

appendix

D

**Some
Thermodynamic Properties**

TABLE D-1a*
Properties of Dry Saturated Steam †
Pressure

Abs. press., psia	Temp., °F	Specific volume		Enthalpy			Entropy		
		Sat. liquid	Sat. vapor	Sat. liquid	Evap.	Sat. vapor	Sat. liquid	Evap.	Sat. vapor
<i>p</i>	<i>t</i>	<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_{fg}</i>	<i>s_g</i>
1.0	101.74	0.01614	333.6	69.70	1036.3	1106.0	0.1326	1.8456	1.9782
2.0	126.08	0.01623	173.73	93.99	1022.2	1116.2	0.1749	1.7451	1.9200
3.0	141.48	0.01630	118.71	109.37	1013.2	1122.6	0.2008	1.6855	1.8863
4.0	152.97	0.01636	90.63	120.86	1006.4	1127.3	0.2198	1.6427	1.8625
5.0	162.24	0.01640	73.52	130.13	1001.0	1131.1	0.2347	2.6094	1.8441
6.0	170.06	0.01645	61.98	137.96	996.2	1134.2	0.2472	1.5820	1.8292
7.0	176.85	0.01649	53.64	144.76	992.1	1136.9	0.2581	1.5586	1.8167
8.0	182.86	0.01653	47.34	150.79	988.5	1139.3	0.2674	1.5383	1.8057
9.0	188.28	0.01656	42.40	156.22	985.2	1141.4	0.2759	1.5203	1.7962
10	193.21	0.01659	38.42	161.17	982.1	1143.3	0.2835	1.5041	1.7876
14.696	212.00	0.01672	26.80	180.07	970.3	1150.4	0.3120	1.4446	1.7566
15	213.03	0.01672	26.29	181.11	969.7	1150.8	0.3135	1.4415	1.7549
20	227.96	0.01683	20.089	196.16	960.1	1156.3	0.3356	1.3962	1.7319
25	240.07	0.01692	16.303	208.42	952.1	1160.6	0.3533	1.3606	1.7139
30	250.33	0.01701	13.746	218.82	945.3	1164.1	0.3680	1.3313	1.6993
35	259.28	0.01708	11.898	227.91	939.2	1167.1	0.3807	1.3063	1.6870
40	267.25	0.01715	10.498	236.03	933.7	1169.7	0.3919	1.2844	1.6763
45	274.44	0.01721	9.401	243.36	928.6	1172.0	0.4019	1.2650	1.6669
50	281.01	0.01727	8.515	250.09	924.0	1174.1	0.4110	1.2474	1.6585
55	287.07	0.01732	7.787	256.30	919.6	1175.9	0.4193	1.2316	1.6509
60	292.71	0.01738	7.175	262.09	915.5	1177.6	0.4270	1.2168	1.6438
65	297.97	0.01743	6.655	267.50	911.6	1179.1	0.4342	1.2032	1.6374
70	302.92	0.01748	6.206	272.61	907.9	1180.6	0.4409	1.1906	1.6315
75	307.60	0.01753	5.816	277.43	904.5	1181.9	0.4472	1.1787	1.6259
80	312.03	0.01757	5.472	282.02	901.1	1183.1	0.4531	1.1676	1.6207
85	316.25	0.01761	5.168	286.39	897.8	1184.2	0.4587	1.1571	1.6158
90	320.27	0.01766	4.896	290.56	894.7	1185.3	0.4641	1.1471	1.6112
95	324.12	0.01770	4.652	294.56	891.7	1186.2	0.4692	1.1376	1.6068
100	327.81	0.01774	4.432	298.40	888.8	1187.2	0.4740	1.1286	1.6026
110	334.77	0.01782	4.049	305.66	883.2	1188.9	0.4832	1.1117	1.5948

* For units used in Appendix D: v , ft³/lb_m; h , Btu/lb_m; s , Btu/lb_m°R.

† Abridged from Joseph H. Keenan and Frederick G. Keyes, *Thermodynamic Properties of Steam*, John Wiley and Sons, Inc., New York. Copyright, 1937, by Joseph H. Keenan and Frederick G. Keyes.

TABLE D-1a
Properties of Dry Saturated Steam (continued)
Pressure

Abs. press., psia	Temp., °F	Specific volume		Enthalpy			Entropy		
		Sat. liquid	Sat. vapor	Sat. liquid	Evap.	Sat. vapor	Sat. liquid	Evap.	Sat. vapor
p	t	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g
120	341.25	0.01789	3.728	312.44	877.9	1190.4	0.4916	1.0962	1.5878
130	347.32	0.01796	3.455	318.81	872.9	1191.7	0.4995	1.0817	1.5812
140	353.02	0.01802	3.220	324.82	868.2	1193.0	0.5069	1.0682	1.5751
150	358.42	0.01809	3.015	330.51	863.6	1194.1	0.5138	1.0556	1.5694
160	363.53	0.01815	2.834	335.93	859.2	1195.1	0.5204	1.0436	1.5640
170	368.41	0.01822	2.675	341.09	854.9	1196.0	0.5266	1.0324	1.5590
180	373.06	0.01827	2.532	346.03	850.8	1196.9	0.5325	1.0217	1.5542
190	377.51	0.01833	2.404	350.79	846.8	1197.6	0.5381	1.0116	1.5497
200	381.79	0.01839	2.288	355.36	843.0	1198.4	0.5435	1.0018	1.5453
250	400.95	0.01865	1.8438	376.00	825.1	1201.1	0.5675	0.9588	1.5263
300	417.33	0.01890	1.5433	393.84	809.0	1202.8	0.5879	0.9225	1.5104
350	431.72	0.01913	1.3260	409.69	794.2	1203.9	0.6056	0.8910	1.4966
400	444.59	0.0193	1.1613	424.0	780.5	1204.5	0.6214	0.8630	1.4844
450	456.28	0.0195	1.0320	437.2	767.4	1204.6	0.6356	0.8378	1.4734
500	467.01	0.0197	0.9278	449.4	755.0	1204.4	0.6487	0.8147	1.4634
550	476.94	0.0199	0.8424	460.8	743.1	1203.9	0.6608	0.7934	1.4542
600	486.21	0.0201	0.7698	471.6	731.6	1203.2	0.6720	0.7734	1.4454
650	494.90	0.0203	0.7083	481.8	720.5	1202.3	0.6826	0.7548	1.4374
700	503.10	0.0205	0.6554	491.5	709.7	1201.2	0.6925	0.7371	1.4296
750	510.86	0.0207	0.6092	500.8	699.2	1200.0	0.7019	0.7204	1.4223
800	518.23	0.0209	0.5687	509.7	688.9	1198.6	0.7108	0.7045	1.4153
850	525.26	0.0210	0.5327	518.3	678.8	1197.1	0.7194	0.6891	1.4085
900	531.98	0.0212	0.5006	526.6	668.8	1195.4	0.7275	0.6744	1.4020
950	538.43	0.0214	0.4717	534.6	659.1	1193.7	0.7355	0.6602	1.3957
1000	544.61	0.0216	0.4456	542.4	649.4	1191.8	0.7430	0.6467	1.3897
1100	556.31	0.0220	0.4001	557.4	630.4	1187.7	0.7575	0.6205	1.3780
1200	567.22	0.0223	0.3619	571.7	611.7	1183.4	0.7711	0.5956	1.3667
1300	577.46	0.0227	0.3293	585.4	593.2	1178.6	0.7840	0.5719	1.3559
1400	587.10	0.0231	0.3012	598.7	574.7	1173.4	0.7963	0.5491	1.3454
1500	596.23	0.0235	0.2765	611.6	556.3	1167.9	0.8082	0.5269	1.3351
2000	635.82	0.0257	0.1878	671.7	463.4	1135.1	0.8619	0.4230	1.2849
2500	668.13	0.0287	0.1307	730.6	360.5	1091.1	0.9126	0.3197	1.2322
3000	695.36	0.0346	0.0858	802.5	217.8	1020.3	0.9731	0.1885	1.1615
3206.2	705.40	0.0503	0.0503	902.7	0	902.7	1.0580	0	1.0580

TABLE D-1b
Properties of Dry Saturated Steam (continued)
Temperature

Temp., °F	Abs press., psia	Specific volume		Enthalpy			Entropy		
		Sat. liquid	Sat. vapor	Sat. liquid	Evap.	Sat. vapor	Sat. liquid	Evap.	Sat. vapor
<i>t</i>	<i>p</i>	<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_{fg}</i>	<i>s_g</i>
32	0.08854	0.01602	3306	0.00	1075.8	1075.8	0.0000	2.1877	2.1877
35	0.09995	0.01602	2947	3.02	1074.1	1077.1	0.0061	2.1709	2.1770
40	0.12170	0.01602	2444	8.05	1071.3	1079.3	0.0162	2.1435	2.1597
45	0.14752	0.01602	2036.4	13.06	1068.4	1081.5	0.0262	2.1167	2.1429
50	0.17811	0.01603	1703.2	18.07	1065.6	1083.7	0.0361	2.0903	2.1264
60	0.2563	0.01604	1206.7	28.06	1059.9	1088.0	0.0555	2.0393	2.0948
70	0.3631	0.01606	867.9	38.04	1054.3	1092.3	0.0745	1.9902	2.0647
80	0.5069	0.01608	633.1	48.02	1048.6	1096.6	0.0932	1.9428	2.0360
90	0.6982	0.01610	468.0	57.99	1042.9	1100.9	0.1115	1.8972	2.0087
100	0.9492	0.01613	350.4	67.97	1037.2	1105.2	0.1295	1.8531	1.9826
110	1.2748	0.01617	265.4	77.94	1031.6	1109.5	0.1477	1.8106	1.9577
120	1.6924	0.01620	203.27	87.92	1025.8	1113.7	0.1645	1.7694	1.9339
130	2.2225	0.01625	157.34	97.90	1020.0	1117.9	0.1816	1.7296	1.9112
140	2.8886	0.01629	123.01	107.89	1014.1	1122.0	0.1984	1.6910	1.8894
150	3.718	0.01634	97.07	117.89	1008.2	1126.1	0.2149	1.6537	1.8685
160	4.741	0.01639	77.29	127.89	1002.3	1130.2	0.2311	1.6174	1.8485
170	5.992	0.01645	62.06	137.90	996.3	1134.2	0.2472	1.5822	1.8293
180	7.510	0.01651	50.23	147.92	990.2	1138.1	0.2630	1.5480	1.8109
190	9.339	0.01657	40.96	157.95	984.1	1142.0	0.2785	1.5147	1.7932
200	11.526	0.01663	33.64	167.99	977.9	1145.9	0.2938	1.4824	1.7762
210	14.123	0.01670	27.82	178.05	971.6	1149.7	0.3090	1.4508	1.7598
212	14.696	0.01672	26.80	180.07	970.3	1150.4	0.3120	1.4446	1.7566
220	17.186	0.01677	23.15	188.13	965.2	1153.4	0.3239	1.4201	1.7440
230	20.780	0.01684	19.382	198.23	958.8	1157.0	0.3387	1.3901	1.7288
240	24.969	0.01692	16.323	208.34	952.2	1160.5	0.3531	1.3609	1.7140
250	29.825	0.01700	13.821	216.48	945.5	1164.0	0.3675	1.3323	1.6998
260	35.429	0.01709	11.763	228.64	938.7	1167.3	0.3817	1.3043	1.6860
270	41.858	0.01717	10.061	238.84	931.8	1170.6	0.3958	1.2769	1.6727
280	49.203	0.01726	8.645	249.06	924.7	1173.8	0.4096	1.2501	1.6597
290	57.556	0.01735	7.461	259.31	917.5	1176.8	0.4234	1.2238	1.6472
300	67.013	0.01745	6.466	269.59	910.1	1179.7	0.4369	1.1980	1.6350
310	77.68	0.01755	5.626	279.92	902.6	1182.5	0.4504	1.1727	1.6231
320	89.66	0.01765	4.914	290.28	894.9	1185.2	0.4637	1.1478	1.6115
330	103.06	0.01776	4.307	300.68	887.0	1187.7	0.4769	1.1233	1.6002
340	118.01	0.01787	3.788	311.13	879.0	1190.1	0.4900	1.0992	1.5891

TABLE D-1b
Properties of Dry Saturated Steam (continued)
Temperature

Temp., °F	Abs. press., psia	Specific volume		Enthalpy			Entropy		
		Sat. liquid	Sat. vapor	Sat. liquid	Evap.	Sat. vapor	Sat. liquid	Evap.	Sat. vapor
<i>t</i>	<i>p</i>	<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_{fg}</i>	<i>s_g</i>
350	134.63	0.01799	3.342	321.63	870.7	1192.3	0.5029	1.0754	1.5783
360	153.04	0.01811	2.957	332.18	852.2	1194.4	0.5158	1.0519	1.5677
370	173.37	0.01823	2.625	342.79	853.5	1196.3	0.5286	1.0287	1.5573
380	195.77	0.01836	2.335	353.45	844.6	1198.1	0.5413	1.0059	1.5471
390	220.37	0.01850	2.0836	364.17	835.4	1199.6	0.5539	0.9832	1.5371
400	247.31	0.01864	1.8633	374.97	826.0	1201.0	0.5664	0.9608	1.5272
410	276.75	0.01878	1.6700	385.83	816.3	1202.1	0.5788	0.9386	1.5174
420	308.83	0.01894	1.5000	396.77	806.3	1203.1	0.5912	0.9166	1.5078
430	343.72	0.01910	1.3499	407.79	796.0	1203.8	0.6035	0.8947	1.4982
440	381.59	0.01926	1.2171	418.90	785.4	1204.3	0.6158	0.8730	1.4887
450	422.6	0.0194	1.0993	430.1	774.5	1204.6	0.6280	0.8513	1.4793
460	466.9	0.0196	0.9944	441.4	763.2	1204.6	0.6402	0.8298	1.4700
470	514.7	0.0198	0.9009	452.8	751.5	1204.3	0.6523	0.8083	1.4606
480	566.1	0.0200	0.8172	464.4	739.4	1203.7	0.6645	0.7868	1.4513
490	621.4	0.0202	0.7423	476.0	726.8	1202.8	0.6766	0.7653	1.4419
500	680.8	0.0204	0.6749	487.8	713.9	1201.7	0.6887	0.7438	1.4325
520	812.4	0.0209	0.5594	511.9	686.4	1198.2	0.7130	0.7006	1.4136
540	962.5	0.0215	0.4649	536.6	656.6	1193.2	0.7374	0.6568	1.3942
560	1133.1	0.0221	0.3868	562.2	624.2	1186.4	0.7621	0.6121	1.3742
580	1325.8	0.0228	0.3217	588.9	588.4	1177.3	0.7872	0.5659	1.3532
600	1542.9	0.0236	0.2668	610.0	548.5	1165.5	0.8131	0.5176	1.3307
620	1786.6	0.0247	0.2201	646.7	503.6	1150.3	0.8398	0.4664	1.3062
640	2059.7	0.0260	0.1798	678.6	452.0	1130.5	0.8679	0.4110	1.2789
660	2365.4	0.0278	0.1442	714.2	390.2	1104.4	0.8987	0.3485	1.2472
680	2708.1	0.0305	0.1115	757.3	309.9	1067.2	0.9351	0.2719	1.2071
700	3093.7	0.0369	0.0761	823.3	172.1	995.4	0.9905	0.1484	1.1389
705.4	3206.2	0.0503	0.0503	902.7	0	902.7	1.0580	0	1.0580

TABLE D-2
Properties of Superheated Steam*

Abs. press., psia (Sat. temp., °F.)	Temperature, °F												
	200	300	400	500	600	700	800	900	1000	1100	1200	1400	
v	392.6	452.3	512.0	571.6	631.2	690.8	750.4	809.9	869.5	929.1	988.7	1107.8	
h	1150.4	1195.8	1241.7	1288.3	1335.7	1383.8	1432.8	1482.7	1533.5	1585.2	1637.7	1745.7	
(101.74)	2.0512	2.1153	2.1720	2.2233	2.2702	2.3137	2.3542	2.3923	2.4283	2.4625	2.4952	2.5566	
v	78.16	90.25	102.26	114.22	126.16	138.10	150.03	161.95	173.87	185.79	197.71	221.6	
h	1148.8	1195.0	1241.2	1288.0	1335.4	1383.6	1432.7	1482.6	1533.4	1585.1	1637.7	1745.7	
(162.24)	1.8718	1.9370	1.9942	2.0456	2.0927	2.1361	2.1767	2.2148	2.2509	2.2851	2.3178	2.3792	
v	38.85	45.00	51.04	57.05	63.03	69.01	74.98	80.95	86.92	92.88	98.84	110.77	
h	1146.6	1193.9	1240.6	1287.5	1335.1	1383.4	1432.5	1482.4	1533.2	1585.0	1637.6	1745.6	
(193.21)	1.7927	1.8595	1.9172	1.9689	2.0160	2.0596	2.1002	2.1383	2.1744	2.2068	2.2413	2.3028	
v	30.53	34.68	38.78	42.86	46.94	51.00	55.07	59.13	63.19	67.25	71.31	75.37	
h	1192.8	1239.9	1287.1	1334.8	1383.2	1432.3	1482.3	1533.1	1584.8	1637.5	1687.5	1745.5	
(212.00)	1.8160	1.8743	1.9261	1.9734	2.0170	2.0576	2.0958	2.1319	2.1662	2.1989	2.2303	2.2603	
v	22.36	25.43	28.46	31.47	34.47	37.46	40.45	43.44	46.42	49.41	52.40	55.37	
h	1191.6	1239.2	1286.6	1334.4	1382.9	1432.1	1482.1	1533.0	1584.7	1637.4	1687.4	1745.4	
(227.96)	1.7808	1.8396	1.8918	1.9392	1.9829	2.0235	2.0618	2.0978	2.1321	2.1648	2.1968	2.2263	
v	11.040	12.628	14.168	15.688	17.198	18.702	20.200	21.700	23.200	24.699	26.198	27.688	
h	1186.8	1236.5	1284.8	1333.1	1381.9	1431.3	1481.4	1532.4	1584.3	1637.0	1687.0	1745.1	
(267.25)	1.6994	1.7608	1.8140	1.8619	1.9058	1.9467	1.9850	2.0212	2.0555	2.0883	2.1198	2.1498	
v	7.259	8.357	9.403	10.427	11.441	12.449	13.452	14.454	15.453	16.451	17.448	18.446	
h	1181.6	1233.6	1283.0	1331.8	1380.9	1430.5	1480.8	1531.9	1583.8	1636.6	1686.6	1744.8	
(292.71)	1.6492	1.7135	1.7678	1.8162	1.8605	1.9015	1.9400	1.9762	2.0106	2.0434	2.0749	2.1049	
v	6.220	7.020	7.797	8.562	9.322	10.077	10.830	11.582	12.332	13.083	13.830	14.583	
h	1230.7	1281.1	1330.5	1379.9	1429.7	1480.1	1531.3	1583.4	1636.2	1687.0	1744.5	1795.5	
(312.03)	1.6791	1.7346	1.7836	1.8281	1.8694	1.9079	1.9442	1.9787	2.0115	2.0434	2.0731	2.1015	
v	4.937	5.589	6.218	6.835	7.446	8.052	8.656	9.259	9.860	10.460	11.060	11.660	
h	1227.6	1279.1	1329.1	1378.9	1428.9	1479.5	1530.8	1582.9	1635.7	1687.7	1744.2	1795.2	
(327.81)	1.6518	1.7085	1.7581	1.8029	1.8443	1.8829	1.9193	1.9538	1.9867	2.0183	2.0484	2.0771	
v	4.081	4.636	5.165	5.683	6.195	6.702	7.207	7.710	8.212	8.714	9.214	9.714	
h	1224.4	1277.2	1327.7	1377.8	1428.1	1478.8	1530.2	1582.4	1635.3	1687.7	1743.9	1795.9	
(341.25)	1.6287	1.6869	1.7370	1.7822	1.8237	1.8625	1.8990	1.9335	1.9664	2.0000	2.0328	2.0644	

v	3.468	3.954	4.413	4.861	5.301	5.738	6.172	6.604	7.035	7.465
140	1221.1	1275.2	1326.4	1376.8	1427.3	1478.2	1529.7	1581.9	1634.9	1687.5
(353.02)	1.6087	1.6683	1.7190	1.7645	1.8063	1.8451	1.8817	1.9163	1.9493	2.0110
O	3.008	3.443	3.849	4.244	4.631	5.015	5.396	5.775	6.152	6.526
160	1217.6	1273.1	1325.0	1375.7	1426.4	1477.5	1529.1	1581.4	1634.5	1687.2
(363.53)	1.5908	1.6519	1.7033	1.7491	1.7911	1.8301	1.8667	1.9014	1.9344	1.9962
v	2.649	3.044	3.411	3.764	4.110	4.452	4.792	5.129	5.466	5.802
180	1214.0	1271.0	1323.5	1374.7	1425.6	1476.8	1528.6	1581.0	1634.1	1687.9
(373.06)	1.5745	1.6373	1.6894	1.7355	1.7776	1.8167	1.8534	1.8882	1.9212	1.9831
v	2.361	2.726	3.060	3.380	3.693	4.002	4.309	4.613	4.917	5.221
200	1210.3	1268.9	1322.1	1373.6	1424.8	1476.2	1528.0	1580.5	1633.7	1687.6
(381.79)	1.5594	1.6240	1.6767	1.7232	1.7655	1.8048	1.8415	1.8763	1.9094	1.9713
v	2.125	2.465	2.772	3.066	3.352	3.634	3.913	4.191	4.467	4.743
220	1206.5	1266.7	1320.7	1372.6	1424.0	1475.5	1527.5	1580.0	1633.3	1687.3
(389.86)	1.5453	1.6117	1.6652	1.7120	1.7545	1.7939	1.8308	1.8656	1.8987	1.9607
v	1.9276	2.247	2.533	2.804	3.068	3.327	3.584	3.839	4.093	4.347
240	1202.5	1264.5	1319.2	1371.5	1423.2	1474.8	1526.9	1579.6	1632.9	1687.0
(397.37)	1.5319	1.6003	1.6546	1.7017	1.7444	1.7839	1.8209	1.8558	1.8889	1.9510
v	2.063	2.330	2.582	2.827	3.067	3.305	3.541	3.776	4.011	4.246
260	1202.5	1262.3	1317.7	1370.4	1422.3	1474.2	1526.3	1579.1	1632.5	1687.7
(404.42)	1.5897	1.6447	1.6922	1.7352	1.7748	1.8118	1.8467	1.8799	1.9120	1.9420
v	1.9047	2.156	2.392	2.621	2.845	3.066	3.286	3.504	3.721	3.938
280	1260.0	1316.2	1369.4	1421.5	1473.5	1525.8	1578.6	1632.1	1686.1	1741.4
(411.05)	1.5796	1.6354	1.6834	1.7265	1.7662	1.8033	1.8383	1.8716	1.9037	1.9337
v	1.7675	2.005	2.227	2.442	2.652	2.859	3.065	3.269	3.474	3.674
300	1260.0	1316.2	1368.3	1420.6	1472.8	1525.2	1578.1	1631.7	1685.7	1741.0
(417.33)	1.5701	1.6268	1.6751	1.7184	1.7582	1.7954	1.8305	1.8638	1.8956	1.9260
v	1.4923	1.7036	1.8980	2.084	2.266	2.445	2.622	2.798	2.974	3.147
350	1251.5	1310.9	1365.5	1418.5	1471.1	1523.8	1577.0	1630.7	1685.0	1740.3
(431.72)	1.5481	1.6070	1.6563	1.7002	1.7403	1.7777	1.8130	1.8463	1.8786	1.9086
v	1.2851	1.4770	1.6508	1.8161	1.9767	2.134	2.290	2.445	2.599	2.751
400	1245.1	1306.9	1362.7	1416.4	1469.4	1522.4	1575.8	1629.6	1683.9	1739.5
(444.59)	1.5281	1.5894	1.6398	1.6842	1.7247	1.7623	1.7977	1.8311	1.8636	1.8936

* Abridged from Joseph H. Keenan and Frederick G. Keyes, *Thermodynamic Properties of Steam*, John Wiley and Sons, Inc., New York. Copyright, 1937, by Joseph H. Keenan and Frederick G. Keyes.

TABLE D-2
Properties of Superheated Steam (continued)

Abs. pres., psia (Sat. temp., °F.)	Temperature, °F													
	500	550	600	620	640	660	680	700	800	900	1000	1200	1400	
v.....	1.1231	1.2155	1.3005	1.3332	1.3652	1.3967	1.4278	1.4584	1.6074	1.7516	1.8928	2.170	2.443	
h.....	1238.4	1272.0	1302.8	1314.6	1326.2	1337.5	1348.8	1359.9	1414.3	1467.7	1521.0	1628.6	1738.7	
(456.28) s.....	1.5095	1.5437	1.5735	1.5845	1.5951	1.6054	1.6153	1.6250	1.6699	1.7108	1.7486	1.8177	1.8803	
v.....	0.9927	1.0800	1.1591	1.1893	1.2188	1.2478	1.2763	1.3044	1.4405	1.5715	1.6996	1.9504	2.197	
h.....	1231.3	1266.8	1298.6	1310.7	1322.6	1334.2	1345.7	1357.0	1412.1	1466.0	1519.6	1627.6	1737.9	
(467.01) s.....	1.4919	1.5280	1.5588	1.5701	1.5810	1.5915	1.6016	1.6115	1.6571	1.6982	1.7363	1.8056	1.8683	
v.....	0.8852	0.9686	1.0431	1.0714	1.0989	1.1259	1.1523	1.1783	1.3038	1.4241	1.5414	1.7706	1.9957	
h.....	1223.7	1261.2	1294.3	1306.8	1318.9	1330.8	1342.5	1354.0	1409.9	1464.3	1518.2	1626.6	1737.1	
(476.94) s.....	1.4751	1.5131	1.5451	1.5568	1.5680	1.5787	1.5890	1.5991	1.6452	1.6868	1.7250	1.7946	1.8575	
v.....	0.7947	0.8753	0.9463	0.9729	0.9988	1.0241	1.0489	1.0732	1.1899	1.3013	1.4096	1.6208	1.8279	
h.....	1215.7	1255.5	1289.9	1302.7	1315.2	1327.4	1339.3	1351.1	1407.7	1462.5	1516.7	1625.5	1736.3	
(486.21) s.....	1.4586	1.4990	1.5323	1.5443	1.5558	1.5667	1.5773	1.5875	1.6343	1.6762	1.7147	1.7846	1.8476	
v.....	0.7277	0.7934	0.8411	0.8177	0.8411	0.8639	0.8860	0.9077	1.0108	1.1082	1.2024	1.3853	1.5641	
h.....	1243.2	1280.6	1294.3	1294.3	1307.7	1320.3	1332.8	1345.0	1403.2	1459.0	1513.9	1623.5	1734.8	
(503.10) s.....	1.4722	1.5084	1.5212	1.5212	1.5333	1.5449	1.5559	1.5665	1.6147	1.6573	1.6963	1.7666	1.8299	
v.....	0.6154	0.6779	0.7006	0.7006	0.7223	0.7433	0.7635	0.7833	0.8763	0.9633	1.0470	1.2088	1.3662	
h.....	1229.8	1270.7	1285.4	1285.4	1299.4	1312.9	1325.9	1338.6	1398.6	1455.3	1511.0	1621.4	1733.2	
(518.23) s.....	1.4467	1.4863	1.5000	1.5000	1.5129	1.5250	1.5366	1.5476	1.5972	1.6407	1.6801	1.7510	1.8146	
v.....	0.5264	0.5873	0.6089	0.6089	0.6294	0.6491	0.6680	0.6863	0.7716	0.8506	0.9262	1.0714	1.2124	
h.....	1215.0	1260.1	1275.9	1275.9	1290.9	1305.1	1318.8	1332.1	1393.9	1451.8	1508.1	1619.3	1731.6	
(531.98) s.....	1.4216	1.4653	1.4800	1.4800	1.4938	1.5066	1.5187	1.5303	1.5814	1.6257	1.6656	1.7371	1.8009	
v.....	0.4533	0.5140	0.5350	0.5350	0.5546	0.5733	0.5912	0.6084	0.6878	0.7604	0.8294	0.9615	1.0893	
h.....	1198.3	1248.8	1265.9	1265.9	1281.9	1297.0	1311.4	1325.3	1389.2	1448.2	1505.1	1617.3	1730.0	
(544.61) s.....	1.3961	1.4450	1.4610	1.4610	1.4757	1.4893	1.5021	1.5141	1.5670	1.6121	1.6525	1.7245	1.7886	
v.....	0.4532	0.4738	0.4929	0.4929	0.5110	0.5281	0.5445	0.5670	0.6191	0.6866	0.7503	0.8716	0.9885	
h.....	1236.7	1255.3	1272.4	1272.4	1288.5	1303.7	1318.3	1332.3	1384.3	1444.5	1502.2	1615.2	1728.4	
(556.31) s.....	1.4251	1.4425	1.4583	1.4583	1.4728	1.4862	1.4989	1.5115	1.5535	1.5995	1.6405	1.7130	1.7775	

1200	v	0.4016	0.4222	0.4410	0.4586	0.4752	0.4909	0.5617	0.6250	0.6843	0.7967	0.9046
(567.22)	h	1223.5	1243.9	1262.4	1279.6	1295.7	1311.0	1379.3	1440.7	1499.2	1613.1	1726.9
	s	1.4052	1.4243	1.4413	1.4568	1.4710	1.4843	1.5409	1.5879	1.6293	1.7025	1.7672
1400	v	0.3174	0.3390	0.3580	0.3753	0.3912	0.4062	0.4714	0.5281	0.5805	0.6789	0.7727
(587.10)	h	1193.0	1218.4	1240.4	1260.3	1278.5	1295.5	1369.1	1433.1	1493.2	1608.9	1723.7
	s	1.3639	1.3877	1.4079	1.4258	1.4419	1.4567	1.5177	1.5666	1.6093	1.6386	1.7489
1600	v	0.2733	0.2936	0.2936	0.3112	0.3271	0.3417	0.4034	0.4553	0.5027	0.5906	0.6738
(604.90)	h	1187.8	1215.2	1215.2	1238.7	1259.6	1278.7	1358.4	1425.3	1487.0	1604.6	1720.5
	s	1.3489	1.3741	1.3741	1.3952	1.4137	1.4304	1.4964	1.5476	1.5914	1.6669	1.7328
1800	v	0.2407	0.2597	0.2407	0.2597	0.2760	0.2907	0.3502	0.3986	0.4421	0.5218	0.5968
(621.03)	h	1185.1	1214.0	1185.1	1214.0	1238.5	1260.3	1347.2	1417.4	1480.8	1600.4	1717.3
	s	1.3377	1.3638	1.3377	1.3638	1.3855	1.4044	1.4765	1.5301	1.5752	1.6520	1.7185
2000	v	0.1936	0.2161	0.1936	0.2161	0.2337	0.2489	0.3074	0.3532	0.3935	0.4668	0.5352
(635.82)	h	1145.6	1184.9	1145.6	1184.9	1214.8	1240.0	1335.5	1409.2	1474.5	1596.1	1714.1
	s	1.2945	1.3300	1.2945	1.3300	1.3564	1.3783	1.4576	1.5139	1.5603	1.6384	1.7055
2500	v	0.1484	0.1686	0.1484	0.1686	0.1884	0.1686	0.2294	0.2710	0.3061	0.3678	0.4244
(668.13)	h	1132.3	1176.8	1132.3	1176.8	1214.8	1176.8	1303.6	1387.8	1458.4	1585.3	1706.1
	s	1.2687	1.3073	1.2687	1.3073	1.3267	1.3073	1.4127	1.4772	1.5273	1.6088	1.6775
3000	v	0.0984	0.10984	0.0984	0.10984	0.1260	0.0984	0.1760	0.2159	0.2476	0.3018	0.3505
(695.36)	h	1060.7	1060.7	1060.7	1060.7	1267.2	1060.7	1267.2	1365.0	1441.8	1574.3	1698.0
	s	1.1966	1.1966	1.1966	1.1966	1.3690	1.1966	1.3690	1.4439	1.4984	1.5837	1.6540
3206.2	v	0.1583	0.1583	0.1583	0.1583	0.1583	0.1583	0.1583	0.1981	0.2288	0.2806	0.3267
(705.40)	h	1250.5	1250.5	1250.5	1250.5	1250.5	1250.5	1250.5	1355.2	1434.7	1569.8	1694.6
	s	1.3508	1.3508	1.3508	1.3508	1.3508	1.3508	1.3508	1.4309	1.4874	1.5742	1.6452
3500	v	0.1364	0.1364	0.1364	0.1364	0.1364	0.1364	0.1364	0.1762	0.2058	0.2546	0.2977
	h	780.5	780.5	780.5	780.5	780.5	780.5	780.5	1340.7	1424.5	1563.3	1689.8
	s	0.9515	0.9515	0.9515	0.9515	0.9515	0.9515	0.9515	1.4127	1.4723	1.5615	1.6336
4000	v	0.0287	0.0287	0.0287	0.0287	0.0287	0.0287	0.1052	0.1462	0.1743	0.2192	0.2581
	h	763.8	763.8	763.8	763.8	763.8	763.8	1174.8	1314.4	1406.8	1552.1	1681.7
	s	0.9347	0.9347	0.9347	0.9347	0.9347	0.9347	1.2757	1.3827	1.4482	1.5417	1.6154

TABLE D-3

Temperature, °F (Sat. press., psia)	Sat. liquid	Sat. vapor	Temperature of				
			800	900	1000	1100	1200
700 v (8.7872 × 10 ⁻³) s	1.7232 × 10 ⁻² 719.7 0.8054	> 10 ⁶ 2180.5 3.4866	2203.1 3.5169	2224.7 3.5424	2246.4 3.5652	2268.0 3.5837	2289.5 3.6043
800 v (1.0100 × 10 ⁻²) s	1.7548 × 10 ⁻² 252.3 0.7296	7.4375 × 10 ⁶ 2206.1 3.1637		8.3835 × 10 ⁶ 2224.4 3.1925	9.3168 × 10 ⁶ 2246.3 3.2155	1.0249 × 10 ⁷ 2267.9 3.2360	1.1180 × 10 ⁷ 2289.5 3.2546
900 v (1.1480 × 10 ⁻²) s	1.7864 × 10 ⁻² 284.3 0.7667	3.6411 × 10 ⁷ 2217.6 2.9148			4.0287 × 10 ⁷ 2245.2 2.9440	4.4718 × 10 ⁷ 2267.7 2.9653	4.8789 × 10 ⁷ 2289.4 2.9841
1000 v (1.3909 × 10 ⁻²) s	1.8180 × 10 ⁻² 325.9 0.7999	3.323 × 10 ⁸ 2232.7 2.7168				3.6834 × 10 ⁸ 2264.8 2.7474	4.0254 × 5 2288.6 2.7680
1100 v (1.0616 × 10 ⁻²) s	1.8496 × 10 ⁻² 347.0 0.8296	4.7592 × 10 ⁸ 2245.1 2.5551					5.2512 × 10 ⁸ 2282.7 2.5878
1200 v (5.7398 × 10 ⁻³) s	1.8812 × 10 ⁻² 377.7 0.8563	9.5235 × 10 ⁸ 2254.9 2.4207					
1300 v (2.3916 × 10 ⁻²) s	1.9128 × 10 ⁻² 408.2 0.8807	2.4520 × 10 ⁹ 2262.8 2.3073					
1400 v (8.1347 × 10 ⁻³) s	1.9444 × 10 ⁻² 438.4 0.9031	7.6798 × 10 ⁹ 2269.3 2.2109					
1500 v (2.3351 × 10 ⁻²) s	1.9760 × 10 ⁻² 468.5 0.9239	2.8334 × 10 ⁹ 2274.9 2.1282					
1600 v (5.8425 × 10 ⁻²) s	2.0076 × 10 ⁻² 498.5 0.9433	1.1935 × 10 ¹⁰ 2280.0 2.0567					
1700 v (1.3170) s	2.0392 × 10 ⁻² 528.5 0.9615	5.5585 × 10 ¹⁰ 2285.3 1.9948					
1800 v (2.7164) s	2.0708 × 10 ⁻² 558.6 0.9786	2.8200 × 10 ¹¹ 2291.1 2.9411					
1900 v (5.1529) s	2.1024 × 10 ⁻² 588.8 0.9949	1.5512 × 10 ¹² 2297.2 1.8941					
2000 v (9.1533) s	2.1340 × 10 ⁻² 619.1 1.0105	90.914 2304.1 1.8530					
2100 v (15.392) s	2.1656 × 10 ⁻² 649.7 1.0255	56.185 2312.1 1.8171					
2200 v (24.692) s	2.1972 × 10 ⁻² 680.7 1.0399	36.338 2321.0 1.7855					
2300 v (38.013) s	2.2288 × 10 ⁻² 712.0 1.0538	24.454 2330.7 1.7576					
2400 v (56.212) s	2.2604 × 10 ⁻² 743.8 1.0673	17.109 2341.2 1.7329					
2500 v (80.236) s	2.2920 × 10 ⁻² 776.2 1.0805	12.388 2352.6 1.7111					
2600 v (1.1116 × 10 ²) s	2.3236 × 10 ⁻² 809.1 1.0934	9.2328 2365.1 1.6919					
2700 v (1.052 × 10 ²) s	2.3552 × 10 ⁻² 842.7 1.1061	7.0380 2378.8 1.6751					

Thermodynamic Properties of Sodium *

Superheated Vapor, °R

1400	1600	1800	2000	2200	2400	2600	2700
2332.7	2375.9	2419.1	2462.3	2505.4	2548.6	2591.8	2613.4
3.6381	3.6665	3.6924	3.7148	3.7354	3.7545	3.7713	3.7796
1.3044×10^3	1.4907×10^3	1.6771×10^3	1.8634×10^3	2.0498×10^3	2.2361×10^3	2.4224×10^3	2.5156×10^3
2332.7	2375.9	2419.1	2462.3	2505.4	2548.6	2591.8	2613.4
3.2884	3.3169	3.3428	3.3652	3.3858	3.4048	3.5217	3.4299
5.6924×10^3	6.5056×10^3	7.3188×10^3	8.1320×10^3	8.9452×10^3	9.7584×10^3	1.0572×10^4	1.0978×10^4
2332.7	2375.9	2419.1	2462.3	2505.4	2548.6	2591.8	2613.4
3.0179	3.0464	3.0723	3.0947	3.1153	3.1343	3.1511	3.1594
4.6978×10^4	5.3693×10^4	6.0406×10^4	6.7118×10^4	7.383×10^4	8.0541×10^4	8.7253×10^4	9.0609×10^4
2332.6	2375.9	2419.1	2462.3	2505.4	2548.6	2591.8	2613.4
2.8024	2.8309	2.8568	2.8792	2.8998	2.9188	2.9357	2.9439
6.1515×10^3	7.0339×10^3	7.9139×10^3	8.7935×10^3	9.6729×10^3	1.0552×10^4	1.1432×10^4	1.1871×10^4
2331.7	2375.7	2419.0	2462.3	2505.4	2548.6	2591.8	2613.4
2.6263	2.6552	2.6812	2.7036	2.7243	2.7433	2.7601	2.7684
1.1345×10^3	1.3001×10^3	1.4635×10^3	1.6263×10^3	1.7891×10^3	1.9517×10^3	2.1144×10^3	2.1957×10^3
2327.6	2374.7	2418.7	2462.2	2505.4	2548.6	2591.8	2613.4
2.4778	2.5089	2.5353	2.5578	2.5785	2.5975	2.6143	2.6226
2.6936×10^4	3.1124×10^4	3.5095×10^4	3.9019×10^4	4.2931×10^4	4.6838×10^4	5.0743×10^4	5.2695×10^4
2312.2	2371.1	2417.6	2461.7	2505.1	2548.5	2591.8	2613.4
2.3445	2.3836	2.4115	2.4343	2.4551	2.4742	2.4911	2.4993
.....	9.0793×10^3	1.0292×10^4	1.1460×10^4	1.2616×10^4	1.3767×10^4	1.4916×10^4	1.5491×10^4
.....	2359.9	2414.0	2460.3	2504.5	2548.1	2591.6	2613.2
.....	2.2715	2.3040	2.3280	2.3491	2.3683	2.3853	2.3935
.....	3.1025×10^3	3.5625×10^3	3.9820×10^3	4.3896×10^3	4.7929×10^3	5.1944×10^3	5.3948×10^3
.....	2332.6	2404.7	2456.5	2502.7	2547.2	2591.0	2612.8
.....	2.1651	2.2083	2.2352	2.2573	2.2769	2.2940	2.3023
.....	1.4040×10^3	1.5823×10^3	1.7496×10^3	1.9128×10^3	2.0743×10^3	2.2358×10^3	2.1548×10^3
.....	2384.7	2448.0	2498.7	2545.1	2589.7	2634.3	2611.8
.....	2.1192	2.1523	2.1765	2.1969	2.2144	2.2288	2.2228
.....	6.0659×10^3	6.9378×10^3	7.7180×10^3	8.4601×10^3	9.1858×10^3	9.8558×10^3	9.5458×10^3
.....	2347.7	2431.3	2490.5	2540.7	2587.1	2633.5	2609.8
.....	2.0309	2.0747	2.1031	2.1252	2.1433	2.1591	2.1519
.....	.....	.....	3.2952×10^3	3.7033×10^3	4.0785×10^3	4.4385×10^3	4.6158×10^3
.....	.....	.....	2402.3	2475.6	2532.5	2582.2	2605.9
.....	.....	.....	1.9996	2.0347	2.0597	2.0792	2.0882
.....	.....	1.6838×10^3	1.9197×10^3	2.1298×10^3	2.3265×10^3	2.4224×10^3	2.4224×10^3
.....	.....	2359.5	2451.8	2518.8	2573.9	2599.3	2599.3
.....	.....	1.9259	1.9701	1.9996	2.0212	2.0209	2.0209
.....	.....	.....	.....	1.0543×10^3	1.1816×10^3	1.2980×10^3	1.3539×10^3
.....	.....	.....	.....	2417.4	2498.0	2560.9	2588.9
.....	.....	.....	.....	1.9072	1.9426	1.9673	1.9780
.....	.....	.....	.....	60.665	68.825	76.167	79.656
.....	.....	.....	.....	2372.9	2469.0	2451.9	2573.5
.....	.....	.....	.....	1.8455	1.8876	1.9164	1.9284
.....	.....	.....	.....	.....	41.754	46.622	48.920
.....	.....	.....	.....	.....	2431.8	2516.2	2552.3
.....	.....	.....	.....	.....	1.8340	1.8674	1.8811
.....	.....	.....	.....	.....	26.244	29.585	31.163
.....	.....	.....	.....	.....	2388.2	2484.0	2525.0
.....	.....	.....	.....	.....	1.7820	1.8201	1.8356
.....	.....	.....	.....	.....	.....	19.460	20.580
.....	.....	.....	.....	.....	.....	2446.8	2492.6
.....	.....	.....	.....	.....	.....	1.7748	1.7922
.....	.....	.....	.....	.....	.....	13.219	14.032
.....	.....	.....	.....	.....	.....	2406.5	2456.5
.....	.....	.....	.....	.....	.....	1.7321	1.7501
.....	.....	.....	.....	.....	.....	.....	9.8326
.....	.....	.....	.....	.....	.....	.....	2418.1
.....	.....	.....	.....	.....	.....	.....	1.7120

* From Ref. 154.

appendix **E**

Some Physical Properties

TABLE E-1
Physical Properties of Ordinary Liquid Water*

Temp., °F	Specific heat c_p , Btu/lb _m °R			Thermal conductivity k , Btu/hr ft °F			Viscosity μ , lb _m /hr ft			Density ρ , lb _m /ft ³		
	Sat. liquid	1,000 psia	2,000 psia	Sat. liquid	1,000 psia	2,000 psia	Sat. liquid	1,000 psia	2,000 psia	Sat. liquid	1,000 psia	2,000 psia
32	1.0083	1.0022	1.0004	0.3185	0.3198	0.3211	4.340	4.309	4.279	62.422	62.637	63.846
40	1.0048	1.0014	0.9986	0.3245	0.3260	0.3275	3.742	3.721	3.699	62.422	62.657	62.854
60	0.9990	0.9968	0.9939	0.3397	0.3414	0.3433	2.731	2.722	2.714	62.344	62.539	62.755
80	0.9975	0.9943	0.9912	0.3532	0.3537	0.3570	2.084	2.084	2.083	62.189	62.383	62.586
100	0.9976	0.9932	0.9897	0.3641	0.3659	0.3680	1.650	1.654	1.658	61.996	62.185	62.371
120	0.9977	0.9934	0.9895	0.3733	0.3751	0.3771	1.353	1.360	1.366	61.728	61.920	62.104
140	0.9988	0.9940	0.9897	0.3810	0.3828	0.3847	1.137	1.145	1.154	61.387	61.576	61.767
160	1.0004	0.9959	0.9913	0.3861	0.3880	0.3902	0.970	0.979	0.988	61.013	61.200	61.395
180	1.0022	0.9980	0.9931	0.3905	0.3924	0.3945	0.839	0.849	0.858	60.569	60.753	60.953
200	1.0047	1.0008	0.9958	0.3935	0.3957	0.3980	0.738	0.748	0.757	60.132	60.314	60.511
210	1.0064	1.0024	0.9974	0.3944	0.3972	0.3998	0.687	0.697	0.706	59.809	60.006	60.205
220	1.0079	1.0039	0.9988	0.3950	0.3977	0.4003	0.660	0.670	0.680	59.630	59.830	60.031
240	1.0119	1.0075	1.0023	0.3961	0.3988	0.4016	0.595	0.604	0.614	59.102	59.305	59.506
260	1.0165	1.0117	1.0061	0.3964	0.3992	0.4021	0.542	0.551	0.560	58.514	58.727	58.938
280	1.0222	1.0163	1.0102	0.3959	0.3987	0.4018	0.494	0.502	0.511	57.937	58.156	58.377

300	1.0289	1.0232	1.0166	0.3952	0.3981	0.4013	0.452	0.460	0.468	57.307	57.537	57.767
320	1.0354	1.0307	1.0235	0.3944	0.3969	0.3998	0.420	0.426	0.433	56.657	56.883	57.136
340	1.0455	1.0999	1.0322	0.3921	0.3947	0.3977	0.391	0.396	0.404	55.960	56.211	56.465
360	1.0564	1.0496	1.0411	0.3891	0.3919	0.3951	0.366	0.372	0.378	55.218	55.463	55.710
380	1.0669	1.0611	1.0510	0.3857	0.3885	0.3919	0.346	0.351	0.356	54.466	54.720	55.012
400	1.0794	1.074	1.062	0.3809	0.3840	0.3880	0.327	0.330	0.335	53.648	53.903	54.218
420	1.0941	1.087	1.075	0.3753	0.3787	0.3833	0.310	0.312	0.317	52.798	53.042	53.396
440	1.1114	1.105	1.091	0.3693	0.3728	0.3776	0.294	0.296	0.301	51.921	52.154	52.546
460	1.1319	1.124	1.109	0.3640	0.3664	0.3713	0.280	0.282	0.286	51.020	51.230	51.661
480	1.1345	1.149	1.131	0.3575	0.3595	0.3642	0.267	0.270	0.273	50.000	50.191	50.659
500	1.1861	1.176	1.154	0.3494	0.3510	0.3562	0.256	0.257	0.260	49.020	49.097	49.618
520	1.23	1.21	1.188	0.3397	0.3410	0.3475	0.246	0.246	0.249	47.847	.....	48.527
540	1.28	.....	1.225	0.3298	.....	0.3371	0.235	0.235	0.239	46.512	.....	47.181
560	1.34	.....	1.278	0.3189	.....	0.3256	0.225	.....	0.231	45.249	.....	45.905
580	1.41	.....	1.341	0.3064	.....	0.3118	0.217	.....	0.222	43.860	.....	44.492
600	1.51	.....	1.448	0.2919	.....	0.2962	0.210	.....	0.212	43.373	.....	42.913
620	1.65	.....	1.62	0.2753	.....	0.2778	0.200	.....	0.202	40.486	.....	40.950
640	1.88	.....	.....	0.2565	.....	.....	0.190	.....	.....	38.452	.....	.....
660	2.34	.....	.....	0.2335	.....	.....	0.177	.....	.....	35.971	.....	.....
680	3.5	.....	.....	0.2056	.....	.....	0.161	.....	.....	32.787	.....	.....
690	5.5	.....	.....	0.1854	.....	.....	0.48	.....	.....	30.488	.....	.....

* c_p , μ , and k data from Ref. 145. ρ data computed from Keenan and Keyes (Table D-1).

TABLE E-2
Physical Properties of Helium* (at 10 atm pressure)

$T, ^\circ\text{F}$	Density ρ , lb_m/ft^3	Viscosity μ , $\text{lb}_m/\text{ft hr}$	Specific heat \dagger c_p , Btu/lb $_m$ $^\circ\text{F}$	Thermal conductivity \dagger k , Btu/ft hr $^\circ\text{F}$	Prandtl no Pr , $c_p\mu/k$
32	0.1117	0.0457	1.248	0.083	0.687
100	0.0974	0.0495	1.248	0.090	0.687
200	0.0827	0.0555	1.248	0.100	0.687
300	0.0718	0.0605	1.248	0.110	0.686
400	0.0635	0.0653	1.248	0.119	0.684
500	0.0569	0.0700	1.248	0.128	0.682
600	0.0516	0.0743	1.248	0.136	0.679
700	0.0475	0.0780	1.248	0.145	0.675
800	0.0430	0.0821	1.248	0.153	0.671
900	0.0399	0.0859	1.248	0.160	0.667
1000	0.0373	0.0889	1.248	0.167	0.662
1100	0.0351	0.0918	1.248	0.175	0.656

* From Ref. 145.

\dagger Extrapolated.

\ddagger Atmospheric pressure.

TABLE E-3
Physical Properties of Carbon Dioxide*

$T, ^\circ\text{F}$	Density \dagger ρ , lb_m/ft^3	Viscosity \dagger μ , $\text{lb}_m/\text{ft hr}$	Specific heat \dagger c_p , Btu/lb $_m$ $^\circ\text{F}$	Thermal conductivity \ddagger k , Btu/ft hr $^\circ\text{F}$	Prandtl no \ddagger Pr , $c_p\mu/k$
32	1.3190	0.03318	0.2187	0.008415	0.782
100	1.1277	0.03739	0.2202	0.009962	0.768
200	0.9373	0.04332	0.2262	0.01261	0.749
300	0.8051	0.04892	0.2342	0.01533	0.729
400	0.7071	0.05419	0.2423	0.01818	0.710
500	0.6310	0.05920	0.2503	0.02117	0.691
600	0.5701	0.06397	0.2476	0.02425	0.672
700	0.5202	0.06851	0.2643		
800	0.4784	0.07288	0.2704		
900	0.4428	0.07709	0.2760		
1000	0.4125	0.0811	0.2812		
1100	0.3850	0.08511	0.2858		
1200	0.3626	0.8891	0.2901		

* From Ref. 155.

\dagger At 10 atm pressure.

\ddagger At atmospheric pressure.

appendix **F**

Moody Friction Factor Chart

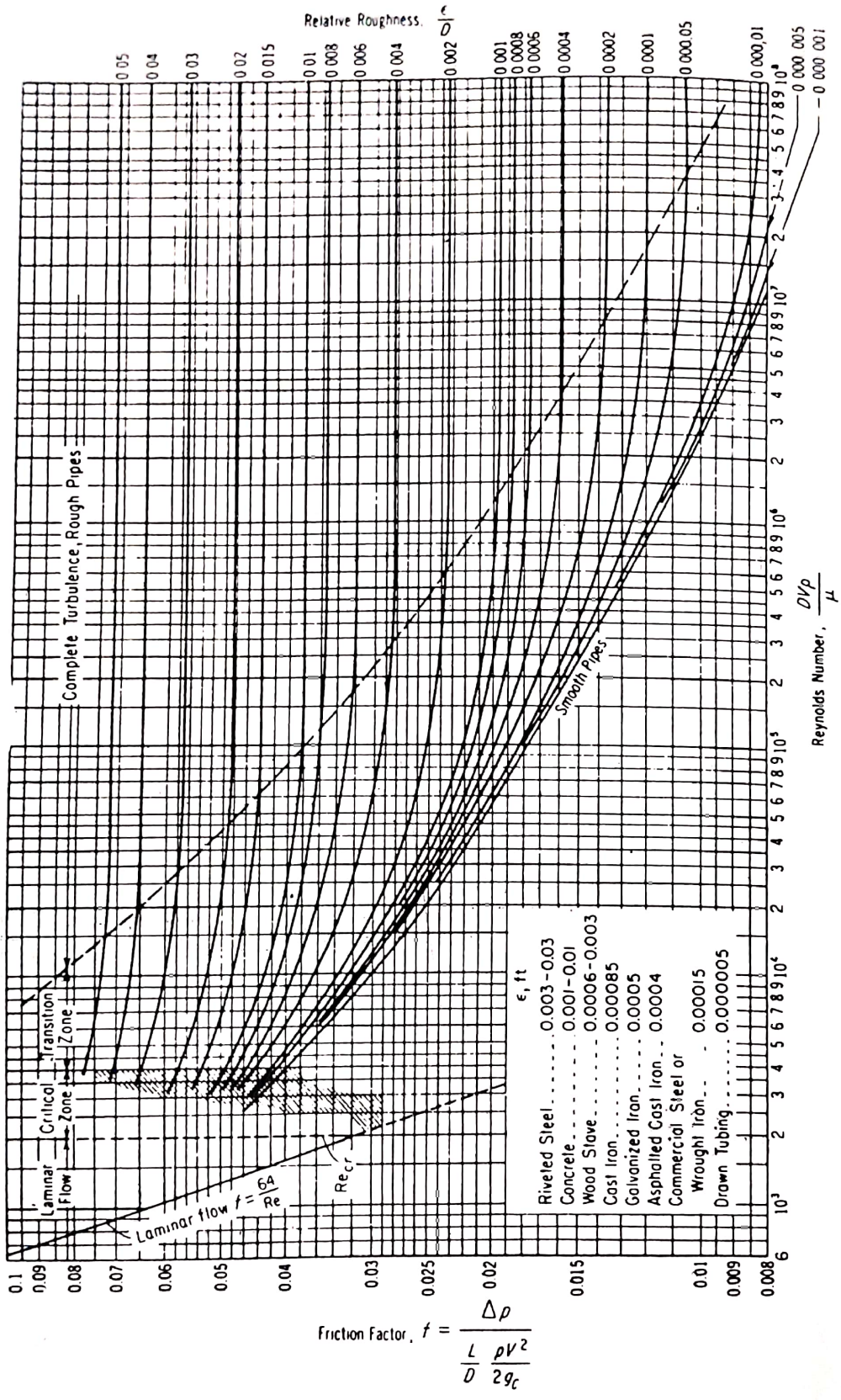


FIG. F-1