

Propriedades Termodinâmicas da Água

Apêndice H
Termodinâmica Aplicada
4.ª Ed. (2018)

Este documento apresenta as tabelas termodinâmicas (em unidades SI) para a água assim como os diagramas temperatura-entropia e entalpia-entropia (também conhecido por diagrama de Mollier). Estas tabelas e figuras correspondem, respectivamente, às Tabelas H-1 a H-5 e às Figs. H-1 e H-2 do Apêndice H, de *Termodinâmica Aplicada* (4.^a edição, 2018, Escolar Editora).

As Tabelas de Vapor são apresentadas nas linhas de saturação líquido-vapor e sólido-vapor, para o vapor de água superaquecido, e para a água líquida superarrefecida (ou comprimida).¹

O estado de referência é a água líquida saturada no ponto triplo (0.01°C e 0.611 kPa), para a qual $u^L = 0$ kJ/kg. As Tabelas H-1 e H-2 apresentam as propriedades termodinâmicas na linha de saturação líquido-vapor; a Tabela H-3, para o vapor de água superaquecido; a Tabela H-4, para a água líquida superarrefecida; e a Tabela H-5, para a linha de saturação gelo-vapor de água.

Estão disponíveis na Internet muitos programas de cálculo com as propriedades da água. Por exemplo, nos seguintes sítios é possível efetuar o cálculo *online* com as Tabelas de Vapor:

<http://webbook.nist.gov/chemistry/fluid/>

<http://www.steamtablesonline.com/steam97web.aspx>

¹ A. P. Harvey, A. P. Peskin, S. A. Klein, 1997, *NIST/ASME Steam Properties*, NIST Standard Reference Data Program.



Tabela H-1 Água saturada (tabela de temperaturas).

Temp. °C	p^{sat} kPa	v^{L} m ³ /kg	v^{V} m ³ /kg	u^{L} kJ/kg	$\Delta_{\text{vap}}u$ kJ/kg	u^{V} kJ/kg	h^{L} kJ/kg	$\Delta_{\text{vap}}h$ kJ/kg	h^{V} kJ/kg	s^{L} kJ/(K kg)	$\Delta_{\text{vap}}s$ kJ/(K kg)	s^{V} kJ/(K kg)
0.01	0.611	0.001000	205.9912	0.00	2374.92	2374.91	0.001	2500.92	2500.92	0.0000	9.1555	9.1555
5	0.872	0.001000	147.0113	21.02	2360.76	2381.78	21.02	2489.04	2510.06	0.0763	8.9485	9.0248
10	1.228	0.001000	106.3032	42.02	2346.63	2388.65	42.02	2477.19	2519.21	0.1511	8.7487	8.8998
15	1.706	0.001001	77.8755	62.98	2332.51	2395.49	62.98	2465.35	2528.33	0.2245	8.5558	8.7803
20	2.339	0.001002	57.7567	83.91	2318.41	2402.32	83.91	2453.52	2537.43	0.2965	8.3695	8.6660
25	3.170	0.001003	43.3373	104.83	2304.30	2409.13	104.83	2441.68	2546.51	0.3672	8.1894	8.5566
30	4.247	0.001004	32.8783	125.73	2290.18	2415.91	125.73	2429.82	2555.55	0.4368	8.0152	8.4520
35	5.629	0.001006	25.2053	146.63	2276.04	2422.67	146.63	2417.92	2564.55	0.5051	7.8466	8.3517
40	7.385	0.001008	19.5151	167.53	2261.86	2429.39	167.53	2405.98	2573.51	0.5724	7.6831	8.2555
45	9.595	0.001010	15.2521	188.43	2247.65	2436.08	188.43	2394.00	2582.43	0.6386	7.5247	8.1633
50	12.350	0.001012	12.0269	209.33	2233.40	2442.73	209.33	2381.95	2591.29	0.7038	7.3710	8.0748
55	15.760	0.001015	9.5643	230.24	2219.10	2449.34	230.26	2369.83	2600.09	0.7680	7.2218	7.9898
60	19.940	0.001017	7.6672	251.16	2204.74	2455.90	251.18	2357.65	2608.83	0.8313	7.0768	7.9081
65	25.030	0.001020	6.1935	272.09	2190.32	2462.41	272.12	2345.38	2617.50	0.8937	6.9359	7.8296
70	31.190	0.001023	5.0395	293.03	2175.83	2468.86	293.07	2333.03	2626.10	0.9551	6.7989	7.7540
75	38.580	0.001026	4.1289	313.99	2161.25	2475.24	314.03	2320.57	2634.60	1.0158	6.6654	7.6812
80	47.390	0.001029	3.4052	334.96	2146.60	2481.56	335.01	2308.01	2643.02	1.0756	6.5355	7.6111
85	57.830	0.001032	2.8258	355.95	2131.86	2487.81	356.01	2295.32	2651.33	1.1346	6.4088	7.5434
90	70.140	0.001036	2.3591	376.97	2117.00	2493.97	377.04	2282.49	2659.53	1.1929	6.2852	7.4781
95	84.550	0.001040	1.9806	398.00	2102.04	2500.04	398.09	2269.52	2667.61	1.2504	6.1647	7.4151
p^{sat} (MPa)												
100	0.1014	0.001043	1.6718	419.06	2086.96	2506.02	419.17	2256.40	2675.57	1.3072	6.0469	7.3541
105	0.1209	0.001047	1.4184	440.15	2071.75	2511.90	440.27	2243.12	2683.39	1.3633	5.9319	7.2952
110	0.1434	0.001052	1.2093	461.26	2056.41	2517.67	461.42	2229.64	2691.06	1.4188	5.8193	7.2381
115	0.1692	0.001056	1.0358	482.41	2040.92	2523.33	482.59	2215.99	2698.58	1.4737	5.7091	7.1828
120	0.1987	0.001060	0.8912	503.60	2025.26	2528.86	503.81	2202.12	2705.93	1.5279	5.6012	7.1291
125	0.2322	0.001065	0.7700	524.83	2009.44	2534.27	525.07	2188.03	2713.10	1.5816	5.4954	7.0770
130	0.2703	0.001070	0.6680	546.09	1993.44	2539.53	546.38	2173.70	2720.08	1.6346	5.3918	7.0264
135	0.3132	0.001075	0.5817	567.41	1977.24	2544.65	567.74	2159.13	2726.87	1.6872	5.2900	6.9772
140	0.3615	0.001080	0.5085	588.77	1960.85	2549.62	589.16	2144.28	2733.44	1.7392	5.1901	6.9293
145	0.4157	0.001085	0.4460	610.19	1944.23	2554.42	610.64	2129.16	2739.80	1.7907	5.0919	6.8826
150	0.4762	0.001091	0.3925	631.66	1927.39	2559.05	632.18	2113.75	2745.93	1.8418	4.9953	6.8371

Tabela H-1 Água saturada (tabela de temperaturas) — continuação.

Temp. °C	p^{sat} MPa	v^{L} m ³ /kg	v^{V} m ³ /kg	u^{L} kJ/kg	$\Delta_{\text{vap}}u$ kJ/kg	u^{V} kJ/kg	h^{L} kJ/kg	$\Delta_{\text{vap}}h$ kJ/kg	h^{V} kJ/kg	s^{L} kJ/(K kg)	$\Delta_{\text{vap}}s$ kJ/(K kg)	s^{V} kJ/(K kg)
155	0.5435	0.001096	0.3465	653.19	1910.32	2563.51	653.79	2098.02	2751.81	1.8924	4.9002	6.7926
160	0.6182	0.001102	0.3068	674.79	1892.99	2567.78	675.47	2081.97	2757.44	1.9426	4.8065	6.7491
165	0.7009	0.001108	0.2724	696.46	1875.39	2571.85	697.24	2065.57	2762.81	1.9923	4.7143	6.7066
170	0.7922	0.001114	0.2426	718.20	1857.53	2575.73	719.08	2048.82	2767.90	2.0417	4.6233	6.6650
175	0.8926	0.001121	0.2166	740.02	1839.37	2579.39	741.02	2031.69	2772.71	2.0906	4.5335	6.6241
180	1.0028	0.001127	0.1938	761.92	1820.91	2582.83	763.05	2014.16	2777.21	2.1392	4.4448	6.5840
185	1.1235	0.001134	0.1739	783.91	1802.13	2586.04	785.19	1996.22	2781.41	2.1875	4.3572	6.5447
190	1.2552	0.001141	0.1564	806.00	1783.01	2589.01	807.43	1977.85	2785.28	2.2355	4.2704	6.5059
195	1.3988	0.001149	0.1409	828.18	1763.56	2591.74	829.79	1959.03	2788.82	2.2832	4.1846	6.4678
200	1.5549	0.001157	0.1272	850.47	1743.73	2594.20	852.27	1939.74	2792.01	2.3305	4.0997	6.4302
205	1.7243	0.001164	0.1151	872.87	1723.53	2596.40	874.88	1919.95	2794.83	2.3777	4.0153	6.3930
210	1.9077	0.001173	0.1043	895.39	1702.92	2598.31	897.63	1899.64	2797.27	2.4245	3.9318	6.3563
215	2.1058	0.001181	0.0947	918.04	1681.90	2599.94	920.53	1878.79	2799.32	2.4712	3.8488	6.3200
220	2.3196	0.001190	0.0861	940.82	1660.43	2601.25	943.58	1857.37	2800.95	2.5177	3.7663	6.2840
225	2.5497	0.001199	0.0784	963.74	1638.50	2602.24	966.80	1835.35	2802.15	2.5640	3.6843	6.2483
230	2.7971	0.001209	0.0715	986.81	1616.09	2602.90	990.19	1812.71	2802.90	2.6101	3.6027	6.2128
235	3.0625	0.001219	0.0653	1010.04	1593.16	2603.20	1013.77	1789.40	2803.17	2.6561	3.5214	6.1775
240	3.3469	0.001229	0.0597	1033.44	1569.69	2603.13	1037.55	1765.41	2802.96	2.7020	3.4403	6.1423
245	3.6512	0.001240	0.0547	1057.02	1545.65	2602.67	1061.55	1740.67	2802.22	2.7478	3.3594	6.1072
250	3.9762	0.001252	0.0501	1080.79	1521.00	2601.79	1085.77	1715.16	2800.93	2.7935	3.2786	6.0721
255	4.3229	0.001264	0.0459	1104.77	1495.72	2600.49	1110.23	1688.84	2799.07	2.8392	3.1977	6.0369
260	4.6923	0.001276	0.0422	1128.97	1469.75	2598.72	1134.96	1661.64	2796.60	2.8849	3.1167	6.0016
265	5.0853	0.001289	0.0387	1153.41	1443.04	2596.45	1159.96	1633.53	2793.49	2.9307	3.0354	5.9661
270	5.5030	0.001303	0.0356	1178.10	1415.57	2593.67	1185.27	1604.42	2789.69	2.9765	2.9539	5.9304
275	5.9464	0.001318	0.0328	1203.07	1387.26	2590.33	1210.90	1574.27	2785.17	3.0224	2.8720	5.8944
280	6.4166	0.001333	0.0302	1228.33	1358.06	2586.39	1236.88	1542.99	2779.87	3.0685	2.7894	5.8579
285	6.9147	0.001349	0.0278	1253.92	1327.89	2581.81	1263.25	1510.48	2773.73	3.1147	2.7062	5.8209
290	7.4418	0.001366	0.0256	1279.86	1296.67	2576.53	1290.03	1476.67	2766.70	3.1612	2.6222	5.7834
295	7.9991	0.001385	0.0235	1306.19	1264.30	2570.49	1317.27	1441.43	2758.70	3.2080	2.5371	5.7451
300	8.5879	0.001404	0.0217	1332.95	1230.67	2563.62	1345.01	1404.63	2749.64	3.2552	2.4507	5.7059
305	9.2094	0.001425	0.0199	1360.18	1195.67	2555.85	1373.30	1366.13	2739.43	3.3028	2.3629	5.6657
310	9.8651	0.001448	0.0183	1387.93	1159.14	2547.07	1402.22	1325.73	2727.95	3.3510	2.2734	5.6244
315	10.5562	0.001472	0.0169	1416.28	1120.89	2537.17	1431.83	1283.22	2715.05	3.3998	2.1818	5.5816

Tabela H-1 Água saturada (tabela de temperaturas) — continuação.

Temp. °C	p^{sat} MPa	v^{L} m ³ /kg	v^{V} m ³ /kg	u^{L} kJ/kg	$\Delta_{\text{vap}}u$ kJ/kg	u^{V} kJ/kg	h^{L} kJ/kg	$\Delta_{\text{vap}}h$ kJ/kg	h^{V} kJ/kg	s^{L} kJ/(K kg)	$\Delta_{\text{vap}}s$ kJ/(K kg)	s^{V} kJ/(K kg)
320	11.2843	0.001499	0.0155	1445.31	1080.70	2526.01	1462.22	1238.37	2700.59	3.4494	2.0878	5.5372
325	12.0510	0.001528	0.0142	1475.11	1038.30	2513.41	1493.52	1190.81	2684.33	3.5000	1.9908	5.4908
330	12.8581	0.001561	0.0130	1505.80	993.35	2499.15	1525.87	1140.16	2666.03	3.5518	1.8904	5.4422
335	13.7073	0.001597	0.0118	1537.56	945.40	2482.96	1559.45	1085.90	2645.35	3.6050	1.7856	5.3906
340	14.6007	0.001638	0.0108	1570.62	893.82	2464.44	1594.53	1027.32	2621.85	3.6601	1.6755	5.3356
345	15.5406	0.001685	0.0098	1605.30	837.79	2443.09	1631.48	963.42	2594.90	3.7176	1.5586	5.2762
350	16.5294	0.001740	0.0088	1642.13	776.01	2418.14	1670.89	892.75	2563.64	3.7784	1.4326	5.2110
355	17.5701	0.001808	0.0079	1681.96	706.44	2388.40	1713.72	812.93	2526.65	3.8439	1.2941	5.1380
360	18.6660	0.001895	0.0069	1726.28	625.50	2351.78	1761.66	719.83	2481.49	3.9167	1.1369	5.0536
365	19.8214	0.002017	0.0060	1777.79	526.00	2303.79	1817.77	605.18	2422.95	4.0014	0.9483	4.9497
370	21.0436	0.002215	0.0050	1844.07	386.19	2230.26	1890.69	443.83	2334.52	4.1112	0.6900	4.8012
373.95	22.0640	0.003106	0.0031	2015.73	0.00	2015.73	2084.26	0.00	2084.26	4.4070	0.0000	4.4070



Tabela H-2 Água saturada (tabela de pressões).

p^{sat} MPa	Temp. °C	v^L m ³ /kg	v^V m ³ /kg	u^L kJ/kg	u^V kJ/kg	$\Delta_{vap}u$ kJ/kg	h^L kJ/kg	h^V kJ/kg	$\Delta_{vap}h$ kJ/kg	h^L kJ/kg	h^V kJ/kg	s^L kJ/(K kg)	s^V kJ/(K kg)	$\Delta_{vap}s$ kJ/(K kg)
0.001	6.97	0.001000	129.1780	29.30	2384.49	2355.19	29.30	2484.37	2513.67	0.1059	8.8690	8.9749	8.9749	
0.002	17.50	0.001001	66.9869	73.43	2325.47	2398.90	73.43	2459.45	2532.88	0.2606	8.4620	8.7226	8.7226	
0.003	24.08	0.001003	45.6532	100.98	2306.90	2407.88	100.98	2443.86	2544.84	0.3543	8.2221	8.5764	8.5764	
0.004	28.96	0.001004	34.7911	121.38	2293.12	2414.50	121.39	2432.28	2553.67	0.4224	8.0510	8.4734	8.4734	
0.005	32.87	0.001005	28.1853	137.74	2282.06	2419.80	137.75	2422.98	2560.73	0.4762	7.9176	8.3938	8.3938	
0.006	36.16	0.001006	23.7334	151.47	2272.76	2424.23	151.48	2415.15	2566.63	0.5208	7.8082	8.3290	8.3290	
0.007	39.00	0.001008	20.5245	163.34	2264.71	2428.05	163.35	2408.37	2571.72	0.5590	7.7155	8.2745	8.2745	
0.008	41.51	0.001008	18.0989	173.83	2257.58	2431.41	173.84	2402.37	2576.21	0.5925	7.6348	8.2273	8.2273	
0.009	43.76	0.001009	16.1992	183.24	2251.19	2434.43	183.25	2396.97	2580.22	0.6223	7.5635	8.1858	8.1858	
0.010	45.81	0.001010	14.6701	191.80	2245.36	2437.16	191.81	2392.05	2583.86	0.6492	7.4996	8.1488	8.1488	
0.020	60.06	0.001017	7.6480	251.40	2204.58	2455.98	251.42	2357.52	2608.94	0.8320	7.0752	7.9072	7.9072	
0.030	69.10	0.001022	5.2284	289.24	2178.46	2467.70	289.27	2335.28	2624.55	0.9441	6.8234	7.7675	7.7675	
0.040	75.86	0.001026	3.9930	317.58	2158.75	2476.33	317.62	2318.43	2636.05	1.0261	6.6429	7.6690	7.6690	
0.050	81.32	0.001030	3.2400	340.49	2142.72	2483.21	340.54	2304.68	2645.22	1.0912	6.5018	7.5930	7.5930	
0.060	85.93	0.001033	2.7317	359.85	2129.10	2488.95	359.91	2292.95	2652.86	1.1455	6.3856	7.5311	7.5311	
0.070	89.93	0.001036	2.3648	376.68	2117.20	2493.88	376.75	2282.67	2659.42	1.1921	6.2869	7.4790	7.4790	
0.080	93.49	0.001039	2.0871	391.63	2106.58	2498.21	391.71	2273.47	2665.18	1.2330	6.2009	7.4339	7.4339	
0.090	96.69	0.001041	1.8694	405.10	2096.97	2502.07	405.20	2265.11	2670.31	1.2696	6.1247	7.3943	7.3943	
0.10	99.61	0.001043	1.6939	417.40	2088.15	2505.55	417.50	2257.45	2674.95	1.3028	6.0561	7.3589	7.3589	
0.20	120.21	0.001061	0.8857	504.49	2024.60	2529.09	504.70	2201.53	2706.23	1.5302	5.5967	7.1269	7.1269	
0.30	133.52	0.001073	0.6058	561.11	1982.04	2543.15	561.43	2163.45	2724.88	1.6717	5.3199	6.9916	6.9916	
0.40	143.61	0.001084	0.4624	604.22	1948.88	2553.10	604.66	2133.39	2738.05	1.7765	5.1190	6.8955	6.8955	
0.50	151.83	0.001093	0.3748	639.54	1921.17	2560.71	640.09	2108.02	2748.11	1.8604	4.9603	6.8207	6.8207	
0.60	158.83	0.001101	0.3156	669.72	1897.07	2566.79	670.38	2085.76	2756.14	1.9308	4.8285	6.7593	6.7593	
0.70	164.95	0.001108	0.2728	696.23	1875.58	2571.81	697.00	2065.75	2762.75	1.9918	4.7153	6.7071	6.7071	
0.80	170.41	0.001115	0.2403	719.97	1856.06	2576.03	720.86	2047.44	2768.30	2.0457	4.6159	6.6616	6.6616	
0.90	175.35	0.001121	0.2149	741.55	1838.09	2579.64	742.56	2030.47	2773.03	2.0941	4.5272	6.6213	6.6213	
1.00	179.88	0.001127	0.1944	761.39	1821.36	2582.75	762.52	2014.59	2777.11	2.1381	4.4469	6.5850	6.5850	
1.20	187.96	0.001139	0.1633	796.96	1790.87	2587.83	798.33	1985.41	2783.74	2.2159	4.3058	6.5217	6.5217	
1.40	195.04	0.001149	0.1408	828.36	1763.40	2591.76	829.97	1958.88	2788.85	2.2835	4.1840	6.4675	6.4675	
1.60	201.37	0.001159	0.1237	856.60	1738.23	2594.83	858.46	1934.36	2792.82	2.3435	4.0764	6.4199	6.4199	
1.80	207.11	0.001168	0.1104	882.37	1714.87	2597.24	884.47	1911.44	2795.91	2.3975	3.9800	6.3775	6.3775	
2.00	212.38	0.001177	0.0996	906.15	1692.97	2599.12	908.50	1889.79	2798.29	2.4468	3.8922	6.3390	6.3390	

Tabela H-2 Água saturada (tabela de pressões) — continuação.

p^{sat} MPa	Temp. °C	v^{L} m ³ /kg	v^{V} m ³ /kg	u^{L} kJ/kg	$\Delta_{\text{vap}}u$ kJ/kg	u^{V} kJ/kg	h^{L} kJ/kg	$\Delta_{\text{vap}}h$ kJ/kg	h^{V} kJ/kg	s^{L} kJ/(K kg)	$\Delta_{\text{vap}}s$ kJ/(K kg)	s^{V} kJ/(K kg)
2.50	223.95	0.001197	0.0799	958.91	1643.15	2602.06	961.91	1840.02	2801.93	2.5543	3.7015	6.2558
3.00	233.85	0.001217	0.0667	1004.69	1598.47	2603.16	1008.34	1794.81	2803.15	2.6456	3.5400	6.1856
3.50	242.56	0.001235	0.0571	1045.47	1557.47	2602.94	1049.80	1752.84	2802.64	2.7254	3.3989	6.1243
4.00	250.35	0.001253	0.0498	1082.48	1519.24	2601.72	1087.49	1713.33	2800.82	2.7968	3.2728	6.0696
4.50	257.44	0.001270	0.0441	1116.53	1483.15	2599.68	1122.25	1675.70	2797.95	2.8615	3.1582	6.0197
5.00	263.94	0.001286	0.0394	1148.21	1448.77	2596.98	1154.64	1639.57	2794.21	2.9210	3.0527	5.9737
6.00	275.59	0.001319	0.0324	1206.01	1383.89	2589.90	1213.92	1570.67	2784.59	3.0278	2.8623	5.8901
7.00	285.83	0.001352	0.0274	1258.20	1322.78	2580.98	1267.66	1504.97	2772.63	3.1224	2.6924	5.8148
8.00	295.01	0.001385	0.0235	1306.23	1264.25	2570.48	1317.31	1441.37	2758.68	3.2081	2.5369	5.7450
9.00	303.35	0.001418	0.0205	1351.11	1207.42	2558.53	1363.87	1379.07	2742.94	3.2870	2.3921	5.6791
10.00	311.00	0.001453	0.0180	1393.54	1151.65	2545.19	1408.06	1317.43	2725.49	3.3607	2.2553	5.6160
12.50	327.81	0.001546	0.0135	1492.26	1013.35	2505.61	1511.58	1162.73	2674.31	3.5290	1.9348	5.4638
15.00	342.16	0.001657	0.0103	1585.35	870.27	2455.62	1610.20	1000.50	2610.70	3.6846	1.6260	5.3106
17.50	354.67	0.001803	0.0079	1679.22	711.32	2390.54	1710.77	818.53	2529.30	3.8394	1.3037	5.1431
20.00	365.75	0.002040	0.0059	1786.41	508.63	2295.04	1827.21	585.14	2412.35	4.0156	0.9159	4.9315
22.064	373.95	0.003106	0.0031	2015.73	0.00	2015.73	2084.26	0.00	2084.26	4.4070	0.0000	4.4070



Tabela H-3 Vapor superaquecido.

Temp. °C	$p = 0.01 \text{ MPa (45.81}^\circ\text{C)}$				$p = 0.05 \text{ MPa (81.32}^\circ\text{C)}$				$p = 0.10 \text{ MPa (99.61}^\circ\text{C)}$			
	v m^3/kg	u kJ/kg	h kJ/kg	s kJ/(K kg)	v m^3/kg	u kJ/kg	h kJ/kg	s kJ/(K kg)	v m^3/kg	u kJ/kg	h kJ/kg	s kJ/(K kg)
Sat.	14.6701	2437.2	2583.9	8.1488	3.2400	2483.2	2645.2	7.5930	1.6939	2505.6	2675.0	7.3588
50	14.9139	2443.3	2592.4	8.1755								
100	17.1964	2515.5	2687.5	8.4489	3.4187	2511.5	2682.4	7.6953	1.6959	2506.2	2675.8	7.3610
150	19.5132	2587.9	2783.0	8.6892	3.8897	2585.7	2780.2	7.9413	1.9367	2582.9	2776.6	7.6148
200	21.8256	2661.3	2879.6	8.9049	4.3562	2660.0	2877.8	8.1592	2.1724	2658.2	2875.5	7.8356
250	24.1361	2736.1	2977.4	9.1015	4.8206	2735.1	2976.1	8.3568	2.4062	2733.9	2974.5	8.0346
300	26.4456	2812.3	3076.7	9.2827	5.2840	2811.6	3075.8	8.5386	2.6388	2810.6	3074.5	8.2172
350	28.7545	2890.0	3177.5	9.4513	5.7469	2889.4	3176.8	8.7076	2.8710	2888.7	3175.8	8.3866
400	31.0631	2969.3	3279.9	9.6094	6.2094	2968.9	3279.3	8.8659	3.1027	2968.3	3278.6	8.5452
450	33.3714	3050.3	3384.0	9.7584	6.6717	3049.9	3383.5	9.0151	3.3342	3049.4	3382.8	8.6946
500	35.6796	3132.9	3489.7	9.8998	7.1338	3132.6	3489.3	9.1566	3.5655	3132.2	3488.7	8.8361
550	37.9876	3217.2	3597.1	10.0344	7.5957	3217.0	3596.8	9.2913	3.7968	3216.6	3596.3	8.9709
600	40.2956	3303.3	3706.3	10.1631	8.0576	3303.1	3706.0	9.4201	4.0279	3302.8	3705.6	9.0998
650	42.6035	3391.2	3817.2	10.2866	8.5195	3391.0	3816.9	9.5436	4.2590	3390.7	3816.6	9.2234
700	44.9113	3480.8	3929.9	10.4055	8.9812	3480.6	3929.7	9.6625	4.4900	3480.4	3929.4	9.3424
750	47.2191	3572.2	4044.4	10.5202	9.4430	3572.0	4044.2	9.7773	4.7209	3571.8	4043.9	9.4572
800	49.5269	3665.3	4160.6	10.6311	9.9047	3665.2	4160.4	9.8882	4.9519	3665.0	4160.2	9.5681
850	51.8347	3760.3	4278.6	10.7386	10.3663	3760.1	4278.5	9.9957	5.1828	3760.0	4278.2	9.6757
900	54.1424	3856.9	4398.3	10.8429	10.8280	3856.8	4398.2	10.1000	5.4137	3856.6	4398.0	9.7800
950	56.4501	3955.2	4519.7	10.9442	11.2896	3955.1	4519.6	10.2014	5.6446	3955.0	4519.5	9.8813
1000	58.7578	4055.2	4642.8	11.0428	11.7513	4055.1	4642.7	10.3000	5.8754	4055.0	4642.6	9.9800
1050	61.0655	4156.8	4767.5	11.1389	12.2129	4156.8	4767.4	10.3960	6.1063	4156.6	4767.3	10.0761
1100	63.3732	4260.0	4893.7	11.2325	12.6745	4259.9	4893.7	10.4897	6.3371	4259.8	4893.5	10.1697
1150	65.6808	4364.7	5021.5	11.3239	13.1361	4364.6	5021.4	10.5811	6.5680	4364.5	5021.3	10.2611
1200	67.9885	4470.9	5150.7	11.4132	13.5977	4470.8	5150.7	10.6703	6.7988	4470.7	5150.6	10.3504
1250	70.2961	4578.4	5281.4	11.5004	14.0592	4578.4	5281.3	10.7576	7.0296	4578.3	5281.2	10.4376
1300	72.6038	4687.4	5413.4	11.5857	14.5208	4687.3	5413.3	10.8428	7.2604	4687.2	5413.2	10.5229



Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 0.20 \text{ MPa (120.21}^\circ\text{C)}$					$p = 0.30 \text{ MPa (133.52}^\circ\text{C)}$					$p = 0.40 \text{ MPa (143.61}^\circ\text{C)}$				
	v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/(K kg)		v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/(K kg)		v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/(K kg)	
Sat.	0.8857	2529.1	2706.2	7.1269		0.6058	2543.2	2724.9	6.9916		0.4624	2553.1	2738.1	6.8955	
150	0.9599	2577.1	2769.1	7.2810		0.6340	2571.0	2761.2	7.0791		0.4709	2564.4	2752.8	6.9506	
200	1.0805	2654.6	2870.7	7.5081		0.7164	2651.0	2865.9	7.3131		0.5343	2647.2	2860.9	7.1723	
250	1.1989	2731.4	2971.2	7.7100		0.7964	2728.9	2967.9	7.5180		0.5952	2726.4	2964.5	7.3804	
300	1.3162	2808.8	3072.1	7.8941		0.8753	2807.0	3069.6	7.7037		0.6549	2805.1	3067.1	7.5677	
350	1.4330	2887.3	3173.9	8.0644		0.9536	2885.9	3172.0	7.8750		0.7140	2884.4	3170.0	7.7399	
400	1.5493	2967.1	3277.0	8.2236		1.0315	2966.0	3275.5	8.0347		0.7726	2964.9	3273.9	7.9002	
450	1.6655	3048.5	3381.6	8.3734		1.1092	3047.5	3380.3	8.1849		0.8311	3046.6	3379.0	8.0508	
500	1.7814	3131.4	3487.7	8.5152		1.1867	3130.6	3486.6	8.3271		0.8894	3129.8	3485.5	8.1933	
550	1.8973	3215.9	3595.4	8.6502		1.2641	3215.3	3594.5	8.4623		0.9475	3214.6	3593.6	8.3287	
600	2.0130	3302.2	3704.8	8.7792		1.3414	3301.6	3704.0	8.5914		1.0056	3301.0	3703.2	8.4580	
650	2.1287	3390.2	3815.9	8.9030		1.4186	3389.7	3815.3	8.7153		1.0636	3389.1	3814.6	8.5820	
700	2.2443	3479.9	3928.8	9.0220		1.4958	3479.5	3928.2	8.8344		1.1215	3479.0	3927.6	8.7012	
750	2.3599	3571.4	4043.4	9.1369		1.5729	3571.0	4042.9	8.9494		1.1794	3570.6	4042.4	8.8162	
800	2.4755	3664.7	4159.8	9.2479		1.6500	3664.3	4159.3	9.0604		1.2373	3663.9	4158.8	8.9273	
850	2.5910	3759.6	4277.8	9.3555		1.7271	3759.3	4277.4	9.1680		1.2951	3759.0	4277.0	9.0350	
900	2.7066	3856.3	4397.6	9.4598		1.8042	3856.0	4397.3	9.2724		1.3530	3855.7	4396.9	9.1394	
950	2.8221	3954.7	4519.1	9.5612		1.8812	3954.4	4518.8	9.3739		1.4108	3954.2	4518.5	9.2409	
1000	2.9375	4054.8	4642.3	9.6599		1.9582	4054.5	4642.0	9.4726		1.4686	4054.3	4641.7	9.3396	
1050	3.0530	4156.4	4767.0	9.7560		2.0352	4156.2	4766.7	9.5687		1.5264	4155.9	4766.5	9.4357	
1100	3.1685	4259.6	4893.3	9.8497		2.1122	4259.4	4893.1	9.6624		1.5841	4259.2	4892.8	9.5295	
1150	3.2839	4364.3	5021.1	9.9411		2.1892	4364.1	5020.9	9.7538		1.6419	4363.9	5020.7	9.6209	
1200	3.3994	4470.5	5150.4	10.0304		2.2662	4470.3	5150.2	9.8431		1.6997	4470.1	5150.0	9.7102	
1250	3.5148	4578.1	5281.1	10.1176		2.3432	4577.9	5280.9	9.9303		1.7574	4577.8	5280.7	9.7975	
1300	3.6302	4687.0	5413.1	10.2029		2.4202	4686.9	5412.9	10.0156		1.8152	4686.7	5412.8	9.8828	



Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 0.50 \text{ MPa (151.83}^\circ\text{C)}$					$p = 0.60 \text{ MPa (158.83}^\circ\text{C)}$					$p = 0.80 \text{ MPa (170.41}^\circ\text{C)}$					
	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$
Sat.	0.3748	2560.7	2748.1	6.8207	0.3156	2566.8	2756.1	6.7593	0.2403	2576.0	2768.3	6.6616	0.2403	2576.0	2768.3	6.6616
200	0.4250	2643.3	2855.8	7.0610	0.3521	2639.3	2850.6	6.9683	0.2609	2631.0	2839.7	6.8176	0.2609	2631.0	2839.7	6.8176
250	0.4744	2723.8	2961.0	7.2724	0.3939	2721.2	2957.6	7.1832	0.2932	2715.9	2950.4	7.0401	0.2932	2715.9	2950.4	7.0401
300	0.5226	2803.2	3064.6	7.4614	0.4344	2801.4	3062.0	7.3740	0.3242	2797.5	3056.9	7.2345	0.3242	2797.5	3056.9	7.2345
350	0.5702	2883.0	3168.1	7.6346	0.4743	2881.6	3166.1	7.5481	0.3544	2878.6	3162.2	7.4106	0.3544	2878.6	3162.2	7.4106
400	0.6173	2963.7	3272.3	7.7955	0.5137	2962.5	3270.8	7.7097	0.3843	2960.2	3267.6	7.5734	0.3843	2960.2	3267.6	7.5734
450	0.6642	3045.6	3377.7	7.9465	0.5530	3044.7	3376.5	7.8611	0.4139	3042.8	3373.9	7.7257	0.4139	3042.8	3373.9	7.7257
500	0.7109	3129.0	3484.5	8.0892	0.5920	3128.2	3483.4	8.0041	0.4433	3126.6	3481.3	7.8692	0.4433	3126.6	3481.3	7.8692
550	0.7576	3213.9	3592.7	8.2249	0.6309	3213.2	3591.8	8.1399	0.4726	3211.9	3590.0	8.0054	0.4726	3211.9	3590.0	8.0054
600	0.8041	3300.4	3702.5	8.3543	0.6698	3299.8	3701.7	8.2695	0.5019	3298.7	3700.1	8.1354	0.5019	3298.7	3700.1	8.1354
650	0.8505	3388.6	3813.9	8.4784	0.7085	3388.1	3813.2	8.3937	0.5310	3387.1	3811.9	8.2598	0.5310	3387.1	3811.9	8.2598
700	0.8970	3478.5	3927.0	8.5977	0.7472	3478.1	3926.4	8.5131	0.5601	3477.2	3925.3	8.3794	0.5601	3477.2	3925.3	8.3794
750	0.9433	3570.2	4041.8	8.7128	0.7859	3569.8	4041.3	8.6283	0.5892	3569.0	4040.3	8.4947	0.5892	3569.0	4040.3	8.4947
800	0.9897	3663.6	4158.4	8.8240	0.8246	3663.2	4157.9	8.7395	0.6182	3662.4	4157.0	8.6061	0.6182	3662.4	4157.0	8.6061
850	1.0360	3758.6	4276.6	8.9317	0.8632	3758.3	4276.2	8.8472	0.6472	3757.6	4275.4	8.7139	0.6472	3757.6	4275.4	8.7139
900	1.0823	3855.4	4396.6	9.0362	0.9018	3855.1	4396.2	8.9518	0.6762	3854.5	4395.5	8.8185	0.6762	3854.5	4395.5	8.8185
950	1.1285	3953.9	4518.2	9.1377	0.9404	3953.6	4517.8	9.0533	0.7052	3953.1	4517.2	8.9201	0.7052	3953.1	4517.2	8.9201
1000	1.1748	4054.0	4641.4	9.2364	0.9789	4053.7	4641.1	9.1521	0.7341	4053.2	4640.5	9.0189	0.7341	4053.2	4640.5	9.0189
1050	1.2210	4155.7	4766.2	9.3326	1.0175	4155.5	4766.0	9.2482	0.7630	4155.0	4765.4	9.1151	0.7630	4155.0	4765.4	9.1151
1100	1.2673	4259.0	4892.6	9.4263	1.0560	4258.7	4892.4	9.3420	0.7920	4258.3	4891.9	9.2089	0.7920	4258.3	4891.9	9.2089
1150	1.3135	4363.7	5020.5	9.5178	1.0946	4363.5	5020.3	9.4335	0.8209	4363.1	5019.8	9.3004	0.8209	4363.1	5019.8	9.3004
1200	1.3597	4470.0	5149.8	9.6071	1.1331	4469.8	5149.6	9.5228	0.8498	4469.4	5149.2	9.3898	0.8498	4469.4	5149.2	9.3898
1250	1.4059	4577.6	5280.5	9.6944	1.1716	4577.4	5280.4	9.6101	0.8787	4577.1	5280.0	9.4771	0.8787	4577.1	5280.0	9.4771
1300	1.4521	4686.6	5412.6	9.7797	1.2101	4686.4	5412.5	9.6954	0.9076	4686.1	5412.2	9.5625	0.9076	4686.1	5412.2	9.5625

Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 1.0 \text{ MPa (179.88}^\circ\text{C)}$					$p = 1.2 \text{ MPa (187.96}^\circ\text{C)}$					$p = 1.4 \text{ MPa (195.04}^\circ\text{C)}$				
	v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/(K kg)		v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/(K kg)		v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/(K kg)	
Sat.	0.1944	2582.8	2777.1	6.5850		0.1633	2587.8	2783.7	6.5217		0.1408	2591.8	2788.9	6.4675	
200	0.2060	2622.2	2828.3	6.6955		0.1693	2612.9	2816.1	6.5909		0.1430	2602.7	2803.0	6.4975	
250	0.2327	2710.4	2943.1	6.9265		0.1924	2704.7	2935.6	6.8313		0.1636	2698.9	2927.9	6.7488	
300	0.2580	2793.6	3051.6	7.1246		0.2139	2789.7	3046.3	7.0335		0.1823	2785.7	3040.9	6.9552	
350	0.2825	2875.7	3158.2	7.3029		0.2346	2872.7	3154.2	7.2139		0.2003	2869.7	3150.1	7.1379	
400	0.3066	2957.9	3264.5	7.4669		0.2548	2955.5	3261.3	7.3793		0.2178	2953.1	3258.1	7.3046	
450	0.3304	3040.9	3371.3	7.6200		0.2748	3038.9	3368.7	7.5332		0.2351	3037.0	3366.1	7.4594	
500	0.3541	3125.0	3479.1	7.7641		0.2946	3123.4	3476.9	7.6779		0.2522	3121.8	3474.8	7.6047	
550	0.3777	3210.5	3588.1	7.9008		0.3143	3209.1	3586.3	7.8150		0.2691	3207.7	3584.5	7.7422	
600	0.4011	3297.5	3698.6	8.0310		0.3339	3296.3	3697.0	7.9455		0.2860	3295.1	3695.4	7.8730	
650	0.4245	3386.0	3810.5	8.1557		0.3535	3385.0	3809.2	8.0704		0.3028	3384.0	3807.8	7.9982	
700	0.4478	3476.2	3924.1	8.2755		0.3730	3475.3	3922.9	8.1904		0.3195	3474.4	3921.7	8.1183	
750	0.4711	3568.1	4039.3	8.3909		0.3924	3567.3	4038.2	8.3060		0.3362	3566.5	4037.2	8.2340	
800	0.4944	3661.7	4156.1	8.5024		0.4118	3661.0	4155.2	8.4176		0.3529	3660.2	4154.3	8.3457	
850	0.5176	3757.0	4274.6	8.6103		0.4312	3756.3	4273.8	8.5256		0.3695	3755.6	4273.0	8.4538	
900	0.5408	3853.9	4394.8	8.7150		0.4506	3853.3	4394.0	8.6303		0.3861	3852.7	4393.3	8.5587	
950	0.5640	3952.5	4516.5	8.8166		0.4699	3952.0	4515.9	8.7320		0.4027	3951.4	4515.2	8.6604	
1000	0.5872	4052.7	4639.9	8.9155		0.4893	4052.2	4639.4	8.8310		0.4193	4051.7	4638.8	8.7594	
1050	0.6104	4154.5	4764.9	9.0118		0.5086	4154.1	4764.4	8.9273		0.4359	4153.6	4763.9	8.8558	
1100	0.6335	4257.9	4891.4	9.1056		0.5279	4257.5	4891.0	9.0212		0.4525	4257.0	4890.5	8.9497	
1150	0.6567	4362.7	5019.4	9.1972		0.5472	4362.3	5019.0	9.1128		0.4690	4361.9	5018.6	9.0413	
1200	0.6798	4469.0	5148.9	9.2866		0.5665	4468.7	5148.5	9.2022		0.4856	4468.3	5148.1	9.1308	
1250	0.7030	4576.7	5279.7	9.3739		0.5858	4576.4	5279.3	9.2895		0.5021	4576.0	5279.0	9.2182	
1300	0.7261	4685.8	5411.9	9.4593		0.6051	4685.4	5411.5	9.3749		0.5187	4685.1	5411.2	9.3036	



Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 1.6 \text{ MPa (201.37}^\circ\text{C)}$					$p = 1.8 \text{ MPa (207.11}^\circ\text{C)}$					$p = 2.0 \text{ MPa (212.38}^\circ\text{C)}$				
	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$		v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$		v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	
Sat.	0.1237	2594.8	2792.8	6.4199		0.1104	2597.2	2795.9	6.3775		0.0996	2599.1	2798.3	6.3390	
250	0.1419	2692.9	2919.9	6.6753		0.1250	2686.7	2911.7	6.6087		0.1115	2680.2	2903.2	6.5475	
300	0.1587	2781.6	3035.4	6.8863		0.1402	2777.4	3029.9	6.8246		0.1255	2773.2	3024.2	6.7684	
350	0.1746	2866.6	3146.0	7.0715		0.1546	2863.6	3141.8	7.0120		0.1386	2860.5	3137.7	6.9583	
400	0.1901	2950.7	3254.9	7.2394		0.1685	2948.3	3251.6	7.1814		0.1512	2945.9	3248.3	7.1292	
450	0.2053	3035.0	3363.5	7.3950		0.1821	3033.1	3360.9	7.3380		0.1635	3031.1	3358.2	7.2866	
500	0.2203	3120.1	3472.6	7.5409		0.1955	3118.5	3470.4	7.4845		0.1757	3116.9	3468.2	7.4337	
550	0.2352	3206.3	3582.6	7.6788		0.2088	3205.0	3580.8	7.6228		0.1877	3203.6	3579.0	7.5725	
600	0.2500	3293.9	3693.9	7.8100		0.2220	3292.7	3692.3	7.7543		0.1996	3291.5	3690.7	7.7043	
650	0.2647	3382.9	3806.5	7.9354		0.2351	3381.9	3805.1	7.8799		0.2115	3380.8	3803.8	7.8502	
700	0.2794	3473.5	3920.5	8.0557		0.2482	3472.6	3919.4	8.0004		0.2233	3471.6	3918.2	7.9509	
750	0.2940	3565.7	4036.1	8.1716		0.2613	3564.9	4035.1	8.1164		0.2350	3564.0	4034.1	8.0670	
800	0.3087	3659.5	4153.3	8.2834		0.2743	3658.8	4152.4	8.2284		0.2467	3658.0	4151.5	8.1790	
850	0.3232	3755.0	4272.2	8.3916		0.2872	3754.3	4271.3	8.3367		0.2584	3753.6	4270.5	8.2874	
900	0.3378	3852.1	4392.6	8.4965		0.3002	3851.5	4391.9	8.4416		0.2701	3850.9	4391.1	8.3925	
950	0.3523	3950.9	4514.6	8.5984		0.3131	3950.3	4514.0	8.5435		0.2818	3949.8	4513.3	8.4945	
1000	0.3669	4051.2	4638.2	8.6974		0.3261	4050.7	4637.6	8.6426		0.2934	4050.2	4637.0	8.5936	
1050	0.3814	4153.1	4763.4	8.7938		0.3390	4152.7	4762.8	8.7391		0.3051	4152.2	4762.3	8.6901	
1100	0.3959	4256.6	4890.0	8.8878		0.3519	4256.2	4889.5	8.8331		0.3167	4255.7	4889.1	8.7842	
1150	0.4104	4361.5	5018.2	8.9794		0.3648	4361.1	5017.7	8.9248		0.3283	4360.7	5017.3	8.8759	
1200	0.4249	4467.9	5147.7	9.0689		0.3777	4467.5	5147.3	9.0143		0.3399	4467.2	5147.0	8.9654	
1250	0.4394	4575.7	5278.7	9.1563		0.3905	4575.3	5278.3	9.1017		0.3515	4575.0	5278.0	9.0529	
1300	0.4538	4684.8	5410.9	9.2417		0.4034	4684.5	5410.6	9.1872		0.3631	4684.1	5410.3	9.1384	

Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 2.5 \text{ MPa (223.95}^\circ\text{C)}$					$p = 3.0 \text{ MPa (233.85}^\circ\text{C)}$					$p = 3.5 \text{ MPa (242.56}^\circ\text{C)}$				
	v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/(K kg)	s kJ/(K kg)	v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/(K kg)	s kJ/(K kg)	v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/(K kg)	s kJ/(K kg)
Sat.	0.0799	2602.1	2801.9	6.2558	6.1856	0.0667	2603.2	2803.2	6.1856	0.0571	2602.9	2802.6	6.1243		
250	0.0871	2663.3	2880.9	6.4107	6.2893	0.0706	2644.7	2856.5	6.2893	0.0588	2624.0	2829.7	6.1764		
300	0.0989	2762.2	3009.6	6.6459	6.5412	0.0812	2750.8	2994.3	6.5412	0.0685	2738.8	2978.4	6.4484		
350	0.1098	2852.5	3127.0	6.8424	6.7449	0.0906	2844.4	3116.1	6.7449	0.0768	2836.0	3104.8	6.6601		
400	0.1201	2939.8	3240.1	7.0170	6.9234	0.0994	2933.5	3231.7	6.9234	0.0846	2927.2	3223.2	6.8427		
450	0.1302	3026.2	3351.6	7.1767	7.0856	0.1079	3021.2	3344.8	7.0856	0.0920	3016.1	3338.0	7.0074		
500	0.1400	3112.8	3462.7	7.3254	7.2359	0.1162	3108.6	3457.2	7.2359	0.0992	3104.5	3451.6	7.1593		
550	0.1497	3200.1	3574.3	7.4653	7.3768	0.1244	3196.6	3569.7	7.3768	0.1063	3193.1	3565.0	7.3014		
600	0.1593	3288.5	3686.8	7.5979	7.5103	0.1324	3285.5	3682.8	7.5103	0.1133	3282.5	3678.9	7.4356		
650	0.1689	3378.2	3800.4	7.7243	7.6373	0.1405	3375.6	3796.9	7.6373	0.1202	3372.9	3793.5	7.5633		
700	0.1783	3469.3	3915.2	7.8455	7.7590	0.1484	3467.0	3912.2	7.7590	0.1270	3464.7	3909.3	7.6854		
750	0.1878	3562.0	4031.5	7.9620	7.8758	0.1563	3559.9	4028.9	7.8758	0.1338	3557.8	4026.3	7.8027		
800	0.1972	3656.2	4149.2	8.0743	7.9885	0.1642	3654.3	4146.9	7.9885	0.1406	3652.5	4144.6	7.9156		
850	0.2066	3752.0	4268.5	8.1830	8.0973	0.1720	3750.3	4266.5	8.0973	0.1474	3748.6	4264.4	8.0247		
900	0.2160	3849.4	4389.3	8.2882	8.2028	0.1799	3847.9	4387.5	8.2028	0.1541	3846.4	4385.7	8.1303		
950	0.2253	3948.4	4511.7	8.3904	8.3051	0.1877	3947.0	4510.1	8.3051	0.1608	3945.6	4508.4	8.2328		
1000	0.2347	4048.9	4635.6	8.4896	8.4045	0.1955	4047.7	4634.1	8.4045	0.1675	4046.4	4632.7	8.3324		
1050	0.2440	4151.0	4761.0	8.5863	8.5012	0.2033	4149.9	4759.7	8.5012	0.1742	4148.7	4758.4	8.4292		
1100	0.2533	4254.7	4887.9	8.6804	8.5955	0.2111	4253.6	4886.7	8.5955	0.1809	4252.5	4885.6	8.5235		
1150	0.2626	4359.7	5016.2	8.7722	8.6874	0.2188	4358.7	5015.2	8.6874	0.1875	4357.7	5014.1	8.6155		
1200	0.2719	4466.2	5146.0	8.8618	8.7770	0.2266	4465.3	5145.0	8.7770	0.1942	4464.4	5144.1	8.7053		
1250	0.2812	4574.1	5277.1	8.9493	8.8646	0.2343	4573.3	5276.2	8.8646	0.2009	4572.4	5275.4	8.7929		
1300	0.2905	4683.3	5409.5	9.0349	8.9502	0.2421	4682.5	5408.8	8.9502	0.2075	4681.7	5408.0	8.8785		



Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 4.0 \text{ MPa (250.55}^\circ\text{C)}$					$p = 4.5 \text{ MPa (257.44}^\circ\text{C)}$					$p = 5.0 \text{ MPa (263.94}^\circ\text{C)}$				
	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$		v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$		v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	
Sat.	0.0498	2601.7	2800.8	6.0696		0.0441	2599.7	2798.0	6.0197		0.0394	2597.0	2794.2	5.9737	
300	0.0589	2726.2	2961.7	6.3639		0.0514	2713.0	2944.2	6.2854		0.0453	2699.0	2925.7	6.2110	
350	0.0665	2827.4	3093.3	6.5843		0.0584	2818.6	3081.5	6.5153		0.0520	2809.5	3069.3	6.4516	
400	0.0734	2920.7	3214.5	6.7714		0.0648	2914.2	3205.6	6.7070		0.0578	2907.5	3196.7	6.6483	
450	0.0800	3011.0	3331.2	6.9386		0.0708	3005.8	3324.2	6.8770		0.0633	3000.6	3317.2	6.8210	
500	0.0864	3100.3	3446.0	7.0922		0.0765	3096.0	3440.4	7.0323		0.0686	3091.7	3434.7	6.9781	
550	0.0927	3189.5	3560.3	7.2355		0.0821	3186.0	3555.6	7.1767		0.0737	3182.4	3550.9	7.1237	
600	0.0989	3279.4	3674.9	7.3705		0.0877	3276.4	3670.9	7.3127		0.0787	3273.3	3666.8	7.2605	
650	0.1049	3370.3	3790.1	7.4988		0.0931	3367.7	3786.6	7.4416		0.0836	3365.0	3783.2	7.3901	
700	0.1110	3462.4	3906.3	7.6214		0.0985	3460.0	3903.3	7.5646		0.0885	3457.7	3900.3	7.5136	
750	0.1170	3555.8	4023.6	7.7390		0.1038	3553.7	4021.0	7.6826		0.0934	3551.6	4018.4	7.6320	
800	0.1229	3650.6	4142.3	7.8523		0.1092	3648.8	4140.0	7.7962		0.0982	3646.9	4137.7	7.7458	
850	0.1289	3747.0	4262.4	7.9616		0.1145	3745.3	4260.3	7.9057		0.1029	3743.6	4258.3	7.8556	
900	0.1348	3844.8	4383.9	8.0674		0.1197	3843.3	4382.1	8.0118		0.1077	3841.8	4380.2	7.9618	
950	0.1406	3944.2	4506.8	8.1701		0.1250	3942.8	4505.2	8.1146		0.1124	3941.5	4503.6	8.0648	
1000	0.1465	4045.1	4631.2	8.2697		0.1302	4043.9	4629.8	8.2144		0.1171	4042.6	4628.3	8.1648	
1050	0.1524	4147.5	4757.1	8.3667		0.1354	4146.4	4755.8	8.3115		0.1219	4145.2	4754.5	8.2620	
1100	0.1582	4251.4	4884.4	8.4611		0.1406	4250.4	4883.2	8.4060		0.1266	4249.3	4882.0	8.3566	
1150	0.1641	4356.7	5013.1	8.5532		0.1458	4355.8	5012.0	8.4981		0.1312	4354.8	5011.0	8.4488	
1200	0.1699	4463.5	5143.1	8.6430		0.1510	4462.5	5142.2	8.5880		0.1359	4461.6	5141.2	8.5388	
1250	0.1757	4571.5	5274.5	8.7307		0.1562	4570.7	5273.7	8.6758		0.1406	4569.8	5272.8	8.6266	
1300	0.1816	4680.9	5407.2	8.8164		0.1614	4680.1	5406.4	8.7615		0.1453	4679.3	5405.7	8.7124	

Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 6.0 \text{ MPa (275.59}^\circ\text{C)}$					$p = 7.0 \text{ MPa (285.83}^\circ\text{C)}$					$p = 8.0 \text{ MPa (295.01}^\circ\text{C)}$					
	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$
Sat.	0.0324	2589.9	2784.6	5.8901	0.0274	2581.0	2772.6	5.8148	0.0235	2570.5	2758.7	5.7450	0.0235	2570.5	2758.7	5.7450
300	0.0362	2668.4	2885.5	6.0703	0.0295	2633.5	2839.9	5.9337	0.0243	2592.3	2786.5	5.7937	0.0243	2592.3	2786.5	5.7937
350	0.0423	2790.4	3043.9	6.3357	0.0353	2770.1	3016.9	6.2304	0.0300	2748.3	2988.1	6.1321	0.0300	2748.3	2988.1	6.1321
400	0.0474	2893.7	3178.2	6.5432	0.0400	2879.5	3159.2	6.4502	0.0343	2864.6	3139.4	6.3658	0.0343	2864.6	3139.4	6.3658
450	0.0522	2989.9	3302.9	6.7219	0.0442	2979.0	3288.3	6.6353	0.0382	2967.8	3273.3	6.5579	0.0382	2967.8	3273.3	6.5579
500	0.0567	3083.1	3423.1	6.8826	0.0482	3074.3	3411.4	6.8000	0.0418	3065.4	3399.5	6.7266	0.0418	3065.4	3399.5	6.7266
550	0.0610	3175.2	3541.3	7.0307	0.0520	3167.9	3531.6	6.9506	0.0452	3160.5	3521.8	6.8799	0.0452	3160.5	3521.8	6.8799
600	0.0653	3267.2	3658.7	7.1693	0.0557	3260.9	3650.6	7.0910	0.0485	3254.7	3642.4	7.0221	0.0485	3254.7	3642.4	7.0221
650	0.0694	3359.6	3776.2	7.3001	0.0593	3354.3	3769.3	7.2231	0.0517	3348.9	3762.3	7.1556	0.0517	3348.9	3762.3	7.1556
700	0.0735	3453.0	3894.3	7.4246	0.0629	3448.3	3888.2	7.3486	0.0548	3443.6	3882.2	7.2821	0.0548	3443.6	3882.2	7.2821
750	0.0776	3547.5	4013.2	7.5438	0.0664	3543.3	4007.9	7.4685	0.0579	3539.1	4002.6	7.4028	0.0579	3539.1	4002.6	7.4028
800	0.0816	3643.2	4133.1	7.6582	0.0699	3639.5	4128.4	7.5836	0.0610	3635.7	4123.8	7.5184	0.0610	3635.7	4123.8	7.5184
850	0.0857	3740.3	4254.2	7.7685	0.0733	3736.9	4250.1	7.6944	0.0641	3733.5	4246.0	7.6297	0.0641	3733.5	4246.0	7.6297
900	0.0896	3838.8	4376.6	7.8751	0.0768	3835.7	4373.0	7.8014	0.0671	3832.6	4369.3	7.7371	0.0671	3832.6	4369.3	7.7371
950	0.0936	3938.7	4500.3	7.9784	0.0802	3935.9	4497.1	7.9050	0.0701	3933.1	4493.8	7.8411	0.0701	3933.1	4493.8	7.8411
1000	0.0976	4040.1	4625.4	8.0786	0.0836	4037.5	4622.5	8.0055	0.0731	4035.0	4619.6	7.9419	0.0731	4035.0	4619.6	7.9419
1050	0.1015	4142.9	4751.9	8.1760	0.0870	4140.5	4749.3	8.1031	0.0761	4138.2	4746.7	8.0397	0.0761	4138.2	4746.7	8.0397
1100	0.1054	4247.1	4879.7	8.2709	0.0903	4245.0	4877.3	8.1981	0.0790	4242.8	4875.0	8.1350	0.0790	4242.8	4875.0	8.1350
1150	0.1093	4352.8	5008.9	8.3632	0.0937	4350.8	5006.7	8.2907	0.0820	4348.8	5004.6	8.2277	0.0820	4348.8	5004.6	8.2277
1200	0.1133	4459.8	5139.3	8.4534	0.0971	4457.9	5137.4	8.3810	0.0849	4456.1	5135.5	8.3181	0.0849	4456.1	5135.5	8.3181
1250	0.1172	4568.1	5271.1	8.5413	0.1004	4566.4	5269.4	8.4690	0.0879	4564.6	5267.7	8.4063	0.0879	4564.6	5267.7	8.4063
1300	0.1211	4677.7	5404.1	8.6272	0.1038	4676.1	5402.6	8.5551	0.0908	4674.5	5401.0	8.4924	0.0908	4674.5	5401.0	8.4924



Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 9.0 \text{ MPa (503.35}^\circ\text{C)}$				$p = 10.0 \text{ MPa (511.00}^\circ\text{C)}$				$p = 12.5 \text{ MPa (527.81}^\circ\text{C)}$			
	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$
Sat.	0.0205	2558.5	2742.9	5.6791	0.0180	2545.2	2725.5	5.6160	0.0135	2505.6	2674.3	5.4638
350	0.0258	2724.9	2957.3	6.0380	0.0224	2699.6	2924.0	5.9459	0.0161	2624.8	2826.6	5.7130
400	0.0300	2849.2	3118.8	6.2876	0.0264	2833.1	3097.4	6.2141	0.0200	2789.6	3040.0	6.0433
450	0.0335	2956.3	3258.0	6.4872	0.0298	2944.5	3242.3	6.4219	0.0230	2913.7	3201.4	6.2749
500	0.0368	3056.3	3387.4	6.6603	0.0328	3047.0	3375.1	6.5995	0.0256	3023.2	3343.6	6.4650
550	0.0399	3153.0	3512.0	6.8164	0.0357	3145.4	3502.0	6.7585	0.0280	3126.1	3476.5	6.6317
600	0.0429	3248.4	3634.1	6.9605	0.0384	3242.0	3625.8	6.9045	0.0303	3225.8	3604.6	6.7828
650	0.0458	3343.4	3755.2	7.0953	0.0410	3337.9	3748.1	7.0408	0.0325	3324.1	3730.2	6.9227
700	0.0486	3438.8	3876.1	7.2229	0.0436	3434.0	3870.0	7.1693	0.0346	3422.0	3854.6	7.0539
750	0.0514	3534.9	3997.3	7.3443	0.0461	3530.7	3992.0	7.2916	0.0367	3520.1	3978.6	7.1782
800	0.0541	3632.0	4119.1	7.4606	0.0486	3628.2	4114.5	7.4085	0.0387	3618.7	4102.8	7.2967
850	0.0569	3730.2	4241.9	7.5724	0.0511	3726.8	4237.8	7.5207	0.0407	3718.3	4227.5	7.4102
900	0.0596	3829.6	4365.7	7.6802	0.0535	3826.5	4362.0	7.6290	0.0427	3818.9	4352.9	7.5194
950	0.0622	3930.3	4490.6	7.7844	0.0560	3927.5	4487.3	7.7335	0.0447	3920.6	4479.2	7.6249
1000	0.0649	4032.4	4616.7	7.8855	0.0584	4029.9	4613.8	7.8349	0.0466	4023.5	4606.5	7.7269
1050	0.0676	4135.9	4744.0	7.9836	0.0608	4133.5	4741.4	7.9332	0.0486	4127.7	4734.9	7.8258
1100	0.0702	4240.6	4872.7	8.0790	0.0632	4238.5	4870.3	8.0288	0.0505	4233.1	4864.5	7.9219
1150	0.0729	4346.8	5002.5	8.1719	0.0656	4344.8	5000.4	8.1219	0.0524	4339.8	4995.1	8.0154
1200	0.0755	4454.2	5133.6	8.2625	0.0679	4452.3	5131.7	8.2126	0.0543	4447.7	5127.0	8.1065
1250	0.0781	4562.9	5266.0	8.3508	0.0703	4561.2	5264.2	8.3010	0.0562	4556.9	5260.0	8.1952
1300	0.0907	4671.9	5399.5	8.4370	0.0727	4671.3	5397.9	8.3874	0.0581	4667.3	5394.1	8.2819

Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 15.0 \text{ MPa (342.16}^\circ\text{C)}$				$p = 17.5 \text{ MPa (354.67}^\circ\text{C)}$				$p = 20.0 \text{ MPa (365.75}^\circ\text{C)}$			
	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$
342.2	0.0103	2455.6	2610.7	5.3106	0.0079	2390.5	2529.3	5.1431	0.0059	2295.0	2412.4	4.9315
350	0.0115	2520.9	2693.1	5.4437								
400	0.0157	2740.6	2975.7	5.8819	0.0125	2684.3	2902.4	5.7211	0.0100	2617.9	2816.9	5.5525
450	0.0185	2880.7	3157.9	6.1434	0.0152	2845.4	3111.4	6.0212	0.0127	2807.2	3061.7	5.9043
500	0.0208	2998.4	3310.8	6.3480	0.0174	2972.4	3276.7	6.2424	0.0148	2945.3	3241.2	6.1446
550	0.0229	3106.2	3450.4	6.5230	0.0193	3085.8	3423.6	6.4266	0.0166	3064.7	3396.1	6.3389
600	0.0249	3209.3	3583.1	6.6796	0.0211	3192.5	3561.3	6.5890	0.0182	3175.3	3539.0	6.5075
650	0.0268	3310.1	3712.1	6.8233	0.0227	3295.8	3693.8	6.7366	0.0197	3281.4	3675.3	6.6593
700	0.0286	3409.8	3839.1	6.9572	0.0243	3397.5	3823.5	6.8734	0.0211	3385.1	3807.8	6.7990
750	0.0304	3509.4	3965.2	7.0836	0.0259	3498.6	3951.7	7.0019	0.0225	3487.7	3938.1	6.9297
800	0.0321	3609.2	4091.1	7.2037	0.0274	3599.7	4079.3	7.1236	0.0239	3590.1	4067.5	7.0531
850	0.0338	3709.8	4217.1	7.3185	0.0289	3701.2	4206.8	7.2398	0.0252	3692.6	4196.4	7.1705
900	0.0355	3811.2	4343.7	7.4288	0.0303	3803.4	4334.5	7.3511	0.0265	3795.7	4325.4	7.2829
950	0.0372	3913.6	4471.0	7.5350	0.0318	3906.6	4462.9	7.4582	0.0278	3899.5	4454.7	7.3909
1000	0.0388	4017.1	4599.2	7.6378	0.0332	4010.7	4592.0	7.5616	0.0290	4004.3	4584.7	7.4950
1050	0.0404	4121.8	4728.4	7.7373	0.0346	4115.9	4721.9	7.6617	0.0303	4110.0	4715.4	7.5957
1100	0.0421	4227.7	4858.6	7.8339	0.0360	4222.3	4852.8	7.7588	0.0315	4216.9	4846.9	7.6933
1150	0.0437	4334.8	4989.9	7.9278	0.0374	4329.8	4984.6	7.8531	0.0327	4324.8	4979.4	7.7880
1200	0.0453	4443.1	5122.3	8.0192	0.0388	4438.4	5117.5	7.9449	0.0340	4433.8	5112.8	7.8802
1250	0.0469	4552.6	5255.7	8.1083	0.0402	4548.3	5251.5	8.0343	0.0352	4544.0	5247.2	7.9699
1300	0.0485	4663.2	5390.3	8.1952	0.0416	4659.2	5386.4	8.1215	0.0364	4655.2	5382.6	8.0574



Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 25.0 \text{ MPa}$				$p = 30.0 \text{ MPa}$				$p = 35.0 \text{ MPa}$			
	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$
400	0.0060	2428.5	2578.7	5.1400	0.0028	2071.9	2156.2	4.4808	0.0021	1914.8	1988.5	4.2142
450	0.0092	2721.2	2950.6	5.6759	0.0067	2618.9	2821.0	5.4421	0.0050	2497.5	2671.0	5.1945
500	0.0111	2887.3	3165.9	5.9642	0.0087	2824.0	3084.7	5.7956	0.0069	2755.3	2997.9	5.6331
550	0.0127	3020.8	3339.2	6.1816	0.0102	2974.5	3279.7	6.0402	0.0083	2925.8	3218.0	5.9092
600	0.0141	3140.0	3493.5	6.3637	0.0114	3103.4	3446.7	6.2373	0.0095	3065.6	3398.9	6.1228
650	0.0154	3251.9	3637.7	6.5242	0.0126	3221.7	3599.4	6.4074	0.0106	3190.9	3560.7	6.3030
700	0.0166	3359.9	3776.0	6.6702	0.0137	3334.3	3743.9	6.5598	0.0115	3308.3	3711.6	6.4622
750	0.0178	3465.8	3910.9	6.8054	0.0147	3443.6	3883.4	6.6997	0.0124	3421.2	3855.9	6.6069
800	0.0189	3570.7	4043.8	6.9322	0.0156	3551.2	4020.0	6.8300	0.0133	3531.5	3996.3	6.7409
850	0.0200	3675.4	4175.6	7.0523	0.0166	3658.0	4154.9	6.9529	0.0141	3640.5	4134.2	6.8665
900	0.0211	3780.2	4307.1	7.1668	0.0175	3764.6	4288.8	7.0695	0.0149	3748.9	4270.6	6.9853
950	0.0221	3885.5	4438.5	7.2765	0.0184	3871.4	4422.3	7.1810	0.0157	3857.2	4406.2	7.0985
1000	0.0232	3991.5	4570.2	7.3820	0.0192	3978.6	4555.8	7.2880	0.0165	3965.8	4541.5	7.2069
1050	0.0242	4098.3	4702.5	7.4839	0.0201	4086.5	4689.6	7.3910	0.0172	4074.8	4676.8	7.3112
1100	0.0252	4206.0	4835.4	7.5825	0.0210	4195.2	4823.8	7.4906	0.0179	4184.4	4812.4	7.4118
1150	0.0262	4314.8	4969.0	7.6781	0.0218	4304.8	4958.7	7.5871	0.0187	4294.8	4948.4	7.5091
1200	0.0272	4424.6	5103.5	7.7710	0.0226	4415.3	5094.2	7.6807	0.0194	4406.1	5085.0	7.6034
1250	0.0281	4535.4	5238.8	7.8613	0.0235	4526.8	5230.5	7.7716	0.0201	4518.2	5222.2	7.6950
1300	0.0291	4647.2	5375.1	7.9493	0.0243	4639.2	5367.6	7.8602	0.0208	4631.2	5360.1	7.7841

Tabela H-3 Vapor superaquecido — continuação.

Temp. °C	$p = 40.0 \text{ MPa}$				$p = 50.0 \text{ MPa}$				$p = 60.0 \text{ MPa}$			
	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$
400	0.0019	1854.9	1951.4	4.1145	0.0017	1787.8	1874.4	4.0029	0.0016	1745.2	1843.2	3.9317
450	0.0037	2364.2	2511.8	4.9449	0.0025	2160.3	2284.7	4.5896	0.0021	2055.1	2180.2	4.4140
500	0.0056	2681.6	2906.5	5.4744	0.0039	2528.1	2722.6	5.1762	0.0030	2393.2	2570.3	4.9356
550	0.0070	2875.0	3154.4	5.7857	0.0051	2769.5	3025.3	5.5563	0.0040	2664.5	2901.9	5.3517
600	0.0081	3026.8	3350.4	6.0170	0.0061	2947.1	3252.5	5.8245	0.0048	2866.8	3156.8	5.6527
650	0.0091	3159.5	3521.6	6.2078	0.0070	3095.6	3443.4	6.0373	0.0056	3031.3	3366.7	5.8867
700	0.0099	3282.0	3679.1	6.3740	0.0077	3228.7	3614.6	6.2178	0.0063	3175.4	3551.3	6.0814
750	0.0107	3398.6	3828.4	6.5236	0.0084	3353.1	3773.9	6.3775	0.0069	3307.6	3720.5	6.2510
800	0.0115	3511.8	3972.6	6.6612	0.0091	3472.2	3925.8	6.5225	0.0075	3432.6	3880.0	6.4033
850	0.0123	3623.1	4113.6	6.7896	0.0097	3588.0	4072.9	6.6565	0.0080	3553.2	4033.1	6.5428
900	0.0130	3733.3	4252.5	6.9106	0.0103	3702.0	4216.8	6.7819	0.0085	3670.9	4182.0	6.6725
950	0.0137	3843.1	4390.2	7.0256	0.0109	3814.9	4358.7	6.9004	0.0090	3786.9	4328.1	6.7944
1000	0.0144	3952.9	4527.3	7.1355	0.0114	3927.3	4499.4	7.0131	0.0095	3901.9	4472.2	6.9099
1050	0.0150	4063.0	4664.2	7.2409	0.0120	4039.7	4639.3	7.1209	0.0100	4016.5	4615.1	7.0200
1100	0.0157	4173.7	4801.1	7.3425	0.0125	4152.2	4778.9	7.2244	0.0104	4130.9	4757.3	7.1255
1150	0.0163	4284.9	4938.3	7.4406	0.0131	4265.1	4918.4	7.3242	0.0109	4245.5	4899.1	7.2269
1200	0.0170	4396.9	5075.9	7.5357	0.0136	4378.6	5058.1	7.4207	0.0113	4360.4	5040.8	7.3248
1250	0.0176	4509.7	5214.1	7.6279	0.0141	4492.7	5198.1	7.5141	0.0118	4475.8	5182.5	7.4194
1300	0.0182	4623.3	5352.8	7.7175	0.0146	4607.4	5338.4	7.6048	0.0122	4591.8	5324.5	7.5111

Tabela H-4 Água líquida superarrefecida — continuação.

Temp. °C	$p = 20 \text{ MPa}$				$p = 50 \text{ MPa}$				$p = 100 \text{ MPa}$			
	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$	v m^3/kg	u kJ/kg	h kJ/kg	s $\text{kJ}/(\text{K kg})$
180	0.001112	750.8	773.0	2.1143	0.001091	735.5	790.1	2.0790	0.001063	714.5	820.8	2.0280
200	0.001139	837.5	860.3	2.3027	0.001115	819.4	875.2	2.2628	0.001083	795.1	903.4	2.2064
220	0.001170	925.8	949.2	2.4867	0.001141	904.4	961.4	2.4414	0.001104	876.3	986.7	2.3788
240	0.001205	1016.1	1040.2	2.6676	0.001171	990.6	1049.1	2.6156	0.001128	958.0	1070.8	2.5459
260	0.001247	1109.0	1134.0	2.8469	0.001204	1078.2	1138.4	2.7864	0.001154	1040.3	1155.8	2.7084
280	0.001298	1205.5	1231.5	3.0265	0.001243	1167.7	1229.9	2.9547	0.001183	1123.5	1241.8	2.8669
300	0.001361	1307.1	1334.4	3.2091	0.001288	1259.6	1324.0	3.1218	0.001215	1207.6	1329.1	3.0219
320	0.001445	1416.6	1445.5	3.3996	0.001341	1354.3	1421.4	3.2888	0.001250	1292.8	1417.8	3.1740
340	0.001569	1540.2	1571.6	3.6086	0.001405	1452.9	1523.1	3.4575	0.001290	1379.1	1508.2	3.3238
360	0.001825	1703.6	1740.1	3.8787	0.001485	1556.5	1630.7	3.6301	0.001335	1466.8	1600.3	3.4717
380					0.001588	1667.1	1746.5	3.8101	0.001385	1556.0	1694.5	3.6182



Tabela H-5 Linha de saturação sólido-vapor.

Temp. °C	p^{sat} kPa	$v_{\text{gelo}} \times 10^3$ m ³ /kg	v m ³ /kg	u_{gelo} kJ/kg	$\Delta_{\text{sub}} u$ kJ/kg	u^V kJ/kg	h_{gelo} kJ/kg	$\Delta_{\text{sub}} h$ kJ/kg	h^V kJ/kg	s_{gelo} kJ/(K kg)	$\Delta_{\text{sub}} s$ kJ/(K kg)	s^V kJ/(K kg)
0.01	0.6113	1.0908	206.1	-333.40	2708.7	2375.3	-333.40	2834.8	2501.4	-1.221	10.378	9.156
0	0.6108	1.0908	206.3	-333.43	2708.8	2375.3	-333.43	2834.8	2501.3	-1.221	10.378	9.157
-2	0.5176	1.0904	241.7	-337.62	2710.2	2372.6	-337.62	2835.3	2497.7	-1.237	10.456	9.219
-4	0.4375	1.0901	283.8	-341.78	2711.6	2369.8	-341.78	2835.7	2494.0	-1.253	10.536	9.283
-6	0.3689	1.0898	334.2	-345.91	2712.9	2367.0	-345.91	2836.2	2490.3	-1.268	10.616	9.348
-8	0.3102	1.0894	394.4	-350.02	2714.2	2364.2	-350.02	2836.6	2486.6	-1.284	10.698	9.414
-10	0.2602	1.0891	466.7	-354.09	2715.5	2361.4	-354.09	2837.0	2482.9	-1.299	10.781	9.481
-12	0.2176	1.0888	553.7	-358.14	2716.8	2358.7	-358.14	2837.3	2479.2	-1.315	10.865	9.550
-14	0.1815	1.0884	658.8	-362.15	2718.0	2355.9	-362.15	2837.6	2475.5	-1.331	10.950	9.619
-16	0.1510	1.0881	786.0	-366.14	2719.2	2353.1	-366.14	2837.9	2471.8	-1.346	11.036	9.690
-18	0.1252	1.0878	940.5	-370.10	2720.4	2350.3	-370.10	2838.2	2468.1	-1.362	11.123	9.762
-20	0.1035	1.0874	1128.6	-374.03	2721.6	2347.5	-374.03	2838.4	2464.3	-1.377	11.212	9.835
-22	0.0853	1.0871	1358.4	-377.93	2722.7	2344.7	-377.93	2838.6	2460.6	-1.393	11.302	9.909
-24	0.0701	1.0868	1640.1	-381.80	2723.7	2342.0	-381.80	2838.7	2456.9	-1.408	11.394	9.985
-26	0.0574	1.0864	1986.4	-385.64	2724.8	2339.2	-385.64	2838.9	2453.2	-1.424	11.486	10.062
-28	0.0469	1.0861	2413.7	-389.45	2725.8	2336.4	-389.45	2839.0	2449.5	-1.439	11.580	10.141
-30	0.0381	1.0858	2943.0	-393.23	2726.8	2333.6	-393.23	2839.0	2445.8	-1.455	11.676	10.221
-32	0.0309	1.0854	3600.0	-396.98	2727.8	2330.8	-396.98	2839.1	2442.1	-1.471	11.775	10.303
-34	0.0250	1.0851	4419.0	-400.71	2728.7	2328.0	-400.71	2839.1	2438.4	-1.486	11.872	10.386
-36	0.0201	1.0848	5444.0	-404.40	2729.6	2325.2	-404.40	2839.1	2434.7	-1.501	11.972	10.470
-38	0.0161	1.0844	6731.0	-408.06	2730.5	2322.4	-408.06	2839.0	2430.9	-1.517	12.073	10.556
-40	0.0129	1.0841	8354.0	-411.70	2731.3	2319.6	-411.70	2839.9	2427.2	-1.532	12.176	10.644

Figura H-1 Diagrama temperatura-entropia para a água (em unidades SI) com várias isobáricas e linhas de título (x^V) constante.

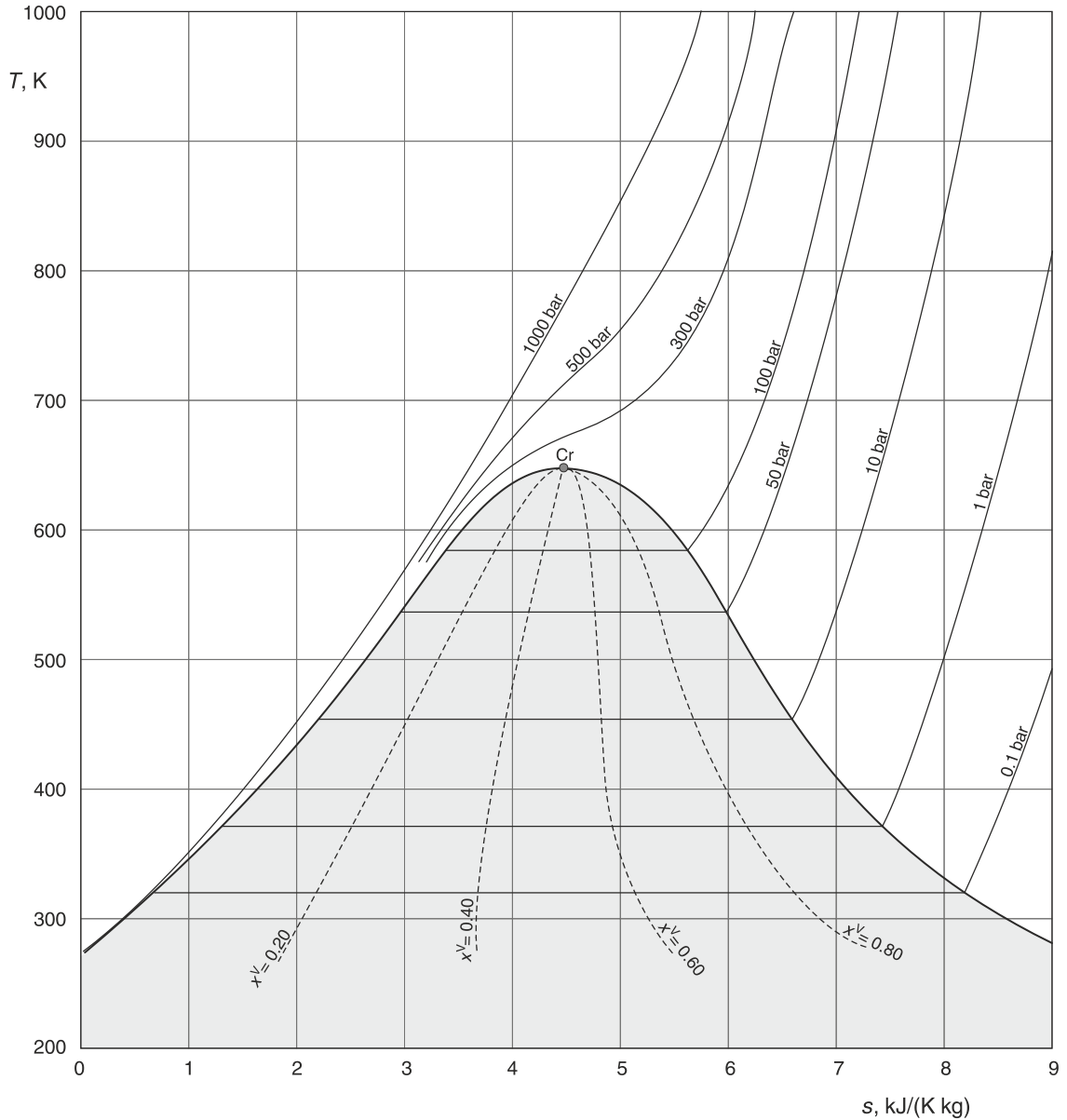


Figura H-2 Diagrama entalpia-entropia (diagrama de Mollier) para a água (em unidades SI) com várias isobáricas, isotérmicas e linhas de título (x^V) constante. As linhas de temperatura constante são retas na região bifásica (L+V), particularmente a pressões baixas. No ponto crítico da água, $h^L = h^V = 2084.3$ kJ/kg e $s^L = s^V = 4.407$ kJ/(°C kg).

