

APPENDIX III: STEAM TABLES — THERMODYNAMIC DATA FOR WATER AT SATURATED VAPOR PRESSURES AND TEMPERATURES

0 - 374.136°C

Derivation: Equation of State of Keenan et al. (1969);  
and calculated by P. Delaney (U.S. Geological Survey)

Reference:

Keenan, J.H., Keyes, F.G., Hill, P.G. and Moore, J.G., 1969, Steam Tables - thermodynamic properties of water including vapor, liquid, and solid phases (International Edition - metric units); Wiley, New York, 162 p.

Temp. (°C)	Press. (bars)	Specific Volume (cc/gm)		Enthalpy (J/gm)		
		vap.	liq.	vap.	liq.	evap.
0.01	0.01	206136	1.000	2501	0.01	2501
1	0.01	192577	1.000	2503	4.16	2499
2	0.01	179889	1.000	2505	8.37	2497
3	0.01	168132	1.000	2507	12.57	2494
4	0.01	157232	1.000	2509	16.78	2492
5	0.01	147120	1.000	2511	20.98	2490
6	0.01	137734	1.000	2512	25.20	2487
7	0.01	129017	1.000	2514	29.39	2485
8	0.01	120917	1.000	2516	33.60	2482
9	0.01	113386	1.000	2518	37.80	2480
10	0.01	106379	1.000	2520	42.01	2478
11	0.01	99857	1.000	2522	46.20	2475
12	0.01	93784	1.001	2523	50.41	2473
13	0.01	88124	1.001	2525	54.60	2471
14	0.02	82848	1.001	2527	58.80	2468
15	0.02	77926	1.001	2529	62.99	2466
16	0.02	73333	1.001	2531	67.19	2464
17	0.02	69044	1.001	2533	71.38	2461
18	0.02	65038	1.001	2534	75.58	2459
19	0.02	61293	1.002	2536	79.77	2456
20	0.02	57791	1.002	2538	83.96	2454
21	0.02	54514	1.002	2540	88.14	2452
22	0.03	51447	1.002	2542	92.33	2449
23	0.03	48574	1.002	2544	96.52	2447
24	0.03	45883	1.003	2545	100.7	2445
25	0.03	43360	1.003	2547	104.9	2442
26	0.03	40994	1.003	2549	109.1	2440
27	0.04	38774	1.003	2551	113.2	2438
28	0.04	36690	1.004	2553	117.4	2435
29	0.04	34733	1.004	2554	121.6	2433

Temp. (°C)	Press. (bars)	Specific Volume (cc/gm)		Enthalpy (J/gm)		
		vap.	liq.	vap.	liq.	evap.
30	0.04	32894	1.004	2556	125.8	2430
31	0.04	31165	1.005	2558	130.0	2428
32	0.05	29540	1.005	2560	134.1	2426
33	0.05	28011	1.005	2562	138.3	2423
34	0.05	26571	1.006	2563	142.5	2421
35	0.06	25216	1.006	2565	146.7	2419
36	0.06	23940	1.006	2567	150.9	2416
37	0.06	22737	1.007	2569	155.0	2414
38	0.07	21602	1.007	2571	159.2	2411
39	0.07	20533	1.007	2572	163.4	2409
40	0.07	19523	1.008	2574	167.6	2407
41	0.08	18570	1.008	2576	171.7	2404
42	0.08	17671	1.009	2578	175.9	2402
43	0.09	16821	1.009	2580	180.1	2400
44	0.09	16018	1.009	2581	184.3	2397
45	0.10	15258	1.010	2583	188.4	2395
46	0.10	14540	1.010	2585	192.6	2392
47	0.11	13861	1.011	2587	196.8	2390
48	0.11	13218	1.011	2589	201.0	2388
49	0.12	12609	1.012	2590	205.1	2385
50	0.12	12032	1.012	2592	209.3	2383
51	0.13	11486	1.013	2594	213.5	2380
52	0.14	10968	1.013	2596	217.7	2378
53	0.14	10476	1.014	2597	221.9	2376
54	0.15	10011	1.014	2599	226.0	2373
55	0.16	9569	1.015	2601	230.2	2371
56	0.17	9149	1.015	2603	234.4	2368
57	0.17	8751	1.016	2604	238.6	2366
58	0.18	8372	1.016	2606	242.8	2363
59	0.19	8013	1.017	2608	246.9	2361
60	0.20	7671	1.017	2610	251.1	2358
61	0.21	7346	1.018	2611	255.3	2356
62	0.22	7037	1.018	2613	259.5	2354
63	0.23	6743	1.019	2615	263.7	2351
64	0.24	6463	1.019	2617	267.9	2349
65	0.25	6197	1.020	2618	272.0	2346
66	0.26	5943	1.020	2620	276.2	2344
67	0.27	5701	1.021	2622	280.4	2341
68	0.29	5471	1.022	2623	284.6	2339
69	0.30	5252	1.022	2625	288.8	2336
70	0.31	5042	1.023	2627	293.0	2334
71	0.33	4843	1.023	2629	297.2	2331
72	0.34	4652	1.024	2630	301.4	2329
73	0.35	4470	1.025	2632	305.5	2326
74	0.37	4297	1.025	2634	309.7	2324
75	0.39	4131	1.026	2635	313.9	2321
76	0.40	3973	1.027	2637	318.1	2319
77	0.42	3822	1.027	2639	322.3	2316
78	0.44	3677	1.028	2640	326.5	2314
79	0.46	3539	1.028	2642	330.7	2311
80	0.47	3407	1.029	2644	334.9	2309
81	0.49	3281	1.030	2645	339.1	2306
82	0.51	3160	1.030	2647	343.3	2304
83	0.53	3044	1.031	2649	347.5	2301
84	0.56	2934	1.032	2650	351.7	2299

Temp. (°C)	Press. (bars)	Specific Volume (cc/gm)		Enthalpy (J/gm)		
		vap.	liq.	vap.	liq.	evap.
85	0.58	2828	1.032	2652	355.9	2296
86	0.60	2726	1.033	2654	360.1	2293
87	0.63	2629	1.034	2655	364.3	2291
88	0.65	2536	1.035	2657	368.5	2288
89	0.68	2446	1.035	2658	372.7	2286
90	0.70	2361	1.036	2660	376.9	2283
91	0.73	2278	1.037	2662	381.1	2281
92	0.76	2200	1.037	2663	385.3	2278
93	0.79	2124	1.038	2665	389.5	2275
94	0.81	2052	1.039	2667	393.7	2273
95	0.85	1982	1.040	2668	398.0	2270
96	0.88	1915	1.040	2670	402.2	2268
97	0.91	1851	1.041	2671	406.4	2265
98	0.94	1789	1.042	2673	410.6	2262
99	0.98	1730	1.043	2674	414.8	2260
100	1.01	1673	1.043	2676	419.0	2257
101	1.05	1618	1.044	2678	423.3	2254
102	1.09	1566	1.045	2679	427.5	2252
103	1.13	1515	1.046	2681	431.7	2249
104	1.17	1466	1.047	2682	435.9	2246
105	1.21	1419	1.047	2684	440.1	2244
106	1.25	1374	1.048	2685	444.4	2241
107	1.29	1331	1.049	2687	448.6	2238
108	1.34	1289	1.050	2688	452.8	2236
109	1.39	1249	1.051	2690	457.1	2233
110	1.43	1210	1.052	2691	461.3	2230
111	1.48	1173	1.052	2693	465.5	2227
112	1.53	1137	1.053	2695	469.8	2225
113	1.58	1102	1.054	2696	474.0	2222
114	1.64	1069	1.055	2697	478.2	2219
115	1.69	1037	1.056	2699	482.5	2217
116	1.75	1006	1.057	2700	486.7	2214
117	1.80	975.6	1.058	2702	491.0	2211
118	1.86	946.7	1.059	2703	495.2	2208
119	1.92	918.8	1.059	2705	499.5	2205
120	1.99	891.9	1.060	2706	503.7	2203
121	2.05	865.9	1.061	2708	508.0	2200
122	2.11	840.8	1.062	2709	512.2	2197
123	2.18	816.6	1.063	2711	516.5	2194
124	2.25	793.2	1.064	2712	520.7	2191
125	2.32	770.6	1.065	2713	525.0	2189
126	2.39	748.8	1.066	2715	529.2	2186
127	2.47	727.7	1.067	2716	533.5	2183
128	2.54	707.3	1.068	2718	537.8	2180
129	2.62	687.6	1.069	2719	542.0	2177
130	2.70	668.5	1.070	2720	546.3	2174
131	2.78	650.1	1.071	2722	550.6	2171
132	2.87	632.3	1.072	2723	554.9	2168
133	2.95	615.0	1.073	2725	559.1	2165
134	3.04	598.3	1.074	2726	563.4	2163
135	3.13	582.2	1.075	2727	567.7	2160
136	3.22	566.6	1.076	2729	572.0	2157
137	3.32	551.4	1.077	2730	576.3	2154
138	3.41	536.8	1.078	2731	580.5	2151
139	3.51	522.6	1.079	2733	584.8	2148

Temp. (°C)	Press. (bars)	Specific Volume (cc/gm)		Enthalpy (J/gm)		
		vap.	liq.	vap.	liq.	evap.
140	3.61	508.9	1.080	2734	589.1	2145
141	3.72	495.6	1.081	2735	593.4	2142
142	3.82	482.7	1.082	2736	597.7	2139
143	3.93	470.2	1.083	2738	602.0	2136
144	4.04	458.1	1.084	2739	606.3	2133
145	4.15	446.3	1.085	2740	610.6	2130
146	4.27	435.0	1.086	2742	614.9	2127
147	4.39	423.9	1.087	2743	619.2	2124
148	4.51	413.2	1.088	2744	623.6	2120
149	4.63	402.9	1.089	2745	627.9	2117
150	4.76	392.8	1.090	2746	632.2	2114
151	4.89	383.0	1.092	2748	636.5	2111
152	5.02	373.5	1.093	2749	640.8	2108
153	5.15	364.4	1.094	2750	645.2	2105
154	5.29	355.4	1.095	2751	649.5	2102
155	5.43	346.8	1.096	2752	653.8	2099
156	5.57	338.4	1.097	2754	658.2	2095
157	5.72	330.2	1.098	2755	662.5	2092
158	5.87	322.3	1.100	2756	666.9	2089
159	6.02	314.5	1.101	2757	671.2	2086
160	6.18	307.1	1.102	2758	675.5	2083
161	6.34	299.8	1.103	2759	679.9	2079
162	6.50	292.7	1.104	2760	684.3	2076
163	6.66	285.9	1.106	2761	688.6	2073
164	6.83	279.2	1.107	2762	693.0	2070
165	7.00	272.7	1.108	2764	697.3	2066
166	7.18	266.4	1.109	2765	701.7	2063
167	7.36	260.2	1.110	2766	706.1	2060
168	7.54	254.3	1.112	2767	710.5	2056
169	7.73	248.5	1.113	2768	714.8	2053
170	7.92	242.8	1.114	2769	719.2	2050
171	8.11	237.3	1.116	2770	723.6	2046
172	8.31	232.0	1.117	2771	728.0	2043
173	8.51	226.8	1.118	2772	732.4	2039
174	8.71	221.7	1.119	2773	736.8	2036
175	8.92	216.8	1.121	2774	741.2	2032
176	9.13	212.0	1.122	2775	745.6	2029
177	9.35	207.3	1.123	2775	750.0	2025
178	9.57	202.8	1.125	2776	754.4	2022
179	9.79	198.4	1.126	2777	758.8	2018
180	10.02	194.0	1.127	2778	763.2	2015
181	10.25	189.8	1.129	2779	767.6	2011
182	10.49	185.8	1.130	2780	772.1	2008
183	10.73	181.8	1.132	2781	776.5	2004
184	10.98	177.9	1.133	2782	780.9	2001
185	11.23	174.1	1.134	2782	785.4	1997
186	11.48	170.4	1.136	2783	789.8	1993
187	11.74	166.8	1.137	2784	794.3	1990
188	12.00	163.3	1.139	2785	798.7	1986
189	12.27	159.9	1.140	2786	803.2	1982
190	12.54	156.5	1.141	2786	807.6	1979
191	12.82	153.3	1.143	2787	812.1	1975
192	13.10	150.1	1.144	2788	816.5	1971
193	13.39	147.0	1.146	2789	821.0	1968
194	13.68	144.0	1.147	2789	825.5	1964

Temp. (°C)	Press. (bars)	Specific Volume (cc/gm)		Enthalpy (J/gm)		
		vap.	liq.	vap.	liq.	evap.
195	13.98	141.1	1.149	2790	830.0	1960
196	14.28	138.2	1.150	2791	834.5	1956
197	14.59	135.4	1.152	2791	839.0	1952
198	14.90	132.6	1.153	2792	843.4	1949
199	15.22	130.0	1.155	2793	847.9	1945
200	15.54	127.4	1.156	2793	852.4	1941
201	15.87	124.8	1.158	2794	857.0	1937
202	16.20	122.3	1.160	2794	861.5	1933
203	16.54	119.9	1.161	2795	866.0	1929
204	16.88	117.5	1.163	2796	870.5	1925
205	17.23	115.2	1.164	2796	875.0	1921
206	17.59	113.0	1.166	2797	879.6	1917
207	17.95	110.7	1.168	2797	884.1	1913
208	18.31	108.6	1.169	2798	888.7	1909
209	18.68	106.5	1.171	2798	893.2	1905
210	19.06	104.4	1.173	2798	897.8	1901
211	19.45	102.4	1.174	2799	902.3	1897
212	19.84	100.4	1.176	2799	906.9	1892
213	20.23	98.51	1.178	2800	911.5	1888
214	20.63	96.63	1.179	2800	916.0	1884
215	21.04	94.79	1.181	2801	920.6	1880
216	21.46	92.99	1.183	2801	925.2	1876
217	21.88	91.23	1.185	2801	929.8	1871
218	22.30	89.52	1.186	2802	934.4	1867
219	22.74	87.84	1.188	2802	939.0	1863
220	23.18	86.19	1.190	2802	943.6	1859
221	23.62	84.58	1.192	2802	948.2	1854
222	24.08	83.01	1.194	2803	952.9	1850
223	24.54	81.47	1.195	2803	957.5	1845
224	25.00	79.96	1.197	2803	962.1	1841
225	25.48	78.49	1.199	2803	966.8	1836
226	25.96	77.05	1.201	2803	971.4	1832
227	26.44	75.64	1.203	2804	976.1	1828
228	26.94	74.26	1.205	2804	980.8	1823
229	27.44	72.90	1.207	2804	985.4	1818
230	27.95	71.58	1.209	2804	990.1	1814
231	28.46	70.29	1.211	2804	994.8	1809
232	28.99	69.02	1.213	2804	999.5	1805
233	29.52	67.77	1.215	2804	1004	1800
234	30.06	66.56	1.217	2804	1009	1795
235	30.60	65.37	1.219	2804	1014	1791
236	31.15	64.20	1.221	2804	1018	1786
237	31.71	63.06	1.223	2804	1023	1781
238	32.28	61.94	1.225	2804	1028	1776
239	32.86	60.84	1.227	2804	1033	1771
240	33.44	59.76	1.229	2804	1037	1767
241	34.03	58.71	1.231	2804	1042	1762
242	34.63	57.68	1.233	2804	1047	1757
243	35.24	56.67	1.236	2803	1052	1752
244	35.86	55.68	1.238	2803	1056	1747
245	36.48	54.71	1.240	2803	1061	1742
246	37.11	53.75	1.242	2803	1066	1737
247	37.76	52.82	1.244	2802	1071	1732
248	38.40	51.90	1.247	2802	1076	1727
249	39.06	51.01	1.249	2802	1081	1721

## APPENDIX III

Temp. (°C)	Press. (bars)	Specific Volume (cc/gm)		Enthalpy (J/gm)		
		vap.	liq.	vap.	liq.	evap.
250	39.73	50.13	1.251	2802	1085	1716
251	40.40	49.26	1.254	2801	1090	1711
252	41.09	48.42	1.256	2801	1095	1706
253	41.78	47.59	1.258	2800	1100	1700
254	42.48	46.77	1.261	2800	1105	1695
255	43.19	45.98	1.263	2800	1110	1690
256	43.91	45.19	1.266	2799	1115	1684
257	44.64	44.42	1.268	2799	1120	1679
258	45.38	43.67	1.270	2798	1124	1674
259	46.13	42.93	1.273	2797	1129	1668
260	46.89	42.21	1.276	2797	1134	1663
261	47.65	41.49	1.278	2796	1139	1657
262	48.43	40.79	1.281	2796	1144	1651
263	49.21	40.11	1.283	2795	1149	1646
264	50.01	39.43	1.286	2794	1154	1640
265	50.81	38.77	1.289	2794	1159	1634
266	51.63	38.12	1.291	2793	1164	1629
267	52.45	37.49	1.294	2792	1169	1623
268	53.29	36.86	1.297	2791	1174	1617
269	54.13	36.25	1.300	2791	1179	1611
270	54.99	35.64	1.302	2790	1185	1605
271	55.85	35.05	1.305	2789	1190	1599
272	56.73	34.47	1.308	2788	1195	1593
273	57.61	33.90	1.311	2787	1200	1587
274	58.51	33.34	1.314	2786	1205	1581
275	59.42	32.79	1.317	2785	1210	1575
276	60.34	32.24	1.320	2784	1215	1569
277	61.26	31.71	1.323	2783	1220	1563
278	62.20	31.19	1.326	2782	1226	1556
279	63.15	30.68	1.329	2781	1231	1550
280	64.12	30.17	1.332	2780	1236	1544
281	65.09	29.67	1.335	2778	1241	1537
282	66.07	29.19	1.338	2777	1246	1531
283	67.07	28.71	1.342	2776	1252	1524
284	68.07	28.24	1.345	2775	1257	1518
285	69.09	27.77	1.348	2773	1262	1511
286	70.12	27.32	1.352	2772	1268	1504
287	71.16	26.87	1.355	2771	1273	1498
288	72.22	26.43	1.359	2769	1278	1491
289	73.28	26.00	1.362	2768	1284	1484
290	74.36	25.57	1.366	2766	1289	1477
291	75.45	25.15	1.369	2765	1294	1470
292	76.55	24.74	1.373	2763	1300	1463
293	77.66	24.33	1.376	2761	1305	1456
294	78.79	23.94	1.380	2760	1311	1449
295	79.93	23.54	1.384	2758	1316	1442
296	81.08	23.16	1.388	2756	1322	1435
297	82.24	22.78	1.392	2755	1327	1427
298	83.42	22.40	1.396	2753	1333	1420
299	84.61	22.04	1.400	2751	1338	1412
300	85.81	21.67	1.404	2749	1344	1405
301	87.02	21.32	1.408	2747	1350	1397
302	88.25	20.97	1.412	2745	1355	1390
303	89.49	20.62	1.416	2743	1361	1382
304	90.75	20.28	1.420	2741	1367	1374
305	92.02	19.95	1.425	2739	1372	1366

Temp. (°C)	Press. (bars)	Specific Volume (cc/gm)		Enthalpy (J/gm)		
		vap.	liq.	vap.	liq.	evap.
306	93.30	19.62	1.429	2737	1378	1358
307	94.59	19.29	1.434	2734	1384	1350
308	95.90	18.97	1.438	2732	1390	1342
309	97.23	18.66	1.443	2730	1395	1334
310	98.56	18.35	1.447	2727	1401	1326
311	99.92	18.04	1.452	2725	1407	1318
312	101.2	17.74	1.457	2722	1413	1309
313	102.6	17.45	1.462	2720	1419	1301
314	104.0	17.16	1.467	2717	1425	1292
315	105.4	16.87	1.472	2714	1431	1283
316	106.8	16.58	1.477	2712	1437	1275
317	108.3	16.30	1.482	2709	1443	1266
318	109.7	16.03	1.488	2706	1449	1257
319	111.2	15.76	1.493	2703	1455	1248
320	112.7	15.49	1.499	2700	1461	1239
321	114.2	15.22	1.504	2697	1468	1229
322	115.7	14.96	1.510	2694	1474	1220
323	117.2	14.71	1.516	2691	1480	1210
324	118.8	14.45	1.522	2687	1486	1201
325	120.3	14.20	1.528	2684	1493	1191
326	121.9	13.95	1.534	2681	1499	1181
327	123.5	13.71	1.541	2677	1506	1171
328	125.1	13.47	1.547	2673	1512	1161
329	126.8	13.23	1.554	2670	1519	1151
330	128.4	13.00	1.561	2666	1525	1141
331	130.1	12.76	1.568	2662	1532	1130
332	131.7	12.54	1.575	2658	1539	1119
333	133.4	12.31	1.582	2654	1545	1109
334	135.2	12.09	1.589	2650	1552	1098
335	136.9	11.87	1.597	2645	1559	1086
336	138.6	11.65	1.605	2641	1566	1075
337	140.4	11.43	1.613	2636	1573	1064
338	142.2	11.22	1.621	2632	1580	1052
339	144.0	11.01	1.629	2627	1587	1040
340	145.8	10.80	1.638	2622	1594	1028
341	147.7	10.59	1.647	2617	1601	1016
342	149.5	10.39	1.656	2612	1609	1003
343	151.4	10.18	1.665	2606	1616	990
344	153.3	9.983	1.675	2601	1624	977
345	155.2	9.784	1.685	2595	1631	964
346	157.1	9.587	1.695	2589	1639	951
347	159.1	9.391	1.706	2583	1647	937
348	161.1	9.197	1.717	2577	1654	923
349	163.1	9.005	1.728	2571	1662	908
350	165.1	8.813	1.740	2564	1671	893
351	167.1	8.623	1.753	2557	1679	878
352	169.2	8.435	1.765	2550	1687	863
353	171.3	8.247	1.779	2542	1696	847
354	173.4	8.060	1.793	2535	1704	830
355	175.5	7.873	1.807	2527	1713	814
356	177.6	7.688	1.822	2518	1722	796
357	179.8	7.502	1.839	2510	1731	778
358	182.0	7.317	1.855	2501	1741	760
359	184.2	7.131	1.873	2491	1751	741

Temp. (°C)	Press. (bars)	Specific Volume (cc/gm)		Enthalpy (J/gm)		
		vap.	liq.	vap.	liq.	evap.
360	186.5	6.945	1.892	2481	1761	721
361	188.7	6.759	1.913	2471	1771	700
362	191.0	6.571	1.934	2459	1781	678
363	193.3	6.381	1.958	2448	1792	655
364	195.7	6.190	1.983	2435	1804	631
365	198.0	5.995	2.011	2421	1816	606
366	200.4	5.797	2.041	2407	1829	578
367	202.8	5.593	2.076	2391	1842	549
368	205.3	5.380	2.114	2374	1857	517
369	207.7	5.162	2.159	2354	1873	482
370	210.2	4.925	2.213	2332	1890	442
371	212.8	4.671	2.280	2306	1911	395
372	215.3	4.380	2.369	2274	1936	338
373	217.9	4.019	2.509	2229	1971	258
374	220.5	3.404	2.880	2140	2049	91
374.136	220.9	3.155	3.155	2099	2099	0