9	0.0516	2.0491	2.1008

59.0	0.24713	1249.1	1249.1	27.060	1060.2	1087.3	0.0536	2.0441	2.0977
60.0	0.25611	1207.6	1207.6	28.060	1059.7	1087.7	0.0555	2.0391	2.0946
61.0	0.26538	1167.6	1167.6	29.059	1058.1	1088.2	0.0574	2.0341	2.0915
62.0	0.27494	1129.2	1129.2	30.059	1058.5	1088.6	0.0593	2.0291	2.0885
63.0	0.28480	1092.1	1092.1	31.058	1058.0	1089.0	0.0613	2.0242	2.0854
64.0	0.29497	1056.5	1056.5	32.058	1057.4	1089.5	0.0632	2.0192	2.0824
65.0	0.30545	1022.1	1022.1	33.057	1056.9	1089.9	0.0651	2.0143	2.0794
66.0	0.31626	989.0	989.1	34.056	1056.3	1090.4	0.0670	2.0094	2.0764
67.0	0.32740	957.2	957.2	35.055	1055.7	1090.8	0.0689	2.0045	2.0734
68.0	0.33889	926.5	926.5	36.054	1055.2	1091.2	0.0708	1.9996	2.0704
69.0	0.35073	896.9	896.9	37.053	1054.6	1091.7	0.0727	1.9948	2.0675
70.0	0.36292	868.4	868.4	38.052	1054.0	1092.1	0.0745	1.9900	2.0645
71.0	0.37549	840.9	840.9	39.050	1053.5	1092.5	0.0764	1.9852	2.0616
72.0	0.38844	814.3	814.3	40.049	1052.9	1093.0	0.0783	1.9804	2.0587
73.0	0.40177	788.8	788.8	41.048	1052.4	1093.4	0.0802	1.9756	2.0558
74.0	0.41550	764.1	764.1	42.046	1051.8	1093.8	0.0821	1.9708	2.0529
75.0	0.42964	740.3	740.3	43.045	1051.2	1094.3	0.0839	1.9661	2.0500
76.0	0.44420	717.4	717.4	44.043	1050.7	1094.7	0.0858	1.9614	2.0472
77.0	0.45919	695.2	695.2	45.042	1050.1	1095.1	0.0877	1.9567	2.0443
78.0	0.47461	673.8	673.9	46.040	1049.5	1095.6	0.0895	1.9520	2.0415
79.0	0.49049	653.2	653.2	47.038	1049.0	1096.0	0.0914	1.9473	2.0387
80.0	0.50683	633.3	633.3	48.037	1048.4	1096.4	0.0932	1.9426	2.0359
81.0	0.52364	614.1	614.1	49.035	1047.8	1096.9	0.0951	1.9380	2.0331
82.0	0.54093	595.5	595.6	50.033	1047.3	1097.3	0.0969	1.9334	2.0303
83.0	0.55872	577.6	577.6	51.031	1046.7	1097.7	0.0988	1.9288	2.0275
84.0	0.57702	560.3	560.3	52.029	1046.1	1098.2	0.1006	1.9242	2.0248
85.0	0.59583	543.6	543.6	53.027	1045.6	1098.6	0.1024	1.9196	2.0221
86.0	0.61518	527.5	527.5	54.026	1045.0	1099.0	0.1043	1.9151	2.0193
87.0	0.63507	511.9	511.9	55.024	1044.4	1099.5	0.1061	1.9105	2.0166
88.0	0.65551	496.8	496.8	56.022	1043.9	1099.9	0.1079	1.9060	2.0139
89.0	0.67653	482.2	482.2	57.020	1043.3	1100.3	0.1097	1.9015	2.0112
90.0	0.69813	468.1	468.1	58.018	1042.7	1100.8	0.1115	1.8970	2.0086
91.0	0.72032	454.5	454.5	59.016	1042.2	1101.2	0.1134	1.8926	2.0059

(Continued)

Table A-2 Saturated steam: temperature table (English units) (Continued)

Temperature, °F	Pressure, psia	Specific volume, ft ³ /lb _m				Specific enthalpy, Btu/lb _m				Specific entropy, Btu/(lb _m ·°F)		
		v_f	v_{fg}	v_g	v_{fg}	h_f	h_{fg}	h_g	h_{fg}	s_f	s_{fg}	s_g
92.0	0.74313	0.016105	441.3	441.3	60.014	1041.6	1101.6	0.1152	1.8881	2.0033		
93.0	0.76655	0.016108	428.6	428.6	61.012	1041.0	1102.1	0.1170	1.8837	2.0006		
94.0	0.79062	0.016111	416.3	416.3	62.010	1040.5	1102.5	0.1188	1.8792	1.9980		
95.0	0.81534	0.016114	404.4	404.4	63.008	1039.9	1102.9	0.1206	1.8748	1.9954		
96.0	0.84072	0.016117	392.8	392.8	64.006	1039.3	1103.3	0.1224	1.8704	1.9928		
97.0	0.86679	0.016120	381.7	381.7	65.005	1038.8	1103.8	0.1242	1.8660	1.9902		
98.0	0.89356	0.016123	370.9	370.9	66.003	1038.2	1104.2	0.1260	1.8617	1.9876		
99.0	0.92103	0.016127	360.5	360.5	67.001	1037.6	1104.6	0.1278	1.8573	1.9851		
100.0	0.94924	0.016130	350.4	350.4	67.999	1037.1	1105.1	0.1295	1.8530	1.9825		
101.0	0.97818	0.016133	340.6	340.6	68.997	1036.5	1105.5	0.1313	1.8487	1.9800		
102.0	1.00789	0.016137	331.1	331.1	69.995	1035.9	1105.9	0.1331	1.8444	1.9775		
103.0	1.03838	0.016140	322.0	322.0	70.993	1035.4	1106.3	0.1349	1.8401	1.9750		
104.0	1.06965	0.016144	313.1	313.1	71.992	1034.8	1106.8	0.1366	1.8358	1.9725		
105.0	1.10174	0.016148	304.5	304.5	72.990	1034.2	1107.2	0.1384	1.8315	1.9700		
110.0	1.2750	0.016165	265.37	265.39	77.98	1031.4	1109.3	0.1472	1.8105	1.9577		
120.0	1.6927	0.016204	203.25	203.26	87.97	1025.6	1113.6	0.1646	1.7693	1.9339		
130.0	2.2230	0.016247	157.32	157.33	97.96	1019.8	1117.8	0.1817	1.7295	1.9112		
140.0	2.8892	0.016293	122.98	123.00	107.95	1014.0	1122.0	0.1985	1.6910	1.8895		
150.0	3.7184	0.016343	97.05	97.07	117.95	1008.2	1126.1	0.2150	1.6536	1.8686		
160.0	4.7414	0.016395	77.27	77.29	127.96	1002.2	1130.2	0.2313	1.6174	1.8487		
170.0	5.9926	0.016451	62.04	62.06	137.97	995.2	1134.2	0.2473	1.5822	1.8295		
180.0	7.5110	0.016510	50.21	50.22	148.00	990.2	1138.2	0.2631	1.5480	1.8111		
190.0	9.340	0.016572	40.941	40.957	158.04	984.1	1142.1	0.2787	1.5148	1.7934		
200.0	11.526	0.016637	33.622	33.639	168.09	977.9	1146.0	0.2940	1.4824	1.7764		
220.0	17.186	0.016775	23.131	23.148	188.23	965.2	1153.4	0.3241	1.4201	1.7442		
240.0	24.968	0.016926	16.304	16.321	208.45	952.1	1160.6	0.3533	1.3609	1.7142		
260.0	35.427	0.017089	11.745	11.762	228.76	938.6	1167.4	0.3819	1.3043	1.6862		

280.0	49.200	0.017264	8.627	8.644	249.17	924.6	1173.8	0.4098	1.2501	1.6599
300.0	67.005	0.01745	6.4483	6.4658	269.7	910.0	1179.7	0.4372	1.1979	1.6351
320.0	89.643	0.01766	4.8961	4.9138	290.4	894.8	1185.2	0.4640	1.1477	1.6116
340.0	117.992	0.01787	3.7699	3.7878	311.3	878.8	1190.1	0.4902	1.0990	1.5892
360.0	153.010	0.01811	2.9392	2.9573	332.3	862.1	1194.4	0.5161	1.0517	1.5678
380.0	195.729	0.01836	2.3170	2.3353	353.6	844.5	1198.0	0.5416	1.0057	1.5473
400.0	247.259	0.01864	1.8444	1.8630	375.1	825.9	1201.0	0.5667	0.9607	1.5274
420.0	308.780	0.01894	1.4808	1.4997	396.9	806.2	1203.1	0.5915	0.9165	1.5080
440.0	381.54	0.01926	1.19761	1.21687	419.0	785.4	1204.4	0.6161	0.8729	1.4890
460.0	466.87	0.01961	0.97463	0.99424	441.5	763.2	1204.8	0.6405	0.8299	1.4704
480.0	566.15	0.02000	0.79716	0.81717	464.5	739.6	1204.1	0.6648	0.7871	1.4518
500.0	680.86	0.02043	0.65448	0.67492	487.9	714.3	1202.2	0.6890	0.7443	1.4333
520.0	812.53	0.02091	0.53864	0.55956	512.0	687.0	1199.0	0.7133	0.7013	1.4146
540.0	962.79	0.02146	0.44367	0.46513	536.8	657.5	1194.3	0.7378	0.6577	1.3954
560.0	1133.38	0.02207	0.36507	0.38714	562.4	625.3	1187.7	0.7625	0.6132	1.3757
580.0	1326.17	0.02279	0.29937	0.32216	589.1	589.9	1179.0	0.7876	0.5673	1.3550
600.0	1543.2	0.02364	0.24384	0.26747	617.1	550.6	1167.7	0.8134	0.5196	1.3330
620.0	1786.9	0.02466	0.19615	0.22081	646.9	506.3	1153.2	0.8403	0.4689	1.3092
640.0	2059.9	0.02595	0.15427	0.18021	679.1	454.6	1133.7	0.8686	0.4134	1.2821
660.0	2365.7	0.02768	0.11663	0.14431	714.9	392.1	1107.0	0.8995	0.3502	1.2498
680.0	2708.6	0.03037	0.08080	0.11117	758.5	310.1	1068.5	0.9365	0.2720	1.2086
700.0	3094.3	0.03662	0.03857	0.07519	822.4	172.7	995.2	0.9901	0.1490	1.1390

Table A-3 Properties of superheated steam, compressed water, and supercritical steam (English units)*

Absolute pressure, psia (saturated temperature)		Temperature, °F														
		100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
1	v	0.0161	392.5	452.3	511.9	571.5	631.1	690.7								
	h	68.00	1150.2	1195.7	1241.8	1288.6	1336.1	1384.5								
(101.74)		s	0.1295	2.0509	2.1152	2.1722	2.2237	2.2708	2.3144							
5	v	0.0161	78.14	90.24	102.24	114.21	126.15	138.08	150.01	161.94	173.86	185.78	197.70	209.62	221.53	233.45
	h	68.01	1148.6	1194.8	1241.3	1288.2	1335.9	1384.0	1433.4	1483.6	1534.7	1586.7	1639.6	1693.3	1748.0	1803.5
(162.24)		s	0.1295	1.8716	1.9369	1.9943	2.0460	2.0932	2.1369	2.1776	2.2159	2.2521	2.2866	2.3194	2.3509	2.3811
10	v	0.0161	38.84	44.98	51.03	57.04	63.03	69.00	74.98	80.94	86.91	92.87	98.84	104.80	110.76	116.72
	h	68.02	1146.6	1193.7	1240.6	1287.8	1335.5	1384.0	1433.4	1483.5	1534.6	1586.6	1639.5	1693.3	1747.9	1803.4
(193.21)		s	0.1295	1.7928	1.8593	1.9173	1.9692	2.0166	2.0603	2.1011	2.1394	2.1757	2.2101	2.2430	2.2744	2.3046
15	v	0.0161	0.0166	29.899	33.963	37.985	41.986	45.978	49.964	53.946	57.926	61.905	65.882	69.858	73.833	77.807
	h	68.04	168.09	1192.5	1239.9	1287.3	1335.2	1383.8	1433.2	1483.4	1534.5	1586.5	1639.4	1693.2	1747.8	1803.4
(213.03)		s	0.1295	0.2940	1.8134	1.8720	1.9242	1.9717	2.0155	2.0563	2.0946	2.1309	2.1653	2.1982	2.2297	2.2599
20	v	0.0161	0.0166	22.356	25.428	28.457	31.466	34.465	37.458	40.447	43.435	46.420	49.405	52.388	55.370	58.352
	h	68.05	168.11	1191.4	1239.2	1286.9	1334.9	1383.5	1432.9	1483.2	1534.3	1586.3	1639.3	1693.1	1747.8	1803.3
(227.96)		s	0.1295	0.2940	1.7805	1.8397	1.8921	1.9397	1.9836	2.0244	2.0628	2.0991	2.1336	2.1665	2.1979	2.2282
40	v	0.0161	0.0166	11.036	12.624	14.165	15.685	17.195	18.699	20.199	21.697	23.194	24.689	26.183	27.676	29.168
	h	68.10	168.15	1186.6	1236.4	1285.0	1333.6	1382.5	1432.1	1482.5	1533.7	1585.8	1638.8	1692.7	1747.5	1803.0
(267.25)		s	0.1295	0.2940	1.6992	1.7608	1.8143	1.8624	1.9065	1.9476	1.9860	2.0224	2.0569	2.0899	2.1224	2.1516
60	v	0.0161	0.0166	7.257	8.354	9.400	10.425	11.438	12.446	13.450	14.452	15.452	16.450	17.448	18.445	19.441
	h	68.15	168.20	1181.6	1233.5	1283.2	1332.3	1381.5	1431.3	1481.8	1533.2	1585.3	1638.4	1692.4	1747.1	1802.8
(292.7F)		s	0.1295	0.2939	1.6492	1.7134	1.7681	1.8168	1.8612	1.9024	1.9410	1.9774	2.0120	2.0450	2.0765	2.1068
80	v	0.0161	0.0166	6.218	7.018	7.794	8.560	9.319	10.075	10.829	11.581	12.331	13.081	13.829	14.577	
	h	68.24	168.24	269.74	1230.5	1281.3	1330.9	1380.5	1430.5	1481.1	1532.6	1584.9	1638.0	1692.0	1746.8	1802.5
(312.04)		s	0.1295	0.2939	0.4371	1.6790	1.7349	1.7842	1.8289	1.8702	1.9089	1.9454	1.9800	2.0131	2.0446	2.0750
100	v	0.0161	0.0166	0.0175	4.935	5.588	6.216	6.833	7.443	8.050	8.655	9.258	9.860	10.460	11.060	
	h	68.26	168.29	269.77	1227.4	1279.3	1329.6	1379.5	1429.7	1480.4	1532.0	1584.4	1637.6	1691.6	1746.5	1802.2
(327.82)		s	0.1295	0.2939	0.4371	1.6516	1.7088	1.7586	1.8036	1.8451	1.8839	1.9205	1.9552	1.9883	2.0199	2.0502

120	y	0.0161	0.0166	0.0175	4.0786	4.6341	5.1637	5.6831	6.1928	6.7006	7.2060	7.7096	8.2119	8.7130	9.2134	9.7130
(341.27)	h	68.31	168.33	269.81	1224.1	1277.4	1328.1	1378.4	1428.8	1479.8	1531.4	1583.9	1637.1	1691.3	1746.2	1802.0
	s	0.1295	0.2939	0.4371	1.6286	1.6872	1.7376	1.7829	1.8246	1.8635	1.9001	1.9349	1.9680	1.9996	2.0300	2.0592
140	y	0.0161	0.0166	0.0175	3.4661	3.9526	4.4119	4.8585	5.2995	5.7364	6.1709	6.6036	7.0349	7.4652	7.8946	8.3233
(353.04)	h	68.37	168.38	269.85	1220.8	1275.3	1326.8	1377.4	1428.0	1479.1	1530.8	1583.4	1636.7	1690.9	1745.9	1801.7
	s	0.1295	0.2939	0.4370	1.6085	1.6686	1.7196	1.7652	1.8071	1.8461	1.8828	1.9176	1.9508	1.9825	2.0129	2.0421
160	y	0.0161	0.0166	0.0175	3.0060	3.4413	3.8480	4.2420	4.6295	5.0132	5.3945	5.7741	6.1522	6.5293	6.9055	7.2811
(363.55)	h	68.42	168.42	269.89	1217.4	1273.3	1325.4	1376.3	1427.4	1478.4	1530.3	1582.9	1636.3	1690.5	1745.6	1801.4
	s	0.1294	0.2938	0.4370	1.5906	1.6522	1.7039	1.7499	1.7919	1.8310	1.8678	1.9027	1.9359	1.9676	1.9980	2.0273
180	y	0.0161	0.0166	0.0174	2.6474	3.0433	3.4093	3.7621	4.1084	4.4505	4.7907	5.1289	5.4657	5.8014	6.1363	6.4704
(373.08)	h	68.47	168.47	269.92	1213.8	1271.2	1324.0	1373.3	1423.4	1473.7	1525.7	1582.4	1635.9	1690.2	1745.3	1801.2
	s	0.1294	0.2938	0.4370	1.5743	1.6376	1.6900	1.7362	1.7784	1.8176	1.8545	1.8894	1.9227	1.9545	1.9849	2.0142
200	y	0.0161	0.0166	0.0174	2.3598	2.7247	3.0583	3.3783	3.6915	4.0008	4.3077	4.6128	4.9165	5.2191	5.5209	5.8219
(381.80)	h	68.52	168.51	269.96	1210.1	1269.0	1322.6	1374.3	1425.5	1477.0	1529.1	1581.9	1635.4	1689.8	1745.0	1800.9
	s	0.1294	0.2938	0.4369	1.5593	1.6242	1.6776	1.7239	1.7663	1.8057	1.8426	1.8776	1.9109	1.9427	1.9732	2.0025
250	y	0.0161	0.0166	0.0174	0.0186	2.1504	2.4662	2.6872	2.9410	3.1909	3.4382	3.6837	3.9278	4.1709	4.4131	4.6546
(400.97)	h	68.66	168.63	270.05	1263.5	1319.0	1371.6	1423.4	1475.3	1527.6	1580.6	1634.4	1688.9	1744.2	1800.2	
	s	0.1294	0.2937	0.4368	0.5667	1.5951	1.6502	1.6976	1.7405	1.7801	1.8173	1.8524	1.8858	1.9177	1.9482	1.9776
300	y	0.0161	0.0166	0.0174	0.0186	1.7665	2.0044	2.2263	2.4407	2.6509	2.8585	3.0643	3.2688	3.4721	3.6746	3.8764
(417.35)	h	68.79	168.74	270.14	1257.7	1315.2	1368.9	1421.3	1473.6	1526.2	1579.4	1633.3	1688.0	1743.4	1799.6	
	s	0.1294	0.2937	0.4307	0.5665	1.5703	1.6274	1.6758	1.7192	1.7591	1.7964	1.8317	1.8652	1.8972	1.9278	1.9572
350	y	0.0161	0.0166	0.0174	0.0186	0.4913	1.7028	1.8970	2.0832	2.2652	2.4445	2.6219	2.7980	2.9730	3.1471	3.3205
(431.73)	h	68.92	168.85	270.24	1251.5	1311.4	1366.2	1419.2	1471.8	1524.7	1578.2	1632.3	1687.1	1742.6	1798.9	
	s	0.1293	0.2936	0.4367	0.5664	1.5483	1.6077	1.6571	1.7000	1.7411	1.7787	1.8141	1.8477	1.8798	1.9105	1.9400
400	y	0.0161	0.0166	0.0174	0.0162	1.2841	1.4763	1.6499	1.8151	1.9759	2.1339	2.2901	2.4450	2.5987	2.7515	2.9037
(444.60)	h	69.05	168.97	270.33	1245.1	1307.4	1363.4	1417.0	1470.1	1523.3	1576.9	1631.2	1686.2	1741.9	1798.2	
	s	0.1293	0.2935	0.4366	0.5663	1.5282	1.5901	1.6406	1.6850	1.7255	1.7632	1.7988	1.8325	1.8647	1.8955	1.9250
500	y	0.0161	0.0166	0.0174	0.0186	0.9919	1.1584	1.3037	1.4397	1.5708	1.6992	1.8256	1.9507	2.0746	2.1977	2.3200
(467.01)	h	69.32	169.19	270.51	1231.2	1299.1	1357.7	1412.7	1466.6	1520.3	1574.4	1629.1	1684.4	1740.3	1796.9	
	s	0.1292	0.2934	0.4364	0.5660	1.4921	1.5595	1.6123	1.6578	1.6990	1.7371	1.7730	1.8069	1.8393	1.8702	1.8998
600	y	0.0161	0.0166	0.0174	0.0186	0.7944	0.9456	1.0726	1.1892	1.3008	1.4093	1.5160	1.6211	1.7252	1.8284	1.9309
(486.20)	h	69.58	169.42	270.70	1219.0	1281.9	1340.3	1395.8	1450.3	1503.8	1557.1	1610.2	1662.9	1715.5	1768.6	
	s	0.1292	0.2933	0.4362	0.5657	1.4590	1.5329	1.5844	1.6351	1.6769	1.7155	1.7517	1.7859	1.8184	1.8494	1.8792

(Continued)

Table A-3 Properties of superheated steam, compressed water, and supercritical steam (English units)* (Continued)

Absolute pressure, psia (saturated temperature)	Temperature, °F														
	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
v	0.0161	0.0166	0.0174	0.0186	0.0204	0.0236	0.0278	0.0322	0.0370	0.0423	0.0481	0.0544	0.0612	0.0685	0.0764
h	69.84	169.65	270.89	375.61	487.93	1281.0	1345.6	1403.7	1459.4	1514.4	1569.4	1624.8	1680.7	1737.2	1794.3
s	0.1291	0.2932	0.4360	0.5655	0.6889	1.5090	1.5673	1.6154	1.6580	1.6970	1.7335	1.7679	1.8006	1.8318	1.8617
v	0.0161	0.0166	0.0174	0.0186	0.0204	0.0236	0.0278	0.0322	0.0370	0.0423	0.0481	0.0544	0.0612	0.0685	0.0764
h	70.11	169.88	271.07	375.73	487.88	1271.1	1339.2	1399.1	1455.8	1511.4	1566.9	1622.7	1678.9	1735.0	1792.9
s	0.1290	0.2930	0.4358	0.5652	0.6885	1.4869	1.5484	1.5980	1.6413	1.6807	1.7175	1.7522	1.7851	1.8164	1.8464
v	0.0161	0.0166	0.0174	0.0186	0.0204	0.0236	0.0278	0.0322	0.0370	0.0423	0.0481	0.0544	0.0612	0.0685	0.0764
h	70.37	170.10	271.26	375.84	487.83	1260.6	1332.7	1394.4	1452.2	1508.5	1564.4	1620.6	1677.1	1734.1	1791.6
s	0.1290	0.2929	0.4357	0.5649	0.6881	1.4659	1.5311	1.5822	1.6263	1.6662	1.7033	1.7382	1.7713	1.8028	1.8329
v	0.0161	0.0166	0.0174	0.0186	0.0204	0.0236	0.0278	0.0322	0.0370	0.0423	0.0481	0.0544	0.0612	0.0685	0.0764
h	70.63	170.33	271.44	375.96	487.79	1249.3	1325.9	1389.6	1448.5	1504.4	1561.9	1618.4	1675.3	1732.5	1790.3
s	0.1289	0.2928	0.4355	0.5647	0.6876	1.4457	1.5149	1.5677	1.6126	1.6530	1.6905	1.7256	1.7589	1.7905	1.8207
v	0.0161	0.0166	0.0174	0.0186	0.0203	0.0236	0.0278	0.0322	0.0370	0.0423	0.0481	0.0544	0.0612	0.0685	0.0764
h	70.90	170.56	271.63	376.08	487.75	1237.3	1318.8	1384.7	1444.7	1502.4	1559.4	1616.3	1673.5	1731.0	1789.0
s	0.1289	0.2927	0.4353	0.5644	0.6872	1.4259	1.4996	1.5542	1.6000	1.6410	1.6787	1.7141	1.7475	1.7793	1.8097
v	0.0161	0.0166	0.0174	0.0186	0.0203	0.0236	0.0278	0.0322	0.0370	0.0423	0.0481	0.0544	0.0612	0.0685	0.0764
h	71.16	170.78	271.82	376.20	487.72	1224.2	1311.5	1379.7	1440.9	1499.4	1556.9	1614.2	1671.6	1729.4	1787.6
s	0.1288	0.2926	0.4351	0.5642	0.6868	1.4061	1.4851	1.5415	1.5883	1.6298	1.6679	1.7035	1.7371	1.7691	1.7996
v	0.0161	0.0166	0.0174	0.0186	0.0203	0.0236	0.0278	0.0322	0.0370	0.0423	0.0481	0.0544	0.0612	0.0685	0.0764
h	71.68	171.24	272.19	376.44	487.65	1194.1	1296.1	1369.3	1433.2	1493.2	1551.8	1609.9	1668.0	1726.3	1785.0
s	0.1287	0.2923	0.4348	0.5636	0.6859	1.3652	1.4575	1.5182	1.5670	1.6096	1.6484	1.6845	1.7185	1.7508	1.7815
v	0.0161	0.0166	0.0173	0.0185	0.0202	0.0236	0.0278	0.0322	0.0370	0.0423	0.0481	0.0544	0.0612	0.0685	0.0764
h	72.21	171.69	272.57	376.69	487.60	616.77	1279.4	1358.54	1425.2	1486.9	1546.6	1605.6	1664.3	1723.2	1782.3
s	0.1286	0.2921	0.4344	0.5631	0.6851	0.8129	1.4712	1.4968	1.5478	1.5916	1.6312	1.6678	1.7022	1.7344	1.7657
v	0.0160	0.0165	0.0173	0.0185	0.0202	0.0235	0.2906	0.3500	0.3988	0.4426	0.4836	0.5229	0.5609	0.5980	0.6343
h	72.7*	172.15	272.95	376.93	487.56	615.58	1261.1	1347.2	1417.1	1480.6	1541.1	1601.2	1660.7	1720.1	1779.7
s	0.1284	0.2918	0.4341	0.5626	0.6843	0.8109	1.4054	1.4768	1.5302	1.5753	1.6156	1.6528	1.6876	1.7204	1.7516

2000 (635.80)	<i>v</i>	0.0160	0.0165	0.0173	0.0184	0.0201	0.0233	0.2488	0.3072	0.3534	0.3942	0.4320	0.4680	0.5027	0.5365	0.5695
	<i>h</i>	73.26	172.60	273.32	377.19	487.53	614.48	1240.9	1353.4	1408.7	1474.1	1536.2	1596.9	1657.0	1717.0	1777.1
	<i>s</i>	0.1283	0.2916	0.4337	0.5621	0.6834	0.8091	1.3794	1.4578	1.5138	1.5603	1.6014	1.6391	1.6743	1.7075	1.7389
2500 (663.11)	<i>v</i>	0.0160	0.0165	0.0173	0.0184	0.0200	0.0230	0.1681	0.2293	0.2712	0.3068	0.3390	0.3692	0.3980	0.4259	0.4529
	<i>h</i>	74.57	173.74	274.27	377.82	487.50	612.08	1176.7	1303.4	1386.7	1457.5	1522.9	1585.9	1647.8	1709.2	1770.4
	<i>s</i>	0.1280	0.2910	0.4329	0.5609	0.6815	0.8048	1.3076	1.4129	1.4766	1.5269	1.5703	1.6094	1.6456	1.6796	1.7116
3000 (695.33)	<i>v</i>	0.0160	0.0165	0.0172	0.0183	0.0200	0.0228	0.0982	0.1759	0.2161	0.2484	0.2770	0.3033	0.3282	0.3522	0.3753
	<i>h</i>	75.88	174.88	275.22	378.47	487.52	610.08	1060.5	1267.0	1363.2	1440.2	1509.4	1574.8	1638.5	1701.4	1761.8
	<i>s</i>	0.1277	0.2904	0.4320	0.5597	0.6796	0.8009	1.1966	1.3692	1.4429	1.4976	1.5434	1.5841	1.6214	1.6561	1.6888
3200 (705.08)	<i>v</i>	0.0160	0.0165	0.0172	0.0183	0.0199	0.0227	0.0335	0.1588	0.1987	0.2301	0.2576	0.2827	0.3065	0.3291	0.3510
	<i>h</i>	76.4	175.3	275.6	378.7	487.5	609.4	800.8	1250.9	1353.4	1433.1	1503.8	1570.3	1634.8	1698.3	1761.2
	<i>s</i>	0.1276	0.2902	0.4317	0.5592	0.6788	0.7994	0.9708	1.3515	1.4300	1.4866	1.5335	1.5749	1.6126	1.6477	1.6806
3500	<i>v</i>	0.0160	0.0164	0.0172	0.0183	0.0199	0.0225	0.0307	0.1364	0.1764	0.2066	0.2326	0.2563	0.2784	0.2995	0.3198
	<i>h</i>	77.2	176.0	276.2	379.1	487.6	608.4	779.4	1224.6	1338.2	1422.2	1495.5	1563.3	1629.2	1693.6	1757.2
	<i>s</i>	0.1274	0.2899	0.4312	0.5585	0.6777	0.7973	0.9508	1.3242	1.4112	1.4709	1.5194	1.5618	1.6002	1.6358	1.6691
4000	<i>v</i>	0.0159	0.0164	0.0172	0.0182	0.0198	0.0223	0.0287	0.1052	0.1463	0.1752	0.1994	0.2210	0.2411	0.2601	0.2783
	<i>h</i>	78.5	177.2	277.1	379.8	487.7	606.9	763.0	1174.3	1311.6	1403.6	1481.3	1552.2	1619.8	1685.7	1750.6
	<i>s</i>	0.1271	0.2893	0.4304	0.5573	0.6760	0.7940	0.9343	1.2754	1.3807	1.4461	1.4976	1.5417	1.5812	1.6177	1.6516
5000	<i>v</i>	0.0159	0.0164	0.0171	0.0181	0.0196	0.0219	0.0268	0.0591	0.1038	0.1312	0.1529	0.1718	0.1890	0.2050	0.2203
	<i>h</i>	81.1	179.5	279.1	381.2	488.1	604.6	746.0	1042.9	1252.9	1364.6	1452.1	1529.1	1600.9	1670.0	1737.4
	<i>s</i>	0.1265	0.2881	0.4287	0.5550	0.6726	0.7880	0.9153	1.1593	1.3207	1.4001	1.4582	1.5061	1.5481	1.5863	1.6216
6000	<i>v</i>	0.0159	0.0163	0.0170	0.0180	0.0195	0.0216	0.0256	0.0397	0.0757	0.1020	0.1221	0.1391	0.1544	0.1684	0.1817
	<i>h</i>	83.7	181.7	281.0	382.7	488.6	602.9	736.1	945.1	1188.8	1323.6	1422.3	1505.9	1582.0	1654.2	1724.2
	<i>s</i>	0.1258	0.2870	0.4271	0.5528	0.6693	0.7826	0.9026	1.0176	1.2615	1.3574	1.4229	1.4748	1.5194	1.5593	1.5962
7000	<i>v</i>	0.0158	0.0163	0.0170	0.0180	0.0193	0.0213	0.0248	0.0334	0.0573	0.0816	0.1004	0.1160	0.1298	0.1424	0.1542
	<i>h</i>	86.2	184.4	283.0	384.2	489.3	601.7	729.3	901.8	1124.9	1281.7	1392.2	1482.6	1563.1	1638.6	1711.1
	<i>s</i>	0.1252	0.2859	0.4256	0.5507	0.6663	0.7777	0.8926	1.0350	1.2055	1.3171	1.3904	1.4466	1.4938	1.5355	1.5735

• Compressed (subcooled) water to the left of the vertical lines; superheated steam to the right of the vertical lines; supercritical steam below the horizontal line.

Table A-4a Saturated steam properties, temperature table (SI units)

Temperature, °C	Pressure,		Specific volume, m ³ /kg			Specific enthalpy, kJ/kg			Specific entropy, kJ/(kg)(K)		
	bar	psia	v_f	v_g	v_{fg}	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
0.01	0.00611	0.0886	0.0010002	206.3	0.00	2501	0.0000	9.1544	0.0000	9.1544	9.1544
1	0.00657	0.0952	0.0010001	192.6	4.22	2498	0.0154	9.1127	0.0154	9.1127	9.1281
2	0.00705	0.1023	0.0010001	179.9	8.42	2496	0.0306	9.0712	0.0306	9.0712	9.1018
3	0.00758	0.1099	0.0010001	168.2	12.63	2493	0.0458	9.0299	0.0458	9.0299	9.0757
4	0.00813	0.1179	0.0010001	157.3	16.84	2491	0.0610	8.9888	0.0610	8.9888	9.0498
5	0.00872	0.1265	0.0010001	147.2	21.05	2489	0.0762	8.9479	0.0762	8.9479	9.0241
6	0.00935	0.1356	0.0010001	137.8	25.25	2485	0.0913	8.9065	0.0913	8.9065	8.9978
7	0.01001	0.1452	0.0010001	129.1	29.45	2482	0.1063	8.8673	0.1063	8.8673	8.9736
8	0.01072	0.1555	0.0010002	121.0	33.55	2482	0.1212	8.8273	0.1212	8.8273	8.9485
9	0.01147	0.1664	0.0010003	113.4	37.85	2479	0.1361	8.7877	0.1361	8.7877	8.9238
10	0.01228	0.1781	0.0010004	106.42	42.04	2477	0.1510	8.7484	0.1510	8.7484	8.8994
11	0.01312	0.1903	0.0010005	99.91	46.22	2475	0.1658	8.7094	0.1658	8.7094	8.8752
12	0.01402	0.2033	0.0010006	93.84	50.41	2473	0.1805	8.6708	0.1805	8.6708	8.8513
13	0.01497	0.2171	0.0010007	88.18	54.60	2470	0.1952	8.6324	0.1952	8.6324	8.8276
14	0.01597	0.2316	0.0010008	82.90	58.78	2468	0.2098	8.5942	0.2098	8.5942	8.8040
15	0.01704	0.2471	0.0010010	77.97	62.97	2465	0.2244	8.5562	0.2244	8.5562	8.7806
16	0.01817	0.2635	0.0010011	73.39	67.16	2463	0.2389	8.5185	0.2389	8.5185	8.7574
17	0.01936	0.2808	0.0010013	69.10	71.34	2461	0.2534	8.4810	0.2534	8.4810	8.7344
18	0.02062	0.2991	0.0010015	65.09	75.53	2458	0.2678	8.4438	0.2678	8.4438	8.7116
19	0.02196	0.3185	0.0010016	61.34	79.72	2456	0.2821	8.4066	0.2821	8.4066	8.6890
20	0.02377	0.3390	0.0010018	57.84	83.90	2454	0.2964	8.3701	0.2964	8.3701	8.6665
21	0.02486	0.3606	0.0010021	54.56	88.09	2451	0.3107	8.3335	0.3107	8.3335	8.6442
22	0.02643	0.3833	0.0010023	51.50	92.27	2449	0.3249	8.2971	0.3249	8.2971	8.6220
23	0.02808	0.4073	0.0010025	48.62	96.46	2447	0.3391	8.2610	0.3391	8.2610	8.6001
24	0.02982	0.4325	0.0010028	45.93	100.63	2444	0.3532	8.2253	0.3532	8.2253	8.5785
25	0.03166	0.4592	0.0010030	43.40	104.81	2442	0.3672	8.1898	0.3672	8.1898	8.5570
26	0.03360	0.4873	0.0010033	41.04	108.99	2440	0.3812	8.1546	0.3812	8.1546	8.5358
27	0.03564	0.5169	0.0010036	38.82	113.17	2437	0.3951	8.1196	0.3951	8.1196	8.5147

28	0.03779	0.5481	0.0010038	36.73	117.35	2435	2552	0.4090	8.0848	8.4938
29	0.04004	0.5807	0.0010041	34.77	121.53	2432	2554	0.4228	8.0502	8.4730
30	0.04241	0.6151	0.0010044	32.93	125.71	2430	2556	0.4366	8.0157	8.4523
31	0.04491	0.6514	0.0010047	31.20	129.89	2428	2558	0.4503	7.9816	8.4319
32	0.04753	0.6894	0.0010051	29.57	134.07	2425	2559	0.4640	7.9477	8.4117
33	0.05029	0.7294	0.0010054	28.04	138.25	2423	2561	0.4777	7.9139	8.3916
34	0.05318	0.7713	0.0010057	26.60	142.42	2421	2563	0.4913	7.8803	8.3716
35	0.05622	0.8154	0.0010061	25.24	146.60	2418	2565	0.5049	7.8470	8.3519
36	0.05940	0.8615	0.0010064	23.97	150.78	2416	2567	0.5185	7.8138	8.3323
37	0.06274	0.9061	0.0010068	22.77	154.96	2414	2569	0.5320	7.7809	8.3129
38	0.06624	0.9607	0.0010071	21.63	159.14	2411	2570	0.5455	7.7483	8.2938
39	0.06991	1.0140	0.0010075	20.56	163.32	2409	2572	0.5589	7.7159	8.2748
40	0.07375	1.0697	0.0010079	19.55	167.50	2406	2574	0.5723	7.6836	8.2559
45	0.0958	1.3898	0.0010098	15.276	188.35	2394.9	2583.3	0.6183	7.5277	8.1661
50	0.1234	1.7890	0.0010121	12.046	209.26	2382.9	2592.2	0.7035	7.3741	8.0776
55	0.1574	2.2830	0.0010145	9.579	230.17	2370.8	2601.0	0.7677	7.2248	7.9925
60	0.1992	2.8892	0.0010171	7.679	251.09	2358.6	2609.7	0.8310	7.0798	7.9108
65	0.2501	3.6274	0.0010199	6.202	272.03	2346.3	2618.3	0.8933	6.9388	7.8322
70	0.3116	4.5194	0.0010228	5.946	292.97	2334.0	2626.9	0.9548	6.8017	7.7565
75	0.3855	5.5912	0.0010259	4.134	313.93	2321.5	2635.4	1.0154	6.6681	7.6835
80	0.4736	6.8690	0.0010292	3.409	334.92	2308.8	2643.8	1.0753	6.5380	7.6132
85	0.5780	8.3832	0.0010326	2.829	355.91	2296.1	2652.0	1.1343	6.4111	7.5454
90	0.7011	10.169	0.0010361	2.3613	376.94	2283.2	2660.1	1.1925	6.2873	7.4799
95	0.8453	12.280	0.0010398	1.9822	397.99	2270.2	2668.2	1.2501	6.1665	7.4166
100	1.0133	14.697	0.0010437	1.6730	419.06	2256.9	2676.0	1.3069	6.0485	7.3554
105	1.2080	17.521	0.0010477	1.4193	440.17	2243.6	2683.7	1.3630	5.9331	7.2962
110	1.4327	20.780	0.0010519	1.2099	461.32	2230.0	2691.3	1.4185	5.8203	7.2388
115	1.6906	24.520	0.0010562	1.0363	482.50	2216.2	2698.7	1.4733	5.7099	7.1832
120	1.9854	28.796	0.0010606	0.8915	503.72	2202.2	2706.0	1.5276	5.6017	7.1293
125	2.321	33.663	0.0010652	0.7702	524.99	2188.0	2713.0	1.5813	5.4957	7.0769
130	2.701	39.175	0.0010700	0.6681	546.31	2173.6	2719.9	1.6344	5.3917	7.0261
135	3.131	45.411	0.0010750	0.5818	567.68	2158.9	2726.6	1.6869	5.2897	6.9766
140	3.614	52.417	0.0010801	0.5085	589.10	2144.0	2733.1	1.7390	5.1894	6.9284
145	4.155	60.263	0.0010853	0.4460	610.59	2128.7	2739.3	1.7906	5.0910	6.8815
150	4.760	69.038	0.0010908	0.3924	632.15	2113.2	2745.4	1.8416	4.9941	6.8358
155	5.433	78.799	0.0010964	0.3464	653.77	2097.4	2751.2	1.8923	4.8989	6.7911

(continued)

Table A-4a Saturated steam properties, temperature table (SI units) (Continued)

Temperature, °C	Pressure,		Specific volume, m ³ /kg				Specific enthalpy, kJ/kg				Specific entropy, kJ/(kg·K)	
	bar	psia	v_f	v_g	h_f	h_g	h_f	h_g	s_f	s_g		
160	6.181	89.648	0.0011022	0.3068	675.47	2081.3	2756.7	1.9425	4.8050	6.7475		
165	7.008	101.64	0.0011082	0.2724	697.25	2064.8	2762.0	1.9923	4.7126	6.7048		
170	7.920	114.87	0.0011145	0.2426	719.12	2047.9	2767.1	2.0416	4.6214	6.6630		
175	8.924	129.43	0.0011209	0.21654	741.07	2030.7	2771.8	2.0906	4.5314	6.6221		
180	10.027	145.43	0.0011275	0.19380	763.12	2013.2	2776.3	2.1393	4.4476	6.5819		
185	11.233	162.92	0.0011344	0.17386	785.26	1995.2	2780.4	2.1876	4.3548	6.5424		
190	12.551	182.04	0.0011415	0.15632	807.52	1976.7	2784.3	2.2356	4.2680	6.5036		
195	13.987	202.86	0.0011489	0.14084	829.88	1957.9	2787.8	2.2833	4.1821	6.4654		
200	15.549	225.52	0.0011565	0.12716	852.37	1938.6	2790.9	2.3307	4.0971	6.4278		
210	19.077	276.89	0.0011726	0.10424	897.73	1898.5	2796.2	2.4247	3.9293	6.3539		
220	23.198	336.45	0.0011900	0.08664	943.67	1856.2	2799.9	2.5178	3.7639	6.2817		
230	27.98	405.82	0.0012087	0.07145	990.27	1811.7	2802.0	2.6102	3.6006	6.2107		
240	33.48	485.59	0.0012291	0.05965	1037.60	1764.6	2802.2	2.7020	3.4386	6.1406		
250	39.78	576.96	0.0012513	0.05004	1085.78	1714.7	2800.4	2.7935	3.2773	6.0708		
260	46.94	680.81	0.0012756	0.04213	1134.94	1661.5	2796.4	2.8848	3.1161	6.0010		
270	55.06	798.58	0.0013025	0.03559	1185.23	1604.6	2789.9	2.9763	2.9544	5.9304		
280	64.20	931.14	0.0013324	0.03013	1236.84	1543.6	2780.4	3.0683	2.7903	5.8586		
290	74.46	1079.95	0.0013659	0.02554	1290.01	1477.6	2767.6	3.1611	2.6237	5.7848		
300	85.93	1246.31	0.0014041	0.021649	1345.05	1406.0	2751.0	3.2552	2.4529	5.7081		
310	98.70	1431.52	0.0014480	0.018334	1402.39	1327.6	2730.0	3.3512	2.2766	5.6278		
320	112.89	1637.33	0.0014995	0.015480	1462.60	1241.1	2703.7	3.4500	2.0923	5.5423		
330	128.63	1865.62	0.0015615	0.012989	1526.52	1143.6	2670.2	3.5528	1.8962	5.4490		
340	146.05	2118.28	0.0016387	0.010780	1595.47	1030.7	2626.2	3.6616	1.6811	5.3427		
350	165.35	2398.20	0.0017411	0.008799	1671.94	895.7	2567.7	3.7800	1.4376	5.2177		
360	186.75	2708.58	0.0018959	0.006940	1764.17	721.3	2485.4	3.9210	1.1390	5.0600		
370	210.54	3053.62	0.0022136	0.004973	1890.21	452.6	2342.8	4.1108	0.7036	4.8144		
374.15	221.20	3208.23	0.00317	0.00317	2107.37	0.0	2107.4	4.4129	0.0	4.4429		

Table A-4b Saturated steam: pressure table (SI units)

bar	Pressure, psia	Temperature, °C	Specific volume, m ³ /kg		Specific enthalpy, kJ/kg			Specific entropy, kJ/(kg)(K)		
			v_f	v_g	h_f	h_g	s_f	s_g		
0.010	0.1450	6.98	0.0010001	129.20	29.30	2484.9	2514.2	0.1034	8.8714	8.9748
0.015	0.2176	13.04	0.0010007	87.98	54.71	2470.6	2525.3	0.1958	8.6312	8.8270
0.020	0.2901	17.51	0.0010014	67.00	73.48	2460.0	2533.5	0.2569	8.4659	8.7228
0.025	0.3626	21.08	0.0010021	54.24	88.49	2451.6	2540.0	0.3083	8.3340	8.6423
0.030	0.4351	24.10	0.0010028	45.66	101.05	2444.5	2545.4	0.3510	8.2258	8.5768
0.040	0.5802	28.98	0.0010041	34.81	121.46	2432.9	2554.4	0.4197	8.0541	8.4738
0.050	0.7252	32.90	0.0010053	28.19	137.82	2423.7	2561.5	0.4740	7.9203	8.3943
0.060	0.8702	36.16	0.0010064	23.74	151.50	2415.0	2566.9	0.5191	7.8105	8.3296
0.070	1.0153	39.03	0.0010075	20.53	163.43	2409	2572.4	0.5591	7.7149	8.2740
0.080	1.1603	41.54	0.0010085	18.10	173.9	2402.6	2576.5	0.5915	7.6364	8.2279
0.090	1.3053	43.79	0.0010094	16.20	183.3	2396.7	2580.0	0.6225	7.5635	8.1860
0.10	1.4504	45.84	0.0010103	14.68	191.9	2392.3	2584.2	0.6488	7.5006	8.1494
0.11	1.5954	47.72	0.0010111	13.40	199.7	2388.3	2588.0	0.6740	7.4420	8.1160
0.12	1.7405	49.45	0.001012	12.36	207.1	2383.5	2590.6	0.6964	7.3891	8.0855
0.14	2.0305	52.58	0.001013	10.69	220.3	2375.8	2596.1	0.7371	7.2964	8.0317
0.16	2.3206	55.34	0.001015	9.433	231.9	2369.1	2601.0	0.7728	7.2124	7.9852
0.18	2.6107	57.82	0.001016	8.445	242.4	2362.9	2605.3	0.8045	7.1397	7.9442
0.20	2.9008	60.09	0.001017	7.649	251.9	2357.4	2609.3	0.8332	7.0745	7.9077
0.25	3.6259	64.99	0.001020	6.204	272.6	2345.1	2617.7	0.8947	6.9359	7.8306
0.30	4.3511	69.12	0.001022	5.229	289.9	2334.9	2624.8	0.9458	6.8220	7.7678
0.40	5.8015	75.88	0.001026	3.993	318.3	2318.0	2636.3	1.0279	6.6413	7.6692
0.50	7.2519	81.35	0.001030	3.240	341.3	2304.1	2645.4	1.0930	6.5001	7.5931
0.60	8.7023	85.95	0.001033	2.732	360.6	2292.4	2653.0	1.1471	6.3841	7.5312
0.80	11.6030	93.52	0.001038	2.087	392.3	2273.0	2665.3	1.2344	6.1994	7.4338
1.0	14.5038	99.64	0.001043	1.694	418.0	2257.0	2675.0	1.3038	6.0548	7.3580
1.013	14.696	100	0.001043	1.673	419.5	2256.1	2675.6	1.3079	6.0462	7.354
1.2	17.4045	104.81	0.001047	1.428	439.7	2243.4	2683.1	1.3617	5.9356	7.2973
1.4	20.305	109.3	0.001051	1.237	458.6	2231.4	2690.0	1.4115	5.834	7.2456
1.6	23.206	113.3	0.001054	1.091	475.5	2220.5	2696.0	1.4553	5.7456	7.2009
1.8	26.107	116.9	0.001058	0.9775	490.8	2210.6	2701.4	1.4945	5.6670	7.1615

(continued)

Table A-4b Saturated steam: pressure table (SI units) (Continued)

bar	Pressure, psia	Temperature, °C	Specific volume, m ³ /kg		Specific enthalpy, kJ/kg			Specific entropy, kJ/(kg·K)		
			v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
120.2		29.008	0.001061	8857	504.7	2201.5	2706.2	1.5300	5.5963	7.1263
127.4		36.259	0.001067	7187	535.2	2181.3	2716.5	1.6068	5.4451	7.0519
133.6		43.511	0.001073	6058	561.2	2163.7	2724.9	1.6710	5.3201	6.9911
143.6		58.015	0.001084	4625	604.3	2133.8	2738.1	1.7755	5.1196	6.8951
151.9		72.519	0.001093	3749	639.8	2108.4	2748.2	1.8594	4.9611	6.8205
158.9		87.023	0.001101	3157	670.1	2086.3	2756.4	1.9299	4.8293	6.7592
170.4		116.03	0.001115	2404	720.7	2048.0	2768.7	2.0451	4.6169	6.6620
179.9		145.04	0.001127	1944	762.5	2015.1	2777.6	2.1378	4.4479	6.5857
188.0		174.05	0.001139	1633	798.5	1985.9	2784.4	2.2160	4.3065	6.5225
195.1		203.05	0.001149	1408	830.2	1959.4	2789.6	2.2838	4.1847	6.4685
201.4		232.06	0.001159	1238	858.8	1934.8	2793.6	2.3440	4.0770	6.4210
207.1		261.07	0.001168	1104	884.9	1911.8	2796.7	2.3981	3.9805	6.3786
212.4		290.08	0.001176	996	908.9	1890.2	2799.1	2.4474	3.8927	6.3401
224.0		362.59	0.001197	780	962.4	1840.2	2802.6	2.5549	3.7018	6.2567
233.9		435.11	0.001216	667	1008.7	1795.0	2803.7	2.6461	3.5400	6.1861
250.4		580.15	0.001252	498	1154.5	1639.4	2801.0	2.7968	3.2725	6.0693
264.0		725.19	0.001286	394	1213.7	1570.2	2783.9	2.9206	3.0520	5.9726
275.6		870.23	0.001319	324	1267.4	1504.3	2771.7	3.0271	2.8613	5.8884
285.9		1015.3	0.001352	274	1274.0	1440.5	2757.5	3.2073	2.5351	5.7424
295.1		1160.3	0.001385	235	1363.7	1379.3	2743.0	3.2870	2.3910	5.6780
303.3		1305.3	0.001417	205	1407.9	1316.4	2724.3	3.3600	2.2533	5.6133
311.1		1450.4	0.001453	180	1450.9	1255.0	2705.2	3.4296	2.1224	5.5520
318.2		1595.4	0.001489	160	1450.2	1193.2	2684.4	3.4980	1.9956	5.4916
324.8		1740.5	0.001527	144	1511.1	1130.7	2661.8	3.5599	1.8717	5.4316
330.9		1885.5	0.001567	128	1570.4	1066.8	2637.2	3.6220	1.7490	5.3710
336.8		2030.5	0.001610	115	1648.9	931.3	2580.2	3.7441	1.5007	5.2448
347.4		2320.6	0.001710	89	1731.4	777.4	2508.8	3.8703	1.2336	5.1039
357.1		2610.7	0.001840	67	1828.5	581.0	2409.5	4.0172	0.9093	4.9265
365.8		2900.8	0.002041	50	2098.8	0	2098.8	4.4289	0	4.4289
374.1		3203.7	0.003155	20						

Table A-5 Properties of superheated steam (SI units)

Pressure, bar (saturated temperature, °C)	Temperature, °C										
	100	150	200	250	300	400	500	600	700	800	
0.1 (45.81)	<i>v</i>	17.196	19.51	21.825	24.136	26.445	31.063	35.679	40.295	44.911	49.526
	<i>h</i>	2867.5	2783.0	2879.5	2977.3	3076.5	3279.6	3489.1	3705.4	3928.7	4159.0
	<i>s</i>	8.4479	8.6882	8.9038	9.1002	9.2813	9.6077	9.8978	10.1608	10.4028	10.6281
0.5 (81.33)	<i>v</i>	3.412	3.889	4.356	4.820	5.284	6.209	7.134	8.057	8.981	9.904
	<i>h</i>	2682.5	2780.1	2877.7	2976.0	3075.5	3278.9	3488.7	3705.1	3928.5	4158.9
	<i>s</i>	7.6947	7.9401	8.1580	8.3556	8.5373	8.8642	9.1546	9.4178	9.6599	9.8852
1.0 (99.63)	<i>v</i>	1.6958	1.9364	2.172	2.406	2.639	3.103	3.565	4.028	4.490	4.952
	<i>h</i>	2676.2	2776.4	2875.3	2974.3	3074.3	3278.2	3488.1	3704.7	3928.2	4158.6
	<i>s</i>	7.3614	7.6134	7.8343	8.0333	8.2158	8.5435	8.8342	9.0976	9.3398	9.5652
2.0 (120.23)	<i>v</i>	0.9596	1.0803	1.1988	1.3162	1.4316	1.5493	1.7814	2.013	2.244	2.475
	<i>h</i>	2768.8	2870.5	2971.0	3071.8	3276.6	3487.1	3704.0	3927.6	4158.2	4388.6
	<i>s</i>	7.2795	7.5066	7.7086	7.8926	8.2218	8.5133	8.7770	9.0194	9.2449	9.4576
3.0 (135.55)	<i>v</i>	0.6339	0.7163	0.7964	0.8753	1.0315	1.1867	1.3414	1.4957	1.6499	1.8041
	<i>h</i>	2761.0	2865.6	2967.6	3069.3	3275.0	3486.0	3703.2	3927.1	4157.8	4388.2
	<i>s</i>	7.0778	7.3115	7.5166	7.7022	8.0330	8.3251	8.5892	8.8319	9.0576	9.2706
4.0 (143.63)	<i>v</i>	0.4708	0.5342	0.5951	0.6548	0.7726	0.8893	1.0552	1.215	1.372	1.5272
	<i>h</i>	2752.8	2860.5	2964.2	3066.8	3273.4	3484.9	3702.4	3926.5	4157.3	4387.7
	<i>s</i>	6.9299	7.1706	7.5662	7.8985	8.1913	8.4558	8.6987	8.9244	9.1372	9.3441
5 (151.86)	<i>v</i>	0.4249	0.4744	0.5226	0.6173	0.7109	0.8041	0.8969	0.9896	1.0823	1.1750
	<i>h</i>	2855.4	2960.7	3064.2	3271.9	3483.9	3701.7	3925.9	4156.9	4387.1	4617.3
	<i>s</i>	7.0592	7.2709	7.4599	7.7938	8.0873	8.3823	8.6787	8.9762	9.2747	9.5741

(continued)

Table A-5 Properties of superheated steam (SI units) (Continued)

Pressure, bar (saturated temperature, °C)	Temperature, °C									
	100	150	200	250	300	400	500	600	700	800
6 (158.58)	v		0.3520	0.3938	0.4344	0.5137	0.5920	0.6697	0.7472	0.8245
	h		2850.1	2957.2	3061.6	3270.3	3482.8	3700.9	3925.3	4156.5
	s		6.9665	7.1816	7.3724	7.7079	8.0021	8.2674	8.5107	8.7367
10 (179.91)	v		0.2060	0.2327	0.2579	0.3066	0.3541	0.4011	0.4478	0.4923
	h		2827.9	2942.6	3051.2	3263.9	3478.5	3697.9	3923.1	4154.7
	s		6.6940	6.9247	7.1229	7.4651	7.7622	8.0290	8.2731	8.4996
20 (212.42)	v			0.1114	0.1255	0.1512	0.1757	0.1996	0.2232	0.2467
	h			2902.5	3023.5	3247.6	3467.6	3690.1	3917.4	4150.3
	s			6.5453	6.7664	7.1271	7.4317	7.7024	7.9487	8.1765
30 (233.9)	v			0.0758	0.08114	0.0994	0.1162	0.1324	0.1484	0.1641
	h			2855.8	2993.5	3230.9	3456.5	3682.3	3911.7	4145.9
	s			6.2872	6.5390	6.9212	7.2338	7.5085	7.7571	7.9862
40 (250.4)	v				0.0588	0.0734	0.0864	0.09885	0.11095	0.12287
	h				2960.7	3213.6	3445.3	3674.4	3905.9	4141.5
	s				6.3615	6.7690	7.0901	7.3688	7.6198	7.8502
50 (263.99)	v					0.0453	0.0578	0.06857	0.07869	0.08849
	h					2924.5	3195.7	3433.8	3666.5	3900.1
	s					6.2084	6.6459	6.9759	7.2589	7.5122
60 (275.64)	v						0.0362	0.0474	0.0567	0.0653
	h						2884.2	3177.2	3422.2	3658.4
	s						6.0674	6.5408	6.8803	7.1677
70 (285.88)	v							0.0295	0.0393	0.0481
	h							2838.4	3158.1	3410.3
	s							5.9305	6.4478	6.7975

80 (295.06)	v	0.0443	0.0418	0.0486	0.0548	0.0610
	h	3138.3	3398.3	3642.0	3882.4	4123.8
	s	5.7906	6.7240	7.0206	7.2812	7.5173
90 (303.40)	v	0.0299	0.0368	0.0429	0.0486	0.0541
	h	3117.8	3386.1	3633.7	3876.5	4119.3
	s	6.2854	6.6576	6.9589	7.2221	7.4596
100 (311.06)	v	0.0264	0.0328	0.0384	0.0436	0.0486
	h	3096.5	3373.7	3625.3	3870.5	4114.8
	s	6.2120	6.5966	6.9029	7.1687	7.4077
150 (342.24)	v	0.0157	0.0208	0.0249	0.0286	0.0321
	h	2975.5	3308.6	3582.3	3840.1	4092.4
	s	5.8811	6.3443	6.6776	6.9572	7.2040
200 (365.81)	v	0.0099	0.0148	0.0182	0.0211	0.0239
	h	2818.1	3238.2	3537.6	3809.0	4069.7
	s	5.5540	6.1401	6.5048	6.7993	7.0544
250	v	0.0060	0.0111	0.0141	0.0167	0.0189
	h	2580.2	3162.4	3491.4	3777.5	4047.1
	s	5.1418	5.9592	6.3602	6.6707	6.9345
300	v	0.0038	0.0087	0.0115	0.0137	0.0156
	h	2151.1	3081.1	3443.9	3745.6	4024.2
	s	4.4738	5.7905	6.2331	6.5606	6.8332
350	v	0.0021	0.0069	0.0095	0.0115	0.0313
	h	1987.6	2994.4	3395.5	3713.5	4001.5
	s	4.2126	5.6282	6.1179	6.4631	6.7450
400	v	0.0019	0.0056	0.0081	0.0099	0.0115
	h	1930.9	2903.3	3346.4	3681.2	3978.7
	s	4.1135	5.4700	6.0114	6.3750	6.6662
500	v	0.00173	0.0039	0.0061	0.0077	0.0091
	h	1874.6	2720.1	3247.6	3616.8	3933.6
	s	4.0031	5.1726	5.8178	6.2189	6.5290

THERMODYNAMIC PROPERTIES OF FREON-12

Table B-1 Saturation properties of Freon-12 (English units)*

Temperature, °F	Pressure, psia	Specific volume, ft ³ /lb _m		Specific enthalpy, Btu/lb _m			Specific entropy, Btu/(lb _m °R)	
		<i>v_f</i>	<i>v_g</i>	<i>h_f</i>	<i>h_{fg}</i>	<i>h_g</i>	<i>s_f</i>	<i>s_g</i>
60	72.433	0.011913	0.55839	21.766	61.643	83.409	0.046180	0.16479
62	74.807	0.011947	0.54112	22.221	61.380	83.601	0.047044	0.16470
64	77.239	0.011982	0.52450	22.676	61.116	83.792	0.047905	0.16460
66	79.729	0.012017	0.50848	23.133	60.849	83.982	0.048765	0.16451
68	82.279	0.012053	0.49305	23.591	60.580	84.171	0.049624	0.16442
70	84.888	0.012089	0.47818	24.050	60.309	84.359	0.050482	0.16434
72	87.559	0.012126	0.46383	24.511	60.035	84.546	0.051338	0.16425
74	90.292	0.012163	0.45000	24.973	59.759	84.732	0.052193	0.16417
76	93.087	0.012201	0.43666	25.435	59.481	84.916	0.053047	0.16408
78	95.946	0.012239	0.42378	25.899	59.201	85.100	0.053900	0.16400
80	98.870	0.012277	0.41135	26.365	58.917	85.282	0.054751	0.16392
82	101.86	0.012316	0.39935	26.832	58.631	85.463	0.055602	0.16384
84	104.92	0.012356	0.38776	27.300	58.343	85.643	0.056452	0.16376
86	108.04	0.012396	0.37657	27.769	58.052	85.821	0.057301	0.16368
88	111.23	0.012437	0.36575	28.241	57.757	85.998	0.058149	0.16360
90	114.49	0.012478	0.35529	28.713	57.461	86.174	0.058997	0.16353
92	117.82	0.012520	0.34518	29.187	57.161	86.348	0.059844	0.16345
94	121.22	0.012562	0.33540	29.663	56.858	86.521	0.060690	0.16338
96	124.70	0.012605	0.32594	30.140	56.551	86.691	0.061536	0.16330
98	128.24	0.012649	0.31679	30.619	56.242	86.861	0.062381	0.16323
100	131.86	0.012693	0.30794	31.100	55.929	87.029	0.063227	0.16315
102	135.56	0.012738	0.29937	31.583	55.613	87.196	0.064072	0.16308
104	139.33	0.012783	0.29106	32.067	55.293	87.360	0.064916	0.16301
106	143.18	0.012829	0.28303	32.553	54.970	87.523	0.065761	0.16293
108	147.11	0.012976	0.27524	33.041	54.643	87.684	0.066606	0.16282
110	151.11	0.012924	0.26769	33.531	54.313	87.844	0.067451	0.16279

Table B-1 Saturation properties of Freon-12 (English units)* (Continued)

Temperature, °F	Pressure, psia	Specific volume, ft ³ /lb _m		Specific enthalpy, Btu/lb _m			Specific entropy, Btu/(lb _m ·°R)	
		<i>v_g</i>	<i>v_f</i>	<i>h_g</i>	<i>h_{fg}</i>	<i>h_f</i>	<i>s_g</i>	<i>s_f</i>
112	155.19	0.012972	0.26037	34.023	53.978	88.001	0.068296	0.16271
114	159.36	0.013022	0.25328	34.517	53.639	88.156	0.069141	0.16264
116	163.61	0.013072	0.24641	35.014	53.296	88.310	0.069987	0.16256
118	167.94	0.013123	0.23974	35.512	52.949	88.461	0.070833	0.16249
120	172.35	0.013174	0.23326	36.013	52.597	88.610	0.071680	0.16241
122	176.85	0.013227	0.22698	36.516	52.241	88.757	0.072528	0.16234
124	181.43	0.013280	0.22089	37.021	51.881	88.902	0.073376	0.16226
126	186.10	0.013335	0.21497	37.529	51.515	89.044	0.074225	0.16218
128	190.86	0.013390	0.20922	38.040	51.144	89.184	0.075075	0.16210
130	195.71	0.013447	0.20364	38.553	50.768	89.321	0.075927	0.16202
132	200.64	0.013504	0.19821	39.069	50.387	89.456	0.076779	0.16194
134	205.67	0.013563	0.19294	39.588	50.000	89.588	0.077633	0.16185
136	210.79	0.013623	0.18782	40.110	49.608	89.718	0.078489	0.16177
138	216.01	0.013684	0.18283	40.634	49.210	89.844	0.079346	0.16168
140	221.32	0.013746	0.17799	41.162	48.805	89.967	0.080205	0.16159
142	226.72	0.013810	0.17327	41.693	48.394	90.087	0.081065	0.16150
144	232.22	0.013874	0.16868	42.227	47.977	90.204	0.081928	0.16141
146	237.82	0.013941	0.16422	42.765	47.553	90.318	0.082794	0.16132
148	243.51	0.014008	0.15987	43.306	47.122	90.428	0.083661	0.16123
150	249.31	0.014078	0.15564	43.850	46.684	90.534	0.084531	0.16114
152	255.20	0.014148	0.15151	44.399	46.238	90.637	0.085404	0.16105
154	261.20	0.014221	0.14750	44.951	45.784	90.735	0.086280	0.16096
156	267.30	0.014295	0.14358	45.508	45.322	90.830	0.087159	0.16087
158	273.51	0.014371	0.13976	46.068	44.852	90.920	0.088041	0.16078
160	279.82	0.014449	0.13604	46.633	44.373	90.006	0.088927	0.16069
162	286.24	0.014529	0.13241	47.202	43.885	91.087	0.089817	0.16060
164	292.77	0.014611	0.12886	47.777	43.386	91.163	0.090710	0.16051
166	299.40	0.014695	0.12540	48.355	42.879	91.234	0.091608	0.16042
168	306.15	0.014782	0.12202	48.939	42.360	91.299	0.092511	0.16033
170	313.00	0.014871	0.11873	49.529	41.830	91.359	0.093418	0.15985
172	319.97	0.014963	0.11550	50.123	41.290	91.413	0.094330	0.15969
174	327.06	0.015058	0.11235	50.724	40.736	91.460	0.095248	0.15953
176	334.25	0.015155	0.10927	51.330	40.171	91.501	0.096172	0.15936
178	341.57	0.015256	0.10625	51.943	39.592	91.535	0.097102	0.15919
180	349.00	0.015360	0.10330	52.562	39.009	91.561	0.098039	0.15900
182	356.55	0.015468	0.10041	53.188	38.391	91.579	0.098982	0.15881
184	364.23	0.015580	0.097584	53.822	37.767	91.589	0.099933	0.15861
186	372.02	0.015696	0.094810	54.463	37.127	91.590	0.10089	0.15839
188	379.94	0.015816	0.092089	55.111	36.469	91.580	0.10186	0.15817
190	387.98	0.015942	0.089418	55.769	35.792	91.561	0.10284	0.15793
192	396.14	0.016073	0.086796	56.435	35.096	91.531	0.10382	0.15768
194	404.44	0.016209	0.084218	57.111	34.377	91.488	0.10482	0.15741
196	412.86	0.016352	0.081683	57.797	33.636	91.433	0.10583	0.15713
198	421.41	0.016502	0.079188	58.494	32.869	91.363	0.10685	0.15683
200	430.09	0.016659	0.076723	59.203	32.075	91.278	0.10789	0.15651
202	438.91	0.016826	0.074301	59.924	31.252	91.176	0.10894	0.15617
204	447.85	0.017002	0.071903	60.659	30.396	91.055	0.11001	0.15580
206	456.94	0.017188	0.069531	61.409	29.505	90.914	0.11109	0.15541

(continued)

Table B-1 Saturation properties of Freon-12 (English units)* (Continued)

Temperature, °F	Pressure, psia	Specific volume, ft ³ /lb _m		Specific enthalpy, Btu/lb _m			Specific entropy, Btu/(lb _m)°R	
		v_f	v_g	h_f	h_{fg}	h_g	s_f	s_g
208	466.16	0.017387	0.067179	62.175	28.574	90.749	0.11220	0.15499
210	475.52	0.017601	0.064843	62.959	27.599	90.558	0.11332	0.15453
212	485.01	0.017713	0.062517	63.764	26.573	90.337	0.11448	0.15404
214	494.65	0.018079	0.060193	64.591	25.490	90.081	0.11566	0.15349
216	504.44	0.018351	0.057864	65.444	24.341	89.785	0.11687	0.15290
218	514.36	0.018651	0.055518	66.327	23.113	89.440	0.11813	0.15223
220	524.43	0.018986	0.053140	67.246	21.790	89.036	0.11943	0.15149
222	534.65	0.019365	0.050711	68.209	20.350	88.559	0.12079	0.15064
224	545.02	0.019804	0.048200	69.228	18.757	87.985	0.12223	0.14966
226	555.54	0.020327	0.045559	70.320	16.958	87.278	0.12377	0.14850
228	566.20	0.020978	0.042702	71.519	14.854	86.373	0.12545	0.14705
230	577.03	0.021854	0.039435	72.893	12.229	85.122	0.12739	0.14512
232	588.01	0.023262	0.035041	74.651	8.335	82.986	0.12987	0.14191
233.6 (Critical)	596.9	0.02870	0.02870	78.86	0	78.86	0.1359	0.1359

* Tables B-1 and B-2 from data of E. I. du Pont de Nemours and Company. Freon is a registered trademark of du Pont.

Table B-2 Properties of superheated Freon-12 (English units)

Pressure psia	Saturated temperature °F	Temperature, T											
		40	50	60	70	80	90	100	150	200	300		
1	3	7.363	7.726	8.038	8.450	8.812	9.173	9.5	9.893	10.79	11.69	12.51	13.00
1	8	73.72	76.36	79.05	81.78	84.56	87.41	90.3	93.25	100.84	108.75	116.88	124.89
1	62.5	0.1920	0.1976	0.2038	0.2095	0.2149	0.220	0.2258	0.2308	0.2366	0.2413	0.2453	0.2490
1	10	1.821	4.006	4.189	4.371	4.556	4.740	4.923	5.179	5.831	6.281	6.781	7.281
1	15	76.11	78.81	81.56	84.35	87.19	90.11	93.05	100.66	108.63	116.88	124.89	132.89
1	100	0.1801	0.1861	0.1919	0.1977	0.2033	0.2087	0.2141	0.2191	0.2239	0.2286	0.2331	0.2376
1	20	2.521	2.640	2.771	2.905	3.039	3.143	3.266	3.371	3.877	4.191	4.505	4.819
1	20.88	78.89	78.39	81.37	84.18	87.03	89.94	92.91	100.53	108.49	116.78	124.89	132.89
1	100	0.17307	0.17913	0.18499	0.19074	0.19635	0.20185	0.20723	0.21258	0.21781	0.22291	0.22789	0.23276
1	20	1.965	2.060	2.155	2.250	2.344	2.437	2.529	2.669	2.903	3.131	3.353	3.570
1	20.88	78.19	81.14	83.97	86.83	89.75	92.75	95.80	100.40	108.35	116.57	124.89	132.89
1	100	0.17407	0.17966	0.18531	0.19118	0.19688	0.20229	0.20729	0.21190	0.21624	0.22041	0.22441	0.22824
1	20	1.712	1.793	1.873	1.952	2.029	2.105	2.179	2.252	2.422	2.591	2.759	2.926
1	20.88	80.95	83.78	86.67	89.63	92.65	95.75	98.90	102.20	105.65	109.25	112.90	116.60
1	100	0.17613	0.18216	0.18783	0.19316	0.19788	0.20229	0.20629	0.21000	0.21345	0.21665	0.21960	0.22230
1	30	1.664	1.630	1.605	1.579	1.552	1.524	1.494	1.464	1.384	1.343	1.303	1.263
1	30.88	80.75	83.56	86.49	89.44	92.42	95.42	98.42	100.12	101.83	103.53	105.23	106.93
1	100	0.17278	0.17859	0.18429	0.18969	0.19469	0.19927	0.20343	0.20719	0.21065	0.21381	0.21676	0.21951
1	30	1.099	1.237	1.295	1.352	1.409	1.469	1.550	1.609	1.609	1.609	1.609	1.609
1	30.88	80.49	83.40	86.30	89.20	92.26	95.26	98.26	99.98	101.63	103.28	104.93	106.58
1	100	0.16963	0.17561	0.18162	0.18710	0.19209	0.19658	0.20058	0.20408	0.20708	0.20958	0.21158	0.21308
1	40	1.044	1.095	1.144	1.194	1.244	1.294	1.344	1.394	1.435	1.455	1.475	1.495
1	40.88	80.20	86.11	89.01	91.91	94.81	97.71	100.61	103.51	106.41	109.31	112.21	115.11
1	100	0.17132	0.17666	0.18165	0.18629	0.19058	0.19453	0.19814	0.20144	0.20444	0.20714	0.20954	0.21174
1	50	0.823	0.863	0.903	0.943	0.983	1.023	1.063	1.103	1.142	1.176	1.206	1.236
1	50.88	82.76	85.72	88.72	91.75	94.75	97.75	100.75	103.75	106.75	109.75	112.75	115.75
1	100	0.16908	0.17425	0.17900	0.18340	0.18745	0.19115	0.19450	0.19745	0.20005	0.20235	0.20435	0.20605
1	60	0.708	0.748	0.788	0.828	0.868	0.908	0.948	0.988	1.027	1.061	1.091	1.116
1	60.88	85.13	88.13	91.13	94.13	97.13	100.13	103.13	106.13	109.13	112.13	115.13	118.13
1	100	0.17120	0.17600	0.18040	0.18440	0.18800	0.19120	0.19400	0.19640	0.19840	0.19990	0.20100	0.20180

(continued)

Table B-2 Properties of superheated Freon-12 (English units) (Continued)

Pressure, psia	Temperature, °F											
	40	-20	0	20	40	60	80	100	150	200	250	300
100						0.853	0.642	0.673	0.750	0.824	0.896	0.967
120						84.64	87.96	91.05	98.84	107.10	115.54	124.29
140						0.16263	0.17594	0.17961	0.19310	0.20667	0.21830	0.23027
160							0.5343	0.5668	0.6108	0.701	0.784	0.858
180							87.35	90.68	95.84	106.84	115.53	124.08
200							0.17108	0.17978	0.19035	0.20338	0.21869	0.23560
220							0.5608	0.5968	0.6527	0.6853	0.742	0.792
240							90.33	96.32	106.56	115.07	123.88	132.88
260							0.17443	0.18013	0.18813	0.20113	0.21536	0.23154
280							0.442	0.499	0.553	0.616	0.676	0.737
300							89.93	97.99	106.29	114.84	123.67	132.67
320							0.17210	0.18590	0.19864	0.21453	0.23247	0.25147
340							0.357	0.407	0.454	0.500	0.543	0.583
360							88.13	97.30	105.70	114.35	123.25	132.40
380							0.16803	0.18207	0.19529	0.20782	0.22060	0.23460
400							0.341	0.381	0.423	0.462	0.502	0.542
420							96.85	105.14	113.85	122.85	132.15	141.65
440							0.17668	0.18205	0.18205	0.20479	0.21701	0.23011
460							0.318	0.355	0.372	0.408	0.445	0.482
480							95.82	104.50	113.15	122.09	131.22	140.52
500							0.17561	0.18927	0.20213	0.21444	0.22844	0.24344
520							0.294	0.287	0.323	0.353	0.383	0.413
540							94.69	103.85	112.83	121.82	131.02	140.42
560							0.17284	0.18688	0.19947	0.21437	0.23037	0.24737
580							0.241	0.255	0.284	0.314	0.344	0.374
600							94.16	103.12	112.23	121.42	130.72	140.22
620							0.16970	0.18395	0.19713	0.21113	0.22613	0.24213
640							0.188	0.232	0.284	0.342	0.402	0.462
660							93.32	102.39	111.59	120.91	130.31	139.81
680							0.16685	0.18142	0.19387	0.20753	0.22253	0.23853

THERMODYNAMIC PROPERTIES OF AMMONIA

Table C-1 Saturated ammonia: pressure table (English units)*

Pressure, psia	Temperature, °F	Specific volume, ft ³ /lb _m			Specific enthalpy, Btu/lb _m			Specific entropy, Btu/(lb _m ·°R)		
		v_f	v_g	v_g	h_f	h_g	h_g	s_f	s_g	s_g
80	44.40	0.02546	3.630	3.655	91.7	532.3	624.0	0.1982	1.0563	1.2545
82	45.66	0.02550	3.545	3.570	93.1	531.2	624.3	0.2010	1.0514	1.2524
84	46.89	0.02554	3.462	3.488	94.5	530.1	624.6	0.2037	1.0467	1.2504
86	48.11	0.02558	3.385	3.411	95.8	529.0	624.8	0.2064	1.0420	1.2484
88	49.30	0.02562	3.311	3.337	97.2	527.9	625.1	0.2090	1.0375	1.2465
90	50.47	0.02566	3.240	3.266	98.4	526.9	625.3	0.2115	1.0330	1.2445
92	51.62	0.02570	3.172	3.198	99.8	525.8	625.6	0.2141	1.0286	1.2427
94	52.76	0.02573	3.166	3.132	101.0	524.8	625.8	0.2165	1.0243	1.2408
96	53.87	0.02577	3.044	3.070	102.3	523.8	626.1	0.2190	1.0201	1.2391
98	54.97	0.02581	2.984	3.010	103.5	522.8	626.3	0.2213	1.0160	1.2373
100	56.05	0.02584	2.926	2.952	104.7	521.8	626.5	0.2237	1.0119	1.2356
102	57.11	0.02588	2.870	2.896	105.9	520.8	626.7	0.2260	1.0079	1.2339
104	58.16	0.02591	2.817	2.843	107.1	519.8	626.9	0.2282	1.0041	1.2323
106	59.19	0.02594	2.765	2.791	108.3	518.8	627.1	0.2305	1.0002	1.2307
108	60.21	0.02598	2.715	2.741	109.4	517.9	627.3	0.2327	0.9964	1.2291
110	61.21	0.02601	2.670	2.693	110.5	517.0	627.5	0.2348	0.9927	1.2275
116	64.13	0.02611	2.533	2.559	113.9	514.2	628.1	0.2411	0.9819	1.2230
118	65.08	0.02614	2.491	2.517	114.9	513.3	628.2	0.2431	0.9784	1.2215
120	66.92	0.02618	2.450	2.476	116.0	512.4	628.4	0.2452	0.9749	1.2201
122	66.94	0.02621	2.411	2.437	117.1	511.5	628.6	0.2471	0.9715	1.2186
124	67.86	0.02624	2.373	2.399	118.1	510.6	628.7	0.2491	0.9682	1.2173
126	68.76	0.02628	2.336	2.362	119.1	509.8	628.9	0.2510	0.9649	1.2159
128	69.65	0.02631	2.300	2.326	120.1	508.9	629.0	0.2529	0.9616	1.2145
130	70.53	0.02634	2.265	2.291	121.1	508.1	629.2	0.2548	0.9584	1.2132
132	71.40	0.02637	2.232	2.258	122.1	507.2	629.3	0.2567	0.9552	1.2119
134	72.26	0.02640	2.199	2.225	123.1	506.4	629.5	0.2585	0.9521	1.2106
136	73.11	0.02643	2.167	2.193	124.1	505.5	629.6	0.2603	0.9490	1.2093
138	73.95	0.02646	2.136	2.162	125.1	504.7	629.8	0.2621	0.9460	1.2081
140	74.79	0.02649	2.106	2.132	126.0	503.9	629.9	0.2638	0.9430	1.2068
142	75.61	0.02652	2.076	2.103	126.9	503.1	630.0	0.2656	0.9400	1.2056
144	76.42	0.02655	2.048	2.075	127.9	502.3	630.2	0.2673	0.9371	1.2044
146	77.23	0.02658	2.020	2.047	128.8	501.5	630.3	0.2690	0.9342	1.2032

148	78.03	0.02661	1.993	2.020	129.7	500.7	630.4	0.2707	0.9313	1.2020
150	78.81	0.02664	1.967	1.994	130.6	499.9	630.5	0.2724	0.9285	1.2009
152	79.60	0.02667	1.941	1.968	131.5	499.1	630.6	0.2740	0.9257	1.1997
154	80.37	0.02669	1.916	1.943	132.4	498.3	630.7	0.2756	0.9229	1.1985
156	81.13	0.02672	1.892	1.919	133.3	497.6	630.9	0.2772	0.9202	1.1974
158	81.89	0.02675	1.868	1.895	134.2	496.8	631.0	0.2788	0.9175	1.1963
160	82.64	0.02678	1.845	1.872	135.0	496.1	631.1	0.2804	0.9148	1.1952
162	83.39	0.02681	1.822	1.849	135.9	495.3	631.2	0.2820	0.9122	1.1942
164	84.12	0.02684	1.800	1.827	136.8	494.5	631.3	0.2835	0.9096	1.1931
166	84.85	0.02686	1.778	1.805	137.6	493.8	631.4	0.2850	0.9070	1.1920
168	85.57	0.02689	1.757	1.784	138.4	493.1	631.5	0.2866	0.9044	1.1910
170	86.29	0.02692	1.737	1.764	139.3	492.3	631.6	0.2881	0.9019	1.1900
172	87.00	0.02695	1.717	1.744	140.1	491.6	631.7	0.2895	0.8994	1.1889
174	87.71	0.02697	1.697	1.724	140.9	490.8	631.7	0.2910	0.8969	1.1879
176	88.40	0.02700	1.678	1.705	141.7	490.1	631.8	0.2925	0.8944	1.1869
178	89.10	0.02703	1.660	1.686	142.5	489.4	631.9	0.2939	0.8920	1.1859
180	89.78	0.02705	1.640	1.667	143.3	488.7	632.0	0.2954	0.8896	1.1850
182	90.46	0.02709	1.622	1.649	144.1	488.0	632.1	0.2968	0.8872	1.1840
184	91.80	0.02714	1.587	1.614	145.6	486.6	632.2	0.2996	0.8825	1.1821
186	92.47	0.02717	1.570	1.597	146.4	485.9	632.3	0.3010	0.8801	1.1811
188	93.13	0.02720	1.554	1.581	147.2	485.2	632.4	0.3024	0.8778	1.1802
190	93.78	0.02722	1.537	1.564	147.9	484.5	632.4	0.3037	0.8755	1.1792
192	94.43	0.02725	1.521	1.548	148.7	483.8	632.5	0.3050	0.8733	1.1783
194	95.07	0.02727	1.505	1.533	149.5	483.1	632.6	0.3064	0.8710	1.1774
196	95.71	0.02730	1.490	1.517	150.2	482.4	632.6	0.3077	0.8688	1.1765
198	96.34	0.02732	1.475	1.502	150.9	481.8	632.7	0.3090	0.8666	1.1756
200	99.43	0.02745	1.404	1.431	154.6	478.4	633.0	0.3154	0.8559	1.1713
202	102.42	0.02757	1.339	1.367	158.0	475.2	633.2	0.3216	0.8455	1.1671
204	105.30	0.02770	1.279	1.307	161.4	472.0	633.4	0.3275	0.8356	1.1631
206	108.09	0.02782	1.225	1.253	164.7	468.9	633.6	0.3332	0.8260	1.1592
208	110.80	0.02794	1.174	1.202	168.0	465.8	633.8	0.3388	0.8167	1.1555
210	113.42	0.02806	1.127	1.155	171.1	462.8	633.9	0.3441	0.8077	1.1518
212	115.97	0.02817	1.084	1.112	174.1	459.8	633.9	0.3494	0.7989	1.1483
214	118.45	0.02829	1.044	1.072	177.1	456.9	634.0	0.3545	0.7904	1.1449
216	120.86	0.02840	1.006	1.034	180.0	454.0	634.0	0.3594	0.7821	1.1415
218	123.21	0.02851	0.970	0.999	182.9	451.1	634.0	0.3642	0.7741	1.1383

* Table C-1 From Ref. 139.

Table C-2 Properties of superheated ammonia (English units)*

Pressure, psia (saturated temperature, °F)		Temperature of superheated vapor, °F																		
		40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400
60 (30.21)	v	4.933	5.184	5.428	5.665	5.897	6.126	6.352	6.576	6.798	7.019	7.238	7.457	7.675	7.892					
	h	626.8	639.0	650.7	662.1	673.3	684.4	695.5	706.5	717.5	728.6	739.7	750.9	762.1	773.3					
70 (37.70)	v	4.177	4.401	4.615	4.822	5.025	5.224	5.420	5.615	5.807	5.998	6.187	6.376	6.563	6.750					
	h	623.9	636.6	648.7	660.4	671.8	683.1	694.3	705.5	716.6	727.7	738.9	750.1	761.4	772.7					
80 (53.10)	v	3.812	4.005	4.190	4.371	4.548	4.722	4.893	5.063	5.231	5.398	5.565	5.730	5.894						
	h	634.3	646.7	658.7	670.4	681.8	693.2	704.4	715.6	726.9	738.1	749.4	760.7	772.1						
90 (59.47)	v	3.353	3.529	3.698	3.862	4.021	4.178	4.332	4.484	4.635	4.785	4.933	5.081	5.228						
	h	631.8	644.7	657.0	668.9	680.5	692.0	703.4	714.7	726.0	737.3	748.7	760.0	771.5						
100 (66.05)	v	2.571	2.814	3.038	3.247	3.444	3.633	3.813	3.988	4.157	4.321	4.481	4.637	4.789						
	h	614.9	630.4	645.4	660.3	675.2	690.0	704.8	719.5	734.2	748.9	763.6	778.3	793.0						
110 (66.02)	v	2.837	2.981	3.120	3.255	3.386	3.515	3.642	3.768	3.892	4.015	4.137	4.259							
	h	642.6	655.4	668.2	681.0	693.8	706.6	719.4	732.2	745.0	757.8	770.6	783.4	796.2						
120 (70.53)	v	2.576	2.712	2.842	2.967	3.089	3.209	3.326	3.442	3.557	3.671	3.783	3.895							
	h	638.3	651.6	664.2	676.5	688.4	700.2	711.8	723.4	734.9	746.5	758.0	769.6							
130	v	2.355	2.484	2.606	2.724	2.838	2.949	3.059	3.167	3.273	3.379	3.483	3.587	3.690						
	h	636.0	649.7	662.7	675.1	687.2	699.1	710.9	722.5	734.1	745.7	757.3	769.0	780.6						
(70.53)	v	2.260	2.509	2.736	2.947	3.146	3.335	3.516	3.690	3.858	4.022	4.181	4.336	4.487						
	h	626.0	641.7	656.7	671.1	685.0	698.4	711.3	723.7	735.7	747.2	758.7	770.2	781.7						

140	2.166	2.288	2.404	2.515	2.622	2.727	2.830	2.931	3.030	3.129	3.227	3.323	3.420
(74.79)	633.8	647.8	661.1	673.7	686.0	698.0	709.9	721.6	733.3	745.0	756.7	768.3	780.0
	1.240	1.2396	1.2628	1.2843	1.3045	1.3246	1.3448	1.3650	1.3763	1.3928	1.4088	1.4243	1.4395
150	2.001	2.118	2.228	2.334	2.435	2.534	2.631	2.726	2.820	2.912	3.004	3.095	3.185
(78.81)	631.4	645.9	659.4	672.3	684.8	696.9	708.9	720.7	732.5	744.3	756.0	767.7	779.4
	1.2025	1.2289	1.2526	1.2745	1.2949	1.3142	1.3327	1.3504	1.3675	1.3840	1.4001	1.4157	1.4310
160	1.969	2.075	2.175	2.272	2.365	2.457	2.547	2.635	2.723	2.809	2.895	2.980	3.064
(82.64)	643.9	657.8	670.9	683.5	695.8	707.9	719.9	731.7	743.5	755.3	767.1	778.9	790.7
	1.2186	1.2429	1.2652	1.2859	1.3054	1.3240	1.3419	1.3591	1.3757	1.3919	1.4076	1.4229	1.4379
170	1.837	1.939	2.035	2.127	2.216	2.303	2.389	2.473	2.555	2.637	2.718	2.798	2.878
(86.29)	641.9	656.1	669.4	682.3	694.7	706.9	719.1	731.3	742.8	754.6	766.4	778.3	790.1
	1.2087	1.2336	1.2563	1.2773	1.2971	1.3159	1.3338	1.3512	1.3679	1.3841	1.3999	1.4153	1.4303
180	1.720	1.818	1.910	1.999	2.084	2.167	2.248	2.328	2.407	2.484	2.561	2.637	2.713
(89.78)	639.9	654.4	668.0	681.0	693.6	705.9	718.1	730.1	742.0	753.9	765.8	777.7	789.6
	1.1992	1.2247	1.2477	1.2691	1.2891	1.3081	1.3262	1.3436	1.3605	1.3768	1.3926	1.4081	1.4231
190	1.615	1.710	1.799	1.884	1.966	2.045	2.123	2.199	2.274	2.348	2.421	2.493	2.565
(93.13)	637.8	652.6	666.5	679.7	692.5	704.9	717.2	729.3	741.3	753.2	765.2	777.1	789.0
	1.1899	1.2160	1.2396	1.2612	1.2815	1.3007	1.3189	1.3365	1.3534	1.3698	1.3857	1.4012	1.4163
200	1.520	1.612	1.698	1.780	1.859	1.935	2.009	2.082	2.154	2.225	2.295	2.364	2.500
(96.34)	635.6	650.9	665.0	678.4	691.3	703.9	716.3	728.4	740.5	752.5	764.5	776.5	788.5
	1.1947	1.2077	1.2117	1.2537	1.2742	1.2935	1.3120	1.3296	1.3467	1.3631	1.3791	1.3947	1.4099
210	1.524	1.608	1.687	1.762	1.836	1.907	1.977	2.046	2.113	2.180	2.246	2.312	2.377
(99.43)	649.1	663.5	677.1	690.2	702.9	715.3	727.6	739.8	751.8	763.9	775.9	787.9	800.0
	1.1966	1.2240	1.2464	1.2622	1.2767	1.3053	1.3231	1.3402	1.3568	1.3728	1.3884	1.4037	1.4186
220	1.443	1.525	1.601	1.675	1.745	1.814	1.881	1.947	2.012	2.076	2.140	2.203	2.265
(102.42)	647.3	662.0	675.8	689.1	701.9	714.4	726.8	739.0	751.1	763.2	775.3	787.4	799.5
	1.1917	1.2167	1.2394	1.2604	1.2801	1.2989	1.3168	1.3340	1.3507	1.3668	1.3825	1.3978	1.4127
230	1.370	1.449	1.524	1.594	1.663	1.729	1.794	1.857	1.920	1.982	2.043	2.103	2.163
(105.30)	645.4	660.4	674.5	687.9	700.9	713.5	726.0	738.3	750.5	762.6	774.7	786.8	798.9
	1.1840	1.2095	1.2325	1.2538	1.2738	1.2927	1.3107	1.3281	1.3448	1.3610	1.3767	1.3921	1.4070

(continued)

Table C-2 Properties of superheated ammonia (English units)* (Continued)

Pressure, psia (saturated temperature, °F)	Temperature of superheated vapor, °F																			
	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	
v	1.302	1.380	1.452	1.521	1.587	1.651	1.714	1.775	1.835	1.895	1.954	2.012	2.069	2.126						
240 h	643.5	658.8	673.1	686.7	699.8	712.6	725.1	737.5	747.8	762.0	774.1	786.3	798.4	810.6						
(108.09) s	1.1764	1.2025	1.2259	1.2475	1.2677	1.2867	1.3049	1.3224	1.3392	1.3554	1.3712	1.3866	1.4216	1.4163						
v	1.240	1.316	1.386	1.453	1.518	1.580	1.640	1.699	1.758	1.815	1.872	1.928	1.983	2.038	2.063					
250 h	641.5	657.2	671.8	685.5	698.8	711.7	724.3	736.7	749.1	761.3	773.5	785.7	797.9	810.1	822.3					
(110.80) s	1.1690	1.1936	1.2195	1.2414	1.2617	1.2810	1.2993	1.3168	1.3337	1.3501	1.3659	1.3814	1.3964	1.4111	1.4255					
v	1.182	1.257	1.326	1.391	1.453	1.514	1.572	1.630	1.686	1.741	1.796	1.850	1.904	1.957	2.009					
260 h	639.5	655.6	670.4	684.4	697.7	710.7	723.4	736.0	748.4	760.7	772.9	785.2	797.4	809.6	821.9					
(113.42) s	1.1617	1.1889	1.2132	1.2354	1.2560	1.2754	1.2938	1.3115	1.3285	1.3449	1.3608	1.3763	1.3914	1.4062	1.4206					
v	1.128	1.202	1.269	1.333	1.394	1.452	1.509	1.565	1.620	1.673	1.726	1.778	1.830	1.881	1.932					
270 h	637.5	653.9	669.0	683.2	696.7	709.8	722.6	735.2	747.7	760.0	772.3	784.6	796.9	809.1	821.4					
(115.97) s	1.1544	1.1823	1.2071	1.2296	1.2504	1.2700	1.2885	1.3063	1.3234	1.3399	1.3559	1.3714	1.3866	1.4014	1.4158					
v	1.078	1.151	1.217	1.279	1.339	1.396	1.451	1.505	1.558	1.610	1.661	1.712	1.762	1.811	1.861					
280 h	635.4	652.2	667.6	681.9	695.6	708.8	721.8	734.4	747.0	759.4	771.7	784.0	796.3	808.7	821.0					
(118.45) s	1.1473	1.1759	1.2011	1.2239	1.2449	1.2647	1.2834	1.3013	1.3184	1.3350	1.3511	1.3667	1.3819	1.3967	1.4112					
v	1.103	1.168	1.229	1.287	1.343	1.397	1.449	1.501	1.551	1.601	1.650	1.698	1.747	1.794						
290 h	650.5	666.1	680.7	694.6	707.9	720.9	733.7	746.3	758.7	771.1	783.5	795.8	808.2	820.5						
(120.86) s	1.695	1.1952	1.2183	1.2396	1.2596	1.2784	1.2964	1.3137	1.3303	1.3464	1.3621	1.3773	1.3922	1.4067						
v	1.058	1.123	1.183	1.239	1.294	1.346	1.397	1.447	1.496	1.544	1.592	1.639	1.686	1.732						
300 h	648.7	664.7	679.5	693.5	706.9	720.0	732.9	745.5	758.1	770.5	782.9	795.3	807.7	820.1						
(123.21) s	1.1632	1.1894	1.2129	1.2344	1.2546	1.2736	1.2917	1.3090	1.3257	1.3419	1.3576	1.3729	1.3878	1.4024						

* Abstracted from Ref. 189.

THERMODYNAMIC PROPERTIES OF PROPANE

Table D Saturation properties of propane C₃H₈*

Temperature, °F	Pressure, psia	Specific volume, ft ³ /lb _m			Specific enthalpy, Btu/lb _m			Specific entropy, Btu/(lb _m ·°R)		
		<i>y_g</i>	<i>v_g</i>	<i>v_f</i>	<i>h_{fg}</i>	<i>h_g</i>	<i>s_f</i>	<i>s_g</i>	<i>s_f</i>	<i>s_g</i>
0	37.81	0.0289	2.711	2.740	205.0	172.2	377.2	0.9812	0.3743	1.3555
10	45.85	0.0293	2.271	2.300	210.7	169.3	380.0	0.9932	0.3599	1.3531
20	55.00	0.0297	1.900	1.930	216.6	166.0	382.6	1.0050	0.3460	1.3510
30	65.70	0.0301	1.570	1.600	222.3	162.8	385.1	1.0167	0.3324	1.3491
40	77.80	0.0306	1.299	1.330	227.9	159.6	387.5	1.0283	0.3190	1.3473
50	91.50	0.0310	1.109	1.140	233.8	156.1	389.9	1.0389	0.3067	1.3456
60	106.9	0.0315	0.953	0.984	239.6	152.6	392.2	1.0511	0.2930	1.3441
70	124.3	0.0321	0.822	0.854	245.7	148.7	394.4	1.0624	0.2803	1.3427
80	143.6	0.0327	0.712	0.745	251.9	144.5	396.4	1.0737	0.2680	1.3413
90	165.0	0.333	0.610	0.643	258.2	140.1	398.3	1.0850	0.2550	1.3400
100	188.7	0.3379	0.524	0.558	264.6	135.6	400.2	1.0963	0.2415	1.3388
110	214.8	0.0345	0.453	0.487	271.1	130.8	401.9	1.1080	0.2298	1.3378
120	243.4	0.0353	0.391	0.426	278.0	125.8	403.8	1.1195	0.2173	1.3368
130	274.5	0.0361	0.334	0.370	285.2	120.2	405.4	1.1310	0.2046	1.3356
140	308.4	0.0370	0.283	0.320	292.7	114.3	407.0	1.1430	0.1917	1.3347
150	354.4	0.0382	0.240	0.278	300.2	108.0	408.2	1.1552	0.1774	1.3336
160	385.0	0.0396	0.200	0.240	308.4	100.4	408.8	1.1680	0.1623	1.3303
170	426.0	0.0413	0.167	0.208	317.5	91.1	408.6	1.1816	0.1456	1.3272
180	473.2	0.0437	0.136	0.180	327.5	80.1	407.6	1.1970	0.1253	1.3223
190	523.4	0.0471	0.102	0.149	339.2	65.4	404.6	1.2140	0.1016	1.3156
200	575.0	0.0521	0.061	0.113	353.5	44.8	398.3	1.2360	0.0680	1.3040

* Abstracted from Ref. 190.

THERMODYNAMIC PROPERTIES OF SODIUM

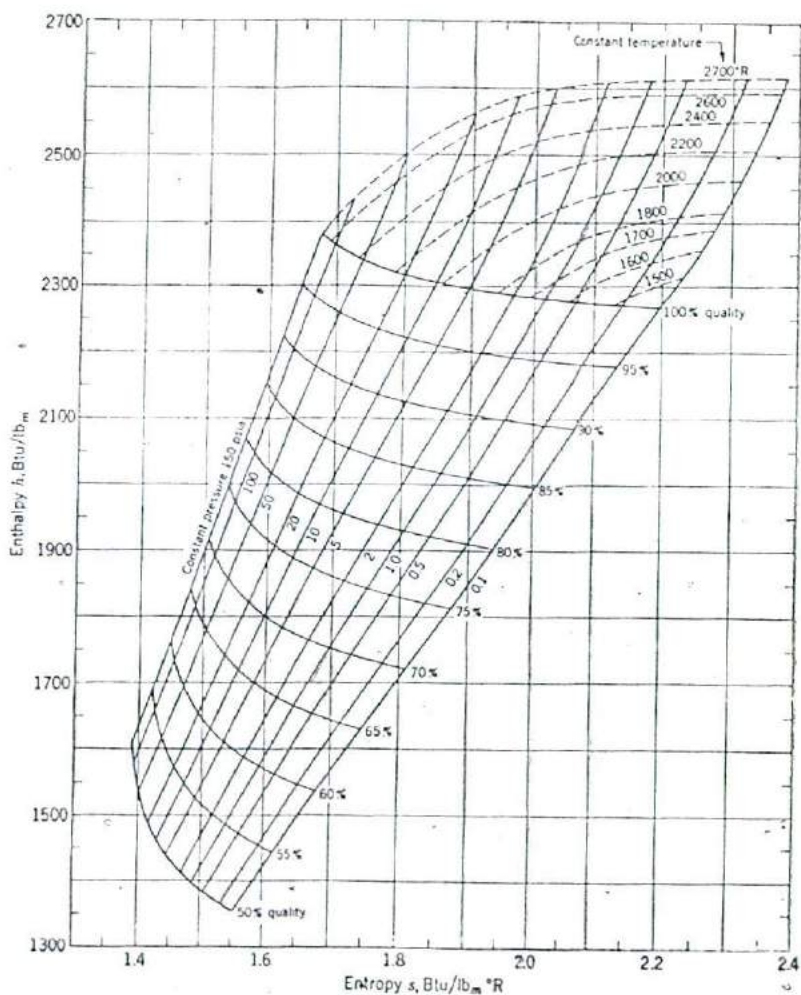


Figure E-1 Mollier diagram for sodium. (Based on charts, courtesy Flight Propulsion Laboratory and the General Electric Company.)

Table E Thermodynamic properties of sodium*

Temperature, °R (Sat. press., psia)	Sat. liquid	Sat. vapor	Temperature of					
			800	900	1000	1100	1200	
700 (3.7472×10^{-3})	r A s	1.7232 $\times 10^3$ 219.7 0.6554	2180.5 3.4560	2203.1 2.5159	2224.7 3.5424	2246.4 3.5532	2258.0 3.5557	2289.5 3.5643
800 (3.0109×10^{-3})	r A s	1.5543 $\times 10^3$ 252.3 0.7290	1.4375 $\times 10^3$ 2100.1 3.1437	.....	8.3435 $\times 10^3$ 2224.4 3.1925	9.3155 $\times 10^3$ 2245.3 3.2153	1.0249 $\times 10^4$ 2267.3 3.2350	1.1190 $\times 10^4$ 2295.5 3.2546
900 (1.1480×10^{-2})	r A s	1.7864 $\times 10^3$ 284.3 0.7967	3.6411 $\times 10^3$ 2217.5 2.9148	.....	.....	4.0267 $\times 10^4$ 2245.2 2.9440	4.4718 $\times 10^4$ 2267.7 2.9653	4.8749 $\times 10^4$ 2289.4 2.9841
1000 (1.3909×10^{-2})	r A s	1.4150 $\times 10^3$ 315.9 0.7998	3.323 $\times 10^3$ 2232.7 2.7198	.....	.....	.....	3.6534 $\times 10^4$ 2264.8 2.7474	4.0245 $\times 10^4$ 2285.6 2.7680
1100 (1.0616×10^{-2})	r A s	1.8496 $\times 10^3$ 347.0 0.8296	4.7592 $\times 10^3$ 2245.1 2.5581	.....	.....	.....	.....	5.2512 $\times 10^4$ 2292.7 2.5878
1200 (5.7398×10^{-3})	r A s	1.8812 $\times 10^3$ 377.7 0.8503	9.5235 $\times 10^3$ 2254.9 2.4207	.....	.....	.....	.....	.....
1300 (2.3016×10^{-2})	r A s	1.9128 $\times 10^3$ 408.2 0.8807	2.4520 $\times 10^4$ 2262.8 2.3073	.....	.....	.....	.....	.....
1400 (8.1347×10^{-3})	r A s	1.6444 $\times 10^3$ 438.4 0.9031	7.6798 $\times 10^3$ 2269.3 2.2109	.....	.....	.....	.....	.....
1500 (2.3351×10^{-2})	r A s	1.6740 $\times 10^3$ 468.7 0.9239	2.8334 $\times 10^3$ 2274.9 2.1282	.....	.....	.....	.....	.....
1600 (5.8425×10^{-3})	r A s	2.0075 $\times 10^3$ 498.5 0.9433	1.1985 $\times 10^4$ 2280.0 2.0367	.....	.....	.....	.....	.....
1700 (1.3170)	r A s	2.0392 $\times 10^3$ 524.5 0.9618	5.5585 $\times 10^3$ 2285.3 1.9948	.....	.....	.....	.....	.....
1800 (2.7184)	r A s	2.0708 $\times 10^3$ 555.8 0.9786	2.8200 $\times 10^3$ 2291.1 1.9411	.....	.....	.....	.....	.....
1900 (5.1529)	r A s	2.1024 $\times 10^3$ 588.8 0.9949	1.5510 $\times 10^3$ 2297.2 1.8941	.....	.....	.....	.....	.....
2000 (9.1833)	r A s	2.1340 $\times 10^3$ 619.1 1.0105	90.014 2304.1 1.8580	.....	.....	.....	.....	.....
2100 (15.392)	r A s	2.1656 $\times 10^3$ 649.7 1.0255	56.185 2312.1 1.8171	.....	.....	.....	.....	.....
2200 (24.692)	r A s	2.1972 $\times 10^3$ 680.7 1.0399	36.338 2321.0 1.7855	.....	.....	.....	.....	.....
2300 (38.013)	r A s	2.2288 $\times 10^3$ 712.0 1.0535	24.454 2330.7 1.7578	.....	.....	.....	.....	.....
2400 (56.212)	r A s	2.2604 $\times 10^3$ 743.8 1.0673	17.109 2341.2 1.7329	.....	.....	.....	.....	.....
2500 (80.236)	r A s	2.2920 $\times 10^3$ 775.2 1.0805	12.388 2352.4 1.7111	.....	.....	.....	.....	.....
2600 (1.1118×10^2)	r A s	2.3236 $\times 10^3$ 809.1 1.0934	9.2328 2365.1 1.6919	.....	.....	.....	.....	.....
2700 (1.5052×10^2)	r A s	2.3551 $\times 10^3$ 842.7 1.1061	7.0380 2378.8 1.6751	.....	.....	.....	.....	.....

* From Ref. 191

1400	1500	1600	2000	2200	2400	2600	2700
2332 7 3 4341	2375 8 3 5605	2419 1 3 6924	2462 3 3 7144	2505 4 3 7358	2548 5 3 7565	2591 5 3 7713	2634 4 3 7795
1 3044 X 10 ⁴ 2312 7 3 2844	1 4407 X 10 ⁴ 2375 8 3 3109	1 5771 X 10 ⁴ 2419 1 3 3425	1 8634 X 10 ⁴ 2462 3 3 3652	2 0449 X 10 ⁴ 2505 4 3 3884	2 2311 X 10 ⁴ 2548 5 3 4044	2 4234 X 10 ⁴ 2591 5 3 5217	2 8186 X 10 ⁴ 2634 4 3 4249
3 6974 X 10 ⁴ 2312 7 3 0179	5 5056 X 10 ⁴ 2375 8 3 0494	7 3188 X 10 ⁴ 2419 1 3 0723	9 1320 X 10 ⁴ 2462 3 3 0947	1 0942 X 10 ⁵ 2505 4 3 1153	1 2844 X 10 ⁵ 2548 5 3 1343	1 4822 X 10 ⁵ 2591 5 3 1511	1 6878 X 10 ⁵ 2634 4 3 1594
4 6974 X 10 ⁴ 2312 6 2 4624	5 5693 X 10 ⁴ 2375 8 2 4808	6 0465 X 10 ⁴ 2419 1 2 4898	6 7118 X 10 ⁴ 2462 3 2 4992	7 332 X 10 ⁴ 2505 4 2 4994	8 0141 X 10 ⁴ 2548 5 2 4988	8 7333 X 10 ⁴ 2591 5 2 4937	9 0609 X 10 ⁴ 2634 4 2 4919
6 1515 X 10 ⁴ 2331 7 2 9293	7 0273 X 10 ⁴ 2375 7 2 9302	7 9139 X 10 ⁴ 2419 0 2 9312	8 7935 X 10 ⁴ 2462 3 2 9336	9 6729 X 10 ⁴ 2505 4 2 9243	1 0552 X 10 ⁵ 2548 5 2 7483	1 1432 X 10 ⁵ 2591 5 2 7601	1 1871 X 10 ⁵ 2634 4 2 7584
1 1345 X 10 ⁵ 2327 6 2 4778	1 3301 X 10 ⁵ 2374 7 2 5049	1 4635 X 10 ⁵ 2419 0 2 5353	1 6293 X 10 ⁵ 2462 2 2 5574	1 7991 X 10 ⁵ 2505 4 2 5785	1 9517 X 10 ⁵ 2548 5 2 5975	2 1144 X 10 ⁵ 2591 5 2 6143	2 1957 X 10 ⁵ 2634 4 2 6226
2 0605 X 10 ⁵ 2312 2 2 3445	3 1124 X 10 ⁵ 2371 4 2 3636	3 5055 X 10 ⁵ 2417 5 2 4115	3 9619 X 10 ⁵ 2461 7 2 4343	4 2931 X 10 ⁵ 2505 1 2 4551	4 6834 X 10 ⁵ 2548 3 2 4742	5 0745 X 10 ⁵ 2591 8 2 4911	5 2055 X 10 ⁵ 2634 3 2 4923
	9 0753 X 10 ⁴ 2 31 8 2 2715	1 0392 X 10 ⁵ 24 4 0 2 3040	1 1460 X 10 ⁵ 24 6 3 2 3240	1 2615 X 10 ⁵ 25 4 3 2 3491	1 3767 X 10 ⁵ 25 8 1 2 3683	1 4916 X 10 ⁵ 25 9 0 2 3802	1 5421 X 10 ⁵ 25 9 3 2 3925
	1 1025 X 10 ⁵ 2372 4 2 1651	3 5625 X 10 ⁴ 2414 7 2 2181	3 9820 X 10 ⁴ 2456 5 2 2332	4 3436 X 10 ⁴ 2502 7 2 2573	4 7029 X 10 ⁴ 2547 2 2 2769	5 1044 X 10 ⁴ 2591 0 2 2940	5 3948 X 10 ⁴ 2612 5 2 3023
	1 4040 X 10 ⁵ 2374 2 2 1142	1 5423 X 10 ⁵ 2374 2 2 1142	1 5423 X 10 ⁵ 2449 0 2 1523	1 7446 X 10 ⁵ 2418 7 2 1745	1 9124 X 10 ⁵ 2545 1 2 1969	2 0743 X 10 ⁵ 2569 7 2 2144	2 1548 X 10 ⁵ 2611 8 2 2225
	6 0659 X 10 ⁴ 2347 2 2 0399	6 6374 X 10 ⁴ 2431 3 2 0747	6 8374 X 10 ⁴ 2431 3 2 0747	7 7140 X 10 ⁴ 2490 5 2 1031	8 4701 X 10 ⁴ 2540 7 2 1252	9 1588 X 10 ⁴ 2587 1 2 1432	9 5458 X 10 ⁴ 2609 8 2 1519
			2 2952 X 10 ⁵ 2402 3 1 9999	3 7033 X 10 ⁵ 2475 6 2 0342	3 7033 X 10 ⁵ 2475 6 2 0342	4 4735 X 10 ⁵ 2532 2 2 0792	4 6158 X 10 ⁵ 2603 9 2 0882
			1 6834 X 10 ⁵ 2219 5 1 9259	1 9197 X 10 ⁵ 2431 8 1 9701	2 1294 X 10 ⁵ 2514 5 1 9669	2 3265 X 10 ⁵ 2573 9 2 0212	2 4224 X 10 ⁵ 2599 3 2 0309
				1 0343 X 10 ⁵ 2417 4 1 9072	1 1816 X 10 ⁵ 2498 0 1 9426	1 2980 X 10 ⁵ 2560 0 1 9673	1 3539 X 10 ⁵ 2588 9 1 9780
				60 665 2372 9 1 8455	65 025 2491 0 1 8070	76 167 2451 9 1 9194	79 656 2573 5 1 9284
				41 754 2431 4 1 8740	46 622 2516 2 1 8674	48 920 2585 2 1 8201	48 920 2552 3 1 8811
				26 214 2385 2 1 7820	29 585 2484 0 1 8201	31 182 2484 0 1 8201	31 182 2525 0 1 8250
						19 490 2465 8 1 7748	20 580 2492 6 1 7922
						13 219 2406 5 1 7321	14 071 2456 5 1 7501
							9 8226 2418 1 1 7120

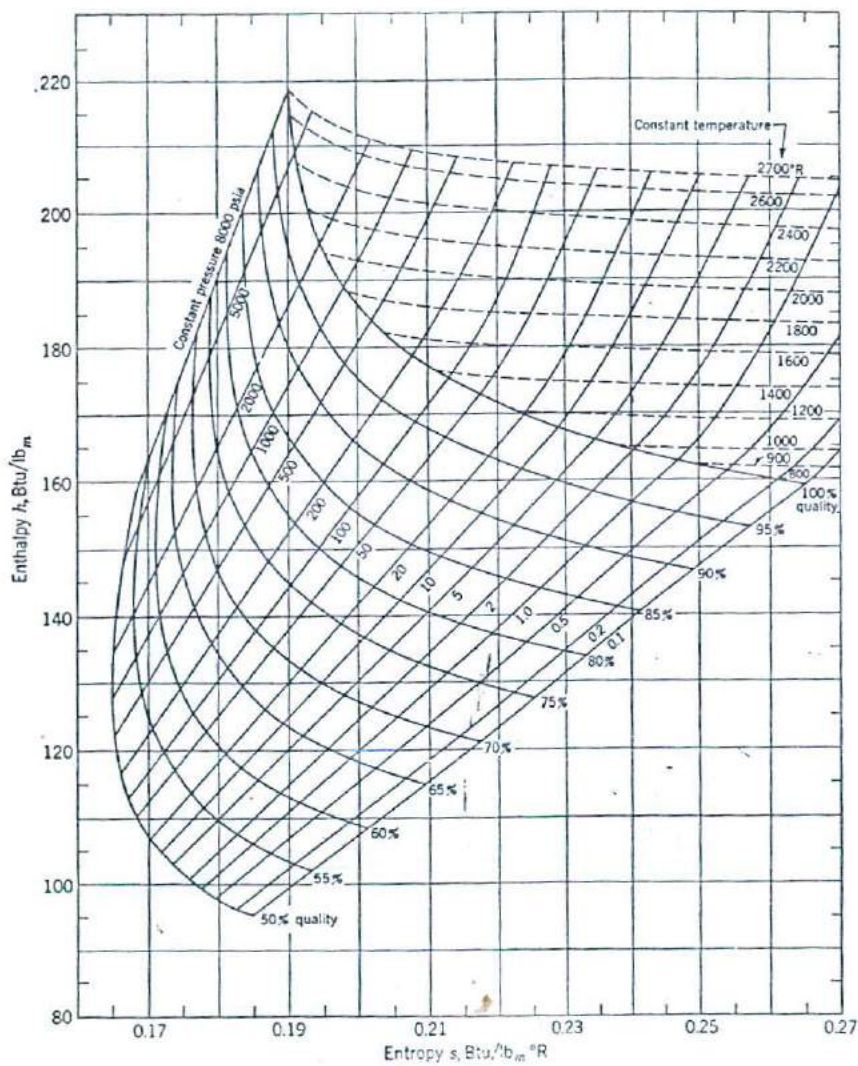


Figure F-1 Mollier diagram for mercury. (Based on charts, courtesy Flight Propulsion Laboratory and the General Electric Company.)

Table F Thermodynamic properties of mercury*

Temperature, °R (Sat. press., psia)	Sat. liquid	Sat. vapor	Temperature of superheated vapor, °R				
			800	900	1000	1100	1200
700 A (1.2041 × 10 ⁻⁴)	0.0012 29.25 0.09998	1.107 × 10 ³ 156.94 0.2924	3.151 × 10 ³ 159.21 0.2554	3.265 × 10 ³ 161.49 0.2492	4.473 × 10 ³ 163.77 0.2406	4.583 × 10 ³ 166.04 0.2325	5.327 × 10 ³ 168.30 0.2248
800 A (1.2541 × 10 ⁻⁴)	0.00122 32.51 0.1043	3.4150 × 10 ³ 159.75 0.2634	.....	39.42 162.07 0.2602	42.69 164.31 0.2565	46.96 166.56 0.2507	51.23 168.80 0.2422
900 A (0.15947) × 10 ⁻⁴	0.00123 35.75 0.1091	62.870 162.54 0.2689	.....	.....	69.86 164.52 0.2514	76.45 166.80 0.2515	83.82 169.04 0.2557
1000 A (1.2319) × 10 ⁻⁴	0.00124 39.95 0.1115	16.520 165.32 0.2679	.....	.....	.....	14.22 167.01 0.2641	19.88 169.24 0.2621
1100 A (1.0.415) × 10 ⁻⁴	0.00125 43.21 0.1145	5.654 168.10 0.2291	.....	.....	.....	.....	8.168 170.49 0.2311
1200 A (27.450) × 10 ⁻⁴	0.00127 45.45 0.1174	2.340 170.88 0.2220	.....	.....	.....	.....	.....
1300 A (52.007) × 10 ⁻⁴	0.00128 48.70 0.1200	1.132 173.65 0.2162	.....	.....	.....	.....	.....
1400 A (1.2613 × 10 ⁻³)	0.00129 51.92 0.1225	0.6259 176.51 0.2114	.....	.....	.....	.....	.....
1500 A (2.2500 × 10 ⁻³)	0.00131 55.27 0.1247	0.3559 179.36 0.2055	.....	.....	.....	.....	.....
1600 A (3.7441 × 10 ⁻³)	0.00132 58.61 0.1269	0.2258 182.25 0.2012	.....	.....	.....	.....	.....
1700 A (5.5943 × 10 ⁻³)	0.00133 62.00 0.1295	0.1521 185.19 0.2014	.....	.....	.....	.....	.....
1800 A (8.5491 × 10 ⁻³)	0.00135 65.44 0.1309	0.1077 188.18 0.1991	.....	.....	.....	.....	.....
1900 A (1.2755 × 10 ⁻²)	0.00136 68.94 0.1329	0.0795 191.23 0.1972	.....	.....	.....	.....	.....
2000 A (1.7917 × 10 ⁻²)	0.00137 72.51 0.1346	0.0628 194.35 0.1956	.....	.....	.....	.....	.....
2100 A (2.3853 × 10 ⁻²)	0.00139 76.10 0.1364	0.04788 197.55 0.1942	.....	.....	.....	.....	.....
2200 A (3.0443 × 10 ⁻²)	0.00140 79.89 0.1382	0.03903 200.83 0.1931	.....	.....	.....	.....	.....
2300 A (3.8523 × 10 ⁻²)	0.00141 83.71 0.1399	0.03196 204.21 0.1922	.....	.....	.....	.....	.....
2400 A (4.7732 × 10 ⁻²)	0.00143 87.54 0.1415	0.02692 207.58 0.1915	.....	.....	.....	.....	.....
2500 A (5.8039 × 10 ⁻²)	0.00144 91.57 0.1432	0.02305 211.27 0.1910	.....	.....	.....	.....	.....
2600 A (6.9479 × 10 ⁻²)	0.00145 95.92 0.1448	0.02093 214.97 0.1905	.....	.....	.....	.....	.....
2700 A (8.1952 × 10 ⁻²)	0.00147 100.10 0.1464	0.01794 218.79 0.1904	.....	.....	.....	.....	.....

* From Ref. 191.

(continued)

Table F Thermodynamic properties of mercury* (Continued)

Temperature, °R (Sat. press., psia)	Temperature of superheated vapor, °R							
	1400	1500	1600	2000	2200	2400	2600	2700
700 (1.2051 × 10 ⁻³)	6.214 × 10 ³ 172.97 0.2994	7.102 × 10 ³ 177.61 0.3015	7.990 × 10 ³ 182.27 0.3042	8.878 × 10 ³ 186.97 0.3067	9.765 × 10 ³ 191.65 0.3090	1.0650 × 10 ⁴ 196.44 0.3111	1.1540 × 10 ⁴ 201.21 0.3130	1.1940 × 10 ⁴ 205.61 0.3139
800 (1.2541 × 10 ⁻³)	5.977 × 10 ³ 173.51 0.2763	6.831 × 10 ³ 178.15 0.2794	7.686 × 10 ³ 182.81 0.2822	8.538 × 10 ³ 187.51 0.2847	9.392 × 10 ³ 192.23 0.2869	1.025 × 10 ⁴ 196.97 0.2890	1.110 × 10 ⁴ 201.75 0.2909	1.153 × 10 ⁴ 204.14 0.2918
900 (0.76637)	97.80 174.02 0.2592	1.115 × 10 ³ 179.65 0.2633	1.257 × 10 ³ 185.33 0.2651	1.397 × 10 ³ 188.02 0.2675	1.537 × 10 ³ 192.74 0.2698	1.677 × 10 ³ 197.49 0.2719	1.816 × 10 ³ 202.23 0.2738	1.896 × 10 ³ 204.65 0.2747
1000 (3.2319)	23.19 174.52 0.2457	26.51 179.16 0.2488	29.82 183.52 0.2515	33.13 188.52 0.2540	36.44 193.24 0.2563	39.76 197.98 0.2584	43.07 202.76 0.2603	44.73 205.14 0.2612
1100 (10.415)	7.197 175.01 0.2347	8.225 179.65 0.2378	9.253 184.31 0.2405	10.28 189.01 0.2430	11.31 193.73 0.2453	12.34 198.47 0.2473	13.37 203.25 0.2493	13.88 205.64 0.2502
1200 (27.450)	2.731 175.50 0.2255	3.121 180.14 0.2287	3.511 184.80 0.2314	3.901 189.50 0.2339	4.291 194.22 0.2362	4.681 198.95 0.2382	5.071 203.74 0.2402	5.266 206.13 0.2411
1300 (62.007)	1.209 175.99 0.2179	1.331 180.63 0.2210	1.554 185.30 0.2238	1.727 189.99 0.2263	1.900 194.71 0.2283	2.072 199.46 0.2306	2.245 204.23 0.2325	2.331 205.63 0.2334
1400 (1.2413 × 10 ³)	0.6901 181.15 0.2145	0.7764 185.81 0.2173	0.8626 190.51 0.2195	0.9489 195.23 0.2220	1.035 199.97 0.2241	1.121 204.75 0.2260	1.195 207.14 0.2269	1.195 207.14 0.2269
1500 (2.2556 × 10 ³)	0.3796 181.68 0.2090	0.4271 184.35 0.2117	0.4745 191.04 0.2142	0.5220 195.76 0.2165	0.5694 200.51 0.2185	0.6169 205.28 0.2205	0.6406 207.68 0.2214	0.6406 207.68 0.2214
1600 (3.7943 × 10 ³)	0.2540 182.92 0.2059	0.2840 185.92 0.2094	0.3140 191.61 0.2117	0.3440 196.33 0.2147	0.3740 201.08 0.2177	0.4040 205.85 0.2197	0.4240 208.25 0.2196	0.4240 208.25 0.2196
1700 (5.9840 × 10 ³)	0.1610 187.82 0.2023	0.1789 192.22 0.2052	0.1968 196.54 0.2075	0.2147 200.85 0.2098	0.2326 205.16 0.2121	0.2505 209.46 0.2144	0.2684 213.75 0.2167	0.2684 213.75 0.2167
1800 (9.2481 × 10 ³)	0.1197 192.87 0.2015	0.1386 197.59 0.2048	0.1575 202.30 0.2081	0.1764 207.01 0.2114	0.1953 211.72 0.2147	0.2142 216.43 0.2180	0.2331 221.14 0.2213	0.2331 221.14 0.2213
1900 (1.3795 × 10 ⁴)	0.08368 193.58 0.1984	0.09205 198.30 0.2008	0.1004 203.05 0.2032	0.1088 207.82 0.2057	0.1172 212.57 0.2081	0.1256 217.32 0.2105	0.1340 222.07 0.2129	0.1340 222.07 0.2129
2000 (1.7517 × 10 ⁴)	0.06686 199.07 0.1978	0.06686 199.07 0.1978	0.06686 199.07 0.1978	0.06686 199.07 0.1978	0.06686 199.07 0.1978	0.06686 199.07 0.1978	0.06686 199.07 0.1978	0.06686 199.07 0.1978
2100 (2.3453 × 10 ⁴)	0.05016 199.91 0.1953	0.05016 199.91 0.1953	0.05016 199.91 0.1953	0.05016 199.91 0.1953	0.05016 199.91 0.1953	0.05016 199.91 0.1953	0.05016 199.91 0.1953	0.05016 199.91 0.1953
2200 (3.0443 × 10 ⁴)	0.04221 205.58 0.1932	0.04221 205.58 0.1932	0.04221 205.58 0.1932	0.04221 205.58 0.1932	0.04221 205.58 0.1932	0.04221 205.58 0.1932	0.04221 205.58 0.1932	0.04221 205.58 0.1932
2300 (3.8523 × 10 ⁴)	0.03335 206.58 0.1933	0.03335 206.58 0.1933	0.03335 206.58 0.1933	0.03335 206.58 0.1933	0.03335 206.58 0.1933	0.03335 206.58 0.1933	0.03335 206.58 0.1933	0.03335 206.58 0.1933
2400 (4.7732 × 10 ⁴)	0.02804 210.07 0.1925	0.02804 210.07 0.1925	0.02804 210.07 0.1925	0.02804 210.07 0.1925	0.02804 210.07 0.1925	0.02804 210.07 0.1925	0.02804 210.07 0.1925	0.02804 210.07 0.1925
2500 (5.8059 × 10 ⁴)	0.02398 213.66 0.1919	0.02398 213.66 0.1919	0.02398 213.66 0.1919	0.02398 213.66 0.1919	0.02398 213.66 0.1919	0.02398 213.66 0.1919	0.02398 213.66 0.1919	0.02398 213.66 0.1919
2600 (6.9479 × 10 ⁴)	0.02051 217.37 0.1915	0.02051 217.37 0.1915	0.02051 217.37 0.1915	0.02051 217.37 0.1915	0.02051 217.37 0.1915	0.02051 217.37 0.1915	0.02051 217.37 0.1915	0.02051 217.37 0.1915
2700 (8.1953 × 10 ⁴)	0.01753 219.53 0.1911	0.01753 219.53 0.1911	0.01753 219.53 0.1911	0.01753 219.53 0.1911	0.01753 219.53 0.1911	0.01753 219.53 0.1911	0.01753 219.53 0.1911	0.01753 219.53 0.1911

*From Ref. 191.

THERMODYNAMIC PROPERTIES OF HELIUM

Table G Thermodynamic properties of helium*

Pressure, psia	Temperature, °F						
	100	200	300	400	500	600	
14.696	<i>v</i>	102.23	120.487	138.743	157.00	175.258	193.515
	<i>P</i>	0.0097820	0.0082997	0.0072076	0.0063694	0.0057055	0.0051676
	<i>h</i>	707.73	827.56	952.38	1077.20	1202.02	1326.83
	<i>s</i>	6.8421	7.0472	7.2233	7.3776	7.5149	7.6386
50	<i>v</i>	30.085	35.451	40.817	46.183	51.549	56.915
	<i>P</i>	0.033239	0.028208	0.024500	0.021653	0.019399	0.017570
	<i>h</i>	703.08	827.90	952.72	1077.54	1202.36	1327.15
	<i>s</i>	6.2342	6.4393	6.6153	6.7697	6.9070	7.0307
150	<i>v</i>	10.063	11.8522	13.6407	15.4293	17.2183	19.008
	<i>P</i>	0.099372	0.084372	0.073310	0.064812	0.058078	0.052610
	<i>h</i>	704.08	828.91	953.73	1078.55	1203.37	1328.18
	<i>s</i>	5.6886	5.8937	6.0698	6.2241	6.3614	6.4852
400	<i>v</i>	3.8062	4.4775	5.1487	5.8197	6.4905	7.1616
	<i>P</i>	0.26273	0.22334	0.194225	0.171831	0.154072	0.139633
	<i>h</i>	706.58	831.42	956.24	1081.06	1205.88	1330.70
	<i>s</i>	5.2013	5.4065	5.5827	5.7371	5.8744	5.9981
600	<i>v</i>	2.5516	3.0023	3.4495	3.8973	4.3449	4.7925
	<i>P</i>	0.39146	0.33308	0.28986	0.25658	0.23016	0.20867
	<i>h</i>	708.49	833.33	958.15	1082.97	1207.79	1332.61
	<i>s</i>	4.9998	5.2050	5.3813	5.5357	5.6730	5.7968
900	<i>v</i>	1.7200	2.0187	2.3173	2.6157	2.91399	3.2122
	<i>P</i>	0.58139	0.49537	0.43154	0.38230	0.34317	0.31199
	<i>h</i>	710.29	835.38	960.40	1085.42	1210.42	1335.36
	<i>s</i>	4.7981	5.0035	5.1797	5.3342	5.4715	5.5953

(continued)

Table G Thermodynamic properties of helium* (Continued)

Pressure, psia	Temperature, °F						
	100	200	300	400	500	600	
1,500	<i>v</i>	1.05192	1.2314	1.4108	1.58994	1.7690	1.9483
	<i>ρ</i>	0.95064	0.81207	0.70880	0.62897	0.56528	0.51328
	<i>h</i>	715.54	840.77	965.88	1090.92	1215.93	1340.97
	<i>s</i>	4.5437	4.7475	4.9257	5.0801	5.2176	5.3414
2,500	<i>v</i>	0.65044	0.75847	0.86635	0.97410	1.08176	1.18947
	<i>ρ</i>	1.53741	1.31845	1.15427	1.02659	0.92442	0.84071
	<i>h</i>	724.37	849.73	974.95	1100.10	1225.22	1350.29
	<i>s</i>	4.2887	4.4928	4.6712	4.8258	4.9634	5.0873
4,000	<i>v</i>	0.42377	0.49161	0.55932	0.62694	0.69444	0.76191
	<i>ρ</i>	2.3598	2.0341	1.78789	1.59503	1.44000	1.31248
	<i>h</i>	736.48	862.24	987.70	1113.12	1238.46	1363.73
	<i>s</i>	4.0531	4.2576	4.4363	4.5912	4.7287	4.8530

* From Ref. 177.

THERMODYNAMIC PROPERTIES OF CARBON DIOXIDE

Table H Thermodynamic properties of carbon dioxide*

Pressure, psia	Temperature, °F												
	50	100	150	200	300	400	600	800	1000	1200	1400	1600	1800
v.....	17.38	13.61	11.84	10.66	8.51	20.96	26.85	30.73	35.61	40.49	45.36	50.24	55.11
h.....	307.3	317.7	328.2	339.0	361.3	384.6	434.4	487.1	542.4	599.6	658.6	718.8	780.0
s.....	1.4277	1.4467	1.4645	1.4813	1.5126	1.5412	1.5930	1.6384	1.6790	1.7158	1.7494	1.7795	1.8084
v.....	6.119	6.778	7.407	8.016	9.247	10.47	12.92	15.36	17.80	20.24	22.68	25.11	27.55
h.....	306.8	317.3	327.9	338.8	361.1	384.5	434.3	487.1	542.4	599.6	658.6	718.8	780.0
s.....	1.3564	1.4154	1.4332	1.4500	1.4813	1.5099	1.5617	1.6071	1.6477	1.6845	1.7181	1.7486	1.7771
v.....	3.053	3.363	3.688	3.993	4.615	5.230	6.458	7.688	8.901	10.12	11.37	12.56	13.78
h.....	305.9	316.5	327.4	338.4	360.9	384.3	434.2	487.0	542.4	599.6	658.6	718.8	780.0
s.....	1.2642	1.3834	1.4014	1.4184	1.4499	1.4787	1.5305	1.5759	1.6165	1.6533	1.6869	1.7174	1.7459
v.....	1.498	1.657	1.828	1.982	2.298	2.608	3.226	3.839	4.448	5.060	5.670	6.281	6.887
h.....	304.1	315.1	326.4	337.7	360.2	383.9	434.0	486.9	542.3	599.5	658.6	718.8	780.0
s.....	1.3284	1.3490	1.3679	1.3855	1.4177	1.4468	1.4991	1.5446	1.5852	1.6220	1.6556	1.6861	1.7146
v.....	0.9799	1.088	1.208	1.311	1.525	1.734	2.148	1.559	2.966	3.373	3.781	4.188	4.592
h.....	302.2	313.6	325.4	337.0	359.7	383.5	433.8	486.8	542.3	599.5	658.6	718.8	780.0
s.....	1.3056	1.3297	1.3488	1.3666	1.3993	1.4285	1.4808	1.5263	1.5669	1.6037	1.6373	1.6678	1.6963
v.....	0.7207	0.8033	0.8960	0.9760	1.139	1.297	1.610	1.918	2.224	2.530	2.836	3.141	3.445
h.....	300.4	312.1	324.4	336.3	359.1	383.1	433.6	486.6	542.2	599.5	658.6	718.8	780.0
s.....	1.2928	1.3154	1.3360	1.3529	1.3857	1.4151	1.4675	1.5133	1.5539	1.5907	1.6243	1.6548	1.6833
v.....	0.5632	0.6376	0.7125	0.7748	0.9075	1.035	1.287	1.534	1.779	2.024	2.269	2.513	2.757
h.....	298.6	310.6	323.4	335.6	358.5	382.7	433.4	486.5	542.2	599.5	658.5	718.8	780.0
s.....	1.2805	1.3038	1.3239	1.3421	1.3753	1.4049	1.4574	1.5033	1.5439	1.5807	1.6143	1.6448	1.6733
v.....	0.4614	0.5237	0.5886	0.6407	0.7532	0.8604	1.071	1.273	1.482	1.687	1.891	2.095	2.297
h.....	296.7	309.1	322.4	334.9	358.0	382.3	433.1	486.4	542.1	599.5	658.5	718.8	780.0
s.....	1.2694	1.2940	1.3145	1.3330	1.3671	1.3963	1.4490	1.4948	1.5356	1.5724	1.6060	1.6365	1.6650
v.....	0.3563	0.4100	0.4636	0.5065	0.5985	0.6868	0.8566	1.021	1.186	1.349	1.513	1.676	1.838
h.....	294.0	306.9	320.9	333.9	357.1	381.6	432.8	486.2	542.0	599.4	658.5	718.7	780.0
s.....	1.2562	1.2813	1.3029	1.3219	1.3560	1.3862	1.4389	1.4848	1.5256	1.5624	1.5960	1.6265	1.6550
v.....	0.2858	0.3441	0.3780	0.4174	0.4958	0.5693	0.7212	0.8502	0.9874	1.125	1.261	1.397	1.533
h.....	291.2	304.6	319.4	332.8	356.3	381.0	432.5	486.0	541.9	599.4	658.5	718.7	779.9
s.....	1.2436	1.2699	1.2925	1.3124	1.3475	1.3779	1.4307	1.4766	1.5174	1.5542	1.5878	1.6183	1.6468

(continued)

Table H Thermodynamic properties of carbon dioxide* (Continued)

Pressure, atm.	Temperature, °F													
	50	100	150	200	300	400	600	800	1000	1200	1400	1600	1800	
440	$v_{f, \text{liq}}$	0.2216	0.2652	0.3040	0.3358	0.4022	0.4633	0.5817	0.6950	0.8079	0.9201	1.032	1.142	1.255
	$v_{f, \text{gas}}$	287.6	301.6	317.4	331.4	355.1	380.2	432.1	485.8	541.7	599.3	658.4	718.6	779.9
	z	1.2282	1.2559	1.2797	1.3009	1.3370	1.3681	1.4215	1.4675	1.5083	1.5451	1.5787	1.6092	1.6377
520	$v_{f, \text{liq}}$	0.1772	0.2174	0.2513	0.2795	0.3374	0.3901	0.4912	0.5881	0.6832	0.7785	0.8733	0.9672	1.062
	$v_{f, \text{gas}}$	283.9	298.7	315.4	330.0	354.0	379.4	431.7	485.5	541.5	599.2	658.3	718.6	779.9
	z	1.2148	1.2418	1.2687	1.2905	1.3281	1.3599	1.4138	1.4599	1.5007	1.5375	1.5711	1.6010	1.6301
600	$v_{f, \text{liq}}$	0.1452	0.1823	0.2123	0.2383	0.2898	0.3363	0.4250	0.5093	0.5921	0.6747	0.7571	0.8385	0.9202
	$v_{f, \text{gas}}$	280.3	295.7	313.4	328.6	352.8	378.6	431.1	485.3	541.4	599.0	658.2	718.6	779.8
	z	1.2020	1.2323	1.2583	1.2809	1.3198	1.3525	1.4071	1.4534	1.4942	1.5310	1.5646	1.5951	1.6236
800	$v_{f, \text{liq}}$	0.1196	0.1483	0.1712	0.2126	0.2489	0.3173	0.3812	0.4436	0.5060	0.5680	0.6292	0.6906	0.6906
	$v_{f, \text{gas}}$	288.2	308.4	325.1	350.0	376.5	430.1	484.7	541.0	598.8	658.0	718.4	779.7	779.7
	z	1.2111	1.2391	1.2631	1.3041	1.3380	1.3935	1.4401	1.4812	1.5180	1.5516	1.5821	1.6108	1.6108
1000	$v_{f, \text{liq}}$	0.1101	0.1310	0.1603	0.1966	0.2526	0.3018	0.3547	0.4049	0.4545	0.5037	0.5526	0.5526	0.5526
	$v_{f, \text{gas}}$	303.4	321.6	337.1	374.5	429.1	484.0	540.6	598.5	657.8	718.3	779.6	779.6	779.6
	z	1.2218	1.2472	1.2903	1.3258	1.3828	1.4302	1.4712	1.5080	1.5410	1.5721	1.6006	1.6006	1.6006

* From Ref. 19.

AIR TABLES

Table I-1 Enthalpy and isentropic pressure ratio for dry air*

T , °R	h , Btu/lb _m	Pr	T , °R	h , Btu/lb _m	Pr	T , °R	h , Btu/lb _m	Pr
450	107.50	0.7329	760	182.08	4.607	1070	258.47	15.734
460	109.90	0.7913	770	184.51	4.826	1080	260.97	16.278
470	112.30	0.8531	780	186.94	5.051	1090	263.48	16.838
480	114.69	0.9182	790	189.38	5.285	1100	265.99	17.413
490	117.08	0.9868	800	191.81	5.526	1110	268.52	18.000
500	119.48	1.0590	810	194.25	5.775	1120	271.03	18.604
510	121.87	1.1349	820	196.69	6.033	1130	273.56	19.223
520	124.27	1.2147	830	199.12	6.299	1140	276.08	19.858
530	126.66	1.2983	840	201.56	6.573	1150	278.61	20.51
540	129.06	1.3860	850	204.01	6.856	1160	281.14	21.18
550	131.46	1.4779	860	206.46	7.149	1170	283.68	21.86
560	133.86	1.5742	870	208.90	7.450	1180	286.2	22.56
570	136.26	1.6748	880	211.35	7.761	1190	288.76	23.28
580	138.66	1.7800	890	213.80	8.081	1200	291.30	24.01
590	141.06	1.8899	900	216.26	8.411	1210	293.86	24.76
600	143.47	2.005	910	218.72	8.752	1220	296.41	25.53
610	145.88	2.124	920	221.18	9.102	1230	298.96	26.32
620	148.28	2.249	930	223.64	9.463	1240	301.52	27.13
630	150.68	2.379	940	226.11	9.834	1250	302.08	27.96
640	153.09	2.514	950	228.58	10.216	1260	306.65	28.80
650	155.50	2.655	960	231.06	10.255	1270	309.22	29.67
660	157.92	2.953	970	233.53	11.014	1280	311.79	30.55
670	160.33	2.953	980	236.02	11.430	1290	314.36	31.46
680	162.73	3.111	990	238.50	11.858	1300	316.94	32.39
690	165.15	3.276	1000	240.98	12.298	1310	319.53	33.34
700	167.56	3.446	1010	243.23	21.523	1320	322.11	34.31
710	169.98	3.623	1020	245.97	13.215	1330	324.69	35.30
720	172.39	3.806	1030	248.45	13.692	1340	327.29	36.31
730	174.82	3.996	1040	250.95	14.182	1350	329.88	37.35
740	177.23	4.193	1050	253.45	14.686	1360	332.48	38.41
750	179.66	4.396	1060	255.96	15.203	1370	335.09	39.49

(continued)

Table I-1 Enthalpy and isentropic pressure ratio for dry air* (Continued)

T, °R	h, Btu/lb _m	Pr	T, °R	h, Btu/lb _m	Pr	T, °R	h, Btu/lb _m	Pr
1380	337.39	40.59	1590	393.07	70.00	1800	449.71	114.03
1390	340.29	41.73	1600	395.74	71.73	1810	452.44	116.57
1400	342.90	42.88	1610	398.42	73.49	1820	455.17	119.16
1410	345.52	44.06	1620	401.09	75.29	1830	457.90	121.79
1420	348.14	45.26	1630	403.77	77.12	1840	460.63	124.47
1430	350.75	46.49	1640	406.45	78.99	1850	463.37	127.37
1440	353.37	47.75	1650	409.13	80.89	1860	466.12	129.56
1450	356.00	49.03	1660	411.82	82.83	1870	468.86	132.77
1460	358.63	50.34	1670	414.51	84.80	1880	471.60	135.64
1470	361.127	51.68	1680	417.20	86.82	1890	474.35	138.55
1480	363.89	53.04	1690	419.89	88.87	1900	477.09	141.51
1490	366.53	54.43	1700	422.59	90.95	1910	479.85	144.53
1500	369.17	55.86	1710	425.29	93.08	1920	482.60	147.59
1510	371.82	57.30	1720	428.00	95.24	1930	485.36	150.70
1520	374.47	58.78	1730	430.69	97.45	1940	488.12	153.87
1530	377.11	60.29	1740	433.41	99.69	1950	490.88	157.10
1540	379.77	61.83	1750	436.12	101.98	1960	493.64	160.37
1550	382.42	63.40	1760	438.83	104.30	1970	496.40	163.69
1560	385.08	65.00	1770	441.55	106.67	1980	499.17	167.07
1570	387.74	66.63	1780	444.26	109.08	1990	501.94	170.50
1580	390.40	68.30	1790	446.99	111.54	2000	504.71	174.00

* Abstracted from Ref. 8.

Table I-2 Enthalpy and isentropic pressure ratio for products of combustion with 200 percent theoretical air*

$T, ^\circ R$	$h, \text{Btu/lb}_m \cdot \text{mol}$	Pr	$T, ^\circ R$	$h, \text{Btu/lb}_m \cdot \text{mol}$	Pr	$T, ^\circ R$	$h, \text{Btu/lb}_m \cdot \text{mol}$	Pr	$T, ^\circ R$	$h, \text{Btu/lb}_m \cdot \text{mol}$	Pr
800	5676.3	5.690	1090	7840.3	18.173	1380	10091.9	45.68	1670	12432.1	99.41
810	5749.7	5.957	1100	7916.4	18.822	1390	10171.3	47.02	1680	12514.2	101.60
820	5823.1	6.234	1110	7993.0	19.486	1400	10250.7	48.38	1690	12596.3	104.12
830	5896.3	6.520	1120	8069.0	20.170	1410	10330.4	49.78	1700	12678.6	106.70
840	5969.9	6.815	1130	8145.7	20.873	1420	10410.0	51.21	1710	12761.0	109.33
850	6043.6	7.120	1140	8222.1	21.595	1430	10489.4	52.67	1720	12843.8	112.01
860	6117.5	7.437	1150	8298.7	22.34	1440	10569.3	54.17	1730	12926.1	114.75
870	6191.0	7.763	1160	8375.5	23.10	1450	10649.2	55.70	1740	13009.0	117.53
880	6264.9	8.101	1170	8452.5	23.88	1460	10729.3	57.26	1750	13091.7	120.38
890	6338.8	8.449	1180	8529.2	24.68	1470	10809.6	58.86	1760	13174.6	123.27
900	6413.0	8.808	1190	8606.5	25.50	1480	10889.5	60.49	1770	13257.5	126.22
910	6487.2	9.181	1200	8683.6	26.34	1490	10969.8	62.16	1780	13340.3	129.23
920	6561.5	9.564	1210	8761.1	27.20	1500	11050.2	63.88	1790	13423.1	132.31
930	6635.8	9.959	1220	8838.6	28.09	1510	11130.8	65.61	1800	13507.0	135.43
940	6710.4	10.366	1230	8915.9	29.00	1520	11211.4	67.40	1810	13590.4	138.61
950	6784.9	10.787	1240	8993.7	29.94	1530	11291.9	69.22	1820	13673.8	141.86
960	6859.8	11.221	1250	9071.4	30.90	1540	11372.8	71.08	1830	13757.0	145.17
970	6934.6	11.666	1260	9149.3	31.87	1550	11453.6	72.98	1840	13840.5	148.54
980	7009.7	12.126	1270	9227.4	32.88	1560	11534.7	74.91	1850	13924.4	151.96
990	7084.6	12.600	1280	9305.3	33.90	1570	11615.8	76.89	1860	14008.4	155.46
1000	7159.8	13.089	1290	9383.4	34.96	1580	11696.8	78.92	1870	14092.2	159.02
1010	7235.2	13.592	1300	9461.7	36.05	1590	11778.2	80.99	1880	14176.1	162.65
1020	7310.5	14.109	1310	9540.3	37.16	1600	11859.6	83.10	1890	14260.2	166.34
1030	7385.5	14.641	1320	9618.8	38.29	1610	11941.3	85.24	1900	14344.1	170.09
1040	7461.1	15.189	1330	9697.1	39.45	1620	12022.7	87.44	1910	14428.5	173.93
1050	7536.8	15.754	1340	9776.2	40.64	1630	12104.5	89.68	1920	14512.5	177.82
1060	7612.7	16.333	1350	9854.8	41.86	1640	12186.2	91.97	1930	14597.0	181.78
1070	7688.6	16.930	1360	9933.8	43.10	1650	12268.0	94.30	1940	14681.4	185.82
1080	7764.3	17.542	1370	10013.2	44.38	1660	12350.0	96.69	1950	14765.9	189.95

(continued)

Table I-2 Enthalpy and isentropic pressure ratio for products of combustion with 200 percent theoretical air*
(Continued)

T , °R	h , Btu/lb _m · mol	P_r	T , °R	h , Btu/lb _m · mol	P_r	T , °R	h , Btu/lb _m · mol	P_r	T , °R	h , Btu/lb _m · mol	P_r
1960	14850.4	194.13	2370	18379.6	44.2	2780	22008.6	900.3	3190	25714.4	1683.3
1970	14935.0	198.38	2380	18467.0	45.0	2790	22097.8	914.9	3200	25805.6	1708.2
1980	15019.8	202.71	2390	18554.3	45.8	2800	22187.5	929.8	3210	25896.8	1732.8
1990	15104.4	207.11	2400	18642.1	46.4	2810	22277.2	945.0	3220	25988.1	1757.8
2000	15189.3	211.6	2410	18729.7	47.0	2820	22367.0	960.2	3230	26079.3	1783.2
2010	15274.5	216.2	2420	18817.4	48.4	2830	22456.6	975.6	3240	26170.6	1808.7
2020	15359.3	220.8	2430	18905.0	49.6	2840	22546.4	991.4	3250	26262.0	1834.4
2030	15444.5	225.5	2440	18992.8	50.7	2850	22636.3	1007.2	3260	26353.3	1860.6
2040	15529.7	230.4	2450	19080.7	51.9	2860	22726.1	1023.4	3270	26444.7	1887.0
2050	15615.1	235.2	2460	19168.6	52.1	2870	22816.2	1039.7	3280	26536.2	1913.8
2060	15700.3	240.2	2470	19256.6	53.0	2880	22905.8	1056.2	3290	26627.6	1940.9
2070	15785.8	245.3	2480	19344.3	54.0	2890	22995.8	1072.9	3300	26719.2	1968.3
2080	15871.3	250.4	2490	19432.3	55.0	2900	23086.0	1089.8	3310	26810.8	1995.9
2090	15956.5	255.6	2500	19520.7	55.8	2910	23176.2	1107.0	3320	26902.4	2023.8
2100	16042.4	260.9	2510	19608.9	56.8	2920	23266.2	1124.4	3330	26993.9	2052.2
2110	16128.3	266.4	2520	19697.0	58.0	2930	23356.5	1142.0	3340	27085.5	2080.7
2120	16214.1	271.9	2530	19785.3	59.3	2940	23446.7	1159.8	3350	27177.3	2109.5
2130	16299.7	277.5	2540	19873.7	60.7	2950	23536.7	1177.9	3360	27269.3	2138.7
2140	16385.6	283.1	2550	19962.0	61.3	2960	23626.9	1196.1	3370	27361.2	2168.4
2150	16471.5	288.9	2560	20050.4	62.2	2970	23717.3	1214.6	3380	27452.8	2198.4
2160	16557.7	294.8	2570	20138.8	63.0	2980	23807.8	1233.3	3390	27544.5	2228.6
2170	16643.8	300.8	2580	20227.5	64.0	2990	23897.9	1252.2	3400	27636.4	2259.1
2180	16730.0	306.8	2590	20315.9	65.3	3000	23988.5	1271.2	3410	27728.4	2290.1
2190	16816.2	313.0	2600	20404.6	66.6	3010	24079.0	1290.8	3420	27820.3	2321.4
2200	16902.5	319.2	2610	20493.3	67.8	3020	24169.1	1310.6	3430	27912.2	2353.0
2210	16989.1	325.6	2620	20582.0	68.9	3030	24259.0	1330.5	3440	28004.1	2385.0
2220	17075.6	332.0	2630	20670.7	70.1	3040	24348.1	1350.6	3450	28096.2	2417.3
2230	17161.9	338.6	2640	20759.5	71.3	3050	24437.2	1371.0	3460	28188.5	2450.0
2240	17248.6	345.2	2650	20848.4	72.5	3060	24526.3	1391.7	3470	28280.7	2483.0

2250	17335.3	352.0	2660	20937.5	738.2	3070	24713.7	1412.6	3480	28372.7	2516.4
2260	17422.0	358.9	2670	21026.6	750.8	3080	24713.7	1433.8	3490	28464.6	2550.0
2270	17508.7	365.9	2680	21115.4	763.4	3090	24804.5	1455.1	3500	28556.8	2584.0
2280	17595.3	373.0	2690	21204.5	776.3	3100	24895.3	1476.8			
2290	17682.4	380.3	2700	21293.8	789.4	3110	24986.1	1498.7			
2300	17769.3	387.5	2710	21382.9	802.5	3120	25077.0	1520.9			
2310	17856.5	395.0	2720	21472.0	815.9	3130	25168.0	1543.3			
2320	17943.4	402.6	2730	21561.5	829.6	3140	25259.0	1566.1			
2330	18030.5	410.2	2740	21650.9	843.4	3150	25350.1	1589.2			
2340	18117.8	418.0	2750	21740.3	857.2	3160	25441.1	1612.4			
2350	18204.9	425.9	2760	21829.4	871.4	3170	25532.2	1636.0			
2360	18292.2	434.0	2770	21918.8	885.8	3180	25623.4	1659.7			

* Abstracted from Ref. 8.

Table I-3 Enthalpy and isentropic pressure ratio for products of combustion with 400 percent theoretical air*

T, °R	h_1		T, °R	h_2		T, °R	h_3	
	Btu/lb _m -mol	Pr		Btu/lb _m -mol	Pr		Btu/lb _m -mol	Pr
1500	10875.6	59.80	1970	14662.6	180.50	2440	18608.9	445.8
1510	10954.4	61.39	1980	14745.3	184.33	2450	18694.1	453.7
1520	11033.1	63.01	1990	14827.7	188.23	2460	18779.5	461.7
1530	11111.6	64.67	2000	14910.3	192.21	2470	18864.9	469.9
1540	11190.7	66.37	2010	14993.2	196.24	2480	18950.2	478.1
1550	11269.6	68.10	2020	15075.8	200.35	2490	19035.7	486.5
1560	11348.6	69.86	2030	15158.7	204.51	2500	19121.4	494.9
1570	11427.6	71.66	2040	15241.6	208.76	2510	19207.2	503.5
1580	11506.8	73.51	2050	15324.7	213.06	2520	19292.8	512.3
1590	11586.3	75.39	2060	15407.6	217.45	2530	19378.4	521.1
1600	11665.6	77.30	2070	15490.9	221.90	2540	19464.2	530.0
1610	11745.2	79.25	2080	15574.0	226.42	2550	19550.1	539.1
1620	11824.6	81.24	2090	15656.9	231.04	2560	19635.9	548.3
1630	11904.4	83.27	2100	15740.5	235.7	2570	19721.8	557.7
1640	11984.1	85.35	2110	15740.5	240.5	2580	19807.8	567.1
1650	12063.8	87.46	2120	15907.5	245.3	2590	19893.7	576.7
1660	12143.8	89.61	2130	15990.7	250.2	2600	19979.7	586.4
1670	12223.8	91.80	2140	16074.2	255.1	2610	20065.9	596.2
1680	12303.9	94.05	2150	16157.9	260.2	2620	20152.0	606.3
1690	12383.9	96.33	2160	16241.7	265.4	2630	20238.1	616.5
1700	12464.3	98.64	2170	16325.5	270.6	2640	20324.3	626.6
1710	12544.6	101.02	2180	16409.4	275.9	2650	20410.6	636.9
1720	12625.3	103.43	2190	16493.3	281.3	2660	20497.0	647.4
1730	12705.5	105.89	2200	16577.1	286.7	2670	20583.5	658.1
1740	12786.4	108.40	2210	16661.3	292.3	2680	20670.0	668.9
1750	12867.0	110.96	2220	16745.4	297.9	2690	20756.4	679.8
1760	12947.8	113.55	2230	16829.4	303.7	2700	20842.8	690.9
1770	13028.6	116.20	2240	16913.6	309.4	2710	20929.2	702.1
1780	13109.4	118.90	2250	16998.0	315.3	2720	21015.7	713.5
1790	13190.5	121.66	2260	17082.3	321.3	2730	21102.4	725.1
1800	13271.7	124.45	2270	17166.6	327.5	2740	21189.2	736.8
1810	13353.0	127.30	2280	17250.7	333.6	2750	21276.0	748.5
1820	13434.3	130.21	2290	17335.4	340.0	2760	21362.6	760.5
1830	13515.5	133.17	2300	17419.8	346.2	2770	21449.4	772.6
1840	13597.0	136.18	2310	17504.6	352.7	2780	21536.2	784.9
1850	13678.5	139.23	2320	17589.0	359.3	2790	21622.7	797.3
1860	13760.3	142.35	2330	17673.6	365.9	2800	21709.8	809.9
1870	13842.0	145.53	2340	17758.4	372.6	2810	21796.9	822.6
1880	13923.6	148.76	2350	17843.2	379.5	2820	21884.0	835.5
1890	14005.6	152.05	2360	17928.1	386.5	2830	21970.9	848.5
1900	14087.2	155.39	2370	18013.0	393.6	2840	22058.0	861.8
1910	14169.5	158.80	2380	18098.0	400.7	2850	22145.3	875.2
1920	14251.3	162.26	2390	18182.9	408.0	2860	22232.5	888.8
1930	14333.4	165.78	2400	18268.0	415.3	2870	22319.8	902.6
1940	14415.7	169.37	2410	18353.2	422.8	2880	22406.6	916.4
1950	14498.0	173.02	2420	18438.4	430.2	2890	22494.1	930.4
1960	14580.3	176.73	2430	18523.5	438.0	2900	22581.4	944.7

Table I-3 Enthalpy and isentropic pressure ratio for products of combustion with 400 percent theoretical air* (Continued)

$T, ^\circ\text{R}$	$h,$ Btu/lb _m -mol	Pr	$T, ^\circ\text{R}$	$h,$ Btu/lb _m -mol	Pr	$T, ^\circ\text{R}$	$h,$ Btu/lb _m -mol	Pr
2910	22668.8	959.1	3110	24423.6	1286.5	3310	26191.6	1698.1
2920	22756.3	973.7	3120	24511.8	1305.0	3320	26280.3	1721.1
2930	22843.7	988.5	3130	24600.1	1323.6	3330	26369.0	1744.5
2940	22931.2	1003.5	3140	24688.2	1342.5	3340	26457.7	1768.0
2950	23018.5	1018.6	3150	24776.5	1361.7	3350	26546.8	1791.6
2960	23105.9	1033.8	3160	24864.7	1381.0	3360	26635.9	1815.6
2970	23193.6	1049.4	3170	24953.0	1400.5	3370	26724.9	1840.0
2980	23281.3	1065.0	3180	25041.4	1420.2	3380	26813.6	1864.7
2990	23368.9	1080.9	3190	25129.6	1440.2	3390	26902.3	1889.5
3000	23456.6	1096.8	3200	25217.8	1460.4	3400	26991.4	1914.6
3010	23544.3	1113.2	3210	25306.3	1480.8	3410	27080.7	1940.0
3020	23632.0	1129.7	3220	25394.7	1501.5	3420	27169.8	1965.7
3030	23719.7	1146.3	3230	25483.1	1522.4	3430	27258.8	1991.6
3040	23807.7	1163.1	3240	25571.6	1543.5	3440	27347.9	2017.8
3050	23895.6	1180.1	3250	25660.1	1564.9	3439	27436.9	2044.3
3060	23983.6	1197.4	3260	25748.5	1586.5	3460	27526.2	2071.0
3070	24071.7	1214.8	3270	25837.1	1608.3	3470	27615.6	2098.0
3080	24159.6	1232.4	3280	25925.8	1630.4	3480	27704.7	2125.4
3090	24247.5	1250.2	3290	26014.3	1652.8	3490	27793.8	2152.9
3100	24335.5	1268.3	3300	26102.9	1675.3			

* Abstracted from Ref. 8.

THE ELEMENTS

Table J Alphabetical list of the elements

Element	Symbol	Atomic number, Z	Element	Symbol	Atomic number, Z
Actinium	Ac	89	Mercury	Hg	80
Aluminum	Al	13	Molybdenum	Mo	42
Americium	Am	95	Neodymium	Nd	60
Antimony	Sb	51	Neon	Ne	10
Argon	A	18	Neptunium	Np	93
Arsenic	As	33	Nickel	Ni	28
Astatine	At	85	Niobium	Nb	41
Barium	Ba	56	Nitrogen	N	7
Berkelium	Bk	97	Nobelium	No	102
Beryllium	Be	4	Osmium	Os	76
Bismuth	Bi	83	Oxygen	O	8
Boron	B	5	Palladium	Pd	46
Bromine	Br	35	Phosphorus	P	15
Cadmium	Cd	48	Platinum	Pt	78
Calcium	Ca	20	Plutonium	Pu	94
Californium	Cf	98	Polonium	Po	84
Carbon	C	6	Potassium	K	19
Cerium	Ce	58	Praseodymium	Pr	59
Cesium	Cs	55	Promethium	Pm	61
Chlorine	Cl	17	Protactinium	Pa	91
Chromium	Cr	24	Radium	Ra	88
Cobalt	Co	27	Radon	Rn	86
Copper	Cu	29	Rhenium	Re	75
Curium	Cm	96	Rhodium	Rh	45
Dysprosium	Dy	66	Rubidium	Rb	37
Einsteinium	Es	99	Ruthenium	Ru	44
Erbium	Er	68	Samarium	Sm	62
Europium	Eu	63	Scandium	Sc	21
Fermium	Fm	100	Selenium	Se	34
Fluorine	F	9	Silicon	Si	14
Francium	Fr	87	Silver	Ag	47
Gadolinium	Gd	64	Sodium	Na	11
Gallium	Ga	31	Strontium	Sr	38
Germanium	Ge	32	Sulfur	S	16
Gold	Au	79	Tantalum	Ta	73
Hafnium	Hf	72	Technetium	Tc	43
Helium	He	2	Tellurium	Te	52
Holmium	Ho	67	Terbium	Tb	65
Hydrogen	H	1	Thallium	Tl	81
Indium	In	49	Thorium	Th	90
Iodine	I	53	Thulium	Tm	69
Iridium	Ir	77	Tin	Sn	50
Iron	Fe	26	Titanium	Ti	22
Krypton	Kr	36	Tungsten (Wolfram)	W	74
Lanthanum	La	57	Uranium	U	92
Lead	Pb	82	Vanadium	V	23
Lithium	Li	3	Xenon	Xe	54
Lutecium	Lu	71	Ytterbium	Yb	70
Magnesium	Mg	12	Yttrium	Y	39
Manganese	Mn	25	Zinc	Zn	30
Mendelevium	Md	101	Zirconium	Zr	40

TUBES

Table K Properties of condenser and feedwater heater tubes

Outside diameter, in	Gage, BWG	Thickness, in	Inside diameter, in	Surface area, ft ² /ft	Waterflow, gpm/(ft)/(s)	Tube mass, lb./ft (Admiralty)
5/8	16	0.065	0.495	0.1636	0.600	0.435
	17	0.058	0.509	0.1636	0.630	0.393
	18	0.049	0.527	0.1636	0.680	0.337
	20	0.035	0.555	0.1636	0.750	0.247
3/4	16	0.065	0.620	0.1963	0.942	0.532
	17	0.058	0.634	0.1963	0.980	0.480
	18	0.049	0.652	0.1963	1.042	0.4110
	20	0.035	0.680	0.1963	1.130	0.299
7/8	16	0.065	0.745	0.2291	1.360	0.630
	17	0.058	0.759	0.2291	1.410	0.567
	18	0.049	0.777	0.2291	1.480	0.484
	20	0.035	0.805	0.2291	1.590	0.352
1	16	0.065	0.870	0.2618	1.854	0.727
	17	0.058	0.884	0.2618	1.910	0.653
	18	0.049	0.902	0.2618	1.994	0.557
	20	0.035	0.930	0.2618	2.120	0.404

APPENDIX

L

FRICTION FACTOR

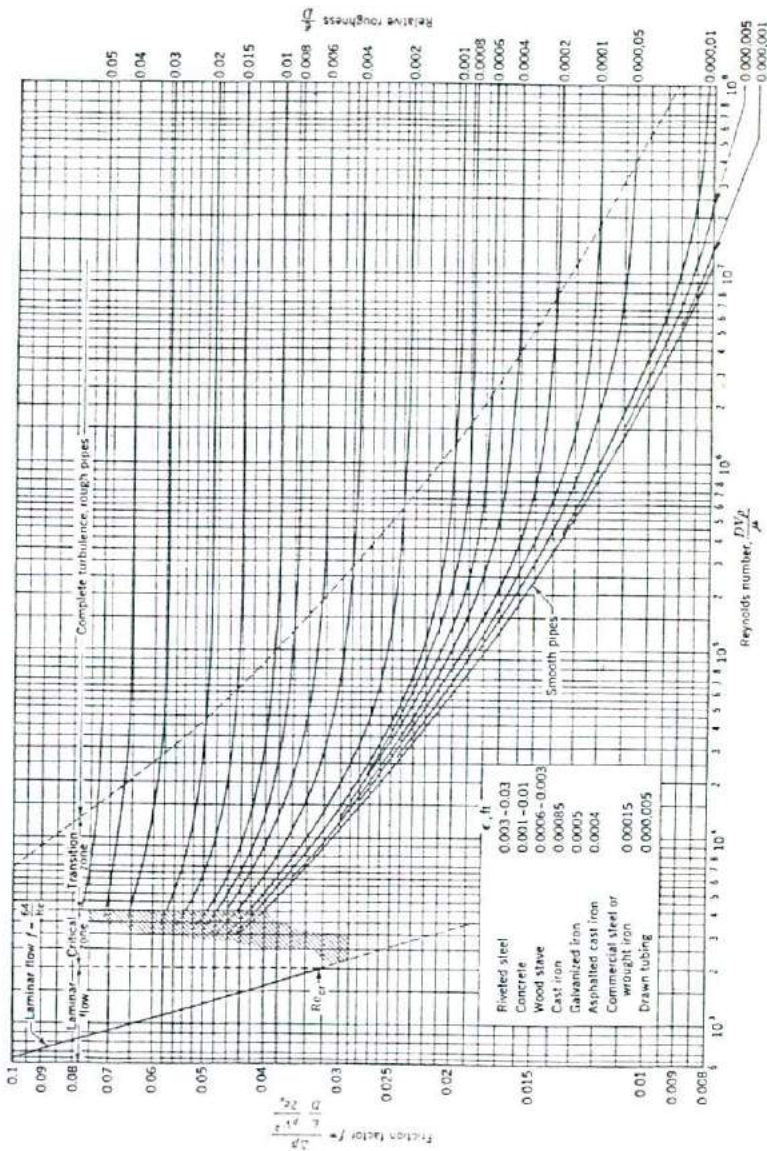


Figure 1-1 Moody friction factor chart (from Ref. 194).

APPENDIX

M

PSYCHROMETRIC CHART

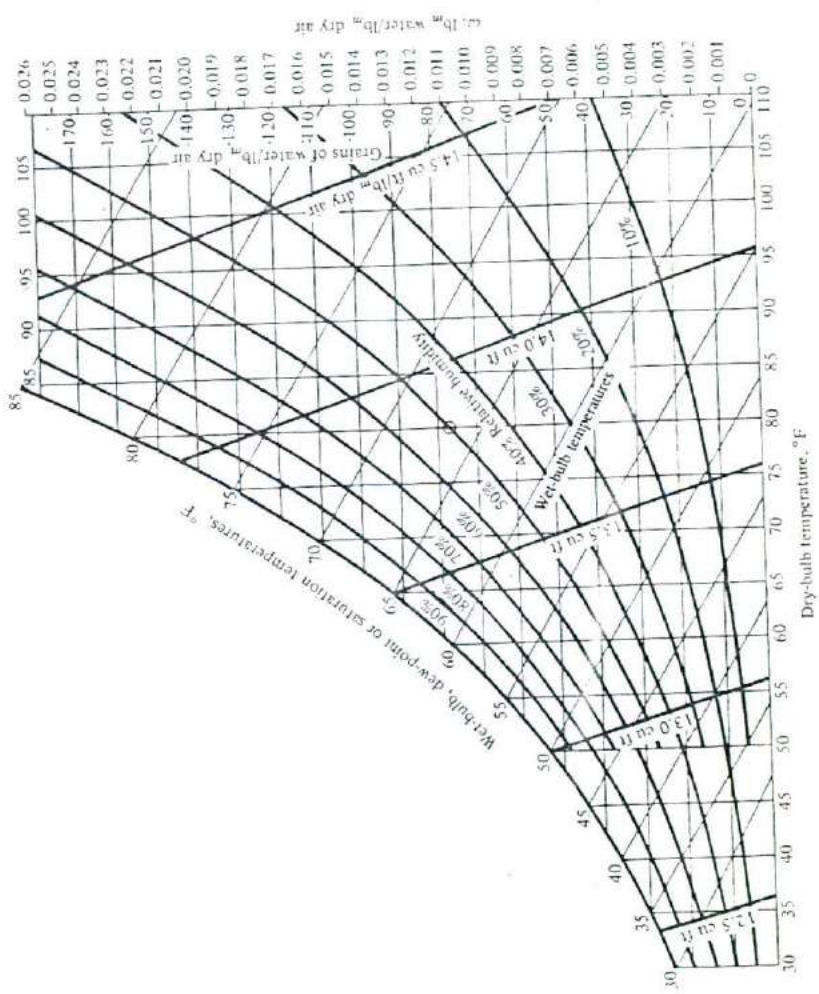


Figure M-1 Psychrometric chart at 1 standard atmosphere.

CONVERSION FACTORS

Table N-1 Some SI basic and derived units of interest

Type	Unit	Symbol	Formula
Length	meter	m	
Mass	kilogram	kg	
Time	second	s	
Temperature	kelvin	K	
Force	newton	N	$(\text{kg})(\text{m})/\text{s}^2$
Pressure	pascal	Pa	N/m^2
Energy, work	joule	J	Nm
Power	watt	W	J/s

Table N-2 Prefixes of multiples and submultiples

Factor	Prefix	Symbol
10^{-18}	atto	a
10^{-15}	femto	f
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	μ
10^{-3}	milli	m
10^{-2}	centi	c
10^{-1}	deci	d
10	deka	da
10^2	hecto	h
10^3	kilo	k
10^6	mega	M
10^9	giga	G
10^{12}	tera	T
10^{15}	peta	P
10^{18}	exa	E

Table N-3 Length

Å	ft	in	light year	mil	micron	mi (statute)	m
1	3.280840	3.937008	1.057021	3.937008	1.000000	6.213712	1.000000
	$E - 10$	$E - 09$	$E - 26$	$E - 06$	$E - 04$	$E - 14$	$E - 10$
3.048000	1	1.200000	3.221807	1.200000	3.048000	1.893939	3.048000
$E + 09$		$E + 01$	$E - 17$	$E + 04$	$E + 05$	$E - 04$	$E - 01$
2.540000	8.333333	1	2.684839	1.000000	2.540000	1.578283	2.540000
$E + 08$	$E - 02$		$E - 18$	$E + 03$	$E + 04$	$E - 05$	$E - 02$
9.460530	3.103848	3.724618	1	3.724618	9.460530	5.878501	9.460530
$E + 25$	$E + 16$	$E + 17$		$E + 20$	$E + 21$	$E + 12$	$E + 15$
2.540000	8.333333	1.000000	2.684839	1	2.540000	1.578283	2.540000
$E + 05$	$E - 05$	$E - 03$	$E - 21$		$E + 01$	$E - 08$	$E - 05$
1.000000	3.280840	3.937008	1.057023	3.937008	1	6.213712	1.000000
$E + 04$	$E - 06$	$E - 05$	$E - 22$	$E - 02$		$E - 10$	$E - 06$
1.609344	5.280000	6.336000	1.701114	6.336000	1.609344	1	1.609344
$E + 13$	$E + 03$	$E + 04$	$E - 13$	$E + 07$	$E + 09$		$E - 03$
1.000000	3.280840	3.937008	1.057023	3.937008	1.000000	6.213712	1
$E + 10$	$E + 00$	$E + 01$	$E - 16$	$E + 04$	$E + 06$	$E - 04$	

Table N-4 Arca

acre	bar	cm ²	ft ²	hectare	in ²	km ²	mi ²	m ²
1	4.046856	4.046856	4.356000	4.046856	6.272640	4.046856	1.562500	4.046856
	E + 31	E + 07	E + 04	E - 01	E + 06	E - 03	E - 03	E + 03
2.471054	1.000000	1.000000	1.076391	1.000000	1.550003	1.000000	3.861022	1.000000
	1	E - 24	E - 27	E - 32	E - 25	E - 34	E - 35	E - 28
E - 32	1.000000	1.000000	1.076391	1.000000	1.550003	1.000000	3.861022	1.000000
1.940761	1.000000	1	E - 03	E - 08	E - 01	E - 10	E - 11	E - 04
E - 08	E + 24	E + 02	E - 03	E - 08	E - 01	E - 10	E - 11	E - 04
2.295684	9.290304	9.290304	1	9.290304	1.440000	9.290304	2.587007	9.290304
E - 05	E + 26	E + 02	1	E - 06	E + 02	E - 08	E - 08	E - 02
2.471054	1.000000	1.000000	1.076391	1	1.550003	1.000000	3.861022	1.000000
E + 00	E + 32	E + 08	E + 05	1	E + 07	E - 02	E - 03	E + 04
1.594225	6.451600	6.451600	6.944444	6.451600	1	6.451600	2.490977	6.451600
E - 07	E + 24	E + 00	E - 03	E - 08	1	E - 10	E - 10	E - 04
2.471054	1.000000	1.000000	1.076391	1.000000	1.550003	1	3.861022	1.000000
E + 02	E + 34	E + 10	E + 07	E + 02	E + 09	1	E - 01	E + 06
6.400000	2.589988	2.589988	2.787840	2.589988	4.014490	2.589988	1	2.589988
E + 02	E + 34	E + 10	E + 07	E + 02	E + 09	E + 00	1	E + 06
2.471054	1.000000	1.000000	1.076391	1.000000	1.550003	1.000000	3.861022	1.000000
E - 04	E + 28	E + 04	E + 01	E - 04	E + 03	E - 06	E - 07	1

Table N-5 Volume

acre-ft	cm ³	ft ³	gal (US liquid)	gal (Imperial liquid)	in ³	L	pt (US liquid)	qt (US liquid)	m ³
1	1.233482	4.356000	3.258514	2.713283	7.527168	1.233482	2.606811	1.303406	1.233482
	<i>E + 09</i>	<i>E + 04</i>	<i>E + 05</i>	<i>E + 05</i>	<i>E + 07</i>	<i>E + 06</i>	<i>E + 06</i>	<i>E + 06</i>	<i>E + 03</i>
8.107132	1	3.531467	2.641721	2.199694	6.102374	1.000000	2.113376	1.056688	1.000000
	<i>E + 10</i>	<i>E - 05</i>	<i>E - 04</i>	<i>E - 04</i>	<i>E - 02</i>	<i>E - 03</i>	<i>E - 03</i>	<i>E - 03</i>	<i>E - 06</i>
2.295684	2.831685	1	7.480520	6.228841	1.728000	2.831685	5.984416	2.992208	2.831685
	<i>E - 05</i>	<i>E + 04</i>	<i>E + 00</i>	<i>E + 00</i>	<i>E + 03</i>	<i>E + 01</i>	<i>E + 01</i>	<i>E + 01</i>	<i>E - 02</i>
3.068883	3.785412	1.336806	1	8.326748	2.310000	3.785412	8.000000	4.000000	3.785412
	<i>E - 06</i>	<i>E + 03</i>	<i>E - 01</i>	<i>E - 01</i>	<i>E + 02</i>	<i>E + 00</i>	<i>E + 00</i>	<i>E + 00</i>	<i>E - 03</i>
3.685572	4.546087	1.605435	1.200949	1	2.774192	4.546086	9.607592	4.803796	4.546086
	<i>E - 06</i>	<i>E + 03</i>	<i>E - 01</i>	<i>E + 00</i>	<i>E + 02</i>	<i>E + 00</i>	<i>E + 00</i>	<i>E + 00</i>	<i>E - 03</i>
1.328521	1.638706	5.787037	4.329004	3.604653	1	1.638706	3.463204	1.731602	1.638706
	<i>E - 08</i>	<i>E + 01</i>	<i>E - 04</i>	<i>E - 03</i>	<i>E - 03</i>	<i>E - 02</i>	<i>E - 02</i>	<i>E - 02</i>	<i>E - 05</i>
8.107132	1.000000	5.787037	2.641721	2.199694	6.102375	1	2.113376	1.056688	1.000000
	<i>E - 07</i>	<i>E + 03</i>	<i>E - 04</i>	<i>E - 01</i>	<i>E + 01</i>	<i>E + 01</i>	<i>E + 00</i>	<i>E + 00</i>	<i>E - 03</i>

(continued)

Table N-5 Volume (Continued)

acre-ft	cm ³	ft ³	gal (US liquid)	gal (Imperial liquid)	in ³	L	pt (US liquid)	qt (US liquid)	m ³
3.836104	4.731765	1.671007	1.250000	1.040844	2.887500	4.731765	1	5.000000	4.731765
E - 07	E + 02	E - 02	E - 01	E - 01	E + 01	E - 01	E - 01	E - 01	E - 04
7.672208	9.463530	3.342014	2.500000	2.081687	5.775000	9.463530	2.000000	1	9.463530
E - 07	E + 02	E - 02	E - 01	E - 01	E + 01	E - 01	E + 00	E - 01	E - 04
8.107132	1.000000	3.531467	2.641721	2.199694	6.102375	1.000000	2.113376	1.056688	1
E - 04	E + 06	E + 01	E + 02	E + 02	E + 04	E + 03	E + 03	E + 03	E + 03

Table N-6 Mass

	dram (avoirdupois)	gr	g	oz	lb _m	ton (long)	ton (metric)	ton (short)	kg
1	9.371957 E - 25	2.562645 E - 23	1.660566 E - 24	5.857476 E - 26	3.660921 E - 27	1.634343 E - 30	1.660566 E - 30	1.830460 E - 30	1.660566 E - 27
1.067013	1	2.734375 E + 01	1.771845 E + 00	6.250000 E - 02	3.906250 E - 03	1.743862 E - 06	1.771845 E - 06	1.953125 E - 06	1.771845 E - 03
3.902218	3.657143 E - 02	1	6.479891 E - 02	2.285714 E - 03	1.428571 E - 04	6.377551 E - 08	6.479891 E - 08	7.142857 E - 08	6.479891 E - 05
6.022043	5.643834 E - 01	1.543236 E + 01	1	3.527396 E - 02	2.204623 E - 03	9.842065 E - 07	1.000000 E - 06	1.102311 E - 06	1.000000 E - 03
1.707220	1.600000 E + 01	4.375000 E + 02	2.834952 E + 01	1	6.250000 E - 02	2.790179 E - 05	2.834952 E - 05	3.125000 E - 05	2.834952 E - 02
2.731553	2.560000 E + 02	7.000000 E + 03	4.535924 E + 02	1.600000 E + 01	1	4.464286 E - 04	4.535924 E - 04	5.000000 E - 04	4.535924 E - 01
6.118679	5.734400 E + 05	1.568000 E + 07	1.016047 E + 06	3.584000 E - 04	2.40000 E + 03	1	1.016047 E + 00	1.120000 E + 00	1.016047 E + 03

(continued)

Table N-6 Mass (Continued)

mu	dram (avoirdupois)	gr	g	oz	lb _a	ton (long)	ton (metric)	ton (short)	kg
5.022043	5.643834	1.543236	1.000000	3.527396	2.204623	9.842065		1.102311	1.000000
E + 29	E + 05	E + 07	E + 06	E + 04	E + 03	E - 01	1	E + 00	E + 03
5.463107	5.120000	1.400000	9.071847	3.200000	2.000000	8.928571	9.071847	1	9.071847
E + 29	E + 05	E + 07	E + 05	E + 04	E + 03	E - 01	E - 01	1	E + 02
6.022043	5.643834	1.543236	1.000000	3.527396	2.204623	9.842065	1.000000	1.102311	
E + 26	E + 02	E + 04	E + 03	E + 01	E + 00	E - 04	E - 03	E - 03	1

Table N-7 Density

g/cm ³	g/L	lb./ft ³	lb./gal (US)	lb./gal (imperial)	lb./in ³	ton/yd ³	kg/m ³
1	1.000000	6.242795	8.345403	1.002240	3.612728	8.427773	1.000000
	E + 03	E + 01	E + 00	E + 01	E - 02	E - 01	E + 03
1.000000	1	6.242795	8.345403	1.002240	3.612728	8.427773	1.000000
E - 03		E - 02	E - 03	E - 02	E - 05	E - 04	E + 00
1.601847	1.601847	1	1.336806	1.605435	5.787037	1.350000	1.601847
E - 02	E + 01		E - 01	E - 01	E - 04	E - 02	E + 01
1.198264	1.198264	7.480519	1	1.200949	4.329004	1.009870	1.198264
E - 01	E + 02	E + 00		E + 00	E - 03	E - 01	E + 02
9.977648	9.977648	6.228841	8.326750	1	3.604654	8.408933	9.977650
E - 02	E + 01	E + 00	E - 01		E - 03	E - 02	E + 01
2.767991	2.767991	1.728000	2.310000	2.774191	1	2.332800	2.767991
E + 01	E + 04	E + 03	E + 02	E + 02		E + 01	E + 04
1.186553	1.186553	7.407407	9.902264	1.189211	4.286694	1	1.186553
E + 00	E + 03	E + 01	E + 00	E + 01	E - 02		E + 03
1.000000	1.000000	6.242795	8.345403	1.002240	3.612728	8.427773	1
E - 03	E + 00	E - 02	E - 03	E - 02	E - 05	E - 04	

Table N-8 Time (mean solar)

day	h	ms	min	lunar month	year	s
1	2.400000	8.640000	1.440000	3.386319	2.737909	8.640000
	E + 01	E + 10	E + 03	E - 02	E - 03	E + 04
4.166667	1	3.600000	6.000000	1.410966	1.140796	3.600000
E - 02		E + 09	E + 01	E - 03	E - 04	E + 03
1.157407	2.777778	1	1.666667	3.919351	3.168876	1.000000
E - 11	E - 10		E - 08	E - 13	E - 14	E - 06

(continued)

Table N-8 Time (mean solar) (Continued)

day	h	ms	min	lunar month	year	s
6.944445	1.666667	6.000000		2.351611	1.901326	6.000000
<i>E</i> - 04	<i>E</i> - 02	<i>E</i> + 07	1	<i>E</i> - 05	<i>E</i> - 06	<i>E</i> + 01
2.953059	7.087341	2.551443	4.252405		8.605207	2.551443
<i>E</i> + 01	<i>E</i> + 02	<i>E</i> + 12	<i>E</i> + 04	1	<i>E</i> - 02	<i>E</i> + 06
3.652422	8.765813	3.155693	5.259488	1.236827		3.155693
<i>E</i> + 02	<i>E</i> + 03	<i>E</i> + 13	<i>E</i> + 05	<i>E</i> + 01	1	<i>E</i> + 07
1.157407	2.777778	1.000000	1.666667	3.919351	3.168876	
<i>E</i> - 05	<i>E</i> - 04	<i>E</i> + 06	<i>E</i> - 02	<i>E</i> - 07	<i>E</i> - 08	1

Table N-9 Speed

ft/h	ft/s	in/s	km/h	kn	mi/h	mi/s	m/s
1	2.777778	3.333333	3.048000	1.645789	1.893939	5.260943	8.466667
	<i>E</i> - 04	<i>E</i> - 03	<i>E</i> - 04	<i>E</i> - 04	<i>E</i> - 04	<i>E</i> - 08	<i>E</i> - 05
3.600000	1	1.200000	1.097280	5.924841	6.818182	1.893939	3.048000
<i>E</i> + 03		<i>E</i> + 01	<i>E</i> + 00	<i>E</i> - 01	<i>E</i> - 01	<i>E</i> - 04	<i>E</i> - 01
3.000000	8.333333	1	9.144000	4.937367	5.681818	1.578283	2.540000
<i>E</i> + 02	<i>E</i> - 02		<i>E</i> - 02	<i>E</i> - 02	<i>E</i> - 02	<i>E</i> - 05	<i>E</i> - 02
3.280840	9.113444	1.093613	1	5.399570	6.213712	1.726031	2.777778
<i>E</i> + 03	<i>E</i> - 01	<i>E</i> + 01		<i>E</i> - 01	<i>E</i> - 01	<i>E</i> - 04	<i>E</i> - 01
6.076112	1.687809	2.025371	1.851999		1.150779	3.196608	5.144444
<i>E</i> + 03	<i>E</i> + 00	<i>E</i> + 01	<i>E</i> + 00	1	<i>E</i> + 00	<i>E</i> - 04	<i>E</i> - 01
5.280000	1.466667	1.760000	1.609344	8.689766		2.777778	4.470400
<i>E</i> + 03	<i>E</i> + 00	<i>E</i> + 01	<i>E</i> + 00	<i>E</i> - 01	1	<i>E</i> - 04	<i>E</i> - 01
1.900800	5.280000	6.336000	5.793639	3.128316	3.600000		1.609344
<i>E</i> + 07	<i>E</i> + 03	<i>E</i> + 04	<i>E</i> + 03	<i>E</i> + 03	<i>E</i> + 03	1	<i>E</i> + 03
1.181102	3.280840	3.155693	3.600000	1.943845	2.236936	6.213712	
<i>E</i> + 04	<i>E</i> + 00	<i>E</i> + 04	<i>E</i> + 00	<i>E</i> + 00	<i>E</i> + 00	<i>E</i> - 04	1

Table N-10 Acceleration

f_0h^2	$f_0\text{min}^2$	f_0s^2	free fall	m/s^2	km/h^2	km/s^2	mi/h^2	m/s^2
1	2.777778	7.716049	2.398221	9.250259	3.048000	2.351852	1.893939	2.351852
	$E - 04$	$E - 08$	$E - 09$	$E - 07$	$E - 04$	$E - 11$	$E - 04$	$E - 08$
3.600000	1	2.777778	8.633597	3.333333	1.097280	8.466666	6.818182	8.466666
	$E + 03$	$E - 04$	$E - 06$	$E - 03$	$E + 00$	$E - 08$	$E - 01$	$E - 05$
1.296000	3.600000	1	3.108095	1.200000	3.950208	3.048000	2.454546	3.048000
	$E + 07$	$E + 03$	$E - 02$	$E + 01$	$E + 03$	$E - 04$	$E + 03$	$E - 01$
4.169757	1.150266	3.217405	1	3.860886	1.270942	9.806650	6.093570	9.806650
	$E + 08$	$E + 05$	$E + 01$	$E + 02$	$E + 05$	$E - 03$	$E - 06$	$E + 00$
1.080000	3.000000	8.333333	2.590079	1	3.291840	2.540000	2.045455	2.540000
	$E + 06$	$E + 02$	$E - 03$	$E - 03$	$E + 02$	$E - 05$	$E + 02$	$E - 02$
3.280840	9.113444	2.531512	7.868180	3.037815	1	7.716049	6.213712	7.716049
	$E + 00$	$E - 04$	$E - 07$	$E - 06$	$E - 03$	$E - 08$	$E - 01$	$E - 05$
4.251969	1.181102	3.280840	1.019716	3.937008	1.296000	1	8.052971	1.000000
	$E + 10$	$E + 07$	$E + 03$	$E + 02$	$E - 04$	$E + 07$	$E + 06$	$E + 03$
1.280000	4.666667	4.074074	1.266261	4.888889	1.609344	1.241778	1	1.241778
	$E + 03$	$E + 00$	$E - 04$	$E - 05$	$E - 03$	$E + 00$	$E - 07$	$E - 04$
4.251969	1.181102	3.280840	1.019716	3.937008	1.296000	1.000000	8.052971	1
	$E + 07$	$E + 04$	$E - 01$	$E + 01$	$E + 04$	$E - 03$	$E + 03$	$E + 03$

Table N-11 Volume flow rate

cm ³ /s	in ³ /s	ft ³ /min	gal(US)/min	gal(imperial)/min	L/min	m ³ /s
1	6.102374	2.118880	1.585032	1.319816	6.000000	1.000000
	E - 02	E - 03	E - 02	E - 02	E - 02	E - 06
1.638706	1	3.472222	2.597403	2.162792	9.832238	1.638707
E + 01		E - 02	E - 01	E - 01	E - 01	E - 05
4.719474	2.880000	1	7.480520	6.228841	2.831685	4.719474
E + 02	E + 01		E + 00	E + 00	E + 01	E - 04
6.309020	3.850000	1.336806	1	8.326748	3.785412	6.309020
E + 01	E + 00	E - 01		E - 01	E + 00	E - 05
7.576811	4.623654	1.605436	1.200949	1	4.546087	7.576811
E + 01	E + 00	E - 01	E + 00		E + 00	E - 05
1.666667	1.017062	3.531467	2.641721	2.199695	1	1.666667
E + 01	E + 00	E - 02	E - 01	E - 01		E - 05
1.000000	6.102374	2.118880	1.585032	1.319816	6.000000	1
E + 06	E + 04	E + 03	E + 04	E + 04	E + 04	

Table N-12 Mass flow rate

g/s	kg/h	lb _m /min	lb _m /h	ton(metric)/day	ton(short)/h	kg/s
1	3.600000	1.322774	7.936642	8.640000	3.968321	1.000000
	E + 00	E - 01	E + 00	E - 02	E - 03	E - 03
2.777778	1	3.674371	2.204623	2.400000	1.102311	2.777778
E - 01		E - 02	E + 00	E - 02	E - 03	E - 04
7.559873	2.721554	1	6.000000	6.531730	3.000000	7.559873
E + 00	E + 01		E + 01	E - 01	E - 02	E - 03

(cont:masu)

Table N-12 Mass flow rate (Continued)

g/s	kg/h	lb _m /min	lb _m /h	ton(metric)/day	ton(short)/h	kg/s
1.259979	4.535924	1.666667	1	1.088622	5.000000	1.259979
E - 01	E - 01	E - 02		E - 02	E - 04	E - 04
1.157407	4.166667	1.530988	9.185928	1	4.592964	1.157407
E + 01	E + 01	E + 00	E + 01		E - 02	E - 02
2.519958	9.071847	3.333333	2.000000	2.177243	1	2.519958
E + 02	E + 02	E + 01	E + 03	E + 01		E - 01
1.000000	3.600000	1.322774	7.936642	8.640000	3.969321	1
E + 03	E + 03	E + 02	E + 03	E + 01	E + 00	

Table N-13 Force

dyn (g/m · cm/s ²)	kg/force (or kilb) kg _f	kip	lb-force lb _f	poundal (lb _m · ft/s ²)	N [(kg)(m)/s ²]
1	1.019716	2.248089	2.248089	7.233014	1.000000
	E - 06	E - 09	E - 06	E - 05	E - 05
9.806650	1	2.204623	2.204623	7.093165	9.806650
E + 02		E - 03	E + 00	E + 01	E + 00
4.448222	4.535924	1	1.000000	3.217405	4.448222
E + 08	E + 02		E + 03	E + 04	E + 03
4.448222	4.535924	1.000000	1	3.217405	4.448222
E + 05	E - 01	E - 03		E + 01	E + 00
1.382550	1.409808	3.108095	3.108095	1	1.382550
E + 04	E - 02	E - 05	E - 02		E - 01
1.000000	1.019716	2.248089	2.248089	7.233014	1
E + 05	E - 01	E - 04	E - 01	E + 00	

Table N-14 Pressure

at/s (normal)	bar	cm Hg (0°C)	dyn/cm ²	ft water (60°F)	in Hg (32°F)	in water (60°F)	kg/cm ²	lb _f /in ²	torr, mm Hg (0°C)	Pa, (N/m ²)
	1.013250	7.600007	1.013250	3.393615	2.992129	4.072338	1.033227	1.469595	7.600007	1.013250
	E + 00	E + 01	E + 06	E + 01	E + 01	E + 02	E + 00	E + 01	E + 02	E + 05
9.869233		7.500624	1.000000	3.349238	2.953001	4.019085	1.019716	1.450377	7.500624	1.000000
E - 01	E + 01	E + 04	E + 04	E + 01	E + 01	E + 02	E + 00	E + 01	E + 02	E + 05
1.315788	1.333222		1.333222	4.465279	3.937008	5.358355	1.359509	1.933676	1.000000	1.333222
E - 02	E - 02		E - 04	E - 01	E - 01	E + 00	E - 02	E - 01	E + 01	E + 03
9.869233	1.000000	7.500624		3.349238	2.953001	4.019085	1.019716	1.450377	7.500624	1.000000
E - 07	E - 06	E - 05		E - 05	E - 05	E - 04	E - 06	E - 05	E - 04	E - 01
2.46710	2.985754	2.239502	3.95754		8.816646	1.200000	3.044622	4.330470	2.239502	2.985754
E - 02	E - 02	E + 00	E + 04		E - 01	E + 01	E - 02	E - 01	E + 01	E + 03

1.3 2102	3.386385	2.540000	3.386385	1.134181		1.261017	3.453152	4.911537	2.540000	3.386385
E - 02	E - 02	E + 01	E + 04	E + 00		E + 01	E - 02	E - 01	E + 01	E + 03
1.4 5152	2.488128	1.866221	2.488128	8.333333	7.347447		2.537185	3.608725	1.866251	2.488126
E - 03	E - 03	E - 0	E + 03	E - 02	E - 02		E - 03	E - 02	E + 00	E + 02
9.6 8411	9.806650	7.355519	9.806650	3.284480	2.895905	3.941376		1.422134	7.355599	9.806650
E - 01	E - 01	E + 0	E + 05	E + 01	E + 01	E + 02		E + 01	E + 02	E + 04
1.8 546	6.894757	5.171478	6.894757	2.109218	2.136023	2.71062	7.030696		5.171498	6.894757
E - 02	E - 02	E + 10	E + 11	E + 03	E + 00	E + 01	E - 02		E + 01	$\times 10^3$
3.5 88	1.333222	1.000000	1.333222	4.465279	3.937008	5.358335	1.359509	1.933676		1.333222
E - 03	E - 03	E - 01	E - 03	E - 02	E - 02	E - 01	E - 03	E - 02		E - 02
5.8 4217	1.000000	7.500624	1.000000	3.349238	2.953001	4.019085	1.019716	1.450377	7.500624	
E - 05	E - 05	E - 04	E + 01	E - 04	E - 04	E - 03	E - 05	E - 04	E - 03	E - 03

Table N-15 Energy

Btu	cal (Int. table)	EV	erg (dyn · cm)	ft · lbf	hp · h	kw · h	MeV	J. W · s or N · m
I	2.521403	6.585086	1.055056	7.781693	3.930148	2.930711	6.585086	1.055056
	E + 02	E + 21	E + 10	E + 02	E - 04	E - 04	E + 15	E + 03
3.968321	I	2.613173	4.186800	3.088025	1.559609	1.163000	2.613173	4.186800
E - 03		E + 19	E + 07	E - 00	E - 06	E - 06	E + 13	E + 00
1.518583	3.826765	I	1.602190	1.181715	5.968256	4.450528	1.000000	1.602190
E - 22	E - 20		E - 12	E - 19	E - 26	E - 26	E - 06	E - 19
9.478172	2.388459	6.241457	I	7.375622	3.725062	2.777777	6.241457	1.000000
E - 11	E - 08	E + 11		E - 08	E - 14	E - 14	E + 05	E - 07
1.285067	3.238315	8.462280	1.355818	I	5.050505	3.766160	8.462280	1.355818
E - 03	E - 11	E + 18	E + 07		E - 07	E - 07	E + 12	E + 00
2.544333	6.411864	1.675531	2.684519	1.980000	I	7.450997	1.675531	2.684519
E + 03	E + 05	E + 25	E + 13	E + 06		E - 01	E + 19	E + 06
3.412142	8.598454	2.246925	3.600000	2.655224	1.341322	I	2.246925	3.600000
E + 03	E + 05	E + 25	E + 13	E + 06	E + 04		E + 19	E + 06
1.518583	3.826765	1.000000	1.602190	1.181715	5.968256	4.450528	I	1.602190
E - 16	E - 14	E + 06	E - 6	E - 13	E - 20	E - 20	E - 13	E - 13
9.478172	2.388459	6.241457	1.000000	7.375622	3.725062	2.777778	6.241457	I
E - 04	E - 01	E + 18	E + 07	E - 01	E - 07	E - 07	E + 12	E + 12

Table N-16 Energy flux

Btu/(h)(ft ²)	cal/(s)(cm ²)	erg/(s)(cm ²)	ft. lb/(h)(ft ²)	hp/ft ²	W/cm ²	W/m ²
1	7.534608	3.154589	7.781696	3.930150	3.154589	3.154589
	E - 05	E + 03	E + 02	E - 04	E - 04	E + 00
1.327209	1	4.186800	1.032794	5.216129	4.186800	4.186800
E + 04		E + 07	E + 07	E + 00	E + 00	E + 04
3.169984	2.388459	1	2.466785	1.245851	1.000000	1.000000
E - 04	E - 08		E - 01	E - 07	E - 07	E - 07
1.285067	9.682478	4.053860	1	5.050505	4.053859	4.053859
E - 03	E - 08	E + 00		E - 07	E - 07	E - 03
2.544432	1.917130	8.026641	1.980000	1	8.026641	8.026641
E + 03	E - 01	E + 06	E + 06		E - 01	E + 03
3.169984	2.388459	1.000000	2.466785	1.245851	1	1.000000
E + 03	E - 01	E + 07	E + 06	E + 00		E + 04
3.169984	2.388459	1.000000	2.466785	1.245851	1.000000	1
E - 01	E - 05	E + 03	E + 02	E - 04	E - 04	

Table N-17 Specific energy

Btu/lb _m	cal/g	kwh/kg	MW · day/ton (metric)	J/kg. (W · s/kg)
1	5.555556	6.461111	2.692130	2.326000
	E - 01	E - 04	E - 05	E + 03
1.800000	1	1.163000	4.845833	4.186800
E + 00		E - 03	E - 05	E + 03
1.547721	8.598452	1	4.166667	3.600000
E + 03	E + 02		E - 02	E + 06
3.714530	2.063618	2.400000	1	8.640000
E + 04	E + 04	E + 01		E + 07
4.299226	2.308459	2.777778	1.157407	1
E - 04	E - 04	E - 07	E - 08	

Table N-18 Power

Btu/h	cal/s	erg/s	eV/s	$\frac{1}{3}$ lb _m /min	hp	kw	W, (J/s)
1	6.999884	2.930711	1.829191	1.296948	3.930143	2.930711	2.930711
	E - 02	E + 06	E + 18	E + 01	E - 04	E - 04	E - 01
1.428595	1	4.186800	2.613173	1.852813	5.614583	4.186800	4.186800
E + 01		E + 07	E + 19	E + 02	E - 03	E - 03	E + 00
3.412141	2.380493	1	6.241457	4.425367	1.341020	1.000000	1.000000
E - 07	E - 08		E + 11	E - 06	E - 10	E - 10	E - 07
5.466898	3.814002	1.602190	1	7.990278	2.148569	1.602190	1.602190
E - 19	E - 20	E - 12		E - 18	E - 22	E - 22	E - 19
7.710415	5.397200	2.259700	1.410382	1	3.030203	2.259697	2.259697
E - 02	E - 03	E + 05	E + 17		E - 05	E - 01	E - 02
2.544437	1.781076	7.457010	4.654261	3.300000	1	7.456999	7.456999
E + 03	E + 02	E + 09	E + 21	E + 04		E - 05	E + 02
3.412141	2.388459	1.000000	6.241457	4.425366	1.341020	1	1.000000
E + 03	E + 02	E + 10	E + 21	E - 04	E + 00		E + 03
3.412141	2.388459	1.000000	6.241457	4.425366	1.341020	1.000000	1
E + 00	E - 01	E + 07	E + 18	E + 01	E - 03	E - 03	

Table N-19 Power density

Btu (h)(ft ³)	cal (s)(cm ³)	MeV/(s)(cm ³)	W/cm ³ , (kW/L)	W/m ³
1	2.471986	6.459728	1.034971	1.034971
	<i>E</i> - 06	<i>E</i> + 07	<i>E</i> - 05	<i>E</i> + 01
4.045330	1	2.613173	4.186800	4.186800
<i>E</i> + 05		<i>E</i> + 13	<i>E</i> + 00	<i>E</i> + 06
1.548053	3.826765	1	1.602190	1.602190
<i>E</i> - 08	<i>E</i> - 14		<i>E</i> - 13	<i>E</i> - 07
9.662106	2.388459	6.241457	1	1.000000
<i>E</i> + 04	<i>E</i> - 01	<i>E</i> + 12		<i>E</i> + 06
9.662106	2.388459	6.241457	1.000000	1
<i>E</i> - 02	<i>E</i> - 07	<i>E</i> + 06	<i>E</i> - 06	

Table N-20 Specific power

Btu (h)(lb _m)	cal (s)(g _m)	ft ³ lb _f /(h)(lb _m)	hp lb _m	W g, (kW/kg)	W/kg
1	1.543210	7.781693	3.930148	6.461113	6.461113
	<i>E</i> - 04	<i>E</i> + 02	<i>E</i> - 04	<i>E</i> - 01	<i>E</i> + 02
6.479999	1	5.042536	2.546735	4.186800	4.186800
<i>E</i> + 03		<i>E</i> + 06	<i>E</i> + 00	<i>E</i> + 03	<i>E</i> + 06
1.285067	1.984456	1	5.050505	8.302965	8.302965
<i>E</i> - 03	<i>E</i> - 07		<i>E</i> - 07	<i>E</i> - 04	<i>E</i> - 01
2.546136	3.929223	1.980000	1	1.643987	1.643987
<i>E</i> + 03	<i>E</i> - 01	<i>E</i> + 06		<i>E</i> + 03	<i>E</i> + 06
1.547721	2.388459	1.204389	6.082773	1	1.000000
<i>E</i> + 00	<i>E</i> - 04	<i>E</i> + 03	<i>E</i> - 04		<i>E</i> + 03
1.547721	2.388459	1.204389	6.082773	1.000000	1
<i>E</i> - 03	<i>E</i> - 07	<i>E</i> + 00	<i>E</i> - 07	<i>E</i> - 03	

Table N-21 Thermal conductivity

Btu/(h)(ft)(°F)	Btu · in/(h)(ft ²)(°F)	cal/(s)(cm)(°C)	kcal/(h)(m)(°C)	W/(m)(°C)
1	1.200000	4.133787	1.488163	1.730734
	E + 01	E - 05	E + 00	E + 00
8.333333	1	3.444823	1.240136	1.442279
E - 02		E - 06	E - 01	E - 01
2.419088	2.902906	1	3.600000	4.186800
E + 04	E + 05		E + 04	E + 04
6.719691	8.063629	2.777778	1	1.163000
E - 01	E + 00	E - 05		E + 00
5.777894	6.933473	2.388459	8.598452	1
E - 01	E + 00	E - 05	E - 01	

Table N-22 Heat-transfer coefficient

Btu/(ft ²)(h)(°F)	cal/(cm ²)(s)(°C)	W/(cm ²)(°C)	W/(m ²)(°C)
1	1.356229	5.678260	5.678260
	E - 04	E - 04	E + 00
7.373386	1	4.186800	4.186800
E + 03		E + 00	E + 04
1.761102	2.388459	1	1.000000
E + 03	E - 01		E + 04
1.761102	2.388459	1.000000	1
E - 01	E - 05	E - 04	

Table N-23 Specific heat and specific gas constant

Btu/(lb _m)(°F)	cal/(g _m)(°C)	ft · lb _f /(lb _m)(°R)	kJ/(kg)(°C)
1	1.000000	7.835679	4.186800
	<i>E</i> + 00	<i>E</i> + 02	<i>E</i> + 00
1.000000	1	7.835679	4.186800
<i>E</i> + 00		<i>E</i> + 02	<i>E</i> + 00
1.276214	1.276214	1	5.343251
<i>E</i> - 03	<i>E</i> - 04		<i>E</i> - 03
2.388459	2.388459	1.871829	1
<i>E</i> - 01	<i>E</i> - 01	<i>E</i> - 02	

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