

TABLE A-11

Saturated refrigerant-134a—Temperature table

Temp., T °C	Sat. press., P_{sat} kPa	Specific volume, m^3/kg		Internal energy, kJ/kg			Enthalpy, kJ/kg			Entropy, kJ/kg·K		
		Sat. liquid, v_f	Sat. vapor, v_g	Sat. liquid, u_f	Evap., u_{fg}	Sat. vapor, u_g	Sat. liquid, h_f	Evap., h_{fg}	Sat. vapor, h_g	Sat. liquid, s_f	Evap., s_{fg}	Sat. vapor, s_g
-40	51.25	0.0007053	0.36064	-0.036	207.42	207.38	0.00	225.86	225.86	0.00000	0.96869	0.96869
-38	56.86	0.0007082	0.32718	2.472	206.06	208.53	2.512	224.62	227.13	0.01071	0.95516	0.96588
-36	62.95	0.0007111	0.29740	4.987	204.69	209.68	5.032	223.37	228.40	0.02137	0.94182	0.96319
-34	69.56	0.0007141	0.27082	7.509	203.32	210.83	7.559	222.10	229.66	0.03196	0.92867	0.96063
-32	76.71	0.0007171	0.24706	10.04	201.94	211.97	10.09	220.83	230.93	0.04249	0.91569	0.95819
-30	84.43	0.0007201	0.22577	12.58	200.55	213.12	12.64	219.55	232.19	0.05297	0.90289	0.95586
-28	92.76	0.0007232	0.20666	15.12	199.15	214.27	15.19	218.25	233.44	0.06339	0.89024	0.95364
-26	101.73	0.0007264	0.18947	17.67	197.75	215.42	17.75	216.95	234.70	0.07376	0.87776	0.95152
-24	111.37	0.0007296	0.17398	20.23	196.34	216.57	20.31	215.63	235.94	0.08408	0.86542	0.94950
-22	121.72	0.0007328	0.15999	22.80	194.92	217.71	22.89	214.30	237.19	0.09435	0.85323	0.94758
-20	132.82	0.0007361	0.14735	25.37	193.49	218.86	25.47	212.96	238.43	0.10456	0.84119	0.94575
-18	144.69	0.0007394	0.13589	27.96	192.05	220.00	28.07	211.60	239.67	0.11473	0.82927	0.94401
-16	157.38	0.0007428	0.12550	30.55	190.60	221.15	30.67	210.23	240.90	0.12486	0.81749	0.94234
-14	170.93	0.0007463	0.11605	33.15	189.14	222.29	33.28	208.84	242.12	0.13493	0.80583	0.94076
-12	185.37	0.0007498	0.10744	35.76	187.66	223.42	35.90	207.44	243.34	0.14497	0.79429	0.93925
-10	200.74	0.0007533	0.099600	38.38	186.18	224.56	38.53	206.02	244.55	0.15496	0.78286	0.93782
-8	217.08	0.0007570	0.092438	41.01	184.69	225.69	41.17	204.59	245.76	0.16491	0.77154	0.93645
-6	234.44	0.0007607	0.085888	43.64	183.18	226.82	43.82	203.14	246.95	0.17482	0.76033	0.93514
-4	252.85	0.0007644	0.079889	46.29	181.66	227.94	46.48	201.66	248.14	0.18469	0.74921	0.93390
-2	272.36	0.0007683	0.074388	48.94	180.12	229.07	49.15	200.17	249.33	0.19452	0.73819	0.93271
0	293.01	0.0007722	0.069335	51.61	178.58	230.18	51.83	198.67	250.50	0.20432	0.72726	0.93158
2	314.84	0.0007761	0.064690	54.28	177.01	231.30	54.53	197.14	251.66	0.21408	0.71641	0.93050
4	337.90	0.0007802	0.060412	56.97	175.44	232.40	57.23	195.58	252.82	0.22381	0.70565	0.92946
6	362.23	0.0007843	0.056469	59.66	173.84	233.51	59.95	194.01	253.96	0.23351	0.69496	0.92847
8	387.88	0.0007886	0.052829	62.37	172.23	234.60	62.68	192.42	255.09	0.24318	0.68435	0.92752
10	414.89	0.0007929	0.049466	65.09	170.61	235.69	65.42	190.80	256.22	0.25282	0.67380	0.92661
12	443.31	0.0007973	0.046354	67.82	168.96	236.78	68.17	189.16	257.33	0.26243	0.66331	0.92574
14	473.19	0.0008018	0.043471	70.56	167.30	237.86	70.94	187.49	258.43	0.27201	0.65289	0.92490
16	504.58	0.0008064	0.040798	73.31	165.62	238.93	73.72	185.80	259.51	0.28157	0.64252	0.92409
18	537.52	0.0008112	0.038317	76.07	163.92	239.99	76.51	184.08	260.59	0.29111	0.63219	0.92330
20	572.07	0.0008160	0.036012	78.85	162.19	241.04	79.32	182.33	261.64	0.30062	0.62192	0.92254
22	608.27	0.0008209	0.033867	81.64	160.45	242.09	82.14	180.55	262.69	0.31012	0.61168	0.92180
24	646.18	0.0008260	0.031869	84.44	158.68	243.13	84.98	178.74	263.72	0.31959	0.60148	0.92107
26	685.84	0.0008312	0.030008	87.26	156.89	244.15	87.83	176.90	264.73	0.32905	0.59131	0.92036
28	727.31	0.0008366	0.028271	90.09	155.08	245.17	90.70	175.03	265.73	0.33849	0.58117	0.91967
30	770.64	0.0008421	0.026648	92.93	153.24	246.17	93.58	173.13	266.71	0.34792	0.57105	0.91897
32	815.89	0.0008477	0.025131	95.79	151.37	247.17	96.49	171.19	267.67	0.35734	0.56095	0.91829
34	863.11	0.0008535	0.023712	98.67	149.48	248.15	99.41	169.21	268.61	0.36675	0.55086	0.91760
36	912.35	0.0008595	0.022383	101.56	147.55	249.11	102.34	167.19	269.53	0.37615	0.54077	0.91692
38	963.68	0.0008657	0.021137	104.47	145.60	250.07	105.30	165.13	270.44	0.38554	0.53068	0.91622
40	1017.1	0.0008720	0.019968	107.39	143.61	251.00	108.28	163.03	271.31	0.39493	0.52059	0.91552
42	1072.8	0.0008786	0.018870	110.34	141.59	251.92	111.28	160.89	272.17	0.40432	0.51048	0.91480
44	1130.7	0.0008854	0.017837	113.30	139.53	252.83	114.30	158.70	273.00	0.41371	0.50036	0.91407

TABLE A-11

Saturated refrigerant-134a—Temperature table (Concluded)

Temp., T , °C	Sat. press., P_{sat} , kPa	Specific volume, m^3/kg		Internal energy, kJ/kg			Enthalpy, kJ/kg			Entropy, $\text{kJ/kg}\cdot\text{K}$		
		Sat. liquid, v_f	Sat. vapor, v_g	Sat. liquid, u_f	Evap., u_{fg}	Sat. vapor, u_g	Sat. liquid, h_f	Evap., h_{fg}	Sat. vapor, h_g	Sat. liquid, s_f	Evap., s_{fg}	Sat. vapor, s_g
46	1191.0	0.0008924	0.016866	116.28	137.43	253.71	117.34	156.46	273.80	0.42311	0.49020	0.91331
48	1253.6	0.0008997	0.015951	119.28	135.30	254.58	120.41	154.17	274.57	0.43251	0.48001	0.91252
52	1386.2	0.0009151	0.014276	125.35	130.89	256.24	126.62	149.41	276.03	0.45136	0.45948	0.91084
56	1529.1	0.0009317	0.012782	131.52	126.29	257.81	132.94	144.41	277.35	0.47028	0.43870	0.90898
60	1682.8	0.0009498	0.011434	137.79	121.45	259.23	139.38	139.09	278.47	0.48930	0.41746	0.90676
65	1891.0	0.0009751	0.009959	145.80	115.06	260.86	147.64	132.05	279.69	0.51330	0.39048	0.90379
70	2118.2	0.0010037	0.008650	154.03	108.17	262.20	156.15	124.37	280.52	0.53763	0.36239	0.90002
75	2365.8	0.0010373	0.007486	162.55	100.62	263.17	165.01	115.87	280.88	0.56252	0.33279	0.89531
80	2635.3	0.0010774	0.006439	171.43	92.22	263.66	174.27	106.35	280.63	0.58812	0.30113	0.88925
85	2928.2	0.0011273	0.005484	180.81	82.64	263.45	184.11	95.39	279.51	0.61487	0.26632	0.88120
90	3246.9	0.0011938	0.004591	190.94	71.19	262.13	194.82	82.22	277.04	0.64354	0.22638	0.86991
95	3594.1	0.0012945	0.003713	202.49	56.25	258.73	207.14	64.94	272.08	0.67605	0.17638	0.85243
100	3975.1	0.0015269	0.002657	218.73	29.72	248.46	224.80	34.22	259.02	0.72224	0.09169	0.81393

Source of Data: Tables A-11 through A-13 are generated using the Engineering Equation Solver (EES) software developed by S. A. Klein and F. L. Alvarado. The routine used in calculations is the R134a, which is based on the fundamental equation of state developed by R. Tillner-Roth and H.D. Baehr, "An International Standard Formulation for the Thermodynamic Properties of 1,1,1,2-Tetrafluoroethane (HFC-134a) for temperatures from 170 K to 455 K and pressures up to 70 MPa," *J. Phys. Chem. Ref. Data*, Vol. 23, No. 5, 1994. The enthalpy and entropy values of saturated liquid are set to zero at -40°C (and -40°F).