

**پیوست A. ۲.۳. خواص بخار اشبع - واحد متریک (SI)**

Temperature (°C)	Vapor pressure (kPa)	Specific volume (m³/kg)		Enthalpy (kJ/kg)		Entropy (kJ/kg.K)	
		Liquid	Saturated vapor	Liquid	Saturated vapor	Liquid	Saturated vapor
0.01	0.6113	0.0010002	206.136	0.00	2501.4	0.0000	9.1562
3	0.7577	0.0010001	168.132	12.57	2506.9	0.0457	9.0773
6	0.9349	0.0010001	137.734	25.20	2512.4	0.0912	9.0003
9	1.1477	0.0010003	113.386	37.80	2517.9	0.1362	8.9253
12	1.4022	0.0010005	93.784	50.41	2523.4	0.1806	8.8524
15	1.7051	0.0010009	77.926	62.99	2528.9	0.2245	8.7814
18	2.0640	0.0010014	65.038	75.58	2534.4	0.2679	8.7123
21	2.487	0.0010020	54.514	88.14	2539.9	0.3109	8.6450
24	2.985	0.0010027	45.883	100.75	2545.4	0.3534	8.5794
27	3.567	0.0010035	38.774	113.25	2550.8	0.3954	8.5156
30	4.246	0.0010043	32.894	125.79	2556.3	0.4369	8.4533
33	5.034	0.0010053	28.011	138.33	2561.7	0.4781	8.3927
36	5.947	0.0010063	23.940	150.86	2567.1	0.5188	8.3336
40	7.384	0.0010078	19.523	167.57	2574.3	0.5725	8.2570
45	9.593	0.0010099	15.258	188.45	2583.2	0.6387	8.1648
50	12.349	0.0010121	12.032	209.33	2592.1	0.7038	8.0763
55	15.758	0.0010146	9.568	230.23	2600.9	0.7679	7.9913
60	19.940	0.0010172	7.671	251.13	2609.6	0.8312	7.9096
65	25.03	0.0010199	6.197	272.06	2618.3	0.8935	7.8310
70	31.19	0.0010228	5.042	292.98	2626.8	0.9549	7.7553
75	38.58	0.0010259	4.131	313.93	2635.3	1.0155	7.6824
80	47.39	0.0010291	3.407	334.91	2643.7	1.0753	7.6122
85	57.83	0.0010325	2.828	355.90	2651.9	1.1343	7.5445
90	70.14	0.0010360	2.361	376.92	2660.1	1.1925	7.4791
95	84.55	0.0010397	1.9819	397.96	2668.1	1.2500	7.4159
100	101.35	0.0010435	1.6729	419.04	2676.1	1.3069	7.3549
105	120.82	0.0010475	1.4194	440.15	2683.8	1.3630	7.2958
110	143.27	0.0010516	1.2102	461.30	2691.5	1.4185	7.2387
115	169.06	0.0010559	1.0366	482.48	2699.0	1.4734	7.1833
120	198.53	0.0010603	0.8919	503.71	2706.3	1.5276	7.1296
125	232.1	0.0010649	0.7706	524.99	2713.5	1.5813	7.0775
130	270.1	0.0010697	0.6685	546.31	2720.5	1.6344	7.0269
135	313.0	0.0010746	0.5822	567.69	2727.3	1.6870	6.9777
140	316.3	0.0010797	0.5089	589.13	2733.9	1.7391	6.9299
145	415.4	0.0010850	0.4463	610.63	2740.3	1.7907	6.8833
150	475.8	0.0010905	0.3928	632.20	2746.5	1.8418	6.8379
155	543.1	0.0010961	0.3468	653.84	2752.4	1.8925	6.7935
160	617.8	0.0011020	0.3071	675.55	2758.1	1.9427	6.7502
165	700.5	0.0011080	0.2727	697.34	2763.5	1.9925	6.7078
170	791.7	0.0011143	0.2428	719.21	2768.7	2.0419	6.6663
175	892.0	0.0011207	0.2168	741.17	2773.6	2.0909	6.6256
180	1002.1	0.0011274	0.19405	763.22	2778.2	2.1396	6.5857
190	1254.4	0.0011414	0.15654	807.62	2786.4	2.2359	6.5079
200	1553.8	0.0011565	0.12736	852.45	2793.2	2.3309	6.4323
225	2548	0.0011992	0.07849	966.78	2803.3	2.5639	6.2503
250	3973	0.0012512	0.05013	1085.36	2801.5	2.7927	6.0730
275	5942	0.0013168	0.03279	1210.07	2785.0	3.0208	5.8938
300	8581	0.0010436	0.02167	1344.0	2749.0	3.2534	5.7045

**پیوست A .٣ .٣ . خواص بخار اشباع - واحد انگلیسی**

Temperature (°F)	Absolute pressure (lbm/in <sup>2</sup> )	Specific volume (ft <sup>3</sup> /lbm)			Enthalpy (BTU/lbm)		
		Saturated liquid	Evaporation vapor	Saturated vapor	Saturated liquid	Evaporation vapor	Saturated vapor
32	0.08859	0.016022	3304.7	3304.7	- 0.0179	1075.5	1075.5
35	0.09998	0.016020	2950.5	2950.5	3.002	1073.8	1076.8
40	0.12163	0.016019	2445.8	2445.8	8.027	1071.0	1079.0
45	0.14753	0.016020	2039.3	2039.3	13.044	1068.2	1081.2
50	0.17796	0.016023	1704.8	1704.8	18.054	1065.3	1083.4
55	0.21404	0.016027	1384.2	1384.2	23.059	1062.5	1085.6
60	0.25611	0.016033	1207.6	1207.6	28.060	1059.7	1087.7
65	0.30562	0.016041	1022.8	1022.8	33.057	1056.9	1089.9
70	0.36292	0.016050	868.3	868.4	38.052	1054.0	1092.1
75	0.42985	0.016061	740.8	740.8	43.045	1051.3	1094.3
80	0.50683	0.016072	633.3	633.3	48.037	1048.4	1096.4
85	0.59610	0.016085	543.9	543.9	53.028	1045.6	1098.6
90	0.69813	0.016099	468.1	468.1	58.018	1042.7	1100.0
95	0.81567	0.016114	404.6	404.6	63.008	1039.9	1102.9
100	0.94924	0.016130	350.4	350.4	67.999	1037.1	1105.1
105	1.10218	0.016148	304.6	304.6	72.991	1034.3	1107.2
110	1.2750	0.016165	265.4	265.4	77.98	1031.4	1109.3
115	1.4716	0.016184	232.03	232.0	82.97	1028.5	1111.5
120	1.6927	0.016204	203.25	203.26	87.97	1025.6	1113.6
125	1.9435	0.016225	178.66	178.67	92.96	1022.8	1115.7
130	2.2230	0.016247	157.32	157.33	97.96	1019.8	1117.8
135	2.5382	0.016270	138.98	138.99	102.95	1016.9	1119.9
140	2.8892	0.016293	122.98	123.00	107.95	1014.0	1122.0
145	3.2825	0.016317	109.16	109.18	112.95	1011.1	1124.1
150	3.7184	0.016343	97.05	97.07	117.95	1008.2	1126.1
155	4.2047	0.016369	86.53	86.55	122.95	1005.2	1128.2
160	4.7414	0.016395	77.27	77.29	127.96	1002.2	1130.2
165	5.3374	0.016423	69.19	69.20	132.97	999.2	1132.2
170	5.9926	0.016451	62.04	62.06	137.97	996.2	1134.2
175	6.7173	0.016480	55.77	55.79	142.99	993.2	1136.2
180	7.5110	0.016510	50.21	50.22	148.00	990.2	1138.2
185	8.3855	0.016543	45.31	45.33	153.02	987.2	1140.2
190	9.340	0.016572	40.941	40.957	158.04	984.1	1142.1
195	10.386	0.016605	37.078	37.094	163.06	981.0	1144.1
200	11.526	0.016637	33.622	33.639	168.09	977.9	1146.0
205	12.776	0.016707	30.567	30.583	173.12	974.8	1147.8
210	14.132	0.016705	27.822	27.839	178.16	971.6	1149.8
212	14.696	0.016719	26.782	26.799	180.17	970.3	1150.5

Temperature (°F)	Absolute pressure (lbm/in <sup>2</sup> )	Specific volume (ft <sup>3</sup> /lbm)			Enthalpy (BTU/lbm)		
		Saturated liquid	Evaporation vapor	Saturated vapor	Saturated liquid	Evaporation vapor	Saturated vapor
220	17.186	0.016775	23.131	23.148	188.23	965.2	1153.4
225	18.921	0.016812	21.161	21.177	193.28	961.9	1155.2
230	20.791	0.016849	19.379	19.396	198.33	958.7	1157.1
235	22.804	0.016887	17.766	17.783	203.39	956.5	1158.9
240	24.968	0.016926	16.304	16.321	208.45	952.1	1160.6
245	27.319	0.016966	14.998	15.015	213.52	948.8	1162.4
250	29.840	0.017006	13.811	13.828	218.59	945.5	1164.1
255	32.539	0.017047	12.729	12.747	223.67	942.1	1165.8
260	35.427	0.017089	11.745	11.762	228.76	938.6	1167.4
265	38.546	0.017132	10.858	10.875	233.85	935.2	1169.0
270	41.875	0.017175	10.048	10.065	238.95	931.7	1170.7
275	45.423	0.017219	9.306	9.324	244.06	928.2	1172.2
280	49.200	0.017264	8.627	8.644	249.17	924.6	1173.8
285	53.259	0.017310	8.0118	8.0291	254.32	920.9	1175.3
290	57.752	0.017360	7.4468	7.4641	259.45	917.3	1176.8

پیوست A .٣ . خواص بخار فوق گرم (سیستم SI)

Absolute pressure [kPa, with sat. temp. °C]		Temperature (°C)						
		100	150	200	250	300	360	420
10	V	17.196	19.512	21.825	24.136	26.445	29.216	31.986
(45.81)	H	2687.5	2783.0	2879.5	2977.3	3076.5	3197.6	3320.9
	s	8.4479	8.6882	8.9038	9.1002	9.2813	9.4821	9.6682
50	V	3.418	3.889	4.356	4.820	5.284	5.839	6.394
(81.33)	H	2682.5	2780.1	2877.7	2976.0	3075.5	3196.8	3320.4
	s	7.6947	7.9401	8.1580	8.3556	8.5373	8.7385	8.9249
75	V	2.270	2.587	2.900	3.211	3.520	3.891	4.262
(91.78)	H	2679.4	2778.2	2876.5	2975.2	3074.9	3196.4	3320.0
	s	7.5009	7.7496	7.9690	8.1673	8.3493	8.5508	8.7374
100	V	1.6958	1.9364	2.172	2.406	2.639	2.917	3.195
(99.63)	H	2676.2	2776.4	2875.3	2974.3	3074.3	3195.9	3319.6
	s	7.3614	7.6134	7.8343	8.0333	8.2158	8.4175	8.6042
150	V	1.2853	1.4443	1.6012	1.7570	1.9432	2.129	2.376
(111.37)	H	2772.6	2872.9	2972.7	3073.1	3195.0	3318.9	3487.6
	s	7.4193	7.6433	7.8438	8.0720	8.2293	8.4163	8.6466
400	V	0.4708	0.5342	0.5951	0.6458	0.7257	0.7960	0.8893
(143.63)	H	2752.8	2860.5	2964.2	3066.8	3190.3	3315.3	3484.9
	s	6.9299	7.1706	7.3789	7.5662	7.7712	7.9598	8.1913
700	V	0.2999	0.3363	0.3714	0.4126	0.4533	0.5070	
(164.97)	H	2844.8	2953.6	3059.1	3184.7	3310.9	3481.7	
	s	6.8865	7.1053	7.2979	7.5063	7.6968	7.9299	
1000	V	0.2060	0.2327	0.2579	0.2873	0.3162	0.3541	
(179.91)	H	2827.9	2942.6	3051.2	3178.9	3306.5	3478.5	
	s	6.6940	6.9247	7.1229	7.3349	7.5275	7.7622	
1500	V	0.13248	0.15195	0.16966	0.18988	0.2095	0.2352	
(198.32)	H	2796.8	2923.3	3037.6	31692	3299.1	3473.1	
	s	6.4546	6.7090	6.9179	7.1363	7.3323	7.5698	
2000	V	0.11144	0.12547	0.14113	0.15616	0.17568		
(212.42)	H	2902.5	3023.5	3159.3	3291.6	3467.6		
	s	6.5433	6.7664	6.9917	7.1915	7.4317		
2500	V	0.08700	0.09890	0.11186	0.12414	0.13998		
(223.99)	H	2880.1	3008.8	3149.1	3284.0	3462.1		
	s	6.4085	6.6438	6.8767	7.0803	7.3234		
3000	V	0.07058	0.08114	0.09233	0.10279	0.11619		
(233.90)	H	2855.8	2993.5	3138.7	3276.3	3456.5		
	s	6.2872	6.5390	6.7801	6.9878	7.2338		

V: حجم مخصوص (m<sup>3</sup>/kg) ; H: انالپی (kJ/kg) ; s: انتروپی (kJ/kg.K)

پیوست A. ۳.۵. خواص بخار فوق گرم (سیستم انگلیسی)

Temp. (°F)	Absolute pressure lb/in <sup>2</sup> (Psi)					
	1 Psi $T_s=101.74^{\circ}\text{F}$		5 Psi $T_s=162.24^{\circ}\text{F}$		10 Psi $T_s=193.21^{\circ}\text{F}$	
	v	h	v	h	v	h
200	392.5	1150.2	78.14	1148.6	38.84	1146.6
250	422.4	1172.9	84.21	1171.7	41.93	1170.2
300	452.3	1195.7	90.24	1194.8	44.98	1193.7
350	482.1	1218.7	96.25	1218.0	48.02	1217.1
400	511.9	1241.8	102.24	1241.3	51.03	1240.6
450	541.7	1265.1	108.23	1264.7	54.04	1264.1
500	571.5	1288.6	114.21	1288.2	57.04	1287.8
600	631.1	1336.1	126.15	1335.9	63.03	1335.5

Temp. (°F)	Absolute pressure lb/in <sup>2</sup> (Psi)					
	14.696 Psi $T_s=212.00^{\circ}\text{F}$		15 Psi $T_s=213.03^{\circ}\text{F}$		20 Psi $T_s=227.96^{\circ}\text{F}$	
	v	h	v	h	v	h
250	28.42	1168.8	27.837	1168.7	20.788	1167.1
300	30.52	1192.6	29.889	1192.5	22.356	1191.4
350	32.60	1216.3	31.939	1216.2	23.900	1215.4
400	34.67	1239.9	33.963	1239.9	25.428	1239.2
450	36.72	1263.6	35.977	1263.6	26.946	1263.0
500	38.77	1287.4	37.985	1287.3	28.457	1286.9
600	42.86	1335.2	41.986	1335.2	31.466	1334.9

Temp. (°F)	Absolute pressure lb/in <sup>2</sup> (psi)					
	25 Psi $T_s=240.07^{\circ}\text{F}$		30 Psi $T_s=250.34^{\circ}\text{F}$		35 Psi $T_s=259.29^{\circ}\text{F}$	
	v	h	v	h	v	h
250	16.558	1165.6				
300	17.829	1190.2	14.810	1189.0	12.654	1187.8
350	19.076	1214.5	15.589	1213.6	12.562	1212.7
400	20.307	1238.5	16.892	1237.8	14.453	1237.1
450	21.527	1262.5	17.914	1261.9	15.334	1261.3
500	22.740	1286.4	18.929	1286.0	16.207	1285.5
600	25.153	1334.6	20.945	1334.2	17.939	1333.9

v = specific volume in ft<sup>3</sup>/lbm; h = enthalpy in BTU/lbm, T<sub>s</sub> = Saturation temperature at designated pressure.