

Table R-1: Refrigerant 134a Saturation Table - Temperature

T (°C)	P (MPa)	$v_f$ (m <sup>3</sup> /kg)	$v_g$ (m <sup>3</sup> /kg)	$u_f$ (kJ/kg)	$u_g$ (kJ/kg)	$h_f$ (kJ/kg)	$h_g$ (kJ/kg)	$s_f$ (kJ/kg-K)	$s_g$ (kJ/kg-K)	T (°C)
-40	0.05164	0.0007055	0.3569	-0.04	204.45	0	222.88	0	0.956	-40
-36	0.06332	0.0007113	0.2947	4.68	206.73	4.73	225.4	0.0201	0.9506	-36
-32	0.07704	0.0007172	0.2451	9.47	209.01	9.52	227.9	0.0401	0.9456	-32
-28	0.09305	0.0007233	0.2052	14.31	211.29	14.37	230.38	0.06	0.9411	-28
-26	0.10199	0.0007265	0.1882	16.75	212.43	16.82	231.62	0.0699	0.939	-26
-24	0.1116	0.0007296	0.1728	19.21	213.57	19.29	232.85	0.0798	0.937	-24
-22	0.12192	0.0007328	0.159	21.68	214.7	21.77	234.08	0.0897	0.9351	-22
-20	0.13299	0.0007361	0.1464	24.17	215.84	24.26	235.31	0.0996	0.9332	-20
-18	0.14483	0.0007395	0.135	26.67	216.97	26.77	236.53	0.1094	0.9315	-18
-16	0.15748	0.0007428	0.1247	29.18	218.1	29.3	237.74	0.1192	0.9298	-16
-12	0.1854	0.0007498	0.1068	34.25	220.36	34.39	240.15	0.1388	0.9267	-12
-8	0.21704	0.0007569	0.0919	39.38	222.6	39.54	242.54	0.1583	0.9239	-8
-4	0.25274	0.0007644	0.0794	44.56	224.84	44.75	244.9	0.1777	0.9213	-4
0	0.29282	0.0007721	0.0689	49.79	227.06	50.02	247.23	0.197	0.919	0
4	0.33765	0.0007801	0.06	55.08	229.27	55.35	249.53	0.2162	0.9169	4
8	0.38756	0.0007884	0.0525	60.43	231.46	60.73	251.8	0.2354	0.915	8
12	0.44294	0.0007971	0.046	65.83	233.63	66.18	254.03	0.2545	0.9132	12
16	0.50416	0.0008062	0.0405	71.29	235.78	71.69	256.22	0.2735	0.9116	16
20	0.5716	0.0008157	0.0358	76.8	237.91	77.26	258.36	0.2924	0.9102	20
24	0.64566	0.0008257	0.0317	82.37	240.01	82.9	260.45	0.3113	0.9089	24
28	0.6853	0.0008309	0.0298	85.18	241.05	85.75	261.48	0.3208	0.9082	28
30	0.72675	0.0008362	0.0281	88	242.08	88.61	262.5	0.3302	0.9076	30
32	0.77006	0.0008417	0.0265	90.84	243.1	91.49	263.5	0.3396	0.907	32
34	0.81528	0.0008473	0.025	93.7	244.12	94.39	264.48	0.349	0.9064	34
36	0.86247	0.000853	0.0236	96.58	245.12	97.31	265.45	0.3584	0.9058	36
38	0.91168	0.000859	0.0223	99.47	246.11	100.25	266.4	0.3678	0.9053	38
40	0.96298	0.0008651	0.021	102.38	247.09	103.21	267.33	0.3772	0.9047	40
42	1.0164	0.0008714	0.0199	105.3	248.06	106.19	268.24	0.3866	0.9041	42
44	1.072	0.000878	0.0188	108.25	249.02	109.19	269.14	0.396	0.9035	44
48	1.1299	0.0008847	0.0177	111.22	249.96	112.22	270.01	0.4054	0.903	48
52	1.2526	0.0008989	0.0159	117.22	251.79	118.35	271.68	0.4243	0.9017	52
56	1.3851	0.0009142	0.0142	123.31	253.55	124.58	273.24	0.4432	0.9004	56
60	1.5278	0.0009308	0.0127	129.51	255.23	130.93	274.68	0.4622	0.899	60
70	1.6813	0.0009488	0.0114	135.82	256.81	137.42	275.99	0.4814	0.8973	70
80	2.1162	0.0010027	0.0086	152.22	260.15	154.34	278.43	0.5302	0.8918	80
88	2.6324	0.0010766	0.0064	169.88	262.14	172.71	279.12	0.5814	0.8827	88
90	3.2435	0.0011949	0.0046	189.82	261.34	193.69	276.32	0.638	0.8655	90
100	3.9742	0.0015443	0.0027	218.6	248.49	224.74	259.13	0.7196	0.8117	100

Table R-2: Refrigerant 134a Saturation Table - Pressure

P (MPa)	T (°C)	$v_f$ (m <sup>3</sup> /kg)	$v_g$ (m <sup>3</sup> /kg)	$u_f$ (kJ/kg)	$u_g$ (kJ/kg)	$h_f$ (kJ/kg)	$h_g$ (kJ/kg)	$s_f$ (kJ/kg-K)	$s_g$ (kJ/kg-K)	P (MPa)
0.06	-37.07	0.0007097	0.31	3.41	206.12	3.46	224.72	0.0147	0.952	0.06
0.08	-31.21	0.0007184	0.2366	10.41	209.46	10.47	228.39	0.044	0.9447	0.08
0.1	-26.43	0.0007258	0.1917	16.22	212.18	16.29	231.35	0.0678	0.9395	0.1
0.12	-22.36	0.0007323	0.1614	21.23	214.5	21.32	233.86	0.0879	0.9354	0.12
0.14	-18.8	0.0007381	0.1395	25.66	216.52	25.77	236.04	0.1055	0.9322	0.14
0.16	-15.62	0.0007435	0.1229	29.66	218.32	29.78	237.97	0.1211	0.9295	0.16
0.18	-12.73	0.0007485	0.1098	33.31	219.94	33.45	239.71	0.1352	0.9273	0.18
0.2	-10.09	0.0007532	0.0993	36.69	221.43	36.84	241.3	0.1481	0.9253	0.2
0.24	-5.37	0.0007618	0.0834	42.77	224.07	42.95	244.09	0.171	0.9222	0.24
0.28	-1.23	0.0007697	0.0719	48.18	226.38	48.39	246.52	0.1911	0.9197	0.28
0.32	2.48	0.000777	0.0632	53.06	228.43	53.31	248.66	0.2089	0.9177	0.32
0.36	5.84	0.0007839	0.0564	57.54	230.28	57.82	250.58	0.2251	0.916	0.36
0.4	8.93	0.0007904	0.0509	61.69	231.97	62	252.32	0.2399	0.9145	0.4
0.5	15.74	0.0008056	0.0409	70.93	235.64	71.33	256.07	0.2723	0.9117	0.5
0.6	21.58	0.0008196	0.0341	78.99	238.74	79.48	259.19	0.2999	0.9097	0.6
0.7	26.72	0.0008328	0.0292	86.19	241.42	86.78	261.85	0.3242	0.908	0.7
0.8	31.33	0.0008454	0.0255	92.75	243.78	93.42	264.15	0.3459	0.9066	0.8
0.9	35.53	0.0008576	0.0226	98.79	245.88	99.56	266.18	0.3656	0.9054	0.9
1	39.39	0.0008695	0.0202	104.42	247.77	105.29	267.97	0.3838	0.9043	1
1.2	46.32	0.0008928	0.0166	114.69	251.03	115.76	270.99	0.4164	0.9023	1.2
1.4	52.43	0.0009159	0.014	123.98	253.74	125.26	273.4	0.4453	0.9003	1.4
1.6	57.92	0.0009392	0.0121	132.52	256	134.02	275.33	0.4714	0.8982	1.6
1.8	62.91	0.0009631	0.0105	140.49	257.88	142.22	276.83	0.4954	0.8959	1.8
2	67.49	0.0009878	0.0093	148.02	259.41	149.99	277.94	0.5178	0.8934	2
2.5	77.59	0.0010562	0.0069	165.48	261.84	168.12	279.17	0.5687	0.8854	2.5
3	86.22	0.0011416	0.0053	181.88	262.16	185.3	278.01	0.6156	0.8735	3

Table R-3: Refrigerant 134a – Superheated Vapor

P = 0.06 MPa				
T (°C)	v (m <sup>3</sup> /kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.31003	206.12	224.72	0.952
-20	0.33536	217.86	237.98	1.0062
-10	0.34992	224.97	245.96	1.0371
0	0.36433	232.24	254.1	1.0675
10	0.37861	239.69	262.41	1.0973
20	0.39279	247.32	270.89	1.1267
30	0.40688	255.12	279.53	1.1557
40	0.42091	263.1	288.35	1.1844
50	0.43487	271.25	297.34	1.2126
60	0.44879	279.58	306.51	1.2405
70	0.46266	288.08	315.84	1.2681
80	0.4765	296.75	325.34	1.2954
90	0.49031	305.58	335	1.3224

P = 0.10 MPa				
T (°C)	v (m <sup>3</sup> /kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.1917	212.18	231.35	0.9395
-20	0.1977	216.77	236.54	0.9602
-10	0.20686	224.01	244.7	0.9918
0	0.21587	231.41	252.99	1.0227
10	0.22473	238.96	261.43	1.0531
20	0.23349	246.67	270.02	1.0829
30	0.24216	254.54	278.76	1.1122
40	0.25076	262.58	287.66	1.1411
50	0.2593	270.79	296.72	1.1696
60	0.26779	279.16	305.94	1.1977
70	0.27623	287.7	315.32	1.2254
80	0.28464	296.4	324.87	1.2528
90	0.29302	305.27	334.57	1.2799

P = 0.14 MPa				
T (°C)	v (m <sup>3</sup> /kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.13945	216.52	236.04	0.9322
-10	0.14549	223.03	243.4	0.9606
0	0.15219	230.55	251.86	0.9922
10	0.15875	238.21	260.43	1.023
20	0.1652	246.01	269.13	1.0532
30	0.17155	253.96	277.97	1.0828
40	0.17783	262.06	286.96	1.112
50	0.18404	270.32	296.09	1.1407
60	0.1902	278.74	305.37	1.169
70	0.19633	287.32	314.8	1.1969
80	0.20241	296.06	324.39	1.2244
90	0.20846	304.95	334.14	1.2516
100	0.21449	314.01	344.04	1.2785

P = 0.18 MPa				
T (°C)	v (m <sup>3</sup> /kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.10983	219.94	239.71	0.9273
-10	0.11135	222.02	242.06	0.9362
0	0.11678	229.67	250.69	0.9684
10	0.12207	237.44	259.41	0.9998
20	0.12723	245.33	268.23	1.0304
30	0.1323	253.36	277.17	1.0604
40	0.1373	261.53	286.24	1.0898
50	0.14222	269.85	295.45	1.1187
60	0.1471	278.31	304.79	1.1472
70	0.15193	286.93	314.28	1.1753
80	0.15672	295.71	323.92	1.203
90	0.16148	304.63	333.7	1.2303
100	0.16622	313.72	343.63	1.2573

P = 0.20 MPa				
T (°C)	v (m <sup>3</sup> /kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.09933	221.43	241.3	0.9253
-10	0.09938	221.5	241.38	0.9256
0	0.10438	229.23	250.1	0.9582
10	0.10922	237.05	258.89	0.9898
20	0.11394	244.99	267.78	1.0206
30	0.11856	253.06	276.77	1.0508
40	0.12311	261.26	285.88	1.0804
50	0.12758	269.61	295.12	1.1094
60	0.13201	278.1	304.5	1.138
70	0.13639	286.74	314.02	1.1661
80	0.14073	295.53	323.68	1.1939
90	0.14504	304.47	333.48	1.2212
100	0.14932	313.57	343.43	1.2483

P = 0.24 MPa				
T (°C)	v (m <sup>3</sup> /kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.08343	224.07	244.09	0.9222
0	0.08574	228.31	248.89	0.9399
10	0.08993	236.26	257.84	0.9721
20	0.09399	244.3	266.85	1.0034
30	0.09794	252.45	275.95	1.0339
40	0.10181	260.72	285.16	1.0637
50	0.10562	269.12	294.47	1.093
60	0.10937	277.67	303.91	1.1218
70	0.11307	286.35	313.49	1.1501
80	0.11674	295.18	323.19	1.178
90	0.12037	304.15	333.04	1.2055
100	0.12398	313.27	343.03	1.2326

P = 0.28 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.07193	226.38	246.52	0.9197
0	0.0724	227.37	247.64	0.9238
10	0.07613	235.44	256.76	0.9566
20	0.07972	243.59	265.91	0.9883
30	0.0832	251.83	275.12	1.0192
40	0.0866	260.17	284.42	1.0494
50	0.08992	268.64	293.81	1.0789
60	0.09319	277.23	303.32	1.1079
70	0.09641	285.96	312.95	1.1364
80	0.0996	294.82	322.71	1.1644
90	0.10275	303.83	332.6	1.192
100	0.10587	312.98	342.62	1.2193
110	0.10897	322.27	352.78	1.2461
120	0.11205	331.71	363.08	1.2727

P = 0.32 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.06322	228.43	248.66	0.9177
10	0.06576	234.61	255.65	0.9427
20	0.06901	242.87	264.95	0.9749
30	0.07214	251.19	274.28	1.0062
40	0.07518	259.61	283.67	1.0367
50	0.07815	268.14	293.15	1.0665
60	0.08106	276.79	302.72	1.0957
70	0.08392	285.56	312.41	1.1243
80	0.08674	294.46	322.22	1.1525
90	0.08953	303.5	332.15	1.1802
100	0.09229	312.68	342.21	1.2076
110	0.09503	322	352.4	1.2345
120	0.09774	331.45	362.73	1.2611

P = 0.40 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.05089	231.97	252.32	0.9145
10	0.05119	232.87	253.35	0.9182
20	0.05397	241.37	262.96	0.9515
30	0.05662	249.89	272.54	0.9837
40	0.05917	258.47	282.14	1.0148
50	0.06164	267.13	291.79	1.0452
60	0.06405	275.89	301.51	1.0748
70	0.06641	284.75	311.32	1.1038
80	0.06873	293.73	321.23	1.1322
90	0.07102	302.84	331.25	1.1602
100	0.07327	312.07	341.38	1.1878
110	0.0755	321.44	351.64	1.2149
120	0.07771	330.94	362.03	1.2417
130	0.07991	340.58	372.54	1.2681
140	0.08208	350.35	383.18	1.2941

P = 0.5 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.04086	235.64	256.07	0.9117
20	0.04188	239.4	260.34	0.9264
30	0.04416	248.2	270.28	0.9597
40	0.04633	256.99	280.16	0.9918
50	0.04842	265.83	290.04	1.0229
60	0.05043	274.73	299.95	1.0531
70	0.0524	283.72	309.92	1.0825
80	0.05432	292.8	319.96	1.1114
90	0.0562	302	330.1	1.1397
100	0.05805	311.31	340.33	1.1675
110	0.05988	320.74	350.68	1.1949
120	0.06168	330.3	361.14	1.2218
130	0.06347	339.98	371.72	1.2484
140	0.06524	349.79	382.42	1.2746

P = 0.6 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.03408	238.74	259.19	0.9097
30	0.03581	246.41	267.89	0.9388
40	0.03774	255.45	278.09	0.9719
50	0.03958	264.48	288.23	1.0037
60	0.04134	273.54	298.35	1.0346
70	0.04304	282.66	308.48	1.0645
80	0.04469	291.86	318.67	1.0938
90	0.04631	301.14	328.93	1.1225
100	0.0479	310.53	339.27	1.1505
110	0.04946	320.03	349.7	1.1781
120	0.05099	329.64	360.24	1.2053
130	0.05251	339.38	370.88	1.232
140	0.05402	349.23	381.64	1.2584
150	0.0555	359.21	392.52	1.2844
160	0.05698	369.32	403.51	1.31

P = 0.7 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.02918	241.42	261.85	0.908
30	0.02979	244.51	265.37	0.9197
40	0.03157	253.83	275.93	0.9539
50	0.03324	263.08	286.35	0.9867
60	0.03482	272.31	296.69	1.0182
70	0.03634	281.57	307.01	1.0487
80	0.03781	290.88	317.35	1.0784
90	0.03924	300.27	327.74	1.1074
100	0.04064	309.74	338.19	1.1358
110	0.04201	319.31	348.71	1.1637
120	0.04335	328.98	359.33	1.191
130	0.04468	338.76	370.04	1.2179
140	0.04599	348.66	380.86	1.2444
150	0.04729	358.68	391.79	1.2706
160	0.04857	368.82	402.82	1.2963

P = 0.8 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat.	0.02547	243.78	264.15	0.9066
40	0.02691	252.13	273.66	0.9374
50	0.02846	261.62	284.39	0.9711
60	0.02992	271.04	294.98	1.0034
70	0.03131	280.45	305.5	1.0345
80	0.03264	289.89	316	1.0647
90	0.03393	299.37	326.52	1.094
100	0.03519	308.93	337.08	1.1227
110	0.03642	318.57	347.71	1.1508
120	0.03762	328.31	358.4	1.1784
130	0.03881	338.14	369.19	1.2055
140	0.03997	348.09	380.07	1.2321
150	0.04113	358.15	391.05	1.2584
160	0.04227	368.32	402.14	1.2843
170	0.0434	378.61	413.33	1.3098
180	0.04452	389.02	424.63	1.3351

P = 0.9 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat.	0.02255	245.88	266.18	0.9054
40	0.02325	250.32	271.25	0.9217
50	0.02472	260.09	282.34	0.9566
60	0.02609	269.72	293.21	0.9897
70	0.02738	279.3	303.94	1.0214
80	0.02861	288.87	314.62	1.0521
90	0.0298	298.46	325.28	1.0819
100	0.03095	308.11	335.96	1.1109
110	0.03207	317.82	346.68	1.1392
120	0.03316	327.62	357.47	1.167
130	0.03423	337.52	368.33	1.1943
140	0.03529	347.51	379.27	1.2211
150	0.03633	357.61	390.31	1.2475
160	0.03736	367.82	401.44	1.2735
170	0.03838	378.14	412.68	1.2992
180	0.03939	388.57	424.02	1.3245

P = 1 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.0202	247.77	267.97	0.9043
40	0.02029	248.39	268.68	0.9066
50	0.02171	258.48	280.19	0.9428
60	0.02301	268.35	291.36	0.9768
70	0.02423	278.11	302.34	1.0093
80	0.02538	287.82	313.2	1.0405
90	0.02649	297.53	324.01	1.0707
100	0.02755	307.27	334.82	1.1
110	0.02858	317.06	345.65	1.1286
120	0.02959	326.93	356.52	1.1567
130	0.03058	336.88	367.46	1.1841
140	0.03154	346.92	378.46	1.2111
150	0.0325	357.06	389.56	1.2376
160	0.03344	367.31	400.74	1.2638
170	0.03436	377.66	412.02	1.2895
180	0.03528	388.12	423.4	1.3149

P = 1.2 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.01663	251.03	270.99	0.9023
50	0.01712	254.98	275.52	0.9164
60	0.01835	265.42	287.44	0.9527
70	0.01947	275.59	298.96	0.9868
80	0.02051	285.62	310.24	1.0192
90	0.0215	295.59	321.39	1.0503
100	0.02244	305.54	332.47	1.0804
110	0.02335	315.5	343.52	1.1096
120	0.02423	325.51	354.58	1.1381
130	0.02508	335.58	365.68	1.166
140	0.02592	345.73	376.83	1.1933
150	0.02674	355.95	388.04	1.2201
160	0.02754	366.27	399.33	1.2465
170	0.02834	376.69	410.7	1.2724
180	0.02912	387.21	422.16	1.298

P = 1.4 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.01405	253.74	273.4	0.9003
60	0.01495	262.17	283.1	0.9297
70	0.01603	272.87	295.31	0.9658
80	0.01701	283.29	307.1	0.9997
90	0.01792	293.55	318.63	1.0319
100	0.01878	303.73	330.02	1.0628
110	0.0196	313.88	341.32	1.0927
120	0.02039	324.05	352.59	1.1218
130	0.02115	334.25	363.86	1.1501
140	0.02189	344.5	375.15	1.1777
150	0.02262	354.82	386.49	1.2048
160	0.02333	365.22	397.89	1.2315
170	0.02403	375.71	409.36	1.2576
180	0.02472	386.29	420.9	1.2834
190	0.02541	396.96	432.53	1.3088
200	0.02608	407.73	444.24	1.3338

P = 1.6 MPa				
T (°C)	v (m³/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
Sat	0.01208	256	275.33	0.8982
60	0.01233	258.48	278.2	0.9069
70	0.0134	269.89	291.33	0.9457
80	0.01435	280.78	303.74	0.9813
90	0.01521	291.39	315.72	1.0148
100	0.01601	301.84	327.46	1.0467
110	0.01677	312.2	339.04	1.0773
120	0.0175	322.53	350.53	1.1069
130	0.0182	332.87	361.99	1.1357
140	0.01887	343.24	373.44	1.1638
150	0.01953	353.66	384.91	1.1912
160	0.02017	364.15	396.43	1.2181
170	0.0208	374.71	407.99	1.2445
180	0.02142	385.35	419.62	1.2704
190	0.02203	396.08	431.33	1.296
200	0.02263	406.9	443.11	1.3212