Steam Tables

Saturated steam by temperature and by pressure, and superheated steam, in SI units (IAPWS-IF97)

For: Mechanical, process and power engineers, boiler operators and thermodynamics students

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BASIS	KEY RELATIONSHIP	READING THE TABLE	WORKED EXAMPLE
IAPWS-IF97; u = 0 and s = 0 for saturated liquid at the triple point (0.01 °C, 0.611657 kPa)	hfg = hg − hf; wet steam h = hf + x × hfg (x = dryness fraction)	Dryness x = (h − hf) ÷ hfg	At 100 kPa: Tsat = 99.61 °C, hfg = 2,257.5 kJ/kg

Pressures are absolute. Enthalpy to 0.01 kJ/kg and entropy to 0.0001 kJ/(kg·K), well within IF97 accuracy. Critical point 373.946 °C, 22.064 MPa.

Saturated steam by temperature

T (°C)	p (kPa)	vf (m³/kg)	vg (m³/kg)	hf (kJ/kg)	hfg (kJ/kg)	hg (kJ/kg)	sf (kJ/kg·K)	sg (kJ/kg·K)
0.01	0.61166	0.001000	206.00	0.00	2,500.91	2,500.91	0.0000	9.1555
5	0.87257	0.001000	147.02	21.02	2,489.05	2,510.07	0.0763	9.0249
10	1.2282	0.001000	106.31	42.02	2,477.21	2,519.23	0.1511	8.8998
15	1.7057	0.001001	77.881	62.98	2,465.38	2,528.36	0.2245	8.7804
20	2.3392	0.001002	57.761	83.92	2,453.55	2,537.47	0.2965	8.6661
25	3.1697	0.001003	43.341	104.84	2,441.71	2,546.54	0.3673	8.5568
30	4.2467	0.001004	32.882	125.75	2,429.84	2,555.58	0.4368	8.4521
35	5.6286	0.001006	25.208	146.64	2,417.94	2,564.59	0.5052	8.3518
40	7.3844	0.001008	19.517	167.54	2,406.00	2,573.54	0.5724	8.2557
45	9.5944	0.001010	15.253	188.44	2,394.02	2,582.45	0.6386	8.1634
50	12.351	0.001012	12.028	209.34	2,381.97	2,591.31	0.7038	8.0749
55	15.761	0.001015	9.5649	230.24	2,369.87	2,600.11	0.7680	7.9899
60	19.946	0.001017	7.6677	251.15	2,357.69	2,608.85	0.8312	7.9082
65	25.041	0.001020	6.1938	272.08	2,345.43	2,617.51	0.8935	7.8296
70	31.201	0.001023	5.0397	293.02	2,333.08	2,626.10	0.9550	7.7540
75	38.595	0.001026	4.1291	313.97	2,320.63	2,634.60	1.0156	7.6812
80	47.415	0.001029	3.4053	334.95	2,308.07	2,643.01	1.0754	7.6110
85	57.867	0.001032	2.8259	355.95	2,295.38	2,651.33	1.1344	7.5434
90	70.182	0.001036	2.3591	376.97	2,282.56	2,659.53	1.1927	7.4781
95	84.609	0.001040	1.9806	398.02	2,269.60	2,667.61	1.2502	7.4150
100	101.42	0.001043	1.6719	419.10	2,256.47	2,675.57	1.3070	7.3541
110	143.38	0.001052	1.2094	461.36	2,229.70	2,691.07	1.4187	7.2380
120	198.67	0.001060	0.89130	503.78	2,202.15	2,705.93	1.5278	7.1291
130	270.26	0.001070	0.66808	546.39	2,173.70	2,720.09	1.6346	7.0264
140	361.50	0.001080	0.50852	589.20	2,144.24	2,733.44	1.7393	6.9293
150	476.10	0.001091	0.39250	632.25	2,113.67	2,745.92	1.8420	6.8370
160	618.14	0.001102	0.30682	675.57	2,081.86	2,757.43	1.9428	6.7491
170	792.05	0.001114	0.24262	719.21	2,048.69	2,767.89	2.0419	6.6649
180	1,002.6	0.001127	0.19386	763.19	2,014.03	2,777.22	2.1395	6.5841
190	1,255.0	0.001141	0.15638	807.57	1,977.75	2,785.31	2.2358	6.5060
200	1,554.7	0.001157	0.12722	852.39	1,939.67	2,792.06	2.3308	6.4303
210	1,907.4	0.001173	0.10430	897.73	1,899.62	2,797.35	2.4248	6.3565
220	2,319.3	0.001190	0.086101	943.64	1,857.41	2,801.05	2.5178	6.2842
230	2,796.8	0.001209	0.071510	990.21	1,812.80	2,803.01	2.6102	6.2131

T (°C)	p (kPa)	vf (m^3/kg)	vg (m^3/kg)	hf (kJ/kg)	hfg (kJ/kg)	hg (kJ/kg)	sf (kJ/kg·K)	sg (kJ/kg·K)
240	3,346.7	0.001229	0.059710	1,037.52	1,765.54	2,803.06	2.7019	6.1425
250	3,975.9	0.001252	0.050087	1,085.69	1,715.33	2,801.01	2.7934	6.0722
260	4,692.1	0.001276	0.042175	1,134.83	1,661.82	2,796.64	2.8847	6.0017
270	5,502.8	0.001303	0.035622	1,185.09	1,604.60	2,789.69	2.9762	5.9304
280	6,416.5	0.001333	0.030154	1,236.67	1,543.15	2,779.82	3.0681	5.8578
290	7,441.6	0.001366	0.025557	1,289.80	1,476.84	2,766.63	3.1608	5.7832
300	8,587.7	0.001404	0.021663	1,344.77	1,404.80	2,749.57	3.2547	5.7058
310	9,864.7	0.001448	0.018339	1,402.00	1,325.92	2,727.92	3.3506	5.6243
320	11,284	0.001499	0.015476	1,462.05	1,238.62	2,700.67	3.4491	5.5373
330	12,858	0.001561	0.012984	1,525.74	1,140.51	2,666.25	3.5516	5.4425
340	14,600	0.001638	0.010784	1,594.45	1,027.62	2,622.07	3.6599	5.3359
350	16,529	0.001740	0.0088009	1,670.86	892.73	2,563.59	3.7783	5.2109
360	18,666	0.001895	0.0069450	1,761.49	719.50	2,480.99	3.9164	5.0527
370	21,043	0.002222	0.0049462	1,892.64	440.86	2,333.50	4.1142	4.7996

Saturated steam by pressure

p (kPa)	p (bar)	T (°C)	vf (m^3/kg)	vg (m^3/kg)	hf (kJ/kg)	hfg (kJ/kg)	hg (kJ/kg)	sf (kJ/kg·K)	sg (kJ/kg·K)
1	0.01	6.97	0.001000	129.18	29.30	2,484.38	2,513.68	0.1059	8.9749
1.5	0.015	13.02	0.001001	87.962	54.69	2,470.06	2,524.75	0.1956	8.8271
2	0.02	17.50	0.001001	66.990	73.43	2,459.48	2,532.91	0.2606	8.7227
2.5	0.025	21.08	0.001002	54.242	88.43	2,451.00	2,539.43	0.3119	8.6422
3	0.03	24.08	0.001003	45.655	100.99	2,443.89	2,544.88	0.3543	8.5766
4	0.04	28.96	0.001004	34.792	121.40	2,432.31	2,553.71	0.4224	8.4735
5	0.05	32.88	0.001005	28.186	137.77	2,423.00	2,560.77	0.4763	8.3939
7.5	0.075	40.29	0.001008	19.234	168.76	2,405.30	2,574.06	0.5763	8.2502
10	0.1	45.81	0.001010	14.671	191.81	2,392.07	2,583.89	0.6492	8.1489
15	0.15	53.97	0.001014	10.020	225.94	2,372.37	2,598.30	0.7548	8.0071
20	0.2	60.06	0.001017	7.6482	251.40	2,357.55	2,608.95	0.8320	7.9072
25	0.25	64.96	0.001020	6.2034	271.93	2,345.52	2,617.45	0.8931	7.8302
30	0.3	69.10	0.001022	5.2286	289.23	2,335.32	2,624.55	0.9439	7.7675
40	0.4	75.86	0.001026	3.9931	317.57	2,318.48	2,636.05	1.0259	7.6690
50	0.5	81.32	0.001030	3.2401	340.48	2,304.74	2,645.21	1.0910	7.5930
75	0.75	91.76	0.001037	2.2171	384.37	2,278.02	2,662.39	1.2130	7.4557
100	1	99.61	0.001043	1.6940	417.44	2,257.51	2,674.95	1.3026	7.3588
101.325	1.01325	99.97	0.001043	1.6733	418.99	2,256.54	2,675.53	1.3067	7.3544
125	1.25	105.97	0.001048	1.3749	444.30	2,240.59	2,684.89	1.3739	7.2840
150	1.5	111.35	0.001053	1.1594	467.08	2,226.03	2,693.11	1.4335	7.2229
175	1.75	116.04	0.001057	1.0036	486.97	2,213.16	2,700.13	1.4849	7.1714
200	2	120.21	0.001061	0.88574	504.68	2,201.56	2,706.24	1.5301	7.1269
250	2.5	127.41	0.001067	0.71870	535.35	2,181.15	2,716.50	1.6072	7.0524
300	3	133.53	0.001073	0.60579	561.46	2,163.44	2,724.89	1.6718	6.9916
350	3.5	138.86	0.001079	0.52420	584.31	2,147.65	2,731.97	1.7275	6.9401
400	4	143.61	0.001084	0.46239	604.72	2,133.33	2,738.06	1.7766	6.8954
450	4.5	147.91	0.001088	0.41390	623.22	2,120.16	2,743.39	1.8206	6.8560
500	5	151.84	0.001093	0.37480	640.19	2,107.92	2,748.11	1.8606	6.8206
600	6	158.83	0.001101	0.31558	670.50	2,085.64	2,756.14	1.9311	6.7592
700	7	164.95	0.001108	0.27276	697.14	2,065.61	2,762.75	1.9921	6.7070
800	8	170.41	0.001115	0.24033	721.02	2,047.28	2,768.30	2.0460	6.6615
900	9	175.36	0.001121	0.21487	742.72	2,030.31	2,773.04	2.0944	6.6212

p (kPa)	p (bar)	T (°C)	vf (m³/kg)	vg (m³/kg)	hf (kJ/kg)	hfg (kJ/kg)	hg (kJ/kg)	sf (kJ/kg·K)	sg (kJ/kg·K)
1,000	10	179.89	0.001127	0.19435	762.68	2,014.44	2,777.12	2.1384	6.5850
1,200	12	187.96	0.001139	0.16325	798.50	1,985.27	2,783.77	2.2163	6.5217
1,400	14	195.05	0.001149	0.14077	830.13	1,958.76	2,788.89	2.2839	6.4675
1,600	16	201.38	0.001159	0.12373	858.61	1,934.27	2,792.88	2.3438	6.4200
1,800	18	207.12	0.001168	0.11036	884.61	1,911.37	2,795.99	2.3978	6.3776
2,000	20	212.38	0.001177	0.099581	908.62	1,889.76	2,798.38	2.4470	6.3392
2,500	25	223.96	0.001197	0.079947	961.98	1,840.06	2,802.04	2.5544	6.2560
3,000	30	233.86	0.001217	0.066664	1,008.37	1,794.89	2,803.27	2.6456	6.1858
3,500	35	242.56	0.001235	0.057058	1,049.78	1,752.97	2,802.74	2.7254	6.1245
4,000	40	250.36	0.001253	0.049777	1,087.43	1,713.47	2,800.90	2.7967	6.0697
5,000	50	263.94	0.001286	0.039446	1,154.50	1,639.73	2,794.23	2.9207	5.9737
6,000	60	275.59	0.001319	0.032449	1,213.73	1,570.83	2,784.56	3.0274	5.8901
7,000	70	285.83	0.001352	0.027380	1,267.44	1,505.13	2,772.57	3.1220	5.8146
8,000	80	295.01	0.001385	0.023528	1,317.08	1,441.53	2,758.61	3.2077	5.7448
9,000	90	303.35	0.001418	0.020493	1,363.65	1,379.23	2,742.88	3.2866	5.6790
10,000	100	311.00	0.001453	0.018034	1,407.87	1,317.61	2,725.47	3.3603	5.6159
12,000	120	324.68	0.001526	0.014269	1,491.33	1,194.26	2,685.58	3.4965	5.4941
14,000	140	336.67	0.001610	0.011489	1,570.88	1,067.22	2,638.09	3.6230	5.3730
16,000	160	347.36	0.001710	0.0093081	1,649.67	931.13	2,580.80	3.7457	5.2463
18,000	180	356.99	0.001839	0.0074987	1,732.02	777.51	2,509.53	3.8717	5.1055
20,000	200	365.75	0.002039	0.0058583	1,827.10	584.29	2,411.39	4.0154	4.9299
22,000	220	373.71	0.002706	0.0035705	2,013.36	149.86	2,163.21	4.2976	4.5293

Superheated steam: specific enthalpy h (kJ/kg)

Rows: temperature (°C). Columns: absolute pressure; the first row is the saturation temperature. — = liquid at that pressure.

T	1 bar	2 bar	5 bar	10 bar	20 bar	40 bar	60 bar	100 bar	150 bar	200 bar
Tsat	99.61	120.21	151.84	179.89	212.38	250.36	275.59	311.00	342.16	365.75
100	2,675.8	—	—	—	—	—	—	—	—	—
150	2,776.6	2,769.1	—	—	—	—	—	—	—	—
200	2,875.5	2,870.8	2,855.9	2,828.3	—	—	—	—	—	—
250	2,974.5	2,971.3	2,961.1	2,943.2	2,903.2	—	—	—	—	—
300	3,074.5	3,072.1	3,064.6	3,051.7	3,024.3	2,961.7	2,885.5	—	—	—
350	3,175.8	3,173.9	3,168.1	3,158.2	3,137.6	3,093.3	3,043.9	2,924.0	2,693.0	—
400	3,278.5	3,277.0	3,272.3	3,264.4	3,248.2	3,214.4	3,178.2	3,097.4	2,975.5	2,816.8
450	3,382.8	3,381.5	3,377.7	3,371.2	3,358.1	3,331.0	3,302.8	3,242.3	3,157.8	3,061.5
500	3,488.7	3,487.6	3,484.4	3,479.0	3,468.1	3,445.8	3,422.9	3,375.1	3,310.8	3,241.2
550	3,596.3	3,595.4	3,592.6	3,588.1	3,578.9	3,560.2	3,541.2	3,501.9	3,450.5	3,396.2
600	3,705.6	3,704.8	3,702.5	3,698.6	3,690.7	3,674.8	3,658.8	3,625.8	3,583.3	3,539.2
650	3,816.6	3,815.9	3,813.9	3,810.5	3,803.8	3,790.2	3,776.4	3,748.3	3,712.4	3,675.6
700	3,929.4	3,928.8	3,927.0	3,924.1	3,918.2	3,906.4	3,894.5	3,870.3	3,839.5	3,808.2
750	4,043.9	4,043.4	4,041.9	4,039.3	4,034.2	4,023.8	4,013.4	3,992.3	3,965.6	3,938.5
800	4,160.2	4,159.8	4,158.4	4,156.1	4,151.6	4,142.5	4,133.3	4,114.7	4,091.3	4,067.7

Superheated steam: specific entropy s (kJ/kg·K)

T	1 bar	2 bar	5 bar	10 bar	20 bar	40 bar	60 bar	100 bar	150 bar	200 bar
Tsat	99.61	120.21	151.84	179.89	212.38	250.36	275.59	311.00	342.16	365.75
100	7.3610	—	—	—	—	—	—	—	—	—
150	7.6147	7.2809	—	—	—	—	—	—	—	—

T	1 bar	2 bar	5 bar	10 bar	20 bar	40 bar	60 bar	100 bar	150 bar	200 bar
200	7.8356	7.5081	7.0611	6.6955	—	—	—	—	—	—
250	8.0346	7.7100	7.2726	6.9266	6.5474	—	—	—	—	—
300	8.2171	7.8940	7.4614	7.1247	6.7685	6.3638	6.0702	—	—	—
350	8.3865	8.0643	7.6345	7.3028	6.9582	6.5843	6.3356	5.9458	5.4435	—
400	8.5451	8.2235	7.7954	7.4668	7.1290	6.7712	6.5431	6.2139	5.8817	5.5525
450	8.6945	8.3733	7.9464	7.6198	7.2863	6.9383	6.7216	6.4217	6.1433	5.9041
500	8.8361	8.5151	8.0891	7.7640	7.4335	7.0919	6.8824	6.5993	6.3479	6.1445
550	8.9709	8.6501	8.2247	7.9007	7.5723	7.2353	7.0306	6.7584	6.5230	6.3390
600	9.0998	8.7792	8.3543	8.0309	7.7042	7.3704	7.1692	6.9045	6.6797	6.5077
650	9.2234	8.9029	8.4784	8.1557	7.8301	7.4989	7.3002	7.0409	6.8235	6.6596
700	9.3424	9.0220	8.5977	8.2755	7.9509	7.6215	7.4248	7.1696	6.9576	6.7994
750	9.4571	9.1368	8.7128	8.3909	8.0670	7.7391	7.5439	7.2918	7.0839	6.9301
800	9.5681	9.2479	8.8240	8.5024	8.1791	7.8523	7.6583	7.4087	7.2039	7.0534

Superheated steam: specific volume v (m^3/kg)

T	1 bar	2 bar	5 bar	10 bar	20 bar	40 bar	60 bar	100 bar	150 bar	200 bar
Tsat	99.61	120.21	151.84	179.89	212.38	250.36	275.59	311.00	342.16	365.75
100	1.696	—	—	—	—	—	—	—	—	—
150	1.937	0.9599	—	—	—	—	—	—	—	—
200	2.172	1.081	0.4250	0.2060	—	—	—	—	—	—
250	2.406	1.199	0.4744	0.2327	0.1115	—	—	—	—	—
300	2.639	1.316	0.5226	0.2580	0.1255	0.05887	0.03619	—	—	—
350	2.871	1.433	0.5701	0.2825	0.1386	0.06647	0.04225	0.02244	0.01148	—
400	3.103	1.549	0.6173	0.3066	0.1512	0.07343	0.04742	0.02644	0.01567	0.009950
450	3.334	1.665	0.6642	0.3304	0.1635	0.08004	0.05217	0.02978	0.01848	0.01272
500	3.566	1.781	0.7109	0.3541	0.1757	0.08644	0.05667	0.03281	0.02083	0.01479
550	3.797	1.897	0.7576	0.3777	0.1877	0.09270	0.06102	0.03566	0.02295	0.01657
600	4.028	2.013	0.8041	0.4011	0.1996	0.09886	0.06526	0.03838	0.02492	0.01818
650	4.259	2.129	0.8506	0.4245	0.2115	0.1049	0.06943	0.04102	0.02680	0.01969
700	4.490	2.244	0.8970	0.4478	0.2233	0.1110	0.07354	0.04359	0.02862	0.02113
750	4.721	2.360	0.9433	0.4711	0.2350	0.1170	0.07761	0.04613	0.03039	0.02252
800	4.952	2.476	0.9897	0.4944	0.2467	0.1229	0.08164	0.04862	0.03212	0.02387

Sources and method

- **IAPWS-IF97 (IAPWS R7-97, 2012 revision)** — Industrial formulation for the thermodynamic properties of water and steam; reference state u = s = 0 for saturated liquid at the triple point (iapws.org/relguide/IF97-Rev.html)
- **IAPWS R2-83 (2012)** — Critical point of water: 647.096 K (373.946 °C), 22.064 MPa, 322 kg/m^3
- **CoolProp 8.0 (Bell et al., Ind. Eng. Chem. Res. 2014)** — Open-source property library used to evaluate IF97 and the refrigerant equations of state (coolprop.org/)

Every property is calculated with IAPWS-IF97; the calculation reproduces the IF97 verification values exactly, and that check runs in the site tests. Interactive version, corrections and more charts: **allunitconversions.com/steam-tables**