

## Physical Properties of Liquid Water<sup>†</sup>

Temp (°F)	Specific Heat, $c_p$ (BTU/lbm·°R)			Thermal Conductivity, $k$ (BTU/hr·ft·°F)			Viscosity, $\mu$ (lbm/hr·ft)		
	Saturated Liquid	1,000 psia	2,000 psia	Saturated Liquid	1,000 psia	2,000 psia	Saturated Liquid	1,000 psia	2,000 psia
80	0.9975	0.9943	0.9912	0.3532	0.3537	0.3570	2.084	2.084	2.083
100	0.9976	0.9932	0.9897	0.3641	0.3659	0.3680	1.650	1.654	1.658
200	1.0047	1.0008	0.9958	0.3935	0.3957	0.3980	0.738	0.748	0.757
300	1.0289	1.0232	1.0166	0.3952	0.3981	0.4013	0.425	0.460	0.468
400	1.0794	1.074	1.062	0.3809	0.3840	0.3880	0.327	0.330	0.335
420	1.0941	1.087	1.075	0.3753	0.3787	0.3833	0.310	0.312	0.317
440	1.1114	1.105	1.091	0.3693	0.3728	0.3776	0.294	0.296	0.301
460	1.1319	1.124	1.109	0.3640	0.3664	0.3713	0.280	0.282	0.286
480	1.1345	1.149	1.131	0.3575	0.3595	0.3642	0.267	0.270	0.273
500	1.1861	1.176	1.154	0.3494	0.3510	0.3562	0.256	0.257	0.260
520	1.23	1.21	1.188	0.3397	0.3410	0.3475	0.246	0.246	0.249
540	1.28	.	1.225	0.3298	.	0.3371	0.235	.	0.239
560	1.34	.	1.278	0.3189	.	0.3256	0.225	.	0.231
580	1.41	.	1.341	0.3064	.	0.3118	0.217	.	0.222
600	1.51	.	1.448	0.2919	.	0.2962	0.210	.	0.212
620	1.65	.	1.62	0.2753	.	0.2778	0.200	.	0.202
640	1.88	.	.	0.2565	.	.	0.190	.	.
660	2.34	.	.	0.2335	.	.	0.177	.	.
680	3.5	.	.	0.2056	.	.	0.161	.	.

Conversion Factors:

$$^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32)$$

$$4.1869 \text{ kJ/kg}\cdot^{\circ}\text{C} = 1 \text{ Btu/lbm}\cdot^{\circ}\text{F}$$

$$1.7307 \text{ W/m}\cdot^{\circ}\text{C} = 1 \text{ Btu/hr}\cdot\text{ft}\cdot^{\circ}\text{F}$$

$$1 \text{ kg/m}\cdot\text{sec} = 2419.2 \text{ lbm/ft}\cdot\text{hr}$$

<sup>†</sup> M.M. El-Wakil, Nuclear Energy Conversion, Intext Educational Publishers, 1971 [TK9202.E46].

## SATURATED WATER TABLES (Temperature)<sup>†</sup>

Pres. (psia)	Temp. (°F)	Specific Volume		Enthalpy			Internal Energy		Entropy	
		$v_f$	$v_g$	$h_f$	$h_{fg}$	$h_g$	$u_f$	$u_g$	$s_f$	$s_g$
32.018	.08866	.016022	3302.	0.01	1075.4	1075.4	0.00	1021.2	.00000	2.1869
40	.12166	.016020	2445.	8.02	1070.9	1078.9	8.02	1023.9	.01617	2.1592
60	.2563	.016035	1206.9	28.08	1059.6	1087.7	28.08	1030.4	.05555	2.0943
80	.5073	.016073	632.8	48.09	1048.3	1096.4	48.08	1037.0	.09332	2.0356
100	0.9503	.016130	350.0	68.05	1037.0	1105.0	68.04	1043.5	.12963	1.9822
120	1.6945	.016205	203.0	88.00	1025.5	1113.5	87.99	1049.9	.16465	1.9336
140	2.892	.016293	122.88	107.96	1014.0	1121.9	107.95	1056.2	.19851	1.8892
160	4.745	.016395	77.23	127.96	1002.2	1130.1	127.94	1062.3	.23130	1.8484
180	7.515	.016509	50.20	147.99	990.2	1138.2	147.97	1068.3	.26311	1.8109
200	11.529	.016634	33.63	168.07	977.9	1145.9	168.04	1074.2	.29400	1.7762
212	14.698	.016716	26.80	180.16	970.3	1150.5	180.11	1077.6	.31213	1.7567
220	17.188	.016772	23.15	188.22	965.3	1153.5	188.17	1079.8	.32406	1.7441
240	24.97	.016922	16.327	208.44	952.3	1160.7	208.36	1085.3	.35335	1.7143
260	35.42	.017084	11.768	228.76	938.8	1167.6	228.64	1090.5	.38193	1.6864
280	49.18	.017259	8.650	249.18	924.9	1174.1	249.02	1095.4	.40986	1.6602
300	66.98	.017448	6.472	269.73	910.4	1180.2	269.52	1100.0	.43720	1.6356
320	89.60	.017652	4.919	290.43	895.3	1185.8	290.14	1104.2	.46400	1.6123
340	117.93	.017872	3.792	311.30	879.5	1190.8	310.91	1108.0	.49031	1.5901
360	152.92	.018108	2.961	332.35	862.9	1195.2	331.84	1111.4	.51617	1.5688
380	195.60	.018363	2.339	353.62	845.4	1199.0	352.95	1114.3	.54163	1.5483
400	247.1	.018638	1.8661	375.12	826.8	1202.0	374.27	1116.6	.56672	1.5284
420	308.5	.018936	1.5024	396.89	807.2	1204.1	395.81	1118.3	.59152	1.5091
440	381.2	.019260	1.2192	418.98	786.3	1205.3	417.62	1119.3	.61605	1.4900
460	466.3	.019614	0.9961	441.4	764.1	1205.5	439.7	1119.6	.6404	1.4712
480	565.5	.020002	0.8187	464.3	740.3	1204.6	462.2	1118.9	.6646	1.4524
500	680.0	.02043	.6761	487.7	714.8	1202.5	485.1	1117.4	.6888	1.4335
520	811.4	.02091	.5605	511.7	687.3	1198.9	508.5	1114.8	.7130	1.4145
540	961.5	.02145	.4658	536.4	657.5	1193.8	532.6	1111.0	.7374	1.3950
560	1131.8	.02207	.3877	562.0	625.0	1187.0	557.4	1105.8	.7620	1.3749
580	1324.3	.02278	.3225	588.6	589.3	1178.0	583.1	1098.9	.7872	1.3540
600	1541.0	.02363	.2677	616.7	549.7	1166.4	609.9	1090.0	.8130	1.3317
620	1784.4	.02465	.2209	646.4	505.0	1151.4	638.3	1078.5	.8398	1.3075
640	2057.1	.02593	.1805	678.6	453.4	1131.9	668.7	1063.2	.8681	1.2803
660	2362.	.02767	.14459	714.4	391.1	1105.5	702.3	1042.3	.8990	1.2483
680	2705.	.03032	.11127	756.9	309.8	1066.7	741.7	1011.0	.9350	1.2068
700	3090.	.03666	.07438	822.7	167.5	990.2	801.7	947.7	0.9902	1.1346
705.44	3204.	.05053	.05053	902.5	0.0	902.5	872.6	872.6	1.0580	1.0580

Enthalpy:  $h$  [Btu/lbm]

Entropy:  $s$  [Btu/lbm·°R]

Internal energy:  $u$  [Btu/lbm]

Specific volume:  $v$  [ft<sup>3</sup>/lbm]

$h \equiv u + pv$

1 Watt = 3.4121 Btu/hr

1 Btu = 778.16 ft·lb<sub>f</sub>

1 Btu/lbm = 2.326 kW·sec/kg

<sup>†</sup> J.H. Keenan, F.G. Keyes *et al.*, Steam Tables, John Wiley and Sons, NY, 1969 [QC311.S79]

## SATURATED WATER TABLES (Pressure)

Pres. (psia)	Temp. (°F)	Specific Volume		Enthalpy			Internal Energy		Entropy	
		$v_f$	$v_g$	$h_f$	$h_{fg}$	$h_g$	$u_f$	$u_g$	$s_f$	$s_g$
1	101.70	.016136	333.6	69.74	1036.0	1105.8	69.74	1044.0	.13266	1.9779
5	162.21	.016407	73.53	130.17	1000.9	1131.0	130.15	1063.0	.23486	1.8441
10	193.19	.016590	38.42	161.23	982.1	1143.3	161.20	1072.2	.28358	1.7877
14.696	211.99	.016715	26.80	180.15	970.4	1150.5	180.10	1077.6	.31212	1.7567
20	227.96	.016830	20.09	196.26	960.1	1156.4	196.19	1082.0	.33580	1.7320
40	267.26	.017146	10.501	236.16	933.8	1170.0	236.03	1092.3	.39214	1.6767
60	292.73	.017378	7.177	262.25	915.8	1178.0	262.06	1098.3	.42733	1.6444
80	312.07	.017570	5.474	282.21	901.4	1183.6	281.95	1102.6	.45344	1.6214
100	327.86	.017736	4.434	298.61	889.2	1187.8	298.28	1105.8	.47439	1.6034
200	381.86	.018387	2.289	355.6	843.7	1199.3	354.9	1114.6	.5440	1.5464
300	417.43	.018896	1.5442	394.1	809.8	1203.9	393.0	1118.2	.5883	1.5115
400	444.70	.019340	1.1620	424.2	781.2	1205.5	422.8	1119.5	.6218	1.4856
500	467.13	.019748	.9283	449.5	755.8	1205.3	447.7	1119.4	.6490	1.4645
600	486.33	.02013	.7702	471.7	732.4	1204.1	469.4	1118.6	.6723	1.4464
700	503.23	.02051	.6558	491.5	710.5	1202.0	488.9	1117.0	.6927	1.4305
800	518.36	.02087	.5691	509.7	689.6	1199.3	506.6	1115.0	.7110	1.4160
900	532.12	.02123	.5009	526.6	669.5	1196.0	523.0	1112.6	.7277	1.4027
1000	544.75	.02159	.4459	542.4	650.0	1192.4	538.4	1109.9	.7432	1.3903
1100	556.45	.02195	.4005	557.4	631.0	1188.3	552.9	1106.8	.7576	1.3786
1200	567.37	.02232	.3623	571.7	612.3	1183.9	566.7	1103.5	.7712	1.3673
1300	577.60	.02269	.3297	585.4	593.8	1179.2	579.9	1099.8	.7841	1.3565
1400	587.25	.02307	.3016	598.6	575.5	1174.1	592.7	1096.0	.7964	1.3461
1500	596.39	.02346	.2769	611.5	557.2	1168.7	605.0	1091.8	.8082	1.3359
1600	605.06	.02386	.2552	624.0	538.9	1162.9	616.9	1087.4	.8196	1.3258
1700	613.32	.02428	.2358	636.2	520.6	1156.9	628.6	1082.7	.8307	1.3159
1800	621.21	.02472	.2183	648.3	502.1	1150.4	640.0	1077.7	.8414	1.3060
1900	628.76	.02517	.2025	660.1	483.4	1143.5	651.3	1072.3	.8519	1.2961
2000	636.00	.02565	.18813	671.9	464.4	1136.3	662.4	1066.6	.8623	1.2861
2100	642.95	.02616	.17491	683.6	445.0	1128.5	673.4	1060.6	.8725	1.2760
2200	649.64	.02670	.16270	695.3	425.0	1120.3	684.4	1054.0	.8826	1.2657
2300	656.09	.02728	.15133	707.0	404.4	1111.4	695.4	1047.0	.8927	1.2551
2400	662.31	.02791	.14067	718.8	383.0	1101.8	706.4	1039.3	.9028	1.2441
2500	668.31	.02860	.13059	730.9	360.5	1091.4	717.7	1031.0	.9131	1.2327
2600	674.11	.02938	.12099	743.3	336.7	1080.0	729.2	1021.8	.9236	1.2205
2700	679.73	.03027	.11172	756.2	311.1	1067.4	741.1	1011.5	.9345	1.2075
2800	685.16	.03131	.10264	770.0	283.0	1053.0	753.8	999.8	.9460	1.1932
2900	690.42	.03260	.09353	785.1	251.1	1036.2	767.6	986.0	.9586	1.1769
3000	695.52	.03431	.08404	802.5	213.0	1015.5	783.4	968.8	.9732	1.1575
3100	700.47	.03701	.07322	825.4	161.5	986.8	804.2	944.8	.9924	1.1316
3203.6	705.44	.05053	.05053	902.5	0.0	902.5	872.6	872.6	1.0580	1.0580

Enthalpy:  $h$  [Btu/lbm]

Entropy:  $s$  [Btu/lbm·°R]

Internal energy:  $u$  [Btu/lbm]

Specific volume:  $v$  [ft<sup>3</sup>/lbm]

$h \equiv u + pv$

1 Watt = 3.4121 Btu/hr

1 Btu = 778.16 ft·lb<sub>f</sub>

1 Btu/lbm = 2.326 kW·sec/kg

## SUPERHEATED STEAM TABLES

Pressure (psia) (T <sub>sat</sub> )		Temperature (°F)											
		250	300	350	400	450	500	600	700	800	900	1000	1100
14.696 (211.99)	v	28.42	30.52	32.60	34.67	36.72	38.77	42.86	46.93	51.00	55.07	59.13	63.19
	h	1168.8	1192.6	1216.3	1239.9	1263.6	1287.3	1335.2	1383.8	1433.1	1483.4	1534.5	1586.4
	u	1091.5	1109.6	1127.6	1145.6	1163.7	1181.8	1218.6	1256.1	1294.4	1333.6	1373.7	1414.6
	s	1.7832	1.8157	1.8458	1.8741	1.9008	1.9263	1.9737	2.0175	2.0584	2.0967	2.1330	2.1674
100 (327.86)	v	.	.	4.592	4.934	5.265	5.587	6.216	6.834	7.445	8.053	8.657	9.260
	h	.	.	1200.4	1227.5	1253.6	1279.1	1329.3	1379.2	1429.6	1480.5	1532.1	1584.5
	u	.	.	1115.4	1136.2	1156.2	1175.7	1214.2	1252.8	1291.8	1331.5	1371.9	1413.1
	s	.	.	1.6191	1.6517	1.6812	1.7085	1.7582	1.8033	1.8449	1.8838	1.9204	1.9551
200 (381.86)	v	.	.	.	2.361	2.548	2.724	3.058	3.379	3.693	4.003	4.310	4.615
	h	.	.	.	1210.8	1240.7	1268.8	1322.1	1373.8	1425.3	1477.1	1529.3	1582.2
	u	.	.	.	1123.5	1146.4	1168.0	1208.9	1248.8	1288.6	1328.9	1369.8	1411.4
	s	.	.	.	1.5600	1.5938	1.6239	1.6767	1.7234	1.7660	1.8055	1.8425	1.8776
300 (417.43)	v	.	.	.	.	1.6361	1.7662	2.004	2.227	2.442	2.653	2.860	3.066
	h	.	.	.	.	1226.2	1257.5	1314.5	1368.3	1421.0	1473.6	1526.5	1579.8
	u	.	.	.	.	1135.4	1159.5	1203.2	1244.6	1285.4	1326.3	1367.7	1409.6
	s	.	.	.	.	1.5365	1.5701	1.6266	1.6751	1.7187	1.7589	1.7964	1.8317
400 (444.70)	v	.	.	.	.	1.1745	1.2843	1.4760	1.6503	1.8163	1.9776	2.136	2.292
	h	.	.	.	.	1209.6	1245.2	1306.6	1362.5	1416.6	1470.1	1523.6	1577.4
	u	.	.	.	.	1122.6	1150.1	1197.3	1240.4	1282.1	1323.7	1365.5	1407.8
	s	.	.	.	.	1.4901	1.5282	1.5892	1.6397	1.6844	1.7252	1.7632	1.7989
500 (467.13)	v	.	.	.	.	.	0.9924	1.1583	1.3040	1.4407	1.5723	1.7008	1.8271
	h	.	.	.	.	.	1231.5	1298.3	1356.7	1412.1	1466.5	1520.7	1575.1
	u	.	.	.	.	.	1139.7	1191.1	1236.0	1278.8	1321.0	1363.3	1406.0
	s	.	.	.	.	.	1.4923	1.5585	1.6112	1.6571	1.6987	1.7371	1.7731
600 (486.33)	v	.	.	.	.	.	0.7947	0.9456	1.0727	1.1900	1.3021	1.4108	1.5173
	h	.	.	.	.	.	1216.2	1289.5	1350.6	1407.6	1462.9	1517.8	1572.7
	u	.	.	.	.	.	1128.0	1184.5	1231.5	1275.4	1318.4	1361.2	1404.2
	s	.	.	.	.	.	1.4592	1.5320	1.5872	1.6343	1.6766	1.7155	1.7519
700 (503.23)	v	.	.	.	.	.	.	0.7929	0.9073	1.0109	1.1089	1.2036	1.2960
	h	.	.	.	.	.	.	1280.2	1344.4	1402.9	1459.3	1514.9	1570.2
	u	.	.	.	.	.	.	1177.5	1226.9	1272.0	1315.6	1358.9	1402.4
	s	.	.	.	.	.	.	1.5081	1.5661	1.6145	1.6576	1.6970	1.7337
800 (518.36)	v	.	.	.	.	.	.	0.6776	0.7829	0.8764	0.9640	1.0482	1.1300
	h	.	.	.	.	.	.	1270.4	1338.0	1398.2	1455.6	1511.9	1567.8
	u	.	.	.	.	.	.	1170.1	1222.1	1268.5	1312.9	1356.7	1400.5
	s	.	.	.	.	.	.	1.4861	1.5471	1.5969	1.6408	1.6807	1.7178
900 (532.12)	v	.	.	.	.	.	.	0.5871	0.6859	0.7717	0.8513	0.9273	1.0009
	h	.	.	.	.	.	.	1260.0	1331.4	1393.4	1451.9	1508.9	1565.4
	u	.	.	.	.	.	.	1162.2	1217.1	1264.9	1310.1	1354.5	1398.7
	s	.	.	.	.	.	.	1.4652	1.5297	1.5810	1.6257	1.6662	1.7036
1000 (544.75)	v	.	.	.	.	.	.	0.5140	0.6080	0.6878	0.7610	0.8305	0.8976
	h	.	.	.	.	.	.	1248.8	1324.6	1388.5	1448.1	1505.9	1562.9
	u	.	.	.	.	.	.	1153.7	1212.0	1261.2	1307.3	1352.2	1396.8
	s	.	.	.	.	.	.	1.4450	1.5135	1.5664	1.6120	1.6530	1.6908

## SUPERHEATED STEAM TABLES (cont'd)<sup>†</sup>

Pressure (psia)		Temperature (°F)											
		(T <sub>sat</sub> )	250	300	350	400	450	500	600	700	800	900	1000
1100	v	.	.	.	.	.	.	0.4532	0.5441	0.6190	0.6871	0.7513	0.8131
(556.45)	h	.	.	.	.	.	.	1236.7	1317.5	1383.5	1444.3	1502.8	1560.4
	u	.	.	.	.	.	.	1144.5	1206.7	1257.5	1304.4	1349.9	1394.9
	s	.	.	.	.	.	.	1.4252	1.4982	1.5529	1.5993	1.6409	1.6790
1200	v	.	.	.	.	.	.	0.4017	0.4906	0.5617	0.6255	0.6853	0.7426
(567.37)	h	.	.	.	.	.	.	1223.6	1310.2	1378.4	1440.4	1499.7	1557.9
	u	.	.	.	.	.	.	1134.4	1201.3	1253.7	1301.5	1347.5	1393.0
	s	.	.	.	.	.	.	1.4054	1.4837	1.5402	1.5876	1.6297	1.6682
1400	v	.	.	.	.	.	.	0.3175	0.4059	0.4713	0.5285	0.5815	0.6319
(587.25)	h	.	.	.	.	.	.	1193.1	1294.8	1367.9	1432.5	1493.5	1552.8
	u	.	.	.	.	.	.	1110.9	1189.6	1245.8	1295.6	1342.8	1389.1
	s	.	.	.	.	.	.	1.3642	1.4562	1.5168	1.5661	1.6094	1.6487
1600	v	.	.	.	.	.	.	.	0.3415	0.4032	0.4557	0.5036	0.5488
(605.06)	h	.	.	.	.	.	.	.	1278.1	1357.0	1424.4	1487.1	1547.7
	u	.	.	.	.	.	.	.	1177.0	1237.7	1289.5	1338.0	1385.2
	s	.	.	.	.	.	.	.	1.4299	1.4953	1.5468	1.5913	1.6315
1800	v	.	.	.	.	.	.	.	0.2905	0.3500	0.3989	0.4430	0.4842
(621.21)	h	.	.	.	.	.	.	.	1259.9	1345.7	1416.1	1480.7	1542.5
	u	.	.	.	.	.	.	.	1163.1	1229.1	1283.2	1333.1	1381.2
	s	.	.	.	.	.	.	.	1.4042	1.4753	1.5291	1.5749	1.6159

<sup>†</sup> J.H. Keenan, F.G. Keyes *et al.*, Steam Tables, John Wiley and Sons, NY, 1969 [QC311.S79]