

# **PROPERTIES OF R-134A (1,1,1,2-TETRAFLUOROETHANE)**



Industrial Refrigeration Consortium  
University of Wisconsin  
Madison, WI USA

## Who we Are

The IRC is a collaborative effort between the University of Wisconsin-Madison and industry. Together we share a common goal of improving safety, efficiency, and productivity of industrial refrigeration systems and technologies. We realize this goal by conducting applied research, delivering knowledge transfer, and providing technical assistance. Although our efforts are focused on industrial refrigeration systems that utilize anhydrous ammonia, we also work with systems that use other refrigerants.

The IRC offers a unique combination of complementary resources that include academic qualifications, technical expertise, and practical experience. We provide objective information that is not biased by an affiliation with any particular organization.

Our primary product is knowledge. We create knowledge through research and technical assistance, and we transfer knowledge to the industry through our training and technology transfer activities.

These services provide substantial benefits to our members and to the entire refrigeration industry. The knowledge that we create and distribute helps to improve the capabilities of individuals at all levels. Increased knowledge can help improve safety, reduce operating costs, increase productivity, and make your organization more competitive.

The IRC is wholly funded by external funds.

Industrial Refrigeration Consortium  
1415 Engineering Dr  
Suite 2342  
Madison, WI 53706-1607

[www.irc.wisc.edu](http://www.irc.wisc.edu)

Toll-free: (866) 635-4721  
Local: (608) 262-8220  
Fax: (608) 262-6209

# PROPERTIES OF R-134A (1,1,1,2-TETRAFLUOROETHANE)

## Foreword

R-134a is a blend component used in many refrigeration systems. It is also a propellant for aerosol and a blowing agent for extruded polystyrene foams. R-134a replaces the CFC R-12 and in few years will replace the HCFC R-22.

The tables attached were developed based on a refrigerant property database (REFPROP 7.0) developed by the National Institute of Standards and Technology (NIST) for 1,1,1,2-tetrafluoroethane. The thermophysical and transport properties given in the attached tables are based on the latest research and equations of state developed for this particular refrigerant. For more information on the equations used, see the References section below.

The property data includes both saturation properties (as a function of temperature and as a function of pressure), subcooled, and superheat properties. Note, the pressure emphasized in all tables is *absolute* pressure. This means that the local barometric pressure needs to be added to any gage pressure readings prior to using the values in the attached tables.

## References

- Tillner-Roth, R. and Baehr, H.D., "An international standard formulation of the thermodynamic properties of 1,1,1,2-tetrafluoroethane (HFC-134a) covering temperatures from 170 K to 455 K at pressures up to 70 MPa," J. Phys. Chem. Ref. Data, 23:657-729, 1994.
- Perkins, R.A., Laesecke, A., Howley, J., Ramires, M.L.V., Gurova, A.N., and Cusco, L., "Experimental thermal conductivity values for the IUPAC round-robin sample of 1,1,1,2-tetrafluoroethane (R134a)," NISTIR, 2000.

## Definitions

P (pressure) Pressure is the force per unit area exerted by the working fluid. Pressure data is expressed in three units: psia, psig, and in Hg (vacuum). The primary unit expresses pressure as absolute pounds per square inch (psia). Converting between gage and absolute pressure can be accomplished by the following,

$$P_{absolute} [psia] = P_{gage} [psig] + P_{local} [psi]$$

where  $P_{absolute}$  is the absolute pressure,  $P_{gage}$  is the gage pressure, and  $P_{local}$  is the local barometric pressure all expressed in units of lb/in<sup>2</sup>.

ρ (density) Density is the mass of refrigerant per unit volume [lb<sub>m</sub>/ft<sup>3</sup>]. The saturation tables express liquid in units of density. The density is inversely proportional to the specific volume,

$$\rho = 1/v$$

where ρ is the density and v is the fluid's specific volume.

v (specific volume) Specific volume represents the volume occupied per unit mass of refrigerant. The saturation tables express all vapor states in terms of the specific volume [ft<sup>3</sup>/lb<sub>m</sub>]. The specific volume is inversely proportional to the fluid density (see definition above).

C<sub>p</sub> (specific heat) Specific heat is a measure of the energy storing capability of the working fluid [Btu/lb<sub>m</sub>-R]. Fluids with large specific heats require significant amounts of energy input (or extraction) to sensibly increase (or decrease) their temperature.

C<sub>p</sub>/C<sub>v</sub> (spec heat ratio) Specific heat ratio refers to the relationship between the isobaric (C<sub>p</sub>) and isochoric (C<sub>v</sub>) specific heat capacities.

h (enthalpy) Enthalpy is a fluid property that is representative of the relative energy content of a flow stream [Btu/lb<sub>m</sub>]. Reported values of enthalpy are dependent on the reference state. The values reported here have a reference state defining the enthalpy as 0 Btu/lb<sub>m</sub> at -40 F (this is consistent with the ASHRAE reference state).

s (entropy) Entropy is a property that is held constant during an ideal process (reversible and adiabatic, i.e. without heat loss). The entropy properties are sometimes used to characterize the behavior of compression processes. The entropy values are reported in units of [Btu/lb<sub>m</sub>-R].

μ (viscosity) The dynamic viscosity is a measure of the working fluid's resistance to flow [centipoise].

k (thermal cond) The thermal conductivity is a measure of the heat conducting capability of the working fluid. Fluids with high thermal conductivity are effective at transferring energy with small temperature differences.

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

T [F]	P [psia]		p [lb/ft <sup>3</sup> ]		v [ft <sup>3</sup> /lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
-100		0.903	94.327	41.637347	-17.626	88.107	-0.0453	0.2487	0.2881	0.1573	1.5042	1.1490	0.87090	0.00801	0.87090	0.00801	0.07392	0.00317
-99		0.942	94.232	40.024592	-17.338	88.256	-0.0445	0.2483	0.2883	0.1576	1.5043	1.1488	0.86008	0.00803	0.86008	0.00803	0.07374	0.00320
-98		0.982	94.138	38.484611	-17.049	88.404	-0.0437	0.2479	0.2884	0.1580	1.5043	1.1487	0.84948	0.00805	0.84948	0.00805	0.07357	0.00322
-97		1.024	94.043	37.013698	-16.761	88.553	-0.0429	0.2475	0.2886	0.1583	1.5044	1.1485	0.83908	0.00807	0.83908	0.00807	0.07339	0.00325
-96		1.067	93.949	35.608356	-16.472	88.702	-0.0421	0.2471	0.2888	0.1586	1.5044	1.1484	0.82889	0.00809	0.82889	0.00809	0.07322	0.00327
-95		1.111	93.854	34.265281	-16.183	88.851	-0.0413	0.2467	0.2889	0.1590	1.5044	1.1482	0.81890	0.00811	0.81890	0.00811	0.07304	0.00330
-94		1.158	93.759	32.981357	-15.894	89.001	-0.0405	0.2464	0.2891	0.1593	1.5044	1.1481	0.80910	0.00814	0.80910	0.00814	0.07287	0.00333
-93		1.205	93.664	31.753636	-15.605	89.150	-0.0397	0.2460	0.2893	0.1596	1.5045	1.1479	0.79949	0.00816	0.79949	0.00816	0.07269	0.00335
-92		1.255	93.569	30.579338	-15.315	89.300	-0.0389	0.2456	0.2894	0.1600	1.5045	1.1478	0.79006	0.00818	0.79006	0.00818	0.07252	0.00338
-91		1.306	93.474	29.455830	-15.026	89.449	-0.0381	0.2453	0.2896	0.1603	1.5045	1.1477	0.78082	0.00820	0.78082	0.00820	0.07235	0.00340
-90		1.359	93.379	28.380627	-14.736	89.599	-0.0373	0.2449	0.2898	0.1607	1.5045	1.1475	0.77174	0.00822	0.77174	0.00822	0.07217	0.00343
-89		1.413	93.284	27.351376	-14.446	89.749	-0.0366	0.2445	0.2900	0.1610	1.5046	1.1474	0.76283	0.00824	0.76283	0.00824	0.07200	0.00345
-88		1.470	93.189	26.365853	-14.156	89.899	-0.0358	0.2442	0.2901	0.1613	1.5046	1.1473	0.75409	0.00826	0.75409	0.00826	0.07183	0.00348
-87		1.528	93.094	25.421951	-13.866	90.049	-0.0350	0.2438	0.2903	0.1617	1.5046	1.1472	0.74550	0.00829	0.74550	0.00829	0.07166	0.00351
-86		1.588	92.998	24.517678	-13.575	90.199	-0.0342	0.2435	0.2905	0.1620	1.5046	1.1471	0.73707	0.00831	0.73707	0.00831	0.07149	0.00353
-85		1.651	92.903	23.651146	-13.285	90.350	-0.0334	0.2432	0.2907	0.1624	1.5046	1.1470	0.72879	0.00833	0.72879	0.00833	0.07132	0.00356
-84		1.715	92.807	22.820568	-12.994	90.500	-0.0327	0.2428	0.2908	0.1627	1.5047	1.1469	0.72066	0.00835	0.72066	0.00835	0.07114	0.00358
-83		1.781	92.712	22.024250	-12.703	90.650	-0.0319	0.2425	0.2910	0.1630	1.5047	1.1468	0.71268	0.00837	0.71268	0.00837	0.07097	0.00361
-82		1.849	92.616	21.260588	-12.412	90.801	-0.0311	0.2422	0.2912	0.1634	1.5047	1.1467	0.70483	0.00839	0.70483	0.00839	0.07080	0.00364
-81		1.920	92.520	20.528060	-12.120	90.952	-0.0304	0.2418	0.2914	0.1637	1.5047	1.1466	0.69712	0.00841	0.69712	0.00841	0.07063	0.00366
-80		1.993	92.424	19.825222	-11.829	91.103	-0.0296	0.2415	0.2916	0.1641	1.5047	1.1465	0.68955	0.00843	0.68955	0.00843	0.07047	0.00369
-79		2.068	92.328	19.150708	-11.537	91.253	-0.0288	0.2412	0.2917	0.1644	1.5048	1.1464	0.68210	0.00846	0.68210	0.00846	0.07030	0.00371
-78		2.145	92.232	18.503218	-11.245	91.404	-0.0281	0.2409	0.2919	0.1648	1.5048	1.1464	0.67478	0.00848	0.67478	0.00848	0.07013	0.00374
-77		2.225	92.136	17.881521	-10.953	91.555	-0.0273	0.2406	0.2921	0.1651	1.5048	1.1463	0.66758	0.00850	0.66758	0.00850	0.06996	0.00376
-76		2.307	92.040	17.284446	-10.661	91.706	-0.0265	0.2403	0.2923	0.1655	1.5048	1.1463	0.66051	0.00852	0.66051	0.00852	0.06979	0.00379
-75		2.392	91.943	16.710884	-10.368	91.857	-0.0258	0.2400	0.2925	0.1658	1.5048	1.1462	0.65355	0.00854	0.65355	0.00854	0.06962	0.00382
-74		2.479	91.847	16.159778	-10.075	92.009	-0.0250	0.2397	0.2927	0.1662	1.5049	1.1462	0.64671	0.00856	0.64671	0.00856	0.06946	0.00384
-73		2.569	91.750	15.630128	-9.782	92.160	-0.0242	0.2394	0.2929	0.1665	1.5049	1.1461	0.63998	0.00858	0.63998	0.00858	0.06929	0.00387
-72		2.661	91.654	15.120981	-9.489	92.311	-0.0235	0.2391	0.2931	0.1669	1.5049	1.1461	0.63336	0.00860	0.63336	0.00860	0.06912	0.00389
-71		2.756	91.557	14.631432	-9.196	92.463	-0.0227	0.2388	0.2933	0.1673	1.5049	1.1461	0.62685	0.00862	0.62685	0.00862	0.06896	0.00392
-70		2.854	91.460	14.160619	-8.903	92.614	-0.0220	0.2385	0.2935	0.1676	1.5050	1.1460	0.62044	0.00865	0.62044	0.00865	0.06879	0.00395
-69		2.955	91.363	13.707724	-8.609	92.766	-0.0212	0.2383	0.2937	0.1680	1.5050	1.1460	0.61413	0.00867	0.61413	0.00867	0.06862	0.00397
-68		3.059	91.266	13.271969	-8.315	92.917	-0.0205	0.2380	0.2939	0.1683	1.5050	1.1460	0.60793	0.00869	0.60793	0.00869	0.06846	0.00400
-67		3.166	91.169	12.852612	-8.021	93.069	-0.0197	0.2377	0.2941	0.1687	1.5050	1.1460	0.60182	0.00871	0.60182	0.00871	0.06829	0.00402
-66		3.276	91.072	12.448949	-7.727	93.220	-0.0190	0.2374	0.2943	0.1691	1.5051	1.1459	0.59580	0.00873	0.59580	0.00873	0.06813	0.00405
-65		3.389	90.974	12.060307	-7.432	93.372	-0.0182	0.2372	0.2945	0.1694	1.5051	1.1459	0.58988	0.00875	0.58988	0.00875	0.06796	0.00408
-64		3.505	90.877	11.686048	-7.137	93.524	-0.0175	0.2369	0.2947	0.1698	1.5051	1.1459	0.58406	0.00877	0.58406	0.00877	0.06780	0.00410

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

T [F]	P [psia]		$\rho$ [lb/ft <sup>3</sup> ]		$v$ [ft <sup>3</sup> /lb]		$h$ [Btu/lb]		$s$ [Btu/R-lb]		$C_p$ [Btu/R-lb]		$C_p/C_v$ [unitless]		$\mu$ [centipose]		$k$ [Btu/hr-ft-R]	
	Bulk	Liquid	Bulk	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
-63	3.624	90.779	11.325562			93.676	-6.843	93.676	-0.0167	0.2367	0.2949	0.1702	1.5052	1.1460	0.57832	0.00879	0.06763	0.00413
-62	3.747	90.682	10.978270			93.827	-6.547	93.827	-0.0160	0.2364	0.2951	0.1705	1.5052	1.1460	0.57266	0.00881	0.06747	0.00415
-61	3.873	90.584	10.643618			93.979	-6.252	93.979	-0.0153	0.2361	0.2953	0.1709	1.5052	1.1460	0.56710	0.00883	0.06731	0.00418
-60	4.002	90.486	10.321080			94.131	-5.957	94.131	-0.0145	0.2359	0.2955	0.1713	1.5053	1.1460	0.56161	0.00886	0.06714	0.00420
-59	4.135	90.388	10.010153			94.283	-5.661	94.283	-0.0138	0.2357	0.2957	0.1716	1.5053	1.1460	0.55621	0.00888	0.06698	0.00423
-58	4.271	90.290	9.710358			94.435	-5.365	94.435	-0.0130	0.2354	0.2959	0.1720	1.5053	1.1461	0.55089	0.00890	0.06682	0.00426
-57	4.412	90.192	9.421238			94.586	-5.069	94.586	-0.0123	0.2352	0.2961	0.1724	1.5054	1.1461	0.54565	0.00892	0.06666	0.00428
-56	4.556	90.094	9.142357			94.738	-4.772	94.738	-0.0116	0.2349	0.2963	0.1728	1.5054	1.1462	0.54048	0.00894	0.06649	0.00431
-55	4.703	89.995	8.873298			94.890	-4.476	94.890	-0.0108	0.2347	0.2965	0.1731	1.5055	1.1462	0.53539	0.00896	0.06633	0.00433
-54	4.855	89.897	8.613665			95.042	-4.179	95.042	-0.0101	0.2345	0.2968	0.1735	1.5055	1.1463	0.53037	0.00898	0.06617	0.00436
-53	5.010	89.798	8.363079			95.194	-3.882	95.194	-0.0094	0.2342	0.2970	0.1739	1.5056	1.1464	0.52542	0.00900	0.06601	0.00439
-52	5.170	89.699	8.121177			95.346	-3.585	95.346	-0.0087	0.2340	0.2972	0.1743	1.5056	1.1464	0.52055	0.00902	0.06585	0.00441
-51	5.334	89.600	7.887614			95.498	-3.287	95.498	-0.0079	0.2338	0.2974	0.1747	1.5057	1.1465	0.51574	0.00904	0.06569	0.00444
-50	5.501	89.501	7.662059			95.650	-2.989	95.650	-0.0072	0.2336	0.2976	0.1751	1.5057	1.1466	0.51100	0.00906	0.06553	0.00446
-49	5.673	89.402	7.444196			95.801	-2.692	95.801	-0.0065	0.2334	0.2978	0.1754	1.5058	1.1467	0.50633	0.00908	0.06537	0.00449
-48	5.850	89.303	7.233723			95.953	-2.393	95.953	-0.0058	0.2331	0.2981	0.1758	1.5059	1.1468	0.50172	0.00910	0.06521	0.00452
-47	6.031	89.204	7.030353			96.105	-2.095	96.105	-0.0050	0.2329	0.2983	0.1762	1.5059	1.1469	0.49717	0.00912	0.06505	0.00454
-46	6.216	89.104	6.833808			96.257	-1.796	96.257	-0.0043	0.2327	0.2985	0.1766	1.5060	1.1470	0.49269	0.00915	0.06489	0.00457
-45	6.406	89.004	6.643826			96.409	-1.498	96.409	-0.0036	0.2325	0.2987	0.1770	1.5061	1.1471	0.48827	0.00917	0.06473	0.00460
-44	6.601	88.905	6.460154			96.560	-1.199	96.560	-0.0029	0.2323	0.2990	0.1774	1.5061	1.1472	0.48390	0.00919	0.06457	0.00462
-43	6.800	88.805	6.282550			96.712	-0.899	96.712	-0.0021	0.2321	0.2992	0.1778	1.5062	1.1473	0.47960	0.00921	0.06441	0.00465
-42	7.004	88.705	6.110783			96.864	-0.600	96.864	-0.0014	0.2319	0.2994	0.1782	1.5063	1.1475	0.47535	0.00923	0.06426	0.00467
-41	7.213	88.605	5.944632			97.015	-0.300	97.015	-0.0007	0.2317	0.2996	0.1786	1.5064	1.1476	0.47116	0.00925	0.06410	0.00470
-40	7.427	88.504	5.783885			97.167	0.000	97.167	0.0000	0.2315	0.2999	0.1790	1.5065	1.1478	0.46703	0.00927	0.06394	0.00473
-39	7.646	88.404	5.628339			97.318	0.300	97.318	0.0007	0.2313	0.3001	0.1794	1.5065	1.1479	0.46295	0.00929	0.06378	0.00475
-38	7.871	88.303	5.477800			97.470	0.601	97.470	0.0014	0.2312	0.3003	0.1798	1.5066	1.1481	0.45892	0.00931	0.06363	0.00478
-37	8.100	88.203	5.332083			97.621	0.901	97.621	0.0021	0.2310	0.3006	0.1802	1.5067	1.1482	0.45495	0.00933	0.06347	0.00480
-36	8.335	88.102	5.191007			97.773	1.202	97.773	0.0028	0.2308	0.3008	0.1807	1.5068	1.1484	0.45102	0.00935	0.06331	0.00483
-35	8.576	88.001	5.054403			97.924	1.503	97.924	0.0036	0.2306	0.3010	0.1811	1.5069	1.1486	0.44715	0.00937	0.06316	0.00486
-34	8.822	87.900	4.922107			98.075	1.805	98.075	0.0043	0.2304	0.3013	0.1815	1.5070	1.1488	0.44332	0.00939	0.06300	0.00488
-33	9.073	87.799	4.793961			98.226	2.107	98.226	0.0050	0.2302	0.3015	0.1819	1.5071	1.1490	0.43955	0.00941	0.06285	0.00491
-32	9.330	87.697	4.669816			98.377	2.408	98.377	0.0057	0.2301	0.3018	0.1823	1.5073	1.1492	0.43582	0.00943	0.06269	0.00494
-31	9.593	87.596	4.549526			98.528	2.711	98.528	0.0064	0.2299	0.3020	0.1827	1.5074	1.1494	0.43213	0.00945	0.06254	0.00496
-30	9.862	87.494	4.432953			98.679	3.013	98.679	0.0071	0.2297	0.3022	0.1832	1.5075	1.1496	0.42850	0.00947	0.06238	0.00499
-29	10.137	87.392	4.319963			98.830	3.316	98.830	0.0078	0.2296	0.3025	0.1836	1.5076	1.1498	0.42491	0.00949	0.06223	0.00501
-28	10.418	87.290	4.210430			98.981	3.619	98.981	0.0085	0.2294	0.3027	0.1840	1.5077	1.1500	0.42136	0.00951	0.06207	0.00504
-27	10.706	87.188	4.104231			99.132	3.922	99.132	0.0092	0.2292	0.3030	0.1844	1.5079	1.1503	0.41785	0.00953	0.06192	0.00507

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

T [F]	P [psia]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
-26	10.999	87.086	4.001248	99.282	0.0099	0.2291	0.3032	0.1849	1.5080	1.1505	0.41439	0.00955	0.06176	0.00509				
-25	11.299	86.983	3.901368	99.433	0.0106	0.2289	0.3035	0.1853	1.5081	1.1508	0.41097	0.00958	0.06161	0.00512				
-24	11.605	86.881	3.804483	99.583	0.0113	0.2288	0.3037	0.1858	1.5083	1.1510	0.40759	0.00960	0.06146	0.00515				
-23	11.918	86.778	3.710488	99.734	0.0120	0.2286	0.3040	0.1862	1.5084	1.1513	0.40425	0.00962	0.06130	0.00517				
-22	12.238	86.675	3.619284	99.884	0.0127	0.2285	0.3042	0.1866	1.5086	1.1515	0.40095	0.00964	0.06115	0.00520				
-21	12.564	86.572	3.530774	100.034	0.0134	0.2283	0.3045	0.1871	1.5087	1.1518	0.39769	0.00966	0.06100	0.00522				
-20	12.898	86.469	3.444866	100.184	0.0141	0.2282	0.3047	0.1875	1.5089	1.1521	0.39447	0.00968	0.06085	0.00525				
-19	13.238	86.365	3.361471	100.334	0.0147	0.2280	0.3050	0.1880	1.5091	1.1524	0.39128	0.00970	0.06069	0.00528				
-18	13.585	86.262	3.280504	100.484	0.0154	0.2279	0.3053	0.1884	1.5092	1.1527	0.38813	0.00972	0.06054	0.00530				
-17	13.940	86.158	3.201882	100.633	0.0161	0.2277	0.3055	0.1889	1.5094	1.1530	0.38502	0.00974	0.06039	0.00533				
-16	14.302	86.054	3.125527	100.783	0.0168	0.2276	0.3058	0.1893	1.5096	1.1533	0.38194	0.00976	0.06024	0.00536				
-15	14.671	85.950	3.051362	100.932	0.0175	0.2274	0.3060	0.1898	1.5098	1.1537	0.37890	0.00978	0.06009	0.00538				
-14	15.048	85.846	2.979314	101.082	0.0182	0.2273	0.3063	0.1902	1.5100	1.1540	0.37590	0.00980	0.05993	0.00541				
-13	15.432	85.742	2.909314	101.231	0.0189	0.2272	0.3066	0.1907	1.5102	1.1543	0.37292	0.00982	0.05978	0.00544				
-12	15.824	85.637	2.841292	101.380	0.0196	0.2270	0.3068	0.1912	1.5104	1.1547	0.36998	0.00984	0.05963	0.00546				
-11	16.224	85.532	2.775185	101.529	0.0202	0.2269	0.3071	0.1916	1.5106	1.1550	0.36707	0.00986	0.05948	0.00549				
-10	16.632	85.427	2.710929	101.677	0.0209	0.2268	0.3074	0.1921	1.5108	1.1554	0.36420	0.00988	0.05933	0.00552				
-9	17.048	85.322	2.648464	101.826	0.0216	0.2266	0.3077	0.1926	1.5110	1.1558	0.36135	0.00990	0.05918	0.00554				
-8	17.472	85.217	2.587732	101.974	0.0223	0.2265	0.3079	0.1931	1.5112	1.1561	0.35854	0.00992	0.05903	0.00557				
-7	17.904	85.111	2.528676	102.123	0.0230	0.2264	0.3082	0.1935	1.5114	1.1565	0.35576	0.00994	0.05888	0.00560				
-6	18.345	85.006	2.471244	102.271	0.0237	0.2263	0.3085	0.1940	1.5117	1.1569	0.35300	0.00996	0.05873	0.00562				
-5	18.794	84.900	2.415381	102.419	0.0243	0.2262	0.3088	0.1945	1.5119	1.1573	0.35028	0.00998	0.05858	0.00565				
-4	19.252	84.794	2.361040	102.567	0.0250	0.2260	0.3090	0.1950	1.5121	1.1578	0.34758	0.01000	0.05844	0.00568				
-3	19.718	84.687	2.308170	102.714	0.0257	0.2259	0.3093	0.1955	1.5124	1.1582	0.34492	0.01002	0.05829	0.00570				
-2	20.193	84.581	2.256727	102.862	0.0264	0.2258	0.3096	0.1960	1.5126	1.1586	0.34228	0.01004	0.05814	0.00573				
-1	20.678	84.474	2.206664	103.009	0.0270	0.2257	0.3099	0.1965	1.5129	1.1590	0.33967	0.01006	0.05799	0.00576				
0	21.171	84.368	2.157938	103.156	0.0277	0.2256	0.3102	0.1969	1.5132	1.1595	0.33709	0.01008	0.05784	0.00578				
1	21.673	84.261	2.110508	103.303	0.0284	0.2255	0.3105	0.1974	1.5134	1.1600	0.33453	0.01010	0.05769	0.00581				
2	22.185	84.153	2.064334	103.450	0.0291	0.2253	0.3108	0.1979	1.5137	1.1604	0.33200	0.01012	0.05755	0.00584				
3	22.706	84.046	2.019376	103.596	0.0297	0.2252	0.3111	0.1985	1.5140	1.1609	0.32950	0.01014	0.05740	0.00586				
4	23.237	83.938	1.975597	103.743	0.0304	0.2251	0.3114	0.1990	1.5143	1.1614	0.32702	0.01016	0.05725	0.00589				
5	23.777	83.830	1.932961	103.889	0.0311	0.2250	0.3117	0.1995	1.5146	1.1619	0.32456	0.01018	0.05710	0.00592				
6	24.328	83.722	1.891433	104.035	0.0317	0.2249	0.3120	0.2000	1.5149	1.1624	0.32214	0.01020	0.05696	0.00594				
7	24.888	83.614	1.850979	104.181	0.0324	0.2248	0.3123	0.2005	1.5152	1.1629	0.31973	0.01022	0.05681	0.00597				
8	25.458	83.505	1.811566	104.326	0.0331	0.2247	0.3126	0.2010	1.5155	1.1634	0.31735	0.01024	0.05666	0.00600				
9	26.038	83.397	1.773164	104.472	0.0337	0.2246	0.3129	0.2015	1.5158	1.1640	0.31499	0.01026	0.05652	0.00603				
10	26.628	83.288	1.735742	104.617	0.0344	0.2245	0.3132	0.2021	1.5162	1.1645	0.31266	0.01028	0.05637	0.00605				

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

T [F]	P [psia]		$\rho$ [lb/ft <sup>3</sup> ]		$v$ [ft <sup>3</sup> /lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		$\mu$ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
11	27.229	83.179	1.699271	15.642	104.762	0.0351	0.2244	0.3135	0.2026	1.5165	1.1651	0.31035	0.01030	0.05623	0.00608			
12	27.840	83.069	1.663721	15.956	104.907	0.0357	0.2243	0.3138	0.2031	1.5169	1.1656	0.30806	0.01032	0.05608	0.00611			
13	28.462	82.960	1.629067	16.271	105.051	0.0364	0.2242	0.3141	0.2037	1.5172	1.1662	0.30579	0.01034	0.05593	0.00613			
14	29.095	82.850	1.595281	16.586	105.195	0.0371	0.2241	0.3144	0.2042	1.5176	1.1668	0.30355	0.01036	0.05579	0.00616			
15	29.739	82.740	1.562338	16.901	105.339	0.0377	0.2240	0.3147	0.2047	1.5179	1.1674	0.30133	0.01038	0.05564	0.00619			
16	30.393	82.629	1.530214	17.216	105.483	0.0384	0.2239	0.3151	0.2053	1.5183	1.1680	0.29912	0.01040	0.05550	0.00622			
17	31.059	82.519	1.498883	17.532	105.627	0.0390	0.2239	0.3154	0.2058	1.5187	1.1686	0.29694	0.01042	0.05535	0.00624			
18	31.736	82.408	1.468324	17.848	105.770	0.0397	0.2238	0.3157	0.2064	1.5191	1.1692	0.29478	0.01044	0.05521	0.00627			
19	32.424	82.297	1.438514	18.165	105.913	0.0404	0.2237	0.3160	0.2069	1.5195	1.1699	0.29264	0.01046	0.05506	0.00630			
20	33.124	82.186	1.409432	18.481	106.056	0.0410	0.2236	0.3164	0.2075	1.5199	1.1705	0.29052	0.01048	0.05492	0.00632			
21	33.835	82.074	1.381056	18.798	106.199	0.0417	0.2235	0.3167	0.2080	1.5203	1.1712	0.28842	0.01050	0.05478	0.00635			
22	34.559	81.962	1.353366	19.116	106.341	0.0423	0.2234	0.3170	0.2086	1.5207	1.1719	0.28634	0.01052	0.05463	0.00638			
23	35.294	81.850	1.326343	19.434	106.483	0.0430	0.2233	0.3174	0.2092	1.5212	1.1726	0.28428	0.01054	0.05449	0.00641			
24	36.041	81.738	1.299968	19.752	106.625	0.0436	0.2232	0.3177	0.2097	1.5216	1.1733	0.28223	0.01056	0.05434	0.00643			
25	36.800	81.626	1.274223	20.070	106.767	0.0443	0.2232	0.3181	0.2103	1.5221	1.1740	0.28021	0.01058	0.05420	0.00646			
26	37.572	81.513	1.249090	20.389	106.908	0.0449	0.2231	0.3184	0.2109	1.5225	1.1747	0.27820	0.01060	0.05406	0.00649			
27	38.356	81.400	1.224551	20.708	107.049	0.0456	0.2230	0.3187	0.2115	1.5230	1.1754	0.27621	0.01062	0.05391	0.00652			
28	39.153	81.286	1.200591	21.027	107.190	0.0462	0.2229	0.3191	0.2121	1.5235	1.1762	0.27424	0.01064	0.05377	0.00655			
29	39.962	81.173	1.177193	21.347	107.330	0.0469	0.2229	0.3194	0.2127	1.5240	1.1769	0.27229	0.01067	0.05363	0.00657			
30	40.784	81.059	1.154342	21.667	107.471	0.0476	0.2228	0.3198	0.2132	1.5245	1.1777	0.27035	0.01069	0.05349	0.00660			
31	41.619	80.945	1.132022	21.988	107.611	0.0482	0.2227	0.3202	0.2138	1.5250	1.1785	0.26843	0.01071	0.05334	0.00663			
32	42.468	80.830	1.110219	22.309	107.750	0.0489	0.2226	0.3205	0.2144	1.5255	1.1793	0.26653	0.01073	0.05320	0.00666			
33	43.329	80.716	1.088919	22.630	107.890	0.0495	0.2226	0.3209	0.2150	1.5260	1.1801	0.26464	0.01075	0.05306	0.00669			
34	44.204	80.601	1.068108	22.952	108.029	0.0501	0.2225	0.3212	0.2157	1.5266	1.1809	0.26277	0.01077	0.05292	0.00671			
35	45.092	80.485	1.047773	23.274	108.167	0.0508	0.2224	0.3216	0.2163	1.5271	1.1818	0.26091	0.01079	0.05277	0.00674			
36	45.994	80.370	1.027901	23.596	108.306	0.0514	0.2223	0.3220	0.2169	1.5277	1.1826	0.25908	0.01081	0.05263	0.00677			
37	46.910	80.254	1.008480	23.919	108.444	0.0521	0.2223	0.3224	0.2175	1.5282	1.1835	0.25725	0.01083	0.05249	0.00680			
38	47.840	80.138	0.989497	24.242	108.582	0.0527	0.2222	0.3227	0.2181	1.5288	1.1844	0.25544	0.01085	0.05235	0.00683			
39	48.783	80.021	0.970941	24.566	108.719	0.0534	0.2221	0.3231	0.2188	1.5294	1.1853	0.25365	0.01087	0.05221	0.00685			
40	49.741	79.904	0.952801	24.890	108.856	0.0540	0.2221	0.3235	0.2194	1.5300	1.1862	0.25187	0.01089	0.05207	0.00688			
41	50.714	79.787	0.935065	25.214	108.993	0.0547	0.2220	0.3239	0.2200	1.5306	1.1871	0.25011	0.01091	0.05192	0.00691			
42	51.701	79.670	0.917723	25.538	109.130	0.0553	0.2219	0.3243	0.2207	1.5312	1.1880	0.24836	0.01093	0.05178	0.00694			
43	52.702	79.552	0.900764	25.864	109.266	0.0560	0.2219	0.3247	0.2213	1.5319	1.1890	0.24663	0.01095	0.05164	0.00697			
44	53.718	79.434	0.884179	26.189	109.401	0.0566	0.2218	0.3251	0.2220	1.5325	1.1900	0.24491	0.01097	0.05150	0.00700			
45	54.749	79.316	0.867957	26.515	109.537	0.0572	0.2217	0.3255	0.2226	1.5332	1.1910	0.24320	0.01099	0.05136	0.00703			
46	55.795	79.197	0.852090	26.841	109.672	0.0579	0.2217	0.3259	0.2233	1.5339	1.1920	0.24151	0.01102	0.05122	0.00705			
47	56.857	79.078	0.836567	27.168	109.807	0.0585	0.2216	0.3263	0.2239	1.5345	1.1930	0.23983	0.01104	0.05108	0.00708			



**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

T [F]	P [psia]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
48	57.934	78.959	0.821381	27.495	109.941	0.0592	0.2216	0.3267	0.2246	1.5352	1.1940	0.23816	0.01106	0.05094	0.00711			
49	59.026	78.839	0.806522	27.822	110.075	0.0598	0.2215	0.3271	0.2253	1.5360	1.1951	0.23651	0.01108	0.05080	0.00714			
50	60.134	78.719	0.791983	28.150	110.209	0.0604	0.2214	0.3275	0.2260	1.5367	1.1961	0.23487	0.01110	0.05066	0.00717			
51	61.257	78.599	0.777754	28.478	110.342	0.0611	0.2214	0.3279	0.2267	1.5374	1.1972	0.23324	0.01112	0.05052	0.00720			
52	62.397	78.478	0.763829	28.807	110.475	0.0617	0.2213	0.3284	0.2273	1.5382	1.1983	0.23162	0.01114	0.05038	0.00723			
53	63.553	78.357	0.750199	29.136	110.607	0.0623	0.2213	0.3288	0.2280	1.5389	1.1995	0.23002	0.01116	0.05024	0.00726			
54	64.725	78.235	0.736857	29.466	110.739	0.0630	0.2212	0.3292	0.2287	1.5397	1.2006	0.22843	0.01118	0.05010	0.00729			
55	65.913	78.114	0.723796	29.796	110.871	0.0636	0.2212	0.3297	0.2294	1.5405	1.2018	0.22685	0.01120	0.04996	0.00732			
56	67.118	77.991	0.711009	30.126	111.002	0.0643	0.2211	0.3301	0.2302	1.5413	1.2030	0.22529	0.01123	0.04982	0.00735			
57	68.339	77.869	0.698489	30.457	111.133	0.0649	0.2210	0.3306	0.2309	1.5422	1.2042	0.22373	0.01125	0.04968	0.00738			
58	69.577	77.746	0.686228	30.788	111.264	0.0655	0.2210	0.3310	0.2316	1.5430	1.2054	0.22219	0.01127	0.04954	0.00741			
59	70.833	77.623	0.674222	31.120	111.394	0.0662	0.2209	0.3315	0.2323	1.5439	1.2066	0.22066	0.01129	0.04940	0.00744			
60	72.105	77.499	0.662464	31.452	111.524	0.0668	0.2209	0.3319	0.2331	1.5447	1.2079	0.21914	0.01131	0.04926	0.00747			
61	73.395	77.375	0.650946	31.785	111.653	0.0674	0.2208	0.3324	0.2338	1.5456	1.2092	0.21763	0.01133	0.04912	0.00750			
62	74.702	77.250	0.639665	32.118	111.782	0.0681	0.2208	0.3329	0.2345	1.5465	1.2105	0.21613	0.01136	0.04898	0.00753			
63	76.027	77.126	0.628613	32.451	111.910	0.0687	0.2207	0.3333	0.2353	1.5474	1.2118	0.21464	0.01138	0.04885	0.00756			
64	77.369	77.000	0.617786	32.785	112.038	0.0693	0.2207	0.3338	0.2361	1.5484	1.2132	0.21317	0.01140	0.04871	0.00759			
65	78.729	76.875	0.607177	33.120	112.165	0.0700	0.2206	0.3343	0.2368	1.5493	1.2145	0.21170	0.01142	0.04857	0.00762			
66	80.108	76.749	0.596783	33.455	112.292	0.0706	0.2206	0.3348	0.2376	1.5503	1.2159	0.21025	0.01144	0.04843	0.00765			
67	81.504	76.622	0.586596	33.790	112.419	0.0712	0.2205	0.3353	0.2384	1.5513	1.2173	0.20880	0.01147	0.04829	0.00768			
68	82.919	76.495	0.576613	34.126	112.545	0.0719	0.2205	0.3358	0.2392	1.5523	1.2188	0.20737	0.01149	0.04815	0.00771			
69	84.353	76.368	0.566829	34.462	112.670	0.0725	0.2204	0.3363	0.2400	1.5533	1.2203	0.20594	0.01151	0.04801	0.00774			
70	85.805	76.240	0.557238	34.799	112.796	0.0731	0.2204	0.3368	0.2408	1.5544	1.2217	0.20453	0.01153	0.04788	0.00777			
71	87.276	76.112	0.547837	35.136	112.920	0.0737	0.2203	0.3373	0.2416	1.5555	1.2233	0.20312	0.01156	0.04774	0.00780			
72	88.765	75.983	0.538620	35.474	113.044	0.0744	0.2203	0.3378	0.2424	1.5566	1.2248	0.20173	0.01158	0.04760	0.00783			
73	90.274	75.854	0.529584	35.813	113.168	0.0750	0.2202	0.3383	0.2432	1.5577	1.2264	0.20034	0.01160	0.04746	0.00787			
74	91.803	75.724	0.520724	36.151	113.291	0.0756	0.2202	0.3389	0.2440	1.5588	1.2280	0.19896	0.01162	0.04732	0.00790			
75	93.351	75.594	0.512037	36.491	113.414	0.0763	0.2201	0.3394	0.2449	1.5599	1.2296	0.19759	0.01165	0.04719	0.00793			
76	94.918	75.464	0.503517	36.831	113.536	0.0769	0.2201	0.3399	0.2457	1.5611	1.2313	0.19624	0.01167	0.04705	0.00796			
77	96.505	75.333	0.495162	37.171	113.657	0.0775	0.2200	0.3405	0.2466	1.5623	1.2329	0.19489	0.01169	0.04691	0.00799			
78	98.113	75.201	0.486967	37.512	113.778	0.0781	0.2200	0.3410	0.2474	1.5635	1.2347	0.19355	0.01172	0.04677	0.00803			
79	99.740	75.069	0.478929	37.853	113.899	0.0788	0.2199	0.3416	0.2483	1.5648	1.2364	0.19221	0.01174	0.04663	0.00806			
80	101.387	74.937	0.471043	38.195	114.019	0.0794	0.2199	0.3422	0.2492	1.5660	1.2382	0.19089	0.01176	0.04650	0.00809			
81	103.055	74.804	0.463308	38.538	114.138	0.0800	0.2198	0.3427	0.2501	1.5673	1.2400	0.18958	0.01179	0.04636	0.00812			
82	104.744	74.670	0.455718	38.881	114.257	0.0806	0.2198	0.3433	0.2510	1.5686	1.2418	0.18827	0.01181	0.04622	0.00816			
83	106.453	74.536	0.448272	39.224	114.375	0.0813	0.2198	0.3439	0.2519	1.5700	1.2437	0.18697	0.01183	0.04608	0.00819			
84	108.184	74.402	0.440965	39.568	114.493	0.0819	0.2197	0.3445	0.2528	1.5713	1.2456	0.18568	0.01186	0.04595	0.00822			

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

T [F]	P [psia]		$v$ [ft <sup>3</sup> /lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		$\mu$ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
85	109.935	74.266	0.433794	114.610	39.913	114.610	0.0825	0.2197	0.3451	0.2537	1.5727	1.2475	0.18440	0.01188	0.04581	0.00826
86	111.708	74.131	0.426757	114.726	40.258	114.726	0.0831	0.2196	0.3457	0.2547	1.5741	1.2495	0.18313	0.01191	0.04567	0.00829
87	113.502	73.995	0.419851	114.842	40.604	114.842	0.0838	0.2196	0.3463	0.2556	1.5756	1.2515	0.18186	0.01193	0.04553	0.00832
88	115.317	73.858	0.413071	114.957	40.951	114.957	0.0844	0.2195	0.3470	0.2566	1.5770	1.2535	0.18060	0.01196	0.04540	0.00836
89	117.155	73.721	0.406417	115.072	41.298	115.072	0.0850	0.2195	0.3476	0.2575	1.5785	1.2556	0.17935	0.01198	0.04526	0.00839
90	119.014	73.583	0.399884	115.186	41.645	115.186	0.0856	0.2194	0.3482	0.2585	1.5801	1.2578	0.17811	0.01201	0.04512	0.00842
91	120.895	73.444	0.393471	115.299	41.993	115.299	0.0863	0.2194	0.3489	0.2595	1.5816	1.2599	0.17687	0.01203	0.04498	0.00846
92	122.799	73.305	0.387174	115.412	42.342	115.412	0.0869	0.2193	0.3495	0.2605	1.5832	1.2621	0.17565	0.01206	0.04485	0.00849
93	124.725	73.166	0.380991	115.524	42.692	115.524	0.0875	0.2193	0.3502	0.2615	1.5848	1.2644	0.17442	0.01208	0.04471	0.00853
94	126.674	73.026	0.374919	115.635	43.042	115.635	0.0881	0.2193	0.3509	0.2625	1.5865	1.2667	0.17321	0.01211	0.04457	0.00856
95	128.646	72.885	0.368956	115.746	43.392	115.746	0.0888	0.2192	0.3515	0.2636	1.5882	1.2690	0.17200	0.01213	0.04443	0.00860
96	130.640	72.743	0.363100	115.856	43.743	115.856	0.0894	0.2192	0.3522	0.2646	1.5899	1.2714	0.17081	0.01216	0.04430	0.00864
97	132.658	72.601	0.357349	115.965	44.095	115.965	0.0900	0.2191	0.3529	0.2657	1.5916	1.2738	0.16961	0.01218	0.04416	0.00867
98	134.699	72.459	0.351699	116.074	44.448	116.074	0.0906	0.2191	0.3537	0.2668	1.5934	1.2763	0.16843	0.01221	0.04402	0.00871
99	136.763	72.315	0.346150	116.181	44.801	116.181	0.0913	0.2190	0.3544	0.2679	1.5952	1.2788	0.16725	0.01224	0.04389	0.00874
100	138.852	72.171	0.340698	116.289	45.155	116.289	0.0919	0.2190	0.3551	0.2690	1.5971	1.2813	0.16607	0.01226	0.04375	0.00878
101	140.964	72.027	0.335341	116.395	45.509	116.395	0.0925	0.2189	0.3558	0.2701	1.5990	1.2840	0.16491	0.01229	0.04361	0.00882
102	143.100	71.881	0.330078	116.500	45.864	116.500	0.0931	0.2189	0.3566	0.2712	1.6009	1.2866	0.16375	0.01232	0.04347	0.00886
103	145.260	71.735	0.324907	116.605	46.220	116.605	0.0938	0.2188	0.3574	0.2724	1.6029	1.2894	0.16260	0.01235	0.04334	0.00889
104	147.444	71.589	0.319825	116.709	46.577	116.709	0.0944	0.2188	0.3581	0.2735	1.6049	1.2921	0.16145	0.01237	0.04320	0.00893
105	149.653	71.441	0.314831	116.813	46.934	116.813	0.0950	0.2187	0.3589	0.2747	1.6070	1.2950	0.16031	0.01240	0.04306	0.00897
106	151.887	71.293	0.309923	116.915	47.292	116.915	0.0956	0.2187	0.3597	0.2759	1.6091	1.2979	0.15917	0.01243	0.04292	0.00901
107	154.146	71.144	0.305099	117.017	47.651	117.017	0.0962	0.2187	0.3605	0.2771	1.6112	1.3008	0.15804	0.01246	0.04279	0.00905
108	156.430	70.995	0.300357	117.118	48.010	117.118	0.0969	0.2186	0.3613	0.2784	1.6134	1.3038	0.15692	0.01249	0.04265	0.00909
109	158.739	70.844	0.295696	117.218	48.370	117.218	0.0975	0.2186	0.3622	0.2796	1.6157	1.3069	0.15580	0.01251	0.04251	0.00912
110	161.074	70.693	0.291113	117.317	48.731	117.317	0.0981	0.2185	0.3630	0.2809	1.6179	1.3101	0.15469	0.01254	0.04237	0.00916
111	163.434	70.541	0.286608	117.415	49.092	117.415	0.0987	0.2185	0.3639	0.2822	1.6203	1.3133	0.15359	0.01257	0.04224	0.00921
112	165.821	70.388	0.282178	117.512	49.455	117.512	0.0994	0.2184	0.3647	0.2835	1.6226	1.3166	0.15249	0.01260	0.04210	0.00925
113	168.233	70.235	0.277823	117.609	49.818	117.609	0.1000	0.2184	0.3656	0.2848	1.6251	1.3199	0.15139	0.01263	0.04196	0.00929
114	170.671	70.081	0.273539	117.704	50.182	117.704	0.1006	0.2183	0.3665	0.2862	1.6276	1.3233	0.15030	0.01266	0.04182	0.00933
115	173.136	69.925	0.269327	117.799	50.546	117.799	0.1012	0.2183	0.3675	0.2875	1.6301	1.3268	0.14922	0.01269	0.04169	0.00937
116	175.628	69.769	0.265184	117.893	50.912	117.893	0.1019	0.2182	0.3684	0.2889	1.6327	1.3304	0.14814	0.01272	0.04155	0.00941
117	178.146	69.612	0.261110	117.985	51.278	117.985	0.1025	0.2182	0.3693	0.2904	1.6353	1.3341	0.14707	0.01276	0.04141	0.00945
118	180.691	69.455	0.257101	118.077	51.645	118.077	0.1031	0.2181	0.3703	0.2918	1.6381	1.3378	0.14600	0.01279	0.04127	0.00950
119	183.264	69.296	0.253159	118.168	52.013	118.168	0.1037	0.2181	0.3713	0.2933	1.6408	1.3417	0.14493	0.01282	0.04113	0.00954
120	185.863	69.137	0.249280	118.258	52.382	118.258	0.1044	0.2180	0.3723	0.2948	1.6437	1.3456	0.14388	0.01285	0.04100	0.00959
121	188.491	68.976	0.245464	118.346	52.752	118.346	0.1050	0.2179	0.3733	0.2963	1.6466	1.3496	0.14282	0.01288	0.04086	0.00963

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

T [F]	P [psia]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
122	191.146	68.815	0.241709	53.122	118.434	0.1056	0.2179	0.3743	0.2978	1.6495	1.3537	0.14177	0.01292	0.04072	0.00968			
123	193.829	68.652	0.238015	53.493	118.520	0.1062	0.2178	0.3754	0.2994	1.6526	1.3579	0.14073	0.01295	0.04058	0.00972			
124	196.541	68.489	0.234379	53.866	118.606	0.1069	0.2178	0.3764	0.3010	1.6557	1.3622	0.13969	0.01298	0.04044	0.00977			
125	199.280	68.325	0.230801	54.239	118.690	0.1075	0.2177	0.3775	0.3026	1.6589	1.3666	0.13865	0.01302	0.04030	0.00981			
126	202.049	68.159	0.227280	54.613	118.774	0.1081	0.2177	0.3786	0.3043	1.6621	1.3711	0.13762	0.01305	0.04017	0.00986			
127	204.846	67.993	0.223814	54.988	118.856	0.1087	0.2176	0.3798	0.3060	1.6654	1.3757	0.13660	0.01309	0.04003	0.00991			
128	207.672	67.826	0.220402	55.364	118.937	0.1094	0.2175	0.3809	0.3077	1.6688	1.3805	0.13557	0.01312	0.03989	0.00996			
129	210.527	67.657	0.217043	55.741	119.016	0.1100	0.2175	0.3821	0.3095	1.6723	1.3854	0.13456	0.01316	0.03975	0.01001			
130	213.412	67.488	0.213737	56.119	119.095	0.1106	0.2174	0.3833	0.3112	1.6759	1.3903	0.13354	0.01320	0.03961	0.01006			
131	216.326	67.317	0.210482	56.497	119.172	0.1112	0.2174	0.3845	0.3131	1.6796	1.3955	0.13253	0.01323	0.03947	0.01011			
132	219.270	67.145	0.207276	56.877	119.248	0.1119	0.2173	0.3858	0.3149	1.6833	1.4007	0.13153	0.01327	0.03933	0.01016			
133	222.244	66.972	0.204120	57.258	119.323	0.1125	0.2172	0.3871	0.3169	1.6872	1.4061	0.13052	0.01331	0.03919	0.01021			
134	225.248	66.798	0.201012	57.640	119.396	0.1131	0.2172	0.3884	0.3188	1.6912	1.4116	0.12953	0.01335	0.03905	0.01026			
135	228.283	66.623	0.197951	58.023	119.468	0.1138	0.2171	0.3897	0.3208	1.6952	1.4173	0.12853	0.01338	0.03891	0.01032			
136	231.349	66.447	0.194936	58.407	119.539	0.1144	0.2170	0.3910	0.3228	1.6994	1.4231	0.12754	0.01342	0.03877	0.01037			
137	234.445	66.269	0.191967	58.792	119.608	0.1150	0.2170	0.3924	0.3249	1.7036	1.4291	0.12656	0.01346	0.03863	0.01043			
138	237.573	66.090	0.189042	59.178	119.676	0.1157	0.2169	0.3939	0.3270	1.7080	1.4353	0.12557	0.01350	0.03849	0.01048			
139	240.732	65.910	0.186160	59.566	119.742	0.1163	0.2168	0.3953	0.3292	1.7125	1.4416	0.12459	0.01355	0.03835	0.01054			
140	243.922	65.728	0.183321	59.954	119.807	0.1169	0.2167	0.3968	0.3315	1.7171	1.4481	0.12361	0.01359	0.03821	0.01060			
141	247.144	65.545	0.180523	60.344	119.871	0.1176	0.2167	0.3983	0.3337	1.7219	1.4548	0.12264	0.01363	0.03807	0.01065			
142	250.399	65.361	0.177767	60.735	119.933	0.1182	0.2166	0.3999	0.3361	1.7267	1.4617	0.12167	0.01367	0.03793	0.01071			
143	253.685	65.175	0.175050	61.127	119.993	0.1188	0.2165	0.4015	0.3385	1.7317	1.4688	0.12070	0.01372	0.03779	0.01077			
144	257.004	64.988	0.172373	61.520	120.051	0.1195	0.2164	0.4031	0.3409	1.7369	1.4761	0.11974	0.01376	0.03765	0.01084			
145	260.356	64.799	0.169735	61.915	120.108	0.1201	0.2163	0.4048	0.3435	1.7422	1.4837	0.11878	0.01381	0.03751	0.01090			
146	263.741	64.609	0.167134	62.311	120.163	0.1207	0.2163	0.4065	0.3460	1.7476	1.4914	0.11782	0.01385	0.03737	0.01096			
147	267.159	64.417	0.164570	62.708	120.217	0.1214	0.2162	0.4082	0.3487	1.7533	1.4994	0.11686	0.01390	0.03723	0.01103			
148	270.610	64.224	0.162042	63.107	120.269	0.1220	0.2161	0.4100	0.3514	1.7590	1.5077	0.11591	0.01395	0.03708	0.01109			
149	274.095	64.029	0.159550	63.507	120.318	0.1227	0.2160	0.4119	0.3542	1.7650	1.5162	0.11496	0.01400	0.03694	0.01116			
150	277.615	63.832	0.157092	63.908	120.366	0.1233	0.2159	0.4138	0.3571	1.7711	1.5250	0.11401	0.01405	0.03680	0.01123			
151	281.168	63.634	0.154669	64.311	120.412	0.1239	0.2158	0.4158	0.3601	1.7775	1.5341	0.11307	0.01410	0.03666	0.01130			
152	284.755	63.434	0.152279	64.715	120.457	0.1246	0.2157	0.4178	0.3632	1.7840	1.5435	0.11212	0.01415	0.03652	0.01137			
153	288.378	63.232	0.149921	65.120	120.499	0.1252	0.2156	0.4198	0.3663	1.7907	1.5533	0.11118	0.01420	0.03637	0.01145			
154	292.035	63.028	0.147596	65.528	120.539	0.1259	0.2155	0.4220	0.3696	1.7977	1.5633	0.11024	0.01425	0.03623	0.01152			
155	295.728	62.822	0.145302	65.936	120.576	0.1265	0.2154	0.4242	0.3729	1.8048	1.5738	0.10931	0.01431	0.03609	0.01160			
156	299.456	62.615	0.143039	66.347	120.612	0.1272	0.2153	0.4264	0.3764	1.8122	1.5845	0.10837	0.01436	0.03594	0.01167			
157	303.220	62.405	0.140806	66.759	120.645	0.1278	0.2152	0.4287	0.3799	1.8199	1.5957	0.10744	0.01442	0.03580	0.01175			
158	307.020	62.194	0.138602	67.172	120.676	0.1285	0.2151	0.4311	0.3836	1.8278	1.6073	0.10651	0.01448	0.03566	0.01184			

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

T [F]	P [psia]		$\rho$ [lb/ft <sup>3</sup> ]		$v$ [ft <sup>3</sup> /lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		$\mu$ [centipose]		k [Btu/hr-ft-R]	
	Bulk		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
159	310.856		61.980	0.136427	67.588	120.705	0.1291	0.2150	0.4336	0.3874	1.8361	1.6194	0.10557	0.01453	0.03551	0.01192		
160	314.729		61.764	0.134281	68.005	120.731	0.1298	0.2149	0.4362	0.3914	1.8446	1.6318	0.10465	0.01459	0.03537	0.01200		
161	318.638		61.546	0.132162	68.424	120.755	0.1304	0.2148	0.4388	0.3955	1.8534	1.6448	0.10372	0.01466	0.03523	0.01209		
162	322.585		61.326	0.130069	68.844	120.776	0.1311	0.2146	0.4416	0.3997	1.8625	1.6583	0.10279	0.01472	0.03508	0.01218		
163	326.569		61.103	0.128004	69.267	120.795	0.1318	0.2145	0.4444	0.4041	1.8720	1.6723	0.10187	0.01478	0.03494	0.01227		
164	330.591		60.877	0.125964	69.692	120.810	0.1324	0.2144	0.4474	0.4086	1.8818	1.6869	0.10094	0.01485	0.03479	0.01237		
165	334.651		60.650	0.123949	70.118	120.823	0.1331	0.2143	0.4504	0.4134	1.8921	1.7022	0.10002	0.01491	0.03465	0.01246		
166	338.750		60.419	0.121959	70.547	120.833	0.1338	0.2141	0.4536	0.4183	1.9027	1.7180	0.09909	0.01498	0.03450	0.01256		
167	342.887		60.186	0.119994	70.978	120.840	0.1344	0.2140	0.4569	0.4234	1.9138	1.7346	0.09817	0.01505	0.03436	0.01266		
168	347.063		59.950	0.118051	71.411	120.844	0.1351	0.2138	0.4603	0.4287	1.9253	1.7519	0.09725	0.01513	0.03421	0.01277		
169	351.278		59.711	0.116132	71.846	120.844	0.1358	0.2137	0.4638	0.4343	1.9374	1.7700	0.09632	0.01520	0.03406	0.01288		
170	355.533		59.469	0.114235	72.283	120.842	0.1364	0.2136	0.4675	0.4400	1.9499	1.7889	0.09540	0.01527	0.03392	0.01299		
171	359.828		59.224	0.112360	72.723	120.835	0.1371	0.2134	0.4714	0.4461	1.9630	1.8087	0.09448	0.01535	0.03377	0.01310		
172	364.163		58.976	0.110506	73.166	120.825	0.1378	0.2132	0.4754	0.4524	1.9767	1.8295	0.09355	0.01543	0.03363	0.01322		
173	368.539		58.725	0.108673	73.611	120.812	0.1385	0.2131	0.4796	0.4590	1.9911	1.8513	0.09263	0.01551	0.03348	0.01334		
174	372.956		58.470	0.106860	74.059	120.794	0.1392	0.2129	0.4840	0.4660	2.0061	1.8742	0.09170	0.01560	0.03333	0.01346		
175	377.414		58.211	0.105067	74.509	120.773	0.1399	0.2127	0.4887	0.4733	2.0219	1.8984	0.09077	0.01568	0.03319	0.01359		
176	381.914		57.948	0.103293	74.963	120.747	0.1405	0.2126	0.4935	0.4809	2.0385	1.9238	0.08985	0.01577	0.03304	0.01372		
177	386.456		57.682	0.101537	75.419	120.717	0.1412	0.2124	0.4986	0.4890	2.0560	1.9506	0.08892	0.01586	0.03289	0.01386		
178	391.040		57.411	0.099799	75.878	120.682	0.1419	0.2122	0.5040	0.4975	2.0744	1.9789	0.08798	0.01596	0.03275	0.01400		
179	395.668		57.136	0.098079	76.341	120.643	0.1426	0.2120	0.5096	0.5065	2.0938	2.0088	0.08705	0.01606	0.03260	0.01415		
180	400.339		56.857	0.096375	76.807	120.598	0.1433	0.2118	0.5156	0.5159	2.1143	2.0405	0.08611	0.01616	0.03246	0.01430		
181	405.053		56.573	0.094687	77.277	120.549	0.1441	0.2116	0.5219	0.5260	2.1360	2.0742	0.08517	0.01626	0.03231	0.01446		
182	409.811		56.284	0.093015	77.750	120.494	0.1448	0.2114	0.5286	0.5366	2.1590	2.1099	0.08423	0.01637	0.03216	0.01462		
183	414.614		55.989	0.091358	78.227	120.433	0.1455	0.2112	0.5357	0.5480	2.1835	2.1480	0.08328	0.01648	0.03202	0.01479		
184	419.463		55.690	0.089714	78.708	120.367	0.1462	0.2109	0.5432	0.5600	2.2096	2.1887	0.08233	0.01659	0.03187	0.01497		
185	424.356		55.384	0.088085	79.193	120.294	0.1469	0.2107	0.5512	0.5729	2.2374	2.2321	0.08137	0.01671	0.03173	0.01515		
186	429.296		55.072	0.086468	79.683	120.214	0.1477	0.2104	0.5598	0.5867	2.2672	2.2787	0.08041	0.01683	0.03159	0.01534		
187	434.282		54.754	0.084864	80.178	120.128	0.1484	0.2102	0.5691	0.6015	2.2991	2.3288	0.07944	0.01696	0.03144	0.01554		
188	439.315		54.428	0.083270	80.677	120.034	0.1492	0.2099	0.5790	0.6174	2.3334	2.3827	0.07847	0.01710	0.03130	0.01575		
189	444.395		54.096	0.081688	81.182	119.932	0.1499	0.2096	0.5896	0.6346	2.3705	2.4410	0.07749	0.01723	0.03116	0.01597		
190	449.523		53.755	0.080115	81.692	119.821	0.1507	0.2094	0.6012	0.6532	2.4106	2.5041	0.07650	0.01738	0.03103	0.01620		
191	454.700		53.407	0.078550	82.209	119.702	0.1514	0.2091	0.6137	0.6734	2.4541	2.5726	0.07550	0.01753	0.03089	0.01644		
192	459.926		53.049	0.076994	82.732	119.574	0.1522	0.2087	0.6274	0.6953	2.5016	2.6475	0.07450	0.01769	0.03076	0.01669		
193	465.202		52.682	0.075444	83.261	119.435	0.1530	0.2084	0.6423	0.7194	2.5536	2.7294	0.07348	0.01785	0.03063	0.01696		
194	470.529		52.304	0.073899	83.798	119.285	0.1538	0.2081	0.6587	0.7459	2.6108	2.8196	0.07245	0.01802	0.03050	0.01724		
195	475.906		51.915	0.072359	84.343	119.123	0.1546	0.2077	0.6768	0.7751	2.6740	2.9192	0.07141	0.01820	0.03038	0.01754		

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

T [F]	P [psia]		$\rho$ [lb/ft <sup>3</sup> ]		$v$ [ft <sup>3</sup> /lb]		$h$ [Btu/lb]		$s$ [Btu/R-lb]		$C_p$ [Btu/R-lb]		$C_p/C_v$ [unitless]		$\mu$ [centipose]		$k$ [Btu/hr-ft-R]	
	Bulk		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
196	481.336		51.514	0.070822	84.897	118.949	0.1554	0.2073	0.6969	0.8075	2.7442	3.0300	0.07035	0.01840	0.03026	0.01786		
197	486.818		51.099	0.069285	85.459	118.760	0.1562	0.2069	0.7194	0.8438	2.8228	3.1537	0.06928	0.01860	0.03015	0.01819		
198	492.353		50.670	0.067748	86.033	118.557	0.1571	0.2065	0.7447	0.8846	2.9113	3.2929	0.06819	0.01881	0.03005	0.01856		
199	497.943		50.224	0.066208	86.617	118.336	0.1579	0.2061	0.7734	0.9307	3.0117	3.4506	0.06708	0.01904	0.02996	0.01894		
200	503.588		49.761	0.064663	87.214	118.097	0.1588	0.2056	0.8062	0.9835	3.1268	3.6309	0.06595	0.01928	0.02988	0.01936		

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		p [lb/ft^3]		v [ft^3/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipoise]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
1	-97.563	94.096	37.834166	-16.923	88.469	-0.0433	0.2477	0.2885	0.1581	1.5043	1.1486	0.84491	0.00806	0.07349	0.00323			
2	-79.902	92.415	19.757581	-11.800	91.117	-0.0295	0.2415	0.2916	0.1641	1.5047	1.1465	0.68881	0.00844	0.07045	0.00369			
3	-68.566	91.321	13.516669	-8.481	92.831	-0.0209	0.2381	0.2937	0.1681	1.5050	1.1460	0.61143	0.00868	0.06855	0.00398			
4	-60.015	90.488	10.325851	-5.961	94.129	-0.0145	0.2359	0.2955	0.1713	1.5053	1.1460	0.56170	0.00885	0.06715	0.00420			
5	-53.066	89.804	8.379256	-3.901	95.184	-0.0094	0.2343	0.2970	0.1739	1.5056	1.1463	0.52575	0.00900	0.06602	0.00439			
6	-47.168	89.220	7.064091	-2.145	96.080	-0.0051	0.2330	0.2982	0.1762	1.5059	1.1469	0.49793	0.00912	0.06508	0.00454			
7	-42.020	88.707	6.114127	-0.606	96.861	-0.0014	0.2319	0.2994	0.1782	1.5063	1.1475	0.47544	0.00923	0.06426	0.00467			
8	-37.434	88.246	5.394758	0.771	97.556	0.0018	0.2310	0.3005	0.1801	1.5067	1.1482	0.45666	0.00932	0.06354	0.00479			
9	-33.288	87.828	4.830488	2.020	98.183	0.0048	0.2303	0.3014	0.1818	1.5071	1.1489	0.44063	0.00941	0.06289	0.00490			
10	-29.497	87.443	4.375642	3.165	98.755	0.0074	0.2296	0.3024	0.1834	1.5076	1.1497	0.42668	0.00948	0.06230	0.00500			
11	-25.997	87.085	4.000942	4.226	99.283	0.0099	0.2291	0.3032	0.1849	1.5080	1.1505	0.41438	0.00955	0.06176	0.00509			
12	-22.742	86.752	3.686737	5.215	99.772	0.0122	0.2286	0.3040	0.1863	1.5085	1.1513	0.40340	0.00962	0.06126	0.00518			
13	-19.697	86.437	3.419340	6.143	100.229	0.0143	0.2281	0.3048	0.1877	1.5090	1.1522	0.39350	0.00968	0.06080	0.00526			
14	-16.832	86.141	3.188921	7.019	100.658	0.0162	0.2277	0.3056	0.1889	1.5094	1.1531	0.38450	0.00974	0.06036	0.00533			
15	-14.125	85.859	2.988233	7.848	101.063	0.0181	0.2273	0.3063	0.1902	1.5099	1.1539	0.37627	0.00980	0.05995	0.00541			
16	-11.558	85.591	2.811816	8.636	101.446	0.0199	0.2270	0.3070	0.1914	1.5104	1.1548	0.36869	0.00985	0.05957	0.00547			
17	-9.114	85.334	2.655474	9.388	101.809	0.0215	0.2267	0.3076	0.1925	1.5110	1.1557	0.36167	0.00990	0.05920	0.00554			
18	-6.780	85.088	2.515932	10.107	102.155	0.0231	0.2264	0.3083	0.1936	1.5115	1.1566	0.35515	0.00994	0.05885	0.00560			
19	-4.547	84.852	2.390593	10.797	102.486	0.0246	0.2261	0.3089	0.1947	1.5120	1.1575	0.34906	0.00999	0.05852	0.00566			
20	-2.405	84.624	2.277370	11.461	102.802	0.0261	0.2258	0.3095	0.1958	1.5125	1.1584	0.34334	0.01003	0.05820	0.00572			
21	-0.344	84.404	2.174571	12.100	103.105	0.0275	0.2256	0.3101	0.1968	1.5131	1.1593	0.33797	0.01007	0.05789	0.00577			
22	1.640	84.192	2.080804	12.717	103.397	0.0288	0.2254	0.3107	0.1978	1.5136	1.1603	0.33291	0.01011	0.05760	0.00583			
23	3.555	83.986	1.994916	13.313	103.678	0.0301	0.2252	0.3112	0.1987	1.5142	1.1612	0.32812	0.01015	0.05732	0.00588			
24	5.407	83.786	1.915944	13.891	103.948	0.0313	0.2250	0.3118	0.1997	1.5147	1.1621	0.32357	0.01019	0.05704	0.00593			
25	7.198	83.592	1.843075	14.451	104.210	0.0325	0.2248	0.3123	0.2006	1.5153	1.1630	0.31926	0.01022	0.05678	0.00598			
26	8.935	83.404	1.775622	14.995	104.462	0.0337	0.2246	0.3128	0.2015	1.5158	1.1639	0.31515	0.01026	0.05653	0.00602			
27	10.621	83.220	1.712995	15.523	104.707	0.0348	0.2244	0.3134	0.2024	1.5164	1.1649	0.31122	0.01029	0.05628	0.00607			
28	12.258	83.041	1.654689	16.038	104.944	0.0359	0.2243	0.3139	0.2033	1.5169	1.1658	0.30747	0.01033	0.05604	0.00611			
29	13.851	82.866	1.600266	16.539	105.174	0.0370	0.2241	0.3144	0.2041	1.5175	1.1667	0.30388	0.01036	0.05581	0.00616			
30	15.401	82.695	1.549347	17.027	105.397	0.0380	0.2240	0.3149	0.2050	1.5181	1.1676	0.30044	0.01039	0.05559	0.00620			
31	16.912	82.529	1.501601	17.504	105.614	0.0390	0.2239	0.3154	0.2058	1.5187	1.1686	0.29713	0.01042	0.05537	0.00624			
32	18.386	82.365	1.456736	17.970	105.826	0.0400	0.2237	0.3158	0.2066	1.5192	1.1695	0.29396	0.01045	0.05515	0.00628			
33	19.824	82.205	1.414496	18.426	106.031	0.0409	0.2236	0.3163	0.2074	1.5198	1.1704	0.29089	0.01048	0.05495	0.00632			
34	21.229	82.049	1.374655	18.871	106.232	0.0418	0.2235	0.3168	0.2082	1.5204	1.1714	0.28794	0.01051	0.05474	0.00636			
35	22.602	81.895	1.337013	19.307	106.427	0.0427	0.2234	0.3172	0.2090	1.5210	1.1723	0.28510	0.01054	0.05455	0.00640			
36	23.946	81.744	1.301389	19.734	106.618	0.0436	0.2233	0.3177	0.2097	1.5216	1.1732	0.28234	0.01056	0.05435	0.00643			
37	25.260	81.596	1.267623	20.153	106.804	0.0445	0.2231	0.3181	0.2105	1.5222	1.1742	0.27968	0.01059	0.05416	0.00647			

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
38	26.548	81.451	1.235574	106.985	0.0453	0.2230	0.3186	0.2112	1.5228	1.1751	0.27711	0.01062	0.05398	0.00651				
39	27.810	81.308	1.205111	107.163	0.0461	0.2229	0.3190	0.2120	1.5234	1.1760	0.27461	0.01064	0.05380	0.00654				
40	29.047	81.167	1.176117	107.337	0.0469	0.2228	0.3195	0.2127	1.5240	1.1770	0.27220	0.01067	0.05362	0.00657				
41	30.260	81.029	1.148489	107.507	0.0477	0.2228	0.3199	0.2134	1.5246	1.1779	0.26985	0.01069	0.05345	0.00661				
42	31.451	80.893	1.122131	107.674	0.0485	0.2227	0.3203	0.2141	1.5252	1.1789	0.26757	0.01071	0.05328	0.00664				
43	32.620	80.759	1.096956	107.837	0.0493	0.2226	0.3207	0.2148	1.5258	1.1798	0.26535	0.01074	0.05311	0.00667				
44	33.768	80.627	1.072885	107.996	0.0500	0.2225	0.3212	0.2155	1.5264	1.1807	0.26320	0.01076	0.05295	0.00671				
45	34.897	80.497	1.049846	108.153	0.0507	0.2224	0.3216	0.2162	1.5270	1.1817	0.26110	0.01079	0.05279	0.00674				
46	36.006	80.369	1.027775	108.307	0.0514	0.2223	0.3220	0.2169	1.5277	1.1826	0.25906	0.01081	0.05263	0.00677				
47	37.098	80.243	1.006609	108.457	0.0522	0.2223	0.3224	0.2176	1.5283	1.1836	0.25707	0.01083	0.05248	0.00680				
48	38.171	80.118	0.986294	108.605	0.0528	0.2222	0.3228	0.2182	1.5289	1.1845	0.25514	0.01085	0.05232	0.00683				
49	39.227	79.995	0.966780	108.750	0.0535	0.2221	0.3232	0.2189	1.5295	1.1855	0.25325	0.01087	0.05217	0.00686				
50	40.267	79.873	0.948018	108.893	0.0542	0.2220	0.3236	0.2196	1.5302	1.1864	0.25140	0.01090	0.05203	0.00689				
51	41.292	79.753	0.929967	109.033	0.0549	0.2220	0.3240	0.2202	1.5308	1.1874	0.24960	0.01092	0.05188	0.00692				
52	42.301	79.635	0.912585	109.170	0.0555	0.2219	0.3244	0.2209	1.5314	1.1883	0.24784	0.01094	0.05174	0.00695				
53	43.295	79.517	0.895836	109.306	0.0561	0.2219	0.3248	0.2215	1.5321	1.1893	0.24612	0.01096	0.05160	0.00698				
54	44.275	79.402	0.879686	109.439	0.0568	0.2218	0.3252	0.2221	1.5327	1.1902	0.24443	0.01098	0.05146	0.00700				
55	45.241	79.287	0.864102	109.569	0.0574	0.2217	0.3256	0.2228	1.5333	1.1912	0.24279	0.01100	0.05133	0.00703				
56	46.194	79.174	0.849055	109.698	0.0580	0.2217	0.3260	0.2234	1.5340	1.1922	0.24118	0.01102	0.05119	0.00706				
57	47.134	79.062	0.834517	109.825	0.0586	0.2216	0.3263	0.2240	1.5346	1.1931	0.23960	0.01104	0.05106	0.00709				
58	48.061	78.951	0.820463	109.949	0.0592	0.2216	0.3267	0.2247	1.5353	1.1941	0.23806	0.01106	0.05093	0.00711				
59	48.976	78.842	0.806868	110.072	0.0598	0.2215	0.3271	0.2253	1.5359	1.1951	0.23654	0.01108	0.05080	0.00714				
60	49.880	78.733	0.793710	110.193	0.0604	0.2214	0.3275	0.2259	1.5366	1.1960	0.23506	0.01110	0.05068	0.00717				
61	50.772	78.626	0.780969	110.312	0.0609	0.2214	0.3279	0.2265	1.5373	1.1970	0.23361	0.01112	0.05055	0.00719				
62	51.653	78.520	0.768624	110.429	0.0615	0.2213	0.3282	0.2271	1.5379	1.1980	0.23218	0.01113	0.05043	0.00722				
63	52.524	78.415	0.756657	110.544	0.0620	0.2213	0.3286	0.2277	1.5386	1.1989	0.23078	0.01115	0.05031	0.00724				
64	53.383	78.310	0.745051	110.658	0.0626	0.2212	0.3290	0.2283	1.5392	1.1999	0.22941	0.01117	0.05019	0.00727				
65	54.233	78.207	0.733789	110.770	0.0631	0.2212	0.3293	0.2289	1.5399	1.2009	0.22806	0.01119	0.05007	0.00729				
66	55.073	78.105	0.722856	110.881	0.0637	0.2211	0.3297	0.2295	1.5406	1.2019	0.22674	0.01121	0.04995	0.00732				
67	55.903	78.003	0.712238	110.990	0.0642	0.2211	0.3301	0.2301	1.5412	1.2028	0.22544	0.01122	0.04983	0.00734				
68	56.724	77.903	0.701921	111.097	0.0647	0.2211	0.3304	0.2307	1.5419	1.2038	0.22416	0.01124	0.04972	0.00737				
69	57.535	77.803	0.691892	111.203	0.0652	0.2210	0.3308	0.2313	1.5426	1.2048	0.22290	0.01126	0.04961	0.00739				
70	58.338	77.704	0.682140	111.308	0.0657	0.2210	0.3312	0.2318	1.5433	1.2058	0.22167	0.01128	0.04949	0.00742				
71	59.132	77.606	0.672652	111.411	0.0662	0.2209	0.3315	0.2324	1.5440	1.2068	0.22046	0.01129	0.04938	0.00744				
72	59.918	77.509	0.663419	111.513	0.0667	0.2209	0.3319	0.2330	1.5447	1.2078	0.21926	0.01131	0.04927	0.00746				
73	60.695	77.413	0.654430	111.613	0.0672	0.2208	0.3322	0.2336	1.5453	1.2088	0.21809	0.01133	0.04917	0.00749				
74	61.465	77.317	0.645674	111.713	0.0677	0.2208	0.3326	0.2341	1.5460	1.2098	0.21693	0.01134	0.04906	0.00751				

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
75	62.226	77.222	77.222	0.637144	32.193	111.811	0.0682	0.2208	0.3330	0.2347	1.5467	1.2108	0.21579	0.01136	0.04895	0.00753		
76	62.980	77.128	77.128	0.628831	32.445	111.907	0.0687	0.2207	0.3333	0.2353	1.5474	1.2118	0.21467	0.01138	0.04885	0.00756		
77	63.726	77.035	77.035	0.620725	32.694	112.003	0.0692	0.2207	0.3337	0.2359	1.5481	1.2128	0.21357	0.01139	0.04875	0.00758		
78	64.466	76.942	76.942	0.612820	32.941	112.097	0.0696	0.2206	0.3340	0.2364	1.5488	1.2138	0.21248	0.01141	0.04864	0.00760		
79	65.197	76.850	76.850	0.605108	33.186	112.190	0.0701	0.2206	0.3344	0.2370	1.5495	1.2148	0.21141	0.01143	0.04854	0.00762		
80	65.922	76.758	76.758	0.597582	33.429	112.282	0.0705	0.2206	0.3347	0.2375	1.5502	1.2158	0.21036	0.01144	0.04844	0.00765		
81	66.641	76.668	76.668	0.590234	33.669	112.373	0.0710	0.2205	0.3351	0.2381	1.5509	1.2168	0.20932	0.01146	0.04834	0.00767		
82	67.352	76.577	76.577	0.583060	33.908	112.463	0.0714	0.2205	0.3354	0.2387	1.5517	1.2179	0.20830	0.01147	0.04824	0.00769		
83	68.057	76.488	76.488	0.576052	34.145	112.552	0.0719	0.2205	0.3358	0.2392	1.5524	1.2189	0.20729	0.01149	0.04815	0.00771		
84	68.755	76.399	76.399	0.569205	34.380	112.640	0.0723	0.2204	0.3361	0.2398	1.5531	1.2199	0.20629	0.01151	0.04805	0.00773		
85	69.447	76.311	76.311	0.562513	34.613	112.726	0.0728	0.2204	0.3365	0.2403	1.5538	1.2209	0.20531	0.01152	0.04795	0.00775		
86	70.134	76.223	76.223	0.555971	34.844	112.812	0.0732	0.2204	0.3368	0.2409	1.5545	1.2219	0.20434	0.01154	0.04786	0.00778		
87	70.814	76.136	76.136	0.549574	35.073	112.897	0.0736	0.2203	0.3372	0.2414	1.5553	1.2230	0.20338	0.01155	0.04776	0.00780		
88	71.488	76.049	76.049	0.543318	35.301	112.981	0.0740	0.2203	0.3375	0.2420	1.5560	1.2240	0.20244	0.01157	0.04767	0.00782		
89	72.156	75.963	75.963	0.537196	35.527	113.064	0.0745	0.2203	0.3379	0.2425	1.5567	1.2251	0.20151	0.01158	0.04758	0.00784		
90	72.819	75.877	75.877	0.531206	35.751	113.146	0.0749	0.2202	0.3382	0.2431	1.5575	1.2261	0.20059	0.01160	0.04749	0.00786		
91	73.476	75.792	75.792	0.525343	35.974	113.227	0.0753	0.2202	0.3386	0.2436	1.5582	1.2271	0.19968	0.01161	0.04740	0.00788		
92	74.128	75.708	75.708	0.519602	36.195	113.307	0.0757	0.2202	0.3389	0.2441	1.5589	1.2282	0.19879	0.01163	0.04731	0.00790		
93	74.775	75.623	75.623	0.513981	36.414	113.386	0.0761	0.2201	0.3393	0.2447	1.5597	1.2292	0.19790	0.01164	0.04722	0.00792		
94	75.416	75.540	75.540	0.508474	36.632	113.464	0.0765	0.2201	0.3396	0.2452	1.5604	1.2303	0.19703	0.01166	0.04713	0.00794		
95	76.052	75.457	75.457	0.503080	36.848	113.542	0.0769	0.2201	0.3400	0.2458	1.5612	1.2313	0.19617	0.01167	0.04704	0.00796		
96	76.683	75.374	75.374	0.497793	37.063	113.619	0.0773	0.2200	0.3403	0.2463	1.5619	1.2324	0.19531	0.01169	0.04695	0.00798		
97	77.309	75.292	75.292	0.492612	37.276	113.695	0.0777	0.2200	0.3407	0.2468	1.5627	1.2335	0.19447	0.01170	0.04687	0.00800		
98	77.930	75.210	75.210	0.487532	37.488	113.770	0.0781	0.2200	0.3410	0.2474	1.5634	1.2345	0.19364	0.01171	0.04678	0.00802		
99	78.547	75.129	75.129	0.482551	37.698	113.844	0.0785	0.2200	0.3413	0.2479	1.5642	1.2356	0.19282	0.01173	0.04670	0.00804		
100	79.159	75.048	75.048	0.477667	37.907	113.918	0.0789	0.2199	0.3417	0.2484	1.5650	1.2367	0.19200	0.01174	0.04661	0.00806		
101	79.766	74.968	74.968	0.472875	38.115	113.991	0.0792	0.2199	0.3420	0.2490	1.5657	1.2377	0.19120	0.01176	0.04653	0.00808		
102	80.369	74.888	74.888	0.468174	38.321	114.063	0.0796	0.2199	0.3424	0.2495	1.5665	1.2388	0.19040	0.01177	0.04645	0.00810		
103	80.967	74.808	74.808	0.463561	38.526	114.134	0.0800	0.2198	0.3427	0.2500	1.5673	1.2399	0.18962	0.01179	0.04636	0.00812		
104	81.561	74.729	74.729	0.459033	38.730	114.205	0.0804	0.2198	0.3431	0.2506	1.5680	1.2410	0.18884	0.01180	0.04628	0.00814		
105	82.151	74.650	74.650	0.454588	38.932	114.275	0.0807	0.2198	0.3434	0.2511	1.5688	1.2421	0.18807	0.01181	0.04620	0.00816		
106	82.736	74.571	74.571	0.450224	39.134	114.344	0.0811	0.2198	0.3438	0.2516	1.5696	1.2432	0.18731	0.01183	0.04612	0.00818		
107	83.317	74.493	74.493	0.445938	39.333	114.412	0.0815	0.2197	0.3441	0.2522	1.5704	1.2443	0.18656	0.01184	0.04604	0.00820		
108	83.895	74.416	74.416	0.441729	39.532	114.480	0.0818	0.2197	0.3444	0.2527	1.5712	1.2454	0.18582	0.01186	0.04596	0.00822		
109	84.468	74.338	74.338	0.437595	39.730	114.547	0.0822	0.2197	0.3448	0.2532	1.5720	1.2465	0.18508	0.01187	0.04588	0.00824		
110	85.037	74.261	74.261	0.433532	39.926	114.614	0.0825	0.2197	0.3451	0.2538	1.5728	1.2476	0.18435	0.01188	0.04580	0.00826		
111	85.602	74.185	74.185	0.429540	40.121	114.680	0.0829	0.2196	0.3455	0.2543	1.5736	1.2487	0.18363	0.01190	0.04573	0.00828		



**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
112	86.164	74.109	0.425617	0.425617	40.315	114.745	0.0833	0.2196	0.3458	0.2548	1.5744	1.2498	0.18292	0.01191	0.04565	0.00829		
113	86.722	74.033	0.421760	0.421760	40.508	114.810	0.0836	0.2196	0.3462	0.2553	1.5752	1.2509	0.18221	0.01192	0.04557	0.00831		
114	87.276	73.957	0.417969	0.417969	40.700	114.874	0.0839	0.2196	0.3465	0.2559	1.5760	1.2521	0.18151	0.01194	0.04550	0.00833		
115	87.826	73.882	0.414241	0.414241	40.890	114.937	0.0843	0.2195	0.3468	0.2564	1.5768	1.2532	0.18082	0.01195	0.04542	0.00835		
116	88.373	73.807	0.410575	0.410575	41.080	115.000	0.0846	0.2195	0.3472	0.2569	1.5776	1.2543	0.18013	0.01196	0.04535	0.00837		
117	88.916	73.732	0.406969	0.406969	41.269	115.062	0.0850	0.2195	0.3475	0.2574	1.5784	1.2555	0.17946	0.01198	0.04527	0.00839		
118	89.456	73.658	0.403422	0.403422	41.456	115.124	0.0853	0.2195	0.3479	0.2580	1.5792	1.2566	0.17878	0.01199	0.04520	0.00841		
119	89.993	73.584	0.399933	0.399933	41.643	115.185	0.0856	0.2194	0.3482	0.2585	1.5801	1.2577	0.17812	0.01201	0.04512	0.00842		
120	90.526	73.510	0.396499	0.396499	41.828	115.245	0.0860	0.2194	0.3486	0.2590	1.5809	1.2589	0.17746	0.01202	0.04505	0.00844		
121	91.055	73.437	0.393120	0.393120	42.013	115.305	0.0863	0.2194	0.3489	0.2596	1.5817	1.2600	0.17681	0.01203	0.04498	0.00846		
122	91.582	73.364	0.389794	0.389794	42.196	115.365	0.0866	0.2194	0.3493	0.2601	1.5825	1.2612	0.17616	0.01205	0.04490	0.00848		
123	92.105	73.291	0.386520	0.386520	42.379	115.424	0.0870	0.2193	0.3496	0.2606	1.5834	1.2624	0.17552	0.01206	0.04483	0.00850		
124	92.625	73.218	0.383297	0.383297	42.560	115.482	0.0873	0.2193	0.3499	0.2611	1.5842	1.2635	0.17488	0.01207	0.04476	0.00852		
125	93.142	73.146	0.380124	0.380124	42.741	115.540	0.0876	0.2193	0.3503	0.2617	1.5851	1.2647	0.17425	0.01208	0.04469	0.00853		
126	93.655	73.074	0.376999	0.376999	42.921	115.597	0.0879	0.2193	0.3506	0.2622	1.5859	1.2659	0.17363	0.01210	0.04462	0.00855		
127	94.166	73.002	0.373921	0.373921	43.100	115.654	0.0882	0.2192	0.3510	0.2627	1.5868	1.2670	0.17301	0.01211	0.04455	0.00857		
128	94.674	72.931	0.370890	0.370890	43.278	115.710	0.0886	0.2192	0.3513	0.2632	1.5876	1.2682	0.17240	0.01212	0.04448	0.00859		
129	95.178	72.860	0.367903	0.367903	43.455	115.765	0.0889	0.2192	0.3517	0.2638	1.5885	1.2694	0.17179	0.01214	0.04441	0.00861		
130	95.680	72.789	0.364961	0.364961	43.631	115.821	0.0892	0.2192	0.3520	0.2643	1.5893	1.2706	0.17119	0.01215	0.04434	0.00862		
131	96.179	72.718	0.362062	0.362062	43.806	115.875	0.0895	0.2192	0.3524	0.2648	1.5902	1.2718	0.17059	0.01216	0.04427	0.00864		
132	96.675	72.648	0.359206	0.359206	43.981	115.930	0.0898	0.2191	0.3527	0.2653	1.5911	1.2730	0.17000	0.01218	0.04420	0.00866		
133	97.168	72.577	0.356390	0.356390	44.155	115.983	0.0901	0.2191	0.3531	0.2659	1.5919	1.2742	0.16941	0.01219	0.04414	0.00868		
134	97.659	72.507	0.353615	0.353615	44.327	116.037	0.0904	0.2191	0.3534	0.2664	1.5928	1.2754	0.16883	0.01220	0.04407	0.00870		
135	98.147	72.438	0.350880	0.350880	44.500	116.089	0.0907	0.2191	0.3538	0.2669	1.5937	1.2766	0.16825	0.01221	0.04400	0.00871		
136	98.632	72.368	0.348183	0.348183	44.671	116.142	0.0910	0.2190	0.3541	0.2675	1.5946	1.2778	0.16768	0.01223	0.04394	0.00873		
137	99.114	72.299	0.345524	0.345524	44.841	116.194	0.0913	0.2190	0.3545	0.2680	1.5955	1.2791	0.16711	0.01224	0.04387	0.00875		
138	99.594	72.230	0.342902	0.342902	45.011	116.245	0.0916	0.2190	0.3548	0.2685	1.5963	1.2803	0.16655	0.01225	0.04380	0.00877		
139	100.071	72.161	0.340316	0.340316	45.180	116.296	0.0919	0.2190	0.3552	0.2691	1.5972	1.2815	0.16599	0.01227	0.04374	0.00878		
140	100.545	72.093	0.337766	0.337766	45.348	116.347	0.0922	0.2190	0.3555	0.2696	1.5981	1.2828	0.16544	0.01228	0.04367	0.00880		
141	101.017	72.024	0.335250	0.335250	45.515	116.397	0.0925	0.2189	0.3559	0.2701	1.5990	1.2840	0.16489	0.01229	0.04361	0.00882		
142	101.487	71.956	0.332769	0.332769	45.682	116.446	0.0928	0.2189	0.3562	0.2706	1.5999	1.2852	0.16434	0.01230	0.04354	0.00884		
143	101.954	71.888	0.330320	0.330320	45.848	116.496	0.0931	0.2189	0.3566	0.2712	1.6008	1.2865	0.16380	0.01232	0.04348	0.00885		
144	102.418	71.820	0.327905	0.327905	46.013	116.544	0.0934	0.2189	0.3569	0.2717	1.6018	1.2878	0.16327	0.01233	0.04342	0.00887		
145	102.880	71.753	0.325521	0.325521	46.178	116.593	0.0937	0.2188	0.3573	0.2722	1.6027	1.2890	0.16273	0.01234	0.04335	0.00889		
146	103.340	71.685	0.323169	0.323169	46.341	116.641	0.0940	0.2188	0.3576	0.2728	1.6036	1.2903	0.16220	0.01235	0.04329	0.00891		
147	103.798	71.618	0.320847	0.320847	46.505	116.688	0.0942	0.2188	0.3580	0.2733	1.6045	1.2916	0.16168	0.01237	0.04323	0.00892		
148	104.253	71.551	0.318556	0.318556	46.667	116.736	0.0945	0.2188	0.3583	0.2738	1.6054	1.2928	0.16116	0.01238	0.04316	0.00894		

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
149	104.705	71.485	0.316294	116.782	0.0948	0.2188	0.3587	0.2744	1.6064	1.2941	0.16064	0.01239	0.04310	0.00896				
150	105.156	71.418	0.314061	116.829	0.0951	0.2187	0.3590	0.2749	1.6073	1.2954	0.16013	0.01241	0.04304	0.00897				
151	105.604	71.352	0.311856	116.875	0.0954	0.2187	0.3594	0.2754	1.6082	1.2967	0.15962	0.01242	0.04298	0.00899				
152	106.050	71.286	0.309680	116.920	0.0957	0.2187	0.3597	0.2760	1.6092	1.2980	0.15912	0.01243	0.04292	0.00901				
153	106.494	71.220	0.307530	116.965	0.0959	0.2187	0.3601	0.2765	1.6101	1.2993	0.15861	0.01244	0.04286	0.00903				
154	106.936	71.154	0.305407	117.010	0.0962	0.2187	0.3605	0.2771	1.6111	1.3006	0.15812	0.01246	0.04280	0.00904				
155	107.375	71.088	0.303311	117.055	0.0965	0.2186	0.3608	0.2776	1.6120	1.3019	0.15762	0.01247	0.04273	0.00906				
156	107.813	71.023	0.301240	117.099	0.0968	0.2186	0.3612	0.2781	1.6130	1.3033	0.15713	0.01248	0.04267	0.00908				
157	108.248	70.957	0.299195	117.142	0.0970	0.2186	0.3615	0.2787	1.6140	1.3046	0.15664	0.01249	0.04261	0.00910				
158	108.681	70.892	0.297174	117.186	0.0973	0.2186	0.3619	0.2792	1.6149	1.3059	0.15616	0.01251	0.04256	0.00911				
159	109.112	70.827	0.295178	117.229	0.0976	0.2186	0.3623	0.2798	1.6159	1.3073	0.15568	0.01252	0.04250	0.00913				
160	109.541	70.762	0.293206	117.271	0.0978	0.2185	0.3626	0.2803	1.6169	1.3086	0.15520	0.01253	0.04244	0.00915				
161	109.968	70.698	0.291257	117.314	0.0981	0.2185	0.3630	0.2809	1.6179	1.3100	0.15473	0.01254	0.04238	0.00916				
162	110.394	70.633	0.289331	117.355	0.0984	0.2185	0.3634	0.2814	1.6188	1.3113	0.15426	0.01256	0.04232	0.00918				
163	110.817	70.569	0.287428	117.397	0.0986	0.2185	0.3637	0.2819	1.6198	1.3127	0.15379	0.01257	0.04226	0.00920				
164	111.238	70.505	0.285547	117.438	0.0989	0.2184	0.3641	0.2825	1.6208	1.3141	0.15332	0.01258	0.04220	0.00921				
165	111.657	70.441	0.283688	117.479	0.0991	0.2184	0.3644	0.2830	1.6218	1.3154	0.15286	0.01259	0.04215	0.00923				
166	112.075	70.377	0.281850	117.520	0.0994	0.2184	0.3648	0.2836	1.6228	1.3168	0.15240	0.01261	0.04209	0.00925				
167	112.490	70.313	0.280034	117.560	0.0997	0.2184	0.3652	0.2841	1.6238	1.3182	0.15195	0.01262	0.04203	0.00927				
168	112.904	70.250	0.278238	117.600	0.0999	0.2184	0.3655	0.2847	1.6248	1.3196	0.15150	0.01263	0.04197	0.00928				
169	113.316	70.186	0.276462	117.639	0.1002	0.2183	0.3659	0.2852	1.6259	1.3210	0.15105	0.01264	0.04192	0.00930				
170	113.726	70.123	0.274707	117.678	0.1004	0.2183	0.3663	0.2858	1.6269	1.3224	0.15060	0.01265	0.04186	0.00932				
171	114.134	70.060	0.272971	117.717	0.1007	0.2183	0.3667	0.2864	1.6279	1.3238	0.15016	0.01267	0.04180	0.00933				
172	114.540	69.997	0.271254	117.756	0.1009	0.2183	0.3670	0.2869	1.6289	1.3252	0.14972	0.01268	0.04175	0.00935				
173	114.945	69.934	0.269557	117.794	0.1012	0.2183	0.3674	0.2875	1.6300	1.3266	0.14928	0.01269	0.04169	0.00937				
174	115.348	69.871	0.267878	117.832	0.1014	0.2182	0.3678	0.2880	1.6310	1.3281	0.14884	0.01270	0.04164	0.00938				
175	115.749	69.809	0.266217	117.869	0.1017	0.2182	0.3681	0.2886	1.6320	1.3295	0.14841	0.01272	0.04158	0.00940				
176	116.149	69.746	0.264575	117.906	0.1019	0.2182	0.3685	0.2892	1.6331	1.3310	0.14798	0.01273	0.04153	0.00942				
177	116.546	69.684	0.262950	117.943	0.1022	0.2182	0.3689	0.2897	1.6341	1.3324	0.14755	0.01274	0.04147	0.00944				
178	116.942	69.622	0.261343	117.980	0.1024	0.2182	0.3693	0.2903	1.6352	1.3339	0.14713	0.01275	0.04142	0.00945				
179	117.337	69.559	0.259752	118.016	0.1027	0.2181	0.3697	0.2908	1.6363	1.3353	0.14671	0.01277	0.04136	0.00947				
180	117.730	69.497	0.258179	118.052	0.1029	0.2181	0.3700	0.2914	1.6373	1.3368	0.14629	0.01278	0.04131	0.00949				
181	118.121	69.436	0.256622	118.088	0.1032	0.2181	0.3704	0.2920	1.6384	1.3383	0.14587	0.01279	0.04126	0.00950				
182	118.510	69.374	0.255082	118.123	0.1034	0.2181	0.3708	0.2925	1.6395	1.3398	0.14545	0.01280	0.04120	0.00952				
183	118.898	69.312	0.253558	118.159	0.1037	0.2181	0.3712	0.2931	1.6405	1.3413	0.14504	0.01282	0.04115	0.00954				
184	119.284	69.251	0.252049	118.193	0.1039	0.2180	0.3716	0.2937	1.6416	1.3428	0.14463	0.01283	0.04109	0.00955				
185	119.669	69.189	0.250557	118.228	0.1041	0.2180	0.3719	0.2943	1.6427	1.3443	0.14422	0.01284	0.04104	0.00957				

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]	p [lb/ft <sup>3</sup> ]		v [ft <sup>3</sup> /lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
186	120.052	69.128	0.249079	52.401	118.262	0.1044	0.2180	0.1044	0.2180	0.3723	0.2948	1.6438	1.3458	0.14382	0.01285	0.04099	0.00959
187	120.434	69.067	0.247617	52.542	118.296	0.1046	0.2180	0.1046	0.2180	0.3727	0.2954	1.6449	1.3473	0.14342	0.01287	0.04094	0.00960
188	120.814	69.006	0.246169	52.683	118.330	0.1049	0.2180	0.1049	0.2180	0.3731	0.2960	1.6460	1.3488	0.14302	0.01288	0.04088	0.00962
189	121.193	68.945	0.244736	52.823	118.363	0.1051	0.2179	0.1051	0.2179	0.3735	0.2966	1.6471	1.3504	0.14262	0.01289	0.04083	0.00964
190	121.570	68.884	0.243317	52.962	118.396	0.1053	0.2179	0.1053	0.2179	0.3739	0.2971	1.6483	1.3519	0.14222	0.01290	0.04078	0.00966
191	121.945	68.824	0.241913	53.102	118.429	0.1056	0.2179	0.1056	0.2179	0.3743	0.2977	1.6494	1.3535	0.14183	0.01291	0.04073	0.00967
192	122.319	68.763	0.240523	53.241	118.462	0.1058	0.2179	0.1058	0.2179	0.3747	0.2983	1.6505	1.3550	0.14144	0.01293	0.04067	0.00969
193	122.692	68.702	0.239146	53.379	118.494	0.1060	0.2178	0.1060	0.2178	0.3750	0.2989	1.6516	1.3566	0.14105	0.01294	0.04062	0.00971
194	123.063	68.642	0.237783	53.517	118.526	0.1063	0.2178	0.1063	0.2178	0.3754	0.2995	1.6528	1.3582	0.14066	0.01295	0.04057	0.00972
195	123.433	68.582	0.236433	53.654	118.558	0.1065	0.2178	0.1065	0.2178	0.3758	0.3001	1.6539	1.3597	0.14028	0.01296	0.04052	0.00974
196	123.801	68.522	0.235096	53.792	118.589	0.1067	0.2178	0.1067	0.2178	0.3762	0.3007	1.6551	1.3613	0.13989	0.01298	0.04047	0.00976
197	124.168	68.461	0.233772	53.928	118.620	0.1070	0.2178	0.1070	0.2178	0.3766	0.3013	1.6562	1.3629	0.13951	0.01299	0.04042	0.00977
198	124.534	68.401	0.232461	54.065	118.651	0.1072	0.2177	0.1072	0.2177	0.3770	0.3019	1.6574	1.3645	0.13913	0.01300	0.04037	0.00979
199	124.898	68.342	0.231163	54.201	118.682	0.1074	0.2177	0.1074	0.2177	0.3774	0.3024	1.6585	1.3662	0.13876	0.01301	0.04032	0.00981
200	125.261	68.282	0.229876	54.336	118.712	0.1076	0.2177	0.1076	0.2177	0.3778	0.3030	1.6597	1.3678	0.13838	0.01303	0.04027	0.00983
201	125.622	68.222	0.228602	54.471	118.742	0.1079	0.2177	0.1079	0.2177	0.3782	0.3036	1.6609	1.3694	0.13801	0.01304	0.04022	0.00984
202	125.983	68.162	0.227340	54.606	118.772	0.1081	0.2177	0.1081	0.2177	0.3786	0.3042	1.6620	1.3710	0.13764	0.01305	0.04017	0.00986
203	126.341	68.103	0.226090	54.741	118.802	0.1083	0.2176	0.1083	0.2176	0.3790	0.3049	1.6632	1.3727	0.13727	0.01306	0.04012	0.00988
204	126.699	68.043	0.224852	54.875	118.831	0.1085	0.2176	0.1085	0.2176	0.3794	0.3055	1.6644	1.3743	0.13690	0.01308	0.04007	0.00989
205	127.055	67.984	0.223625	55.008	118.860	0.1088	0.2176	0.1088	0.2176	0.3798	0.3061	1.6656	1.3760	0.13654	0.01309	0.04002	0.00991
206	127.410	67.925	0.222409	55.142	118.889	0.1090	0.2176	0.1090	0.2176	0.3802	0.3067	1.6668	1.3777	0.13618	0.01310	0.03997	0.00993
207	127.763	67.865	0.221205	55.275	118.918	0.1092	0.2176	0.1092	0.2176	0.3807	0.3073	1.6680	1.3794	0.13582	0.01311	0.03992	0.00995
208	128.116	67.806	0.220011	55.407	118.946	0.1094	0.2175	0.1094	0.2175	0.3811	0.3079	1.6692	1.3810	0.13546	0.01313	0.03987	0.00996
209	128.467	67.747	0.218829	55.539	118.974	0.1097	0.2175	0.1097	0.2175	0.3815	0.3085	1.6705	1.3827	0.13510	0.01314	0.03982	0.00998
210	128.816	67.688	0.217657	55.671	119.002	0.1099	0.2175	0.1099	0.2175	0.3819	0.3091	1.6717	1.3844	0.13474	0.01315	0.03977	0.01000
211	129.165	67.629	0.216495	55.803	119.029	0.1101	0.2175	0.1101	0.2175	0.3823	0.3097	1.6729	1.3862	0.13439	0.01316	0.03973	0.01001
212	129.512	67.571	0.215344	55.934	119.057	0.1103	0.2174	0.1103	0.2174	0.3827	0.3104	1.6742	1.3879	0.13404	0.01318	0.03968	0.01003
213	129.858	67.512	0.214204	56.065	119.084	0.1105	0.2174	0.1105	0.2174	0.3831	0.3110	1.6754	1.3896	0.13369	0.01319	0.03963	0.01005
214	130.203	67.453	0.213073	56.195	119.111	0.1107	0.2174	0.1107	0.2174	0.3836	0.3116	1.6767	1.3914	0.13334	0.01320	0.03958	0.01007
215	130.546	67.395	0.211952	56.325	119.137	0.1110	0.2174	0.1110	0.2174	0.3840	0.3122	1.6779	1.3931	0.13299	0.01322	0.03953	0.01008
216	130.889	67.336	0.210842	56.455	119.164	0.1112	0.2174	0.1112	0.2174	0.3844	0.3129	1.6792	1.3949	0.13264	0.01323	0.03949	0.01010
217	131.230	67.278	0.209740	56.585	119.190	0.1114	0.2173	0.1114	0.2173	0.3848	0.3135	1.6804	1.3966	0.13230	0.01324	0.03944	0.01012
218	131.570	67.219	0.208649	56.714	119.216	0.1116	0.2173	0.1116	0.2173	0.3852	0.3141	1.6817	1.3984	0.13196	0.01325	0.03939	0.01014
219	131.909	67.161	0.207567	56.843	119.241	0.1118	0.2173	0.1118	0.2173	0.3857	0.3148	1.6830	1.4002	0.13162	0.01327	0.03934	0.01015
220	132.246	67.103	0.206494	56.971	119.267	0.1120	0.2173	0.1120	0.2173	0.3861	0.3154	1.6843	1.4020	0.13128	0.01328	0.03930	0.01017
221	132.583	67.045	0.205431	57.099	119.292	0.1122	0.2173	0.1122	0.2173	0.3865	0.3161	1.6856	1.4038	0.13094	0.01329	0.03925	0.01019
222	132.918	66.987	0.204376	57.227	119.317	0.1125	0.2172	0.1125	0.2172	0.3870	0.3167	1.6869	1.4056	0.13061	0.01330	0.03920	0.01021

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
223	133.253	66.929	0.203331	119.341	0.1127	0.2172	0.3874	0.3173	1.6882	1.4075	0.13027	0.01332	0.03916	0.01022				
224	133.586	66.871	0.202294	119.366	0.1129	0.2172	0.3878	0.3180	1.6895	1.4093	0.12994	0.01333	0.03911	0.01024				
225	133.918	66.813	0.201266	119.390	0.1131	0.2172	0.3882	0.3186	1.6908	1.4111	0.12961	0.01334	0.03906	0.01026				
226	134.249	66.755	0.200247	119.414	0.1133	0.2171	0.3887	0.3193	1.6921	1.4130	0.12928	0.01336	0.03902	0.01028				
227	134.578	66.697	0.199236	119.438	0.1135	0.2171	0.3891	0.3200	1.6935	1.4149	0.12895	0.01337	0.03897	0.01029				
228	134.907	66.639	0.198234	119.462	0.1137	0.2171	0.3896	0.3206	1.6948	1.4168	0.12862	0.01338	0.03893	0.01031				
229	135.235	66.582	0.197240	119.485	0.1139	0.2171	0.3900	0.3213	1.6962	1.4186	0.12830	0.01339	0.03888	0.01033				
230	135.561	66.524	0.196254	119.508	0.1141	0.2171	0.3904	0.3219	1.6975	1.4205	0.12798	0.01341	0.03883	0.01035				
231	135.887	66.467	0.195276	119.531	0.1143	0.2170	0.3909	0.3226	1.6989	1.4224	0.12765	0.01342	0.03879	0.01036				
232	136.211	66.409	0.194306	119.554	0.1145	0.2170	0.3913	0.3233	1.7003	1.4244	0.12733	0.01343	0.03874	0.01038				
233	136.535	66.352	0.193344	119.576	0.1147	0.2170	0.3918	0.3239	1.7016	1.4263	0.12701	0.01345	0.03870	0.01040				
234	136.857	66.294	0.192389	119.598	0.1149	0.2170	0.3922	0.3246	1.7030	1.4282	0.12670	0.01346	0.03865	0.01042				
235	137.178	66.237	0.191443	119.620	0.1151	0.2169	0.3927	0.3253	1.7044	1.4302	0.12638	0.01347	0.03861	0.01044				
236	137.498	66.180	0.190504	119.642	0.1153	0.2169	0.3931	0.3260	1.7058	1.4322	0.12606	0.01348	0.03856	0.01045				
237	137.818	66.123	0.189572	119.664	0.1155	0.2169	0.3936	0.3267	1.7072	1.4341	0.12575	0.01350	0.03852	0.01047				
238	138.136	66.066	0.188648	119.685	0.1157	0.2169	0.3940	0.3273	1.7086	1.4361	0.12544	0.01351	0.03847	0.01049				
239	138.453	66.008	0.187731	119.706	0.1159	0.2168	0.3945	0.3280	1.7100	1.4381	0.12513	0.01352	0.03843	0.01051				
240	138.769	65.951	0.186821	119.727	0.1161	0.2168	0.3950	0.3287	1.7115	1.4401	0.12482	0.01354	0.03839	0.01052				
241	139.084	65.894	0.185918	119.748	0.1163	0.2168	0.3954	0.3294	1.7129	1.4421	0.12451	0.01355	0.03834	0.01054				
242	139.399	65.837	0.185023	119.769	0.1165	0.2168	0.3959	0.3301	1.7143	1.4442	0.12420	0.01356	0.03830	0.01056				
243	139.712	65.780	0.184134	119.789	0.1167	0.2168	0.3964	0.3308	1.7158	1.4462	0.12390	0.01358	0.03825	0.01058				
244	140.024	65.724	0.183252	119.809	0.1169	0.2167	0.3968	0.3315	1.7172	1.4483	0.12359	0.01359	0.03821	0.01060				
245	140.336	65.667	0.182377	119.829	0.1171	0.2167	0.3973	0.3322	1.7187	1.4503	0.12329	0.01360	0.03817	0.01062				
246	140.646	65.610	0.181509	119.848	0.1173	0.2167	0.3978	0.3329	1.7202	1.4524	0.12299	0.01361	0.03812	0.01063				
247	140.955	65.553	0.180647	119.868	0.1175	0.2167	0.3982	0.3336	1.7216	1.4545	0.12268	0.01363	0.03808	0.01065				
248	141.264	65.497	0.179792	119.887	0.1177	0.2166	0.3987	0.3343	1.7231	1.4566	0.12239	0.01364	0.03803	0.01067				
249	141.571	65.440	0.178943	119.906	0.1179	0.2166	0.3992	0.3351	1.7246	1.4587	0.12209	0.01365	0.03799	0.01069				
250	141.878	65.383	0.178101	119.925	0.1181	0.2166	0.3997	0.3358	1.7261	1.4609	0.12179	0.01367	0.03795	0.01071				
251	142.184	65.327	0.177265	119.944	0.1183	0.2166	0.4002	0.3365	1.7276	1.4630	0.12149	0.01368	0.03791	0.01072				
252	142.488	65.270	0.176435	119.962	0.1185	0.2165	0.4006	0.3372	1.7292	1.4651	0.12120	0.01369	0.03786	0.01074				
253	142.792	65.214	0.175611	119.980	0.1187	0.2165	0.4011	0.3380	1.7307	1.4673	0.12090	0.01371	0.03782	0.01076				
254	143.095	65.157	0.174794	119.998	0.1189	0.2165	0.4016	0.3387	1.7322	1.4695	0.12061	0.01372	0.03778	0.01078				
255	143.397	65.101	0.173982	120.016	0.1191	0.2165	0.4021	0.3394	1.7338	1.4717	0.12032	0.01373	0.03773	0.01080				
256	143.698	65.044	0.173176	120.034	0.1193	0.2164	0.4026	0.3402	1.7353	1.4739	0.12003	0.01375	0.03769	0.01082				
257	143.999	64.988	0.172377	120.051	0.1195	0.2164	0.4031	0.3409	1.7369	1.4761	0.11974	0.01376	0.03765	0.01084				
258	144.298	64.932	0.171583	120.069	0.1197	0.2164	0.4036	0.3417	1.7385	1.4783	0.11945	0.01377	0.03761	0.01085				
259	144.597	64.875	0.170794	120.086	0.1198	0.2164	0.4041	0.3424	1.7400	1.4806	0.11917	0.01379	0.03757	0.01087				

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		$\rho$ [lb/ft <sup>3</sup> ]		$v$ [ft <sup>3</sup> /lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		$\mu$ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Liquid	Liquid	Vapor	Vapor	Liquid	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
260	144.894	64.819	0.170012	0.170012	120.102	61.873	120.102	0.1200	0.1200	0.2164	0.4046	0.3432	1.7416	1.4828	0.11888	0.01380	0.03752	0.01089
261	145.191	64.763	0.169235	0.169235	120.119	61.991	120.119	0.1202	0.1202	0.2163	0.4051	0.3439	1.7432	1.4851	0.11860	0.01382	0.03748	0.01091
262	145.487	64.707	0.168464	0.168464	120.135	62.108	120.135	0.1204	0.1204	0.2163	0.4056	0.3447	1.7448	1.4874	0.11831	0.01383	0.03744	0.01093
263	145.782	64.650	0.167698	0.167698	120.152	62.225	120.152	0.1206	0.1206	0.2163	0.4061	0.3455	1.7464	1.4897	0.11803	0.01384	0.03740	0.01095
264	146.076	64.594	0.166937	0.166937	120.168	62.341	120.168	0.1208	0.1208	0.2163	0.4066	0.3462	1.7481	1.4920	0.11775	0.01386	0.03736	0.01097
265	146.369	64.538	0.166182	0.166182	120.183	62.458	120.183	0.1210	0.1210	0.2162	0.4071	0.3470	1.7497	1.4944	0.11747	0.01387	0.03731	0.01099
266	146.662	64.482	0.165432	0.165432	120.199	62.574	120.199	0.1212	0.1212	0.2162	0.4076	0.3478	1.7513	1.4967	0.11719	0.01388	0.03727	0.01101
267	146.954	64.426	0.164688	0.164688	120.215	62.690	120.215	0.1214	0.1214	0.2162	0.4082	0.3486	1.7530	1.4991	0.11691	0.01390	0.03723	0.01102
268	147.245	64.370	0.163948	0.163948	120.230	62.806	120.230	0.1215	0.1215	0.2162	0.4087	0.3494	1.7547	1.5014	0.11663	0.01391	0.03719	0.01104
269	147.535	64.314	0.163214	0.163214	120.245	62.921	120.245	0.1217	0.1217	0.2161	0.4092	0.3502	1.7563	1.5038	0.11635	0.01393	0.03715	0.01106
270	147.824	64.258	0.162485	0.162485	120.260	63.036	120.260	0.1219	0.1219	0.2161	0.4097	0.3510	1.7580	1.5062	0.11608	0.01394	0.03711	0.01108
271	148.112	64.202	0.161760	0.161760	120.274	63.152	120.274	0.1221	0.1221	0.2161	0.4102	0.3518	1.7597	1.5086	0.11580	0.01395	0.03707	0.01110
272	148.400	64.146	0.161041	0.161041	120.289	63.266	120.289	0.1223	0.1223	0.2161	0.4108	0.3526	1.7614	1.5111	0.11553	0.01397	0.03703	0.01112
273	148.687	64.090	0.160327	0.160327	120.303	63.381	120.303	0.1225	0.1225	0.2160	0.4113	0.3534	1.7631	1.5135	0.11526	0.01398	0.03699	0.01114
274	148.973	64.034	0.159617	0.159617	120.317	63.496	120.317	0.1226	0.1226	0.2160	0.4118	0.3542	1.7648	1.5160	0.11499	0.01399	0.03695	0.01116
275	149.258	63.978	0.158912	0.158912	120.331	63.610	120.331	0.1228	0.1228	0.2160	0.4124	0.3550	1.7666	1.5185	0.11472	0.01401	0.03691	0.01118
276	149.542	63.922	0.158212	0.158212	120.345	63.724	120.345	0.1230	0.1230	0.2159	0.4129	0.3558	1.7683	1.5210	0.11445	0.01402	0.03687	0.01120
277	149.826	63.866	0.157517	0.157517	120.358	63.838	120.358	0.1232	0.1232	0.2159	0.4135	0.3566	1.7700	1.5235	0.11418	0.01404	0.03682	0.01122
278	150.109	63.811	0.156827	0.156827	120.372	63.952	120.372	0.1234	0.1234	0.2159	0.4140	0.3575	1.7718	1.5260	0.11391	0.01405	0.03678	0.01124
279	150.391	63.755	0.156140	0.156140	120.385	64.065	120.385	0.1236	0.1236	0.2159	0.4146	0.3583	1.7736	1.5286	0.11364	0.01406	0.03674	0.01126
280	150.672	63.699	0.155459	0.155459	120.398	64.179	120.398	0.1237	0.1237	0.2158	0.4151	0.3591	1.7754	1.5311	0.11338	0.01408	0.03670	0.01128
281	150.953	63.643	0.154782	0.154782	120.410	64.292	120.410	0.1239	0.1239	0.2158	0.4157	0.3600	1.7771	1.5337	0.11311	0.01409	0.03666	0.01130
282	151.233	63.587	0.154109	0.154109	120.423	64.405	120.423	0.1241	0.1241	0.2158	0.4162	0.3608	1.7790	1.5363	0.11285	0.01411	0.03662	0.01132
283	151.512	63.532	0.153441	0.153441	120.435	64.517	120.435	0.1243	0.1243	0.2158	0.4168	0.3617	1.7808	1.5389	0.11258	0.01412	0.03659	0.01134
284	151.790	63.476	0.152777	0.152777	120.447	64.630	120.447	0.1245	0.1245	0.2157	0.4173	0.3625	1.7826	1.5415	0.11232	0.01414	0.03655	0.01136
285	152.068	63.420	0.152118	0.152118	120.459	64.742	120.459	0.1246	0.1246	0.2157	0.4179	0.3634	1.7844	1.5442	0.11206	0.01415	0.03651	0.01138
286	152.345	63.364	0.151463	0.151463	120.471	64.854	120.471	0.1248	0.1248	0.2157	0.4185	0.3642	1.7863	1.5469	0.11180	0.01416	0.03647	0.01140
287	152.621	63.309	0.150812	0.150812	120.483	64.966	120.483	0.1250	0.1250	0.2157	0.4190	0.3651	1.7881	1.5495	0.11154	0.01418	0.03643	0.01142
288	152.896	63.253	0.150165	0.150165	120.494	65.078	120.494	0.1252	0.1252	0.2156	0.4196	0.3660	1.7900	1.5523	0.11128	0.01419	0.03639	0.01144
289	153.171	63.197	0.149522	0.149522	120.506	65.190	120.506	0.1253	0.1253	0.2156	0.4202	0.3669	1.7919	1.5550	0.11102	0.01421	0.03635	0.01146
290	153.445	63.141	0.148884	0.148884	120.517	65.301	120.517	0.1255	0.1255	0.2156	0.4208	0.3677	1.7938	1.5577	0.11076	0.01422	0.03631	0.01148
291	153.718	63.086	0.148249	0.148249	120.527	65.413	120.527	0.1257	0.1257	0.2156	0.4214	0.3686	1.7957	1.5605	0.11051	0.01424	0.03627	0.01150
292	153.990	63.030	0.147618	0.147618	120.538	65.524	120.538	0.1259	0.1259	0.2155	0.4219	0.3695	1.7976	1.5632	0.11025	0.01425	0.03623	0.01152
293	154.262	62.974	0.146992	0.146992	120.549	65.635	120.549	0.1261	0.1261	0.2155	0.4225	0.3704	1.7995	1.5660	0.11000	0.01427	0.03619	0.01154
294	154.533	62.919	0.146369	0.146369	120.559	65.745	120.559	0.1262	0.1262	0.2155	0.4231	0.3713	1.8015	1.5688	0.10974	0.01428	0.03615	0.01156
295	154.804	62.863	0.145750	0.145750	120.569	65.856	120.569	0.1264	0.1264	0.2154	0.4237	0.3722	1.8034	1.5717	0.10949	0.01430	0.03612	0.01158
296	155.073	62.807	0.145135	0.145135	120.579	65.966	120.579	0.1266	0.1266	0.2154	0.4243	0.3732	1.8054	1.5745	0.10924	0.01431	0.03608	0.01160

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
297	155.342	62.752	0.144524	66.077	120.589	0.1268	0.2154	0.4249	0.3741	1.8073	1.5774	0.10899	0.01433	0.03604	0.01162			
298	155.611	62.696	0.143917	66.187	120.598	0.1269	0.2154	0.4255	0.3750	1.8093	1.5803	0.10873	0.01434	0.03600	0.01164			
299	155.878	62.640	0.143313	66.297	120.608	0.1271	0.2153	0.4261	0.3759	1.8113	1.5832	0.10848	0.01435	0.03596	0.01166			
300	156.145	62.585	0.142713	66.406	120.617	0.1273	0.2153	0.4267	0.3769	1.8133	1.5861	0.10824	0.01437	0.03592	0.01169			
301	156.411	62.529	0.142117	66.516	120.626	0.1274	0.2153	0.4274	0.3778	1.8154	1.5891	0.10799	0.01438	0.03589	0.01171			
302	156.677	62.473	0.141524	66.625	120.635	0.1276	0.2152	0.4280	0.3788	1.8174	1.5921	0.10774	0.01440	0.03585	0.01173			
303	156.942	62.418	0.140935	66.735	120.644	0.1278	0.2152	0.4286	0.3797	1.8195	1.5951	0.10749	0.01441	0.03581	0.01175			
304	157.206	62.362	0.140349	66.844	120.652	0.1280	0.2152	0.4292	0.3807	1.8215	1.5981	0.10725	0.01443	0.03577	0.01177			
305	157.470	62.306	0.139767	66.953	120.660	0.1281	0.2152	0.4299	0.3817	1.8236	1.6011	0.10700	0.01444	0.03573	0.01179			
306	157.733	62.251	0.139189	67.062	120.668	0.1283	0.2151	0.4305	0.3826	1.8257	1.6042	0.10675	0.01446	0.03570	0.01181			
307	157.995	62.195	0.138613	67.170	120.676	0.1285	0.2151	0.4311	0.3836	1.8278	1.6073	0.10651	0.01448	0.03566	0.01184			
308	158.256	62.139	0.138042	67.279	120.684	0.1286	0.2151	0.4318	0.3846	1.8299	1.6104	0.10627	0.01449	0.03562	0.01186			
309	158.517	62.083	0.137473	67.387	120.692	0.1288	0.2150	0.4324	0.3856	1.8321	1.6135	0.10602	0.01451	0.03558	0.01188			
310	158.778	62.028	0.136908	67.495	120.699	0.1290	0.2150	0.4331	0.3866	1.8342	1.6166	0.10578	0.01452	0.03555	0.01190			
311	159.037	61.972	0.136346	67.603	120.706	0.1292	0.2150	0.4337	0.3876	1.8364	1.6198	0.10554	0.01454	0.03551	0.01192			
312	159.296	61.916	0.135788	67.711	120.713	0.1293	0.2150	0.4344	0.3886	1.8385	1.6230	0.10530	0.01455	0.03547	0.01194			
313	159.555	61.861	0.135233	67.819	120.720	0.1295	0.2149	0.4350	0.3896	1.8407	1.6262	0.10506	0.01457	0.03543	0.01197			
314	159.813	61.805	0.134681	67.926	120.727	0.1297	0.2149	0.4357	0.3906	1.8429	1.6295	0.10482	0.01458	0.03540	0.01199			
315	160.070	61.749	0.134132	68.034	120.733	0.1298	0.2149	0.4364	0.3917	1.8452	1.6327	0.10458	0.01460	0.03536	0.01201			
316	160.326	61.693	0.133586	68.141	120.739	0.1300	0.2148	0.4370	0.3927	1.8474	1.6360	0.10434	0.01461	0.03532	0.01203			
317	160.582	61.637	0.133044	68.248	120.746	0.1302	0.2148	0.4377	0.3937	1.8497	1.6393	0.10411	0.01463	0.03529	0.01205			
318	160.837	61.582	0.132504	68.355	120.751	0.1303	0.2148	0.4384	0.3948	1.8519	1.6427	0.10387	0.01465	0.03525	0.01208			
319	161.092	61.526	0.131968	68.462	120.757	0.1305	0.2147	0.4391	0.3958	1.8542	1.6460	0.10363	0.01466	0.03521	0.01210			
320	161.346	61.470	0.131434	68.569	120.763	0.1307	0.2147	0.4398	0.3969	1.8565	1.6494	0.10340	0.01468	0.03518	0.01212			
321	161.600	61.414	0.130904	68.676	120.768	0.1308	0.2147	0.4405	0.3980	1.8588	1.6528	0.10316	0.01469	0.03514	0.01215			
322	161.852	61.358	0.130377	68.782	120.773	0.1310	0.2147	0.4412	0.3991	1.8611	1.6563	0.10293	0.01471	0.03510	0.01217			
323	162.105	61.302	0.129852	68.889	120.778	0.1312	0.2146	0.4419	0.4001	1.8635	1.6597	0.10269	0.01472	0.03507	0.01219			
324	162.356	61.246	0.129331	68.995	120.783	0.1313	0.2146	0.4426	0.4012	1.8658	1.6632	0.10246	0.01474	0.03503	0.01221			
325	162.607	61.191	0.128812	69.101	120.788	0.1315	0.2146	0.4433	0.4023	1.8682	1.6668	0.10223	0.01476	0.03499	0.01224			
326	162.858	61.135	0.128296	69.207	120.792	0.1317	0.2145	0.4440	0.4034	1.8706	1.6703	0.10200	0.01477	0.03496	0.01226			
327	163.108	61.079	0.127783	69.313	120.797	0.1318	0.2145	0.4447	0.4046	1.8730	1.6739	0.10177	0.01479	0.03492	0.01228			
328	163.357	61.023	0.127273	69.418	120.801	0.1320	0.2145	0.4455	0.4057	1.8755	1.6775	0.10154	0.01481	0.03488	0.01231			
329	163.606	60.967	0.126766	69.524	120.805	0.1322	0.2144	0.4462	0.4068	1.8779	1.6811	0.10131	0.01482	0.03485	0.01233			
330	163.854	60.911	0.126261	69.629	120.808	0.1323	0.2144	0.4469	0.4079	1.8804	1.6848	0.10108	0.01484	0.03481	0.01235			
331	164.101	60.855	0.125759	69.735	120.812	0.1325	0.2144	0.4477	0.4091	1.8829	1.6885	0.10085	0.01485	0.03478	0.01238			
332	164.348	60.798	0.125260	69.840	120.815	0.1327	0.2143	0.4484	0.4102	1.8854	1.6922	0.10062	0.01487	0.03474	0.01240			
333	164.594	60.742	0.124763	69.945	120.818	0.1328	0.2143	0.4492	0.4114	1.8879	1.6959	0.10039	0.01489	0.03471	0.01242			

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
334	164.840	60.686	0.124270	70.050	120.821	0.1330	0.2143	0.4499	0.4126	1.8904	1.6997	0.10016	0.01490	0.03467	0.01245			
335	165.085	60.630	0.123778	70.155	120.824	0.1331	0.2142	0.4507	0.4138	1.8930	1.7035	0.09994	0.01492	0.03463	0.01247			
336	165.330	60.574	0.123290	70.260	120.827	0.1333	0.2142	0.4514	0.4150	1.8955	1.7073	0.09971	0.01494	0.03460	0.01250			
337	165.574	60.518	0.122804	70.364	120.829	0.1335	0.2142	0.4522	0.4161	1.8981	1.7112	0.09949	0.01495	0.03456	0.01252			
338	165.818	60.461	0.122320	70.469	120.832	0.1336	0.2142	0.4530	0.4174	1.9007	1.7151	0.09926	0.01497	0.03453	0.01254			
339	166.061	60.405	0.121839	70.573	120.834	0.1338	0.2141	0.4538	0.4186	1.9034	1.7190	0.09904	0.01499	0.03449	0.01257			
340	166.303	60.349	0.121361	70.677	120.836	0.1340	0.2141	0.4545	0.4198	1.9060	1.7230	0.09881	0.01500	0.03446	0.01259			
341	166.545	60.292	0.120885	70.781	120.837	0.1341	0.2141	0.4553	0.4210	1.9087	1.7270	0.09859	0.01502	0.03442	0.01262			
342	166.786	60.236	0.120411	70.886	120.839	0.1343	0.2140	0.4561	0.4223	1.9114	1.7310	0.09837	0.01504	0.03439	0.01264			
343	167.027	60.180	0.119940	70.989	120.840	0.1344	0.2140	0.4569	0.4235	1.9141	1.7351	0.09814	0.01506	0.03435	0.01267			
344	167.268	60.123	0.119472	71.093	120.841	0.1346	0.2140	0.4578	0.4248	1.9168	1.7392	0.09792	0.01507	0.03432	0.01269			
345	167.507	60.067	0.119005	71.197	120.842	0.1348	0.2139	0.4586	0.4261	1.9196	1.7433	0.09770	0.01509	0.03428	0.01272			
346	167.746	60.010	0.118542	71.301	120.843	0.1349	0.2139	0.4594	0.4273	1.9224	1.7474	0.09748	0.01511	0.03425	0.01274			
347	167.985	59.954	0.118080	71.404	120.844	0.1351	0.2139	0.4602	0.4286	1.9252	1.7516	0.09726	0.01512	0.03421	0.01277			
348	168.223	59.897	0.117621	71.508	120.844	0.1352	0.2138	0.4610	0.4299	1.9280	1.7559	0.09704	0.01514	0.03418	0.01279			
349	168.461	59.840	0.117164	71.611	120.845	0.1354	0.2138	0.4619	0.4312	1.9308	1.7601	0.09682	0.01516	0.03414	0.01282			
350	168.698	59.784	0.116710	71.714	120.845	0.1356	0.2137	0.4627	0.4326	1.9337	1.7644	0.09660	0.01518	0.03411	0.01284			
351	168.934	59.727	0.116257	71.817	120.844	0.1357	0.2137	0.4636	0.4339	1.9366	1.7688	0.09638	0.01519	0.03407	0.01287			
352	169.170	59.670	0.115807	71.920	120.844	0.1359	0.2137	0.4644	0.4352	1.9395	1.7732	0.09617	0.01521	0.03404	0.01289			
353	169.406	59.613	0.115359	72.023	120.844	0.1360	0.2136	0.4653	0.4366	1.9424	1.7776	0.09595	0.01523	0.03401	0.01292			
354	169.641	59.557	0.114914	72.126	120.843	0.1362	0.2136	0.4662	0.4379	1.9453	1.7820	0.09573	0.01525	0.03397	0.01295			
355	169.875	59.500	0.114470	72.229	120.842	0.1364	0.2136	0.4671	0.4393	1.9483	1.7865	0.09551	0.01526	0.03394	0.01297			
356	170.109	59.443	0.114029	72.331	120.841	0.1365	0.2135	0.4679	0.4407	1.9513	1.7910	0.09530	0.01528	0.03390	0.01300			
357	170.343	59.386	0.113590	72.434	120.840	0.1367	0.2135	0.4688	0.4421	1.9543	1.7956	0.09508	0.01530	0.03387	0.01302			
358	170.576	59.329	0.113153	72.536	120.838	0.1368	0.2135	0.4697	0.4435	1.9574	1.8002	0.09487	0.01532	0.03383	0.01305			
359	170.808	59.272	0.112718	72.639	120.837	0.1370	0.2134	0.4706	0.4449	1.9605	1.8049	0.09465	0.01534	0.03380	0.01308			
360	171.040	59.215	0.112286	72.741	120.835	0.1371	0.2134	0.4715	0.4463	1.9636	1.8095	0.09444	0.01536	0.03377	0.01310			
361	171.271	59.157	0.111855	72.843	120.833	0.1373	0.2134	0.4725	0.4478	1.9667	1.8143	0.09423	0.01537	0.03373	0.01313			
362	171.502	59.100	0.111426	72.945	120.831	0.1375	0.2133	0.4734	0.4492	1.9698	1.8190	0.09401	0.01539	0.03370	0.01316			
363	171.733	59.043	0.111000	73.047	120.828	0.1376	0.2133	0.4743	0.4507	1.9730	1.8239	0.09380	0.01541	0.03367	0.01319			
364	171.963	58.986	0.110575	73.149	120.826	0.1378	0.2133	0.4753	0.4522	1.9762	1.8287	0.09359	0.01543	0.03363	0.01321			
365	172.192	58.928	0.110153	73.251	120.823	0.1379	0.2132	0.4762	0.4537	1.9794	1.8336	0.09337	0.01545	0.03360	0.01324			
366	172.421	58.871	0.109732	73.353	120.820	0.1381	0.2132	0.4772	0.4552	1.9827	1.8386	0.09316	0.01547	0.03356	0.01327			
367	172.649	58.813	0.109313	73.455	120.817	0.1382	0.2131	0.4781	0.4567	1.9860	1.8436	0.09295	0.01548	0.03353	0.01329			
368	172.877	58.756	0.108897	73.556	120.814	0.1384	0.2131	0.4791	0.4582	1.9893	1.8486	0.09274	0.01550	0.03350	0.01332			
369	173.105	58.698	0.108482	73.658	120.810	0.1385	0.2131	0.4801	0.4598	1.9926	1.8537	0.09253	0.01552	0.03346	0.01335			
370	173.332	58.640	0.108069	73.759	120.806	0.1387	0.2130	0.4811	0.4613	1.9960	1.8588	0.09232	0.01554	0.03343	0.01338			

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
371	173.558	58.583	0.107658	0.107658	73.861	120.802	0.1389	0.2130	0.4821	0.4629	1.9994	1.8640	0.09211	0.01556	0.03340	0.01341		
372	173.784	58.525	0.107249	0.107249	73.962	120.798	0.1390	0.2130	0.4831	0.4645	2.0028	1.8692	0.09190	0.01558	0.03337	0.01343		
373	174.010	58.467	0.106842	0.106842	74.063	120.794	0.1392	0.2129	0.4841	0.4661	2.0063	1.8745	0.09169	0.01560	0.03333	0.01346		
374	174.235	58.409	0.106437	0.106437	74.164	120.790	0.1393	0.2129	0.4851	0.4677	2.0098	1.8798	0.09148	0.01562	0.03330	0.01349		
375	174.460	58.351	0.106033	0.106033	74.265	120.785	0.1395	0.2128	0.4861	0.4693	2.0133	1.8852	0.09128	0.01564	0.03327	0.01352		
376	174.684	58.293	0.105632	0.105632	74.366	120.780	0.1396	0.2128	0.4872	0.4709	2.0169	1.8906	0.09107	0.01566	0.03323	0.01355		
377	174.908	58.235	0.105232	0.105232	74.467	120.775	0.1398	0.2128	0.4882	0.4726	2.0204	1.8961	0.09086	0.01568	0.03320	0.01358		
378	175.131	58.177	0.104834	0.104834	74.568	120.770	0.1399	0.2127	0.4893	0.4743	2.0241	1.9016	0.09065	0.01570	0.03317	0.01361		
379	175.354	58.119	0.104437	0.104437	74.669	120.764	0.1401	0.2127	0.4903	0.4759	2.0277	1.9072	0.09045	0.01572	0.03314	0.01364		
380	175.576	58.060	0.104043	0.104043	74.770	120.758	0.1402	0.2126	0.4914	0.4776	2.0314	1.9128	0.09024	0.01573	0.03310	0.01367		
381	175.798	58.002	0.103650	0.103650	74.871	120.752	0.1404	0.2126	0.4925	0.4794	2.0351	1.9185	0.09003	0.01575	0.03307	0.01370		
382	176.019	57.943	0.103259	0.103259	74.971	120.746	0.1406	0.2126	0.4936	0.4811	2.0389	1.9243	0.08983	0.01577	0.03304	0.01373		
383	176.240	57.885	0.102870	0.102870	75.072	120.740	0.1407	0.2125	0.4947	0.4828	2.0426	1.9301	0.08962	0.01579	0.03301	0.01376		
384	176.460	57.826	0.102482	0.102482	75.172	120.734	0.1409	0.2125	0.4958	0.4846	2.0465	1.9359	0.08942	0.01581	0.03297	0.01379		
385	176.680	57.768	0.102096	0.102096	75.273	120.727	0.1410	0.2124	0.4969	0.4864	2.0503	1.9418	0.08921	0.01583	0.03294	0.01382		
386	176.900	57.709	0.101712	0.101712	75.373	120.720	0.1412	0.2124	0.4981	0.4882	2.0542	1.9478	0.08901	0.01586	0.03291	0.01385		
387	177.119	57.650	0.101329	0.101329	75.473	120.713	0.1413	0.2124	0.4992	0.4900	2.0581	1.9538	0.08880	0.01588	0.03288	0.01388		
388	177.338	57.591	0.100948	0.100948	75.574	120.706	0.1415	0.2123	0.5004	0.4918	2.0621	1.9599	0.08860	0.01590	0.03284	0.01391		
389	177.556	57.532	0.100568	0.100568	75.674	120.698	0.1416	0.2123	0.5015	0.4937	2.0661	1.9661	0.08840	0.01592	0.03281	0.01394		
390	177.774	57.473	0.100190	0.100190	75.774	120.690	0.1418	0.2122	0.5027	0.4955	2.0701	1.9723	0.08819	0.01594	0.03278	0.01397		
391	177.991	57.414	0.099814	0.099814	75.874	120.683	0.1419	0.2122	0.5039	0.4974	2.0742	1.9786	0.08799	0.01596	0.03275	0.01400		
392	178.208	57.355	0.099440	0.099440	75.974	120.674	0.1421	0.2122	0.5051	0.4993	2.0783	1.9849	0.08779	0.01598	0.03272	0.01403		
393	178.425	57.295	0.099066	0.099066	76.074	120.666	0.1422	0.2121	0.5063	0.5012	2.0825	1.9914	0.08759	0.01600	0.03269	0.01406		
394	178.641	57.236	0.098695	0.098695	76.174	120.658	0.1424	0.2121	0.5075	0.5032	2.0867	1.9978	0.08738	0.01602	0.03265	0.01410		
395	178.856	57.176	0.098325	0.098325	76.274	120.649	0.1425	0.2120	0.5088	0.5051	2.0909	2.0044	0.08718	0.01604	0.03262	0.01413		
396	179.071	57.117	0.097956	0.097956	76.374	120.640	0.1427	0.2120	0.5100	0.5071	2.0952	2.0110	0.08698	0.01606	0.03259	0.01416		
397	179.286	57.057	0.097589	0.097589	76.474	120.631	0.1428	0.2119	0.5113	0.5091	2.0995	2.0177	0.08678	0.01608	0.03256	0.01419		
398	179.500	56.997	0.097224	0.097224	76.574	120.621	0.1430	0.2119	0.5126	0.5111	2.1039	2.0244	0.08658	0.01611	0.03253	0.01422		
399	179.714	56.937	0.096860	0.096860	76.674	120.612	0.1431	0.2119	0.5138	0.5132	2.1083	2.0313	0.08638	0.01613	0.03250	0.01426		
400	179.928	56.877	0.096497	0.096497	76.773	120.602	0.1433	0.2118	0.5151	0.5152	2.1128	2.0382	0.08618	0.01615	0.03247	0.01429		
401	180.141	56.817	0.096136	0.096136	76.873	120.592	0.1434	0.2118	0.5164	0.5173	2.1173	2.0451	0.08598	0.01617	0.03243	0.01432		
402	180.353	56.757	0.095776	0.095776	76.973	120.582	0.1436	0.2117	0.5178	0.5194	2.1218	2.0522	0.08578	0.01619	0.03240	0.01436		
403	180.566	56.697	0.095418	0.095418	77.072	120.571	0.1437	0.2117	0.5191	0.5216	2.1264	2.0593	0.08558	0.01621	0.03237	0.01439		
404	180.777	56.637	0.095061	0.095061	77.172	120.560	0.1439	0.2116	0.5204	0.5237	2.1311	2.0665	0.08538	0.01624	0.03234	0.01442		
405	180.989	56.576	0.094706	0.094706	77.271	120.550	0.1440	0.2116	0.5218	0.5259	2.1358	2.0738	0.08518	0.01626	0.03231	0.01446		
406	181.200	56.516	0.094352	0.094352	77.371	120.538	0.1442	0.2116	0.5232	0.5281	2.1405	2.0811	0.08498	0.01628	0.03228	0.01449		
407	181.410	56.455	0.093999	0.093999	77.470	120.527	0.1443	0.2115	0.5246	0.5303	2.1453	2.0886	0.08478	0.01630	0.03225	0.01452		



**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		$\rho$ [lb/ft <sup>3</sup> ]		$v$ [ft <sup>3</sup> /lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		$\mu$ [centipose]		k [Btu/hr-ft-R]	
	Bulk		Liquid	Vapor	Vapor		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
408	181.620		56.394	0.093648	77.570	120.515	0.1445	0.2115	0.5260	0.5325	2.1501	2.0961	0.08459	0.01633	0.03222	0.01456		
409	181.830		56.333	0.093298	77.669	120.504	0.1446	0.2114	0.5274	0.5348	2.1550	2.1037	0.08439	0.01635	0.03219	0.01459		
410	182.039		56.272	0.092949	77.768	120.492	0.1448	0.2114	0.5288	0.5371	2.1600	2.1114	0.08419	0.01637	0.03216	0.01463		
411	182.248		56.211	0.092602	77.868	120.479	0.1449	0.2113	0.5303	0.5394	2.1650	2.1192	0.08399	0.01639	0.03213	0.01466		
412	182.457		56.150	0.092256	77.967	120.467	0.1451	0.2113	0.5317	0.5417	2.1700	2.1270	0.08380	0.01642	0.03210	0.01470		
413	182.665		56.089	0.091911	78.067	120.454	0.1452	0.2112	0.5332	0.5441	2.1751	2.1350	0.08360	0.01644	0.03207	0.01473		
414	182.873		56.027	0.091568	78.166	120.441	0.1454	0.2112	0.5347	0.5465	2.1803	2.1430	0.08340	0.01646	0.03204	0.01477		
415	183.080		55.966	0.091226	78.265	120.428	0.1455	0.2111	0.5362	0.5489	2.1855	2.1512	0.08320	0.01649	0.03201	0.01480		
416	183.287		55.904	0.090885	78.364	120.415	0.1457	0.2111	0.5378	0.5514	2.1908	2.1594	0.08301	0.01651	0.03198	0.01484		
417	183.493		55.842	0.090545	78.464	120.401	0.1458	0.2110	0.5393	0.5538	2.1962	2.1677	0.08281	0.01653	0.03195	0.01488		
418	183.699		55.780	0.090207	78.563	120.387	0.1460	0.2110	0.5409	0.5563	2.2016	2.1762	0.08261	0.01656	0.03192	0.01491		
419	183.905		55.718	0.089870	78.662	120.373	0.1461	0.2109	0.5425	0.5589	2.2070	2.1847	0.08242	0.01658	0.03189	0.01495		
420	184.110		55.656	0.089534	78.761	120.359	0.1463	0.2109	0.5441	0.5614	2.2126	2.1933	0.08222	0.01661	0.03186	0.01499		
421	184.315		55.594	0.089199	78.860	120.344	0.1464	0.2109	0.5457	0.5640	2.2182	2.2021	0.08203	0.01663	0.03183	0.01502		
422	184.520		55.531	0.088866	78.960	120.330	0.1466	0.2108	0.5473	0.5666	2.2238	2.2109	0.08183	0.01665	0.03180	0.01506		
423	184.724		55.469	0.088534	79.059	120.315	0.1467	0.2108	0.5490	0.5693	2.2295	2.2198	0.08164	0.01668	0.03177	0.01510		
424	184.928		55.406	0.088203	79.158	120.299	0.1469	0.2107	0.5506	0.5720	2.2353	2.2289	0.08144	0.01670	0.03174	0.01514		
425	185.131		55.343	0.087873	79.257	120.284	0.1470	0.2107	0.5523	0.5747	2.2412	2.2381	0.08125	0.01673	0.03171	0.01518		
426	185.334		55.280	0.087544	79.356	120.268	0.1472	0.2106	0.5541	0.5774	2.2471	2.2473	0.08105	0.01675	0.03168	0.01521		
427	185.536		55.217	0.087216	79.455	120.252	0.1473	0.2106	0.5558	0.5802	2.2531	2.2567	0.08086	0.01678	0.03165	0.01525		
428	185.739		55.154	0.086890	79.555	120.236	0.1475	0.2105	0.5575	0.5830	2.2592	2.2662	0.08066	0.01680	0.03162	0.01529		
429	185.940		55.091	0.086564	79.654	120.219	0.1476	0.2105	0.5593	0.5859	2.2653	2.2759	0.08047	0.01683	0.03160	0.01533		
430	186.142		55.027	0.086240	79.753	120.202	0.1478	0.2104	0.5611	0.5887	2.2716	2.2856	0.08027	0.01685	0.03157	0.01537		
431	186.343		54.964	0.085917	79.852	120.185	0.1479	0.2104	0.5629	0.5917	2.2779	2.2955	0.08008	0.01688	0.03154	0.01541		
432	186.544		54.900	0.085595	79.951	120.168	0.1481	0.2103	0.5648	0.5946	2.2842	2.3055	0.07989	0.01690	0.03151	0.01545		
433	186.744		54.836	0.085273	80.051	120.150	0.1482	0.2103	0.5666	0.5976	2.2907	2.3156	0.07969	0.01693	0.03148	0.01549		
434	186.944		54.772	0.084953	80.150	120.133	0.1484	0.2102	0.5685	0.6006	2.2972	2.3259	0.07950	0.01695	0.03145	0.01553		
435	187.143		54.707	0.084635	80.249	120.115	0.1485	0.2101	0.5704	0.6037	2.3039	2.3363	0.07930	0.01698	0.03142	0.01557		
436	187.342		54.643	0.084317	80.348	120.096	0.1487	0.2101	0.5724	0.6068	2.3106	2.3468	0.07911	0.01701	0.03140	0.01561		
437	187.541		54.578	0.084000	80.447	120.078	0.1488	0.2100	0.5743	0.6100	2.3174	2.3575	0.07892	0.01703	0.03137	0.01565		
438	187.740		54.514	0.083684	80.547	120.059	0.1490	0.2100	0.5763	0.6132	2.3243	2.3683	0.07872	0.01706	0.03134	0.01570		
439	187.938		54.449	0.083369	80.646	120.040	0.1491	0.2099	0.5783	0.6164	2.3312	2.3792	0.07853	0.01709	0.03131	0.01574		
440	188.135		54.384	0.083055	80.745	120.020	0.1493	0.2099	0.5804	0.6197	2.3383	2.3903	0.07834	0.01711	0.03128	0.01578		
441	188.333		54.319	0.082742	80.845	120.001	0.1494	0.2098	0.5824	0.6230	2.3455	2.4016	0.07814	0.01714	0.03126	0.01582		
442	188.530		54.253	0.082431	80.944	119.981	0.1495	0.2098	0.5845	0.6264	2.3527	2.4130	0.07795	0.01717	0.03123	0.01587		
443	188.726		54.188	0.082120	81.043	119.960	0.1497	0.2097	0.5866	0.6298	2.3601	2.4246	0.07776	0.01720	0.03120	0.01591		
444	188.923		54.122	0.081810	81.143	119.940	0.1498	0.2097	0.5888	0.6332	2.3675	2.4363	0.07756	0.01722	0.03117	0.01595		

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
445	189.118		54.056	0.081501	81.242	119.919	0.1500	0.2096	0.5910	0.6367	2.3751	2.4482	0.07737	0.01725	0.03115	0.01600		
446	189.314		53.990	0.081193	81.342	119.898	0.1501	0.2096	0.5932	0.6403	2.3827	2.4602	0.07718	0.01728	0.03112	0.01604		
447	189.509		53.923	0.080885	81.441	119.877	0.1503	0.2095	0.5954	0.6439	2.3905	2.4724	0.07699	0.01731	0.03109	0.01608		
448	189.704		53.857	0.080579	81.541	119.855	0.1504	0.2094	0.5977	0.6475	2.3984	2.4848	0.07679	0.01733	0.03107	0.01613		
449	189.898		53.790	0.080274	81.640	119.833	0.1506	0.2094	0.6000	0.6512	2.4064	2.4974	0.07660	0.01736	0.03104	0.01617		
450	190.092		53.723	0.079969	81.740	119.811	0.1507	0.2093	0.6023	0.6550	2.4145	2.5102	0.07641	0.01739	0.03101	0.01622		
451	190.286		53.656	0.079666	81.840	119.788	0.1509	0.2093	0.6047	0.6588	2.4227	2.5231	0.07622	0.01742	0.03099	0.01627		
452	190.480		53.589	0.079363	81.939	119.766	0.1510	0.2092	0.6071	0.6626	2.4310	2.5362	0.07602	0.01745	0.03096	0.01631		
453	190.673		53.522	0.079061	82.039	119.742	0.1512	0.2092	0.6095	0.6666	2.4395	2.5495	0.07583	0.01748	0.03093	0.01636		
454	190.865		53.454	0.078760	82.139	119.719	0.1513	0.2091	0.6120	0.6705	2.4481	2.5631	0.07564	0.01751	0.03091	0.01641		
455	191.058		53.386	0.078460	82.239	119.695	0.1515	0.2090	0.6145	0.6746	2.4568	2.5768	0.07544	0.01754	0.03088	0.01645		
456	191.250		53.318	0.078161	82.339	119.671	0.1516	0.2090	0.6170	0.6787	2.4656	2.5907	0.07525	0.01757	0.03086	0.01650		
457	191.441		53.250	0.077863	82.439	119.647	0.1518	0.2089	0.6196	0.6828	2.4746	2.6048	0.07506	0.01760	0.03083	0.01655		
458	191.632		53.181	0.077565	82.539	119.622	0.1519	0.2089	0.6222	0.6870	2.4837	2.6192	0.07487	0.01763	0.03081	0.01660		
459	191.823		53.113	0.077268	82.639	119.597	0.1521	0.2088	0.6249	0.6913	2.4929	2.6338	0.07467	0.01766	0.03078	0.01665		
460	192.014		53.044	0.076972	82.739	119.572	0.1522	0.2087	0.6276	0.6957	2.5023	2.6486	0.07448	0.01769	0.03076	0.01670		
461	192.204		52.975	0.076677	82.839	119.546	0.1524	0.2087	0.6303	0.7001	2.5119	2.6636	0.07429	0.01772	0.03073	0.01675		
462	192.394		52.905	0.076382	82.939	119.520	0.1525	0.2086	0.6331	0.7046	2.5215	2.6789	0.07410	0.01775	0.03071	0.01680		
463	192.584		52.836	0.076088	83.040	119.494	0.1527	0.2086	0.6359	0.7091	2.5314	2.6944	0.07390	0.01778	0.03068	0.01685		
464	192.773		52.766	0.075795	83.140	119.467	0.1528	0.2085	0.6388	0.7138	2.5414	2.7102	0.07371	0.01781	0.03066	0.01690		
465	192.962		52.696	0.075503	83.241	119.440	0.1530	0.2084	0.6417	0.7185	2.5515	2.7262	0.07352	0.01784	0.03063	0.01695		
466	193.150		52.625	0.075211	83.341	119.413	0.1531	0.2084	0.6446	0.7232	2.5619	2.7424	0.07332	0.01788	0.03061	0.01700		
467	193.339		52.555	0.074920	83.442	119.385	0.1533	0.2083	0.6477	0.7281	2.5723	2.7590	0.07313	0.01791	0.03058	0.01705		
468	193.526		52.484	0.074630	83.543	119.357	0.1534	0.2082	0.6507	0.7330	2.5830	2.7758	0.07294	0.01794	0.03056	0.01710		
469	193.714		52.413	0.074341	83.644	119.329	0.1536	0.2082	0.6538	0.7380	2.5938	2.7929	0.07275	0.01797	0.03054	0.01716		
470	193.901		52.342	0.074052	83.745	119.300	0.1537	0.2081	0.6570	0.7431	2.6049	2.8103	0.07255	0.01801	0.03051	0.01721		
471	194.088		52.270	0.073764	83.846	119.271	0.1539	0.2080	0.6602	0.7483	2.6161	2.8280	0.07236	0.01804	0.03049	0.01727		
472	194.275		52.198	0.073476	83.947	119.242	0.1540	0.2080	0.6635	0.7536	2.6275	2.8460	0.07217	0.01807	0.03047	0.01732		
473	194.461		52.126	0.073189	84.048	119.212	0.1542	0.2079	0.6668	0.7590	2.6391	2.8642	0.07197	0.01811	0.03044	0.01738		
474	194.647		52.054	0.072903	84.150	119.182	0.1543	0.2078	0.6702	0.7644	2.6509	2.8829	0.07178	0.01814	0.03042	0.01743		
475	194.832		51.981	0.072617	84.251	119.151	0.1545	0.2078	0.6736	0.7700	2.6629	2.9018	0.07158	0.01817	0.03040	0.01749		
476	195.017		51.908	0.072332	84.353	119.121	0.1546	0.2077	0.6771	0.7756	2.6751	2.9211	0.07139	0.01821	0.03038	0.01754		
477	195.202		51.835	0.072048	84.454	119.089	0.1547	0.2076	0.6807	0.7814	2.6876	2.9407	0.07120	0.01824	0.03036	0.01760		
478	195.387		51.761	0.071764	84.556	119.058	0.1549	0.2076	0.6843	0.7872	2.7002	2.9607	0.07100	0.01828	0.03033	0.01766		
479	195.571		51.687	0.071481	84.658	119.025	0.1550	0.2075	0.6880	0.7932	2.7131	2.9810	0.07081	0.01831	0.03031	0.01772		
480	195.755		51.613	0.071198	84.760	118.993	0.1552	0.2074	0.6918	0.7993	2.7263	3.0017	0.07061	0.01835	0.03029	0.01778		
481	195.938		51.539	0.070916	84.862	118.960	0.1554	0.2074	0.6956	0.8054	2.7397	3.0228	0.07042	0.01838	0.03027	0.01784		

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
	Bulk	Bulk	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
482	196.122	51.464	0.070635	84.965	118.927	0.1555	0.2073	0.6995	0.8117	2.7533	3.0443	0.07022	0.01842	0.03025	0.01790			
483	196.305	51.389	0.070354	85.067	118.893	0.1557	0.2072	0.7035	0.8181	2.7672	3.0662	0.07003	0.01846	0.03023	0.01796			
484	196.487	51.313	0.070073	85.170	118.859	0.1558	0.2071	0.7075	0.8247	2.7814	3.0885	0.06983	0.01849	0.03021	0.01802			
485	196.669	51.238	0.069793	85.272	118.824	0.1560	0.2071	0.7117	0.8313	2.7958	3.1112	0.06964	0.01853	0.03019	0.01808			
486	196.851	51.161	0.069513	85.375	118.789	0.1561	0.2070	0.7159	0.8381	2.8105	3.1344	0.06944	0.01857	0.03017	0.01814			
487	197.033	51.085	0.069234	85.478	118.754	0.1563	0.2069	0.7202	0.8451	2.8256	3.1580	0.06924	0.01860	0.03015	0.01821			
488	197.214	51.008	0.068956	85.581	118.718	0.1564	0.2069	0.7246	0.8521	2.8409	3.1821	0.06905	0.01864	0.03013	0.01827			
489	197.395	50.931	0.068678	85.685	118.682	0.1566	0.2068	0.7290	0.8593	2.8565	3.2067	0.06885	0.01868	0.03011	0.01833			
490	197.576	50.854	0.068400	85.788	118.645	0.1567	0.2067	0.7336	0.8667	2.8724	3.2318	0.06865	0.01872	0.03009	0.01840			
491	197.756	50.776	0.068123	85.892	118.608	0.1569	0.2066	0.7382	0.8742	2.8887	3.2574	0.06846	0.01876	0.03008	0.01846			
492	197.936	50.697	0.067846	85.996	118.570	0.1570	0.2066	0.7430	0.8818	2.9053	3.2835	0.06826	0.01880	0.03006	0.01853			
493	198.116	50.619	0.067569	86.100	118.532	0.1572	0.2065	0.7478	0.8896	2.9223	3.3102	0.06806	0.01884	0.03004	0.01860			
494	198.296	50.540	0.067293	86.204	118.493	0.1573	0.2064	0.7528	0.8976	2.9396	3.3374	0.06786	0.01888	0.03002	0.01867			
495	198.475	50.460	0.067018	86.309	118.454	0.1575	0.2063	0.7579	0.9057	2.9573	3.3652	0.06767	0.01892	0.03001	0.01874			
496	198.653	50.381	0.066742	86.413	118.415	0.1576	0.2062	0.7630	0.9141	2.9754	3.3936	0.06747	0.01896	0.02999	0.01881			
497	198.832	50.300	0.066467	86.518	118.374	0.1578	0.2062	0.7683	0.9226	2.9939	3.4226	0.06727	0.01900	0.02998	0.01888			
498	199.010	50.220	0.066192	86.623	118.334	0.1579	0.2061	0.7737	0.9312	3.0128	3.4523	0.06707	0.01904	0.02996	0.01895			
499	199.188	50.139	0.065918	86.728	118.293	0.1581	0.2060	0.7792	0.9401	3.0322	3.4826	0.06687	0.01908	0.02994	0.01902			
500	199.366	50.057	0.065644	86.834	118.251	0.1582	0.2059	0.7849	0.9492	3.0519	3.5136	0.06667	0.01913	0.02993	0.01909			
501	199.543	49.975	0.065370	86.940	118.209	0.1584	0.2058	0.7906	0.9585	3.0722	3.5454	0.06647	0.01917	0.02992	0.01917			
502	199.720	49.893	0.065097	87.046	118.166	0.1586	0.2058	0.7966	0.9680	3.0929	3.5778	0.06627	0.01921	0.02990	0.01924			
503	199.896	49.810	0.064823	87.152	118.123	0.1587	0.2057	0.8026	0.9777	3.1141	3.6110	0.06606	0.01925	0.02989	0.01932			
504	200.073	49.726	0.064550	87.258	118.079	0.1589	0.2056	0.8088	0.9877	3.1358	3.6450	0.06586	0.01930	0.02988	0.01939			
505	200.249	49.643	0.064278	87.365	118.034	0.1590	0.2055	0.8151	0.9978	3.1580	3.6798	0.06566	0.01934	0.02986	0.01947			
506	200.424	49.558	0.064005	87.472	117.989	0.1592	0.2054	0.8216	1.0083	3.1808	3.7154	0.06546	0.01939	0.02985	0.01955			
507	200.600	49.473	0.063732	87.579	117.944	0.1593	0.2053	0.8283	1.0190	3.2042	3.7519	0.06525	0.01943	0.02984	0.01963			
508	200.775	49.388	0.063460	87.686	117.897	0.1595	0.2052	0.8351	1.0299	3.2281	3.7893	0.06505	0.01948	0.02983	0.01971			
509	200.950	49.302	0.063188	87.794	117.851	0.1596	0.2051	0.8421	1.0412	3.2527	3.8277	0.06485	0.01953	0.02982	0.01979			
510	201.124	49.216	0.062916	87.902	117.803	0.1598	0.2051	0.8493	1.0527	3.2779	3.8670	0.06464	0.01957	0.02981	0.01988			
511	201.298	49.129	0.062644	88.011	117.755	0.1600	0.2050	0.8567	1.0645	3.3038	3.9073	0.06444	0.01962	0.02980	0.01996			
512	201.472	49.041	0.062372	88.119	117.706	0.1601	0.2049	0.8643	1.0766	3.3303	3.9487	0.06423	0.01967	0.02979	0.02005			
513	201.646	48.953	0.062100	88.228	117.657	0.1603	0.2048	0.8720	1.0890	3.3576	3.9912	0.06402	0.01972	0.02978	0.02013			
514	201.819	48.864	0.061829	88.338	117.607	0.1604	0.2047	0.8800	1.1018	3.3856	4.0348	0.06382	0.01977	0.02978	0.02022			
515	201.992	48.775	0.061557	88.447	117.556	0.1606	0.2046	0.8882	1.1149	3.4144	4.0796	0.06361	0.01981	0.02977	0.02031			
516	202.164	48.685	0.061285	88.557	117.504	0.1608	0.2045	0.8967	1.1284	3.4440	4.1256	0.06340	0.01986	0.02976	0.02040			
517	202.337	48.595	0.061014	88.668	117.452	0.1609	0.2044	0.9053	1.1423	3.4744	4.1729	0.06319	0.01992	0.02976	0.02049			
518	202.509	48.503	0.060742	88.778	117.399	0.1611	0.2043	0.9143	1.1565	3.5058	4.2216	0.06298	0.01997	0.02976	0.02058			

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]		$\rho$ [lb/ft <sup>3</sup> ]		$v$ [ft <sup>3</sup> /lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		$\mu$ [centipose]		k [Btu/hr-ft-R]	
	Bulk		Liquid	Vapor	Vapor		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
519	202.681		48.411	0.060470	88.889	117.345	0.1612	0.2042	0.9235	1.1712	3.5380	4.2716	0.06277	0.02002	0.02975	0.02068		
520	202.852		48.319	0.060198	89.001	117.291	0.1614	0.2041	0.9329	1.1863	3.5712	4.3231	0.06256	0.02007	0.02975	0.02077		
521	203.023		48.226	0.059926	89.113	117.236	0.1616	0.2040	0.9427	1.2018	3.6055	4.3762	0.06234	0.02012	0.02975	0.02087		
522	203.194		48.132	0.059654	89.225	117.180	0.1617	0.2039	0.9527	1.2178	3.6407	4.4308	0.06213	0.02018	0.02975	0.02097		
523	203.365		48.037	0.059382	89.338	117.123	0.1619	0.2038	0.9631	1.2343	3.6771	4.4871	0.06192	0.02023	0.02975	0.02107		
524	203.535		47.942	0.059109	89.451	117.065	0.1621	0.2037	0.9738	1.2513	3.7147	4.5451	0.06170	0.02029	0.02975	0.02118		
525	203.705		47.845	0.058836	89.565	117.006	0.1622	0.2036	0.9848	1.2689	3.7534	4.6050	0.06149	0.02034	0.02975	0.02128		
526	203.875		47.748	0.058563	89.679	116.947	0.1624	0.2035	0.9962	1.2870	3.7935	4.6667	0.06127	0.02040	0.02975	0.02139		
527	204.044		47.650	0.058290	89.793	116.887	0.1626	0.2034	1.0080	1.3057	3.8348	4.7305	0.06105	0.02046	0.02975	0.02149		
528	204.213		47.552	0.058016	89.908	116.825	0.1627	0.2033	1.0201	1.3250	3.8776	4.7964	0.06083	0.02052	0.02976	0.02160		
529	204.382		47.452	0.057742	90.024	116.763	0.1629	0.2032	1.0327	1.3450	3.9218	4.8645	0.06061	0.02058	0.02976	0.02172		
530	204.550		47.352	0.057468	90.140	116.700	0.1631	0.2031	1.0458	1.3656	3.9676	4.9349	0.06039	0.02064	0.02977	0.02183		
531	204.718		47.250	0.057193	90.257	116.636	0.1632	0.2029	1.0593	1.3870	4.0151	5.0077	0.06017	0.02070	0.02978	0.02195		
532	204.886		47.148	0.056917	90.374	116.571	0.1634	0.2028	1.0733	1.4091	4.0643	5.0832	0.05995	0.02076	0.02979	0.02207		
533	205.054		47.045	0.056642	90.492	116.504	0.1636	0.2027	1.0878	1.4321	4.1153	5.1614	0.05972	0.02082	0.02980	0.02219		
534	205.221		46.941	0.056365	90.611	116.437	0.1638	0.2026	1.1029	1.4558	4.1682	5.2424	0.05950	0.02089	0.02981	0.02231		
535	205.388		46.835	0.056088	90.730	116.368	0.1639	0.2025	1.1185	1.4805	4.2231	5.3264	0.05927	0.02095	0.02983	0.02244		
536	205.555		46.729	0.055811	90.850	116.299	0.1641	0.2024	1.1348	1.5061	4.2803	5.4137	0.05904	0.02102	0.02984	0.02257		
537	205.721		46.621	0.055532	90.970	116.228	0.1643	0.2022	1.1517	1.5327	4.3397	5.5044	0.05881	0.02108	0.02986	0.02270		
538	205.887		46.513	0.055253	91.091	116.156	0.1645	0.2021	1.1693	1.5604	4.4015	5.5986	0.05858	0.02115	0.02987	0.02283		
539	206.053		46.403	0.054973	91.213	116.083	0.1646	0.2020	1.1876	1.5892	4.4660	5.6967	0.05835	0.02122	0.02989	0.02297		
540	206.219		46.292	0.054693	91.336	116.008	0.1648	0.2019	1.2067	1.6192	4.5331	5.7988	0.05811	0.02129	0.02992	0.02311		
541	206.384		46.180	0.054411	91.459	115.932	0.1650	0.2017	1.2267	1.6505	4.6032	5.9052	0.05788	0.02136	0.02994	0.02325		
542	206.549		46.066	0.054129	91.584	115.855	0.1652	0.2016	1.2475	1.6831	4.6764	6.0163	0.05764	0.02143	0.02996	0.02340		
543	206.714		45.951	0.053845	91.709	115.776	0.1653	0.2015	1.2693	1.7171	4.7530	6.1322	0.05740	0.02151	0.02999	0.02355		
544	206.878		45.835	0.053560	91.835	115.696	0.1655	0.2013	1.2921	1.7527	4.8331	6.2533	0.05716	0.02158	0.03002	0.02371		
545	207.042		45.717	0.053275	91.962	115.614	0.1657	0.2012	1.3160	1.7900	4.9170	6.3800	0.05692	0.02166	0.03005	0.02387		
546	207.206		45.598	0.052987	92.090	115.531	0.1659	0.2011	1.3411	1.8290	5.0051	6.5128	0.05667	0.02174	0.03008	0.02403		
547	207.369		45.477	0.052699	92.219	115.446	0.1661	0.2009	1.3674	1.8699	5.0975	6.6519	0.05643	0.02181	0.03012	0.02420		
548	207.532		45.354	0.052409	92.349	115.359	0.1663	0.2008	1.3951	1.9129	5.1947	6.7979	0.05618	0.02190	0.03016	0.02437		
549	207.695		45.230	0.052118	92.481	115.271	0.1665	0.2006	1.4242	1.9580	5.2969	6.9514	0.05592	0.02198	0.03020	0.02455		
550	207.858		45.104	0.051825	92.613	115.181	0.1667	0.2005	1.4550	2.0055	5.4047	7.1129	0.05567	0.02206	0.03025	0.02473		
551	208.020		44.976	0.051530	92.747	115.088	0.1669	0.2003	1.4874	2.0556	5.5185	7.2830	0.05541	0.02215	0.03029	0.02492		
552	208.182		44.846	0.051234	92.882	114.994	0.1671	0.2002	1.5217	2.1085	5.6387	7.4625	0.05516	0.02224	0.03034	0.02512		
553	208.344		44.714	0.050936	93.018	114.898	0.1673	0.2000	1.5579	2.1643	5.7661	7.6522	0.05489	0.02233	0.03040	0.02532		
554	208.505		44.580	0.050635	93.156	114.799	0.1675	0.1998	1.5964	2.2235	5.9010	7.8530	0.05463	0.02242	0.03046	0.02553		
555	208.666		44.444	0.050332	93.295	114.698	0.1677	0.1997	1.6373	2.2862	6.0444	8.0658	0.05436	0.02251	0.03052	0.02574		

**R-134a (1,1,1,2-tetrafluoroethane) Properties at Saturation**

P [psia]	T [F]	ρ [lb/ft³]		v [ft³/lb]		h [Btu/lb]		s [Btu/R-lb]		Cp [Btu/R-lb]		Cp/Cv [unitless]		μ [centipose]		k [Btu/hr-ft-R]	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
556	208.827	44.305	0.050027	93.436	114.595	0.1679	0.1995	1.6809	2.3528	6.1970	8.2918	0.05409	0.02261	0.03058	0.02597		
557	208.987	44.164	0.049720	93.578	114.489	0.1681	0.1993	1.7273	2.4237	6.3597	8.5324	0.05381	0.02271	0.03065	0.02620		
558	209.148	44.020	0.049410	93.723	114.380	0.1683	0.1992	1.7769	2.4993	6.5336	8.7888	0.05354	0.02281	0.03073	0.02644		
559	209.307	43.873	0.049097	93.869	114.269	0.1685	0.1990	1.8301	2.5801	6.7197	9.0627	0.05325	0.02292	0.03081	0.02669		
560	209.467	43.723	0.048781	94.017	114.154	0.1687	0.1988	1.8871	2.6666	6.9195	9.3561	0.05297	0.02302	0.03090	0.02695		
561	209.626	43.570	0.048461	94.167	114.037	0.1689	0.1986	1.9485	2.7596	7.1345	9.6710	0.05268	0.02313	0.03099	0.02723		
562	209.785	43.414	0.048138	94.320	113.916	0.1691	0.1984	2.0148	2.8596	7.3664	10.0100	0.05238	0.02325	0.03109	0.02751		
563	209.944	43.255	0.047811	94.475	113.791	0.1694	0.1982	2.0866	2.9676	7.6174	10.3758	0.05208	0.02337	0.03120	0.02781		
564	210.102	43.091	0.047480	94.633	113.663	0.1696	0.1980	2.1645	3.0846	7.8899	10.7718	0.05178	0.02349	0.03132	0.02813		
565	210.260	42.924	0.047145	94.793	113.530	0.1698	0.1978	2.2495	3.2117	8.1866	11.2020	0.05146	0.02361	0.03145	0.02846		
566	210.418	42.752	0.046805	94.956	113.394	0.1701	0.1976	2.3423	3.3503	8.5111	11.6709	0.05115	0.02374	0.03158	0.02881		
567	210.575	42.575	0.046459	95.123	113.252	0.1703	0.1974	2.4443	3.5020	8.8672	12.1840	0.05082	0.02388	0.03173	0.02918		
568	210.733	42.393	0.046108	95.293	113.106	0.1706	0.1971	2.5568	3.6688	9.2597	12.7478	0.05049	0.02402	0.03189	0.02957		
569	210.889	42.206	0.045750	95.467	112.954	0.1708	0.1969	2.6815	3.8530	9.6946	13.3704	0.05015	0.02416	0.03207	0.02999		
570	211.046	42.013	0.045386	95.646	112.796	0.1711	0.1966	2.8205	4.0574	10.1788	14.0612	0.04981	0.02431	0.03227	0.03043		
571	211.202	41.813	0.045014	95.828	112.632	0.1713	0.1964	2.9762	4.2857	10.7212	14.8322	0.04945	0.02447	0.03248	0.03091		
572	211.358	41.606	0.044633	96.016	112.461	0.1716	0.1961	3.1520	4.5423	11.3328	15.6983	0.04908	0.02464	0.03272	0.03142		
573	211.513	41.391	0.044244	96.210	112.281	0.1719	0.1958	3.3517	4.8326	12.0275	16.6779	0.04871	0.02481	0.03298	0.03198		
574	211.668	41.167	0.043843	96.410	112.094	0.1722	0.1955	3.5806	5.1637	12.8230	17.7950	0.04832	0.02499	0.03328	0.03259		
575	211.823	40.933	0.043432	96.617	111.896	0.1725	0.1952	3.8455	5.5450	13.7426	19.0805	0.04791	0.02518	0.03361	0.03325		
576	211.978	40.688	0.043006	96.832	111.688	0.1728	0.1949	4.1552	5.9886	14.8171	20.5754	0.04749	0.02539	0.03399	0.03399		
577	212.132	40.430	0.042566	97.056	111.467	0.1731	0.1946	4.5221	6.5109	16.0885	22.3350	0.04705	0.02561	0.03442	0.03480		
578	212.286	40.158	0.042108	97.291	111.232	0.1735	0.1942	4.9630	7.1348	17.6149	24.4358	0.04659	0.02584	0.03492	0.03572		
579	212.439	39.868	0.041630	97.538	110.980	0.1738	0.1938	5.5022	7.8927	19.4794	26.9868	0.04611	0.02610	0.03551	0.03676		
580	212.592	39.558	0.041127	97.800	110.708	0.1742	0.1934	6.1756	8.8325	21.8054	30.1483	0.04560	0.02637	0.03622	0.03797		
581	212.745	39.223	0.040595	98.080	110.413	0.1746	0.1930	7.0388	10.0274	24.7825	34.1661	0.04505	0.02667	0.03708	0.03939		
582	212.897	38.857	0.040026	98.382	110.089	0.1751	0.1925	8.1819	11.5958	28.7193	39.4370	0.04447	0.02701	0.03814	0.04109		
583	213.049	38.453	0.039412	98.713	109.728	0.1755	0.1919	9.7613	13.7411	34.1500	46.6431	0.04383	0.02739	0.03952	0.04320		
584	213.200	37.999	0.038737	99.082	109.319	0.1761	0.1913	12.0728	16.8443	42.0834	57.0619	0.04312	0.02782	0.04137	0.04592		
585	213.351	37.473	0.037978	99.504	108.843	0.1767	0.1906	15.7466	21.7079	54.6661	73.3834	0.04231	0.02834	0.04400	0.04962		
586	213.501	36.840	0.037093	100.007	108.265	0.1774	0.1897	22.3864	30.3438	77.3527	102.353	0.04136	0.02898	0.04813	0.05514		
587	213.651	36.023	0.035995	100.651	107.515	0.1784	0.1886	37.5056	49.5209	128.860	166.668	0.04016	0.02985	0.05579	0.06478		
588	213.800	34.787	0.034423	101.623	106.379	0.1798	0.1869	98.2662	123.085	335.047	413.462	0.03841	0.03124	0.07701	0.08938		

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=10 psia (-29.50 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	10	89.5055	0.0112	-2.98	-0.0072	0.2976	1.5057	Subcooled	0.51117	0.065537
-45	10	89.0079	0.0112	-1.49	-0.0036	0.2987	1.5060	Subcooled	0.48839	0.064738
-40	10	88.5069	0.0113	0.00	0.0000	0.2999	1.5064	Subcooled	0.46712	0.063946
-35	10	88.0024	0.0114	1.51	0.0036	0.3010	1.5069	Subcooled	0.44719	0.063161
-30	10	87.4941	0.0114	3.01	0.0071	0.3022	1.5075	Subcooled	0.42850	0.062381
-25	10	0.2258	4.4279	99.58	0.2316	0.1836	1.1473	Superheated	0.00958	0.005116
-20	10	0.2229	4.4856	100.50	0.2337	0.1841	1.1449	Superheated	0.00970	0.005244
-15	10	0.2201	4.5430	101.42	0.2357	0.1847	1.1426	Superheated	0.00981	0.005373
-10	10	0.2174	4.6001	102.35	0.2378	0.1853	1.1405	Superheated	0.00992	0.005501
-5	10	0.2147	4.6570	103.27	0.2399	0.1860	1.1385	Superheated	0.01003	0.005629
0	10	0.2122	4.7136	104.21	0.2419	0.1868	1.1367	Superheated	0.01014	0.005758
5	10	0.2096	4.7700	105.14	0.2439	0.1877	1.1349	Superheated	0.01025	0.005886
10	10	0.2072	4.8262	106.08	0.2459	0.1885	1.1332	Superheated	0.01036	0.006014
15	10	0.2048	4.8822	107.03	0.2479	0.1895	1.1315	Superheated	0.01048	0.006143
20	10	0.2025	4.9380	107.98	0.2499	0.1904	1.1300	Superheated	0.01059	0.006271
25	10	0.2003	4.9938	108.93	0.2519	0.1914	1.1285	Superheated	0.01070	0.006399
30	10	0.1980	5.0493	109.89	0.2539	0.1923	1.1271	Superheated	0.01081	0.006528
35	10	0.1959	5.1048	110.86	0.2558	0.1933	1.1257	Superheated	0.01092	0.006656
40	10	0.1938	5.1601	111.83	0.2578	0.1943	1.1244	Superheated	0.01102	0.006785
45	10	0.1917	5.2153	112.80	0.2597	0.1953	1.1231	Superheated	0.01113	0.006913
50	10	0.1897	5.2704	113.78	0.2617	0.1964	1.1218	Superheated	0.01124	0.007042
55	10	0.1878	5.3254	114.76	0.2636	0.1974	1.1206	Superheated	0.01135	0.007170
60	10	0.1859	5.3802	115.75	0.2655	0.1985	1.1195	Superheated	0.01146	0.007298
65	10	0.1840	5.4351	116.75	0.2674	0.1995	1.1184	Superheated	0.01157	0.007427
70	10	0.1822	5.4898	117.75	0.2693	0.2006	1.1173	Superheated	0.01168	0.007555
75	10	0.1804	5.5444	118.75	0.2712	0.2016	1.1162	Superheated	0.01179	0.007684
80	10	0.1786	5.5990	119.76	0.2731	0.2027	1.1152	Superheated	0.01189	0.007812
85	10	0.1769	5.6535	120.78	0.2749	0.2037	1.1142	Superheated	0.01200	0.007941
90	10	0.1752	5.7079	121.80	0.2768	0.2048	1.1132	Superheated	0.01211	0.008069
95	10	0.1735	5.7623	122.83	0.2787	0.2059	1.1123	Superheated	0.01222	0.008198
100	10	0.1719	5.8166	123.86	0.2805	0.2069	1.1114	Superheated	0.01232	0.008326
105	10	0.1703	5.8708	124.90	0.2824	0.2080	1.1105	Superheated	0.01243	0.008455
110	10	0.1688	5.9250	125.94	0.2842	0.2091	1.1096	Superheated	0.01254	0.008583
115	10	0.1672	5.9791	126.99	0.2860	0.2102	1.1087	Superheated	0.01265	0.008712
120	10	0.1657	6.0332	128.04	0.2879	0.2112	1.1079	Superheated	0.01275	0.008840
125	10	0.1643	6.0872	129.10	0.2897	0.2123	1.1071	Superheated	0.01286	0.008969
130	10	0.1628	6.1412	130.17	0.2915	0.2134	1.1063	Superheated	0.01297	0.009097
135	10	0.1614	6.1951	131.23	0.2933	0.2145	1.1055	Superheated	0.01307	0.009226
140	10	0.1600	6.2490	132.31	0.2951	0.2155	1.1048	Superheated	0.01318	0.009355
145	10	0.1587	6.3029	133.39	0.2969	0.2166	1.1040	Superheated	0.01329	0.009483
150	10	0.1573	6.3567	134.48	0.2987	0.2177	1.1033	Superheated	0.01339	0.009612

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=15 psia (-14.12 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	15	89.5101	0.0112	-2.98	-0.0072	0.2976	1.5056	Subcooled	0.51135	0.065545
-45	15	89.0127	0.0112	-1.49	-0.0036	0.2987	1.5059	Subcooled	0.48857	0.064747
-40	15	88.5119	0.0113	0.01	0.0000	0.2998	1.5063	Subcooled	0.46729	0.063955
-35	15	88.0075	0.0114	1.51	0.0035	0.3010	1.5068	Subcooled	0.44736	0.063170
-30	15	87.4994	0.0114	3.02	0.0071	0.3022	1.5074	Subcooled	0.42866	0.062390
-25	15	86.9874	0.0115	4.53	0.0106	0.3035	1.5081	Subcooled	0.41109	0.061617
-20	15	86.4712	0.0116	6.05	0.0141	0.3047	1.5089	Subcooled	0.39453	0.060849
-15	15	85.9506	0.0116	7.58	0.0175	0.3060	1.5098	Subcooled	0.37891	0.060087
-10	15	0.3310	3.0212	101.85	0.2291	0.1902	1.1514	Superheated	0.00989	0.005512
-5	15	0.3267	3.0608	102.80	0.2312	0.1904	1.1486	Superheated	0.01000	0.005640
0	15	0.3226	3.1001	103.75	0.2333	0.1908	1.1460	Superheated	0.01012	0.005768
5	15	0.3186	3.1392	104.71	0.2353	0.1913	1.1435	Superheated	0.01023	0.005896
10	15	0.3147	3.1781	105.66	0.2374	0.1919	1.1413	Superheated	0.01034	0.006024
15	15	0.3109	3.2167	106.63	0.2394	0.1925	1.1391	Superheated	0.01045	0.006152
20	15	0.3072	3.2552	107.59	0.2414	0.1932	1.1371	Superheated	0.01056	0.006280
25	15	0.3036	3.2934	108.56	0.2434	0.1940	1.1352	Superheated	0.01067	0.006408
30	15	0.3002	3.3316	109.53	0.2454	0.1948	1.1334	Superheated	0.01079	0.006536
35	15	0.2968	3.3696	110.51	0.2474	0.1956	1.1317	Superheated	0.01090	0.006665
40	15	0.2935	3.4074	111.49	0.2494	0.1965	1.1301	Superheated	0.01101	0.006793
45	15	0.2903	3.4452	112.47	0.2514	0.1974	1.1285	Superheated	0.01112	0.006921
50	15	0.2871	3.4828	113.46	0.2533	0.1983	1.1270	Superheated	0.01123	0.007049
55	15	0.2841	3.5203	114.45	0.2552	0.1993	1.1255	Superheated	0.01134	0.007178
60	15	0.2811	3.5577	115.45	0.2572	0.2002	1.1241	Superheated	0.01145	0.007306
65	15	0.2782	3.5950	116.46	0.2591	0.2012	1.1228	Superheated	0.01156	0.007434
70	15	0.2753	3.6323	117.47	0.2610	0.2022	1.1215	Superheated	0.01167	0.007563
75	15	0.2725	3.6694	118.48	0.2629	0.2031	1.1203	Superheated	0.01177	0.007691
80	15	0.2698	3.7065	119.50	0.2648	0.2041	1.1191	Superheated	0.01188	0.007820
85	15	0.2671	3.7435	120.52	0.2667	0.2051	1.1179	Superheated	0.01199	0.007948
90	15	0.2645	3.7804	121.55	0.2686	0.2062	1.1168	Superheated	0.01210	0.008076
95	15	0.2620	3.8172	122.58	0.2705	0.2072	1.1157	Superheated	0.01221	0.008205
100	15	0.2595	3.8540	123.62	0.2723	0.2082	1.1146	Superheated	0.01232	0.008333
105	15	0.2570	3.8908	124.66	0.2742	0.2092	1.1136	Superheated	0.01243	0.008461
110	15	0.2546	3.9274	125.71	0.2760	0.2102	1.1126	Superheated	0.01253	0.008590
115	15	0.2523	3.9641	126.77	0.2779	0.2113	1.1116	Superheated	0.01264	0.008718
120	15	0.2500	4.0006	127.82	0.2797	0.2123	1.1107	Superheated	0.01275	0.008847
125	15	0.2477	4.0371	128.89	0.2815	0.2133	1.1098	Superheated	0.01286	0.008975
130	15	0.2455	4.0736	129.96	0.2833	0.2144	1.1089	Superheated	0.01296	0.009104
135	15	0.2433	4.1100	131.03	0.2852	0.2154	1.1080	Superheated	0.01307	0.009232
140	15	0.2412	4.1464	132.11	0.2870	0.2164	1.1071	Superheated	0.01318	0.009361
145	15	0.2391	4.1828	133.20	0.2888	0.2175	1.1063	Superheated	0.01328	0.009489
150	15	0.2370	4.2191	134.29	0.2906	0.2185	1.1055	Superheated	0.01339	0.009618

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=20 psia (-2.40 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	20	89.5148	0.0112	-2.97	-0.0072	0.2976	1.5055	Subcooled	0.51154	0.065554
-45	20	89.0175	0.0112	-1.48	-0.0036	0.2987	1.5058	Subcooled	0.48875	0.064756
-40	20	88.5168	0.0113	0.01	0.0000	0.2998	1.5062	Subcooled	0.46746	0.063964
-35	20	88.0126	0.0114	1.52	0.0035	0.3010	1.5067	Subcooled	0.44753	0.063179
-30	20	87.5047	0.0114	3.02	0.0071	0.3022	1.5073	Subcooled	0.42883	0.062400
-25	20	86.9929	0.0115	4.54	0.0106	0.3034	1.5079	Subcooled	0.41125	0.061627
-20	20	86.4769	0.0116	6.06	0.0140	0.3047	1.5087	Subcooled	0.39469	0.060859
-15	20	85.9565	0.0116	7.58	0.0175	0.3060	1.5096	Subcooled	0.37906	0.060097
-10	20	85.4314	0.0117	9.12	0.0209	0.3074	1.5107	Subcooled	0.36429	0.059340
-5	20	84.9013	0.0118	10.66	0.0243	0.3088	1.5119	Subcooled	0.35031	0.058587
0	20	0.4363	2.2922	103.27	0.2269	0.1956	1.1567	Superheated	0.01009	0.005780
5	20	0.4305	2.3228	104.25	0.2290	0.1956	1.1534	Superheated	0.01020	0.005907
10	20	0.4250	2.3531	105.23	0.2311	0.1957	1.1504	Superheated	0.01031	0.006035
15	20	0.4196	2.3831	106.21	0.2332	0.1960	1.1476	Superheated	0.01043	0.006162
20	20	0.4144	2.4130	107.19	0.2352	0.1964	1.1450	Superheated	0.01054	0.006290
25	20	0.4094	2.4426	108.17	0.2372	0.1969	1.1426	Superheated	0.01065	0.006418
30	20	0.4045	2.4721	109.16	0.2393	0.1975	1.1403	Superheated	0.01077	0.006546
35	20	0.3998	2.5015	110.15	0.2413	0.1982	1.1382	Superheated	0.01088	0.006674
40	20	0.3952	2.5306	111.14	0.2433	0.1989	1.1362	Superheated	0.01099	0.006802
45	20	0.3907	2.5597	112.14	0.2453	0.1996	1.1343	Superheated	0.01110	0.006930
50	20	0.3863	2.5886	113.14	0.2472	0.2004	1.1325	Superheated	0.01121	0.007058
55	20	0.3821	2.6174	114.14	0.2492	0.2012	1.1307	Superheated	0.01132	0.007186
60	20	0.3779	2.6461	115.15	0.2511	0.2021	1.1291	Superheated	0.01143	0.007314
65	20	0.3739	2.6747	116.16	0.2531	0.2030	1.1275	Superheated	0.01154	0.007443
70	20	0.3699	2.7032	117.18	0.2550	0.2038	1.1260	Superheated	0.01165	0.007571
75	20	0.3661	2.7316	118.20	0.2569	0.2047	1.1245	Superheated	0.01176	0.007699
80	20	0.3623	2.7600	119.23	0.2588	0.2057	1.1231	Superheated	0.01187	0.007827
85	20	0.3586	2.7882	120.26	0.2607	0.2066	1.1218	Superheated	0.01198	0.007955
90	20	0.3551	2.8164	121.29	0.2626	0.2075	1.1205	Superheated	0.01209	0.008084
95	20	0.3515	2.8445	122.33	0.2645	0.2085	1.1192	Superheated	0.01220	0.008212
100	20	0.3481	2.8726	123.38	0.2664	0.2095	1.1180	Superheated	0.01231	0.008340
105	20	0.3448	2.9006	124.43	0.2683	0.2104	1.1168	Superheated	0.01242	0.008468
110	20	0.3415	2.9285	125.48	0.2701	0.2114	1.1157	Superheated	0.01253	0.008597
115	20	0.3383	2.9564	126.54	0.2720	0.2124	1.1146	Superheated	0.01264	0.008725
120	20	0.3351	2.9842	127.61	0.2738	0.2134	1.1135	Superheated	0.01274	0.008853
125	20	0.3320	3.0120	128.67	0.2757	0.2144	1.1125	Superheated	0.01285	0.008982
130	20	0.3290	3.0397	129.75	0.2775	0.2154	1.1115	Superheated	0.01296	0.009110
135	20	0.3260	3.0674	130.83	0.2793	0.2164	1.1105	Superheated	0.01307	0.009239
140	20	0.3231	3.0950	131.91	0.2811	0.2174	1.1096	Superheated	0.01317	0.009367
145	20	0.3202	3.1226	133.00	0.2829	0.2184	1.1087	Superheated	0.01328	0.009495
150	20	0.3174	3.1501	134.10	0.2847	0.2194	1.1078	Superheated	0.01339	0.009624



# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=25 psia (7.20 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	25	89.5195	0.0112	-2.97	-0.0072	0.2976	1.5054	Subcooled	0.51172	0.065563
-45	25	89.0223	0.0112	-1.48	-0.0036	0.2987	1.5057	Subcooled	0.48893	0.064765
-40	25	88.5218	0.0113	0.02	0.0000	0.2998	1.5061	Subcooled	0.46764	0.063973
-35	25	88.0178	0.0114	1.52	0.0035	0.3010	1.5066	Subcooled	0.44770	0.063188
-30	25	87.5101	0.0114	3.03	0.0070	0.3022	1.5072	Subcooled	0.42899	0.062409
-25	25	86.9984	0.0115	4.54	0.0105	0.3034	1.5078	Subcooled	0.41140	0.061636
-20	25	86.4826	0.0116	6.06	0.0140	0.3047	1.5086	Subcooled	0.39484	0.060869
-15	25	85.9624	0.0116	7.59	0.0175	0.3060	1.5095	Subcooled	0.37921	0.060107
-10	25	85.4375	0.0117	9.12	0.0209	0.3073	1.5106	Subcooled	0.36444	0.059350
-5	25	84.9077	0.0118	10.66	0.0243	0.3087	1.5117	Subcooled	0.35046	0.058598
0	25	84.3726	0.0119	12.21	0.0277	0.3102	1.5131	Subcooled	0.33719	0.057850
5	25	83.8320	0.0119	13.77	0.0311	0.3117	1.5145	Subcooled	0.32460	0.057107
10	25	0.5384	1.8572	104.77	0.2260	0.2003	1.1608	Superheated	0.01029	0.006048
15	25	0.5313	1.8823	105.77	0.2281	0.2001	1.1571	Superheated	0.01040	0.006175
20	25	0.5244	1.9070	106.77	0.2302	0.2001	1.1538	Superheated	0.01052	0.006302
25	25	0.5177	1.9316	107.77	0.2323	0.2003	1.1507	Superheated	0.01063	0.006429
30	25	0.5113	1.9559	108.78	0.2343	0.2006	1.1479	Superheated	0.01075	0.006557
35	25	0.5050	1.9801	109.78	0.2364	0.2010	1.1453	Superheated	0.01086	0.006684
40	25	0.4990	2.0041	110.79	0.2384	0.2015	1.1428	Superheated	0.01097	0.006812
45	25	0.4931	2.0280	111.79	0.2404	0.2020	1.1405	Superheated	0.01108	0.006940
50	25	0.4874	2.0518	112.81	0.2424	0.2027	1.1383	Superheated	0.01120	0.007068
55	25	0.4818	2.0754	113.82	0.2444	0.2033	1.1362	Superheated	0.01131	0.007196
60	25	0.4764	2.0989	114.84	0.2464	0.2041	1.1343	Superheated	0.01142	0.007323
65	25	0.4712	2.1223	115.86	0.2483	0.2048	1.1324	Superheated	0.01153	0.007451
70	25	0.4661	2.1456	116.89	0.2503	0.2056	1.1307	Superheated	0.01164	0.007579
75	25	0.4611	2.1688	117.92	0.2522	0.2064	1.1290	Superheated	0.01175	0.007707
80	25	0.4562	2.1919	118.95	0.2541	0.2073	1.1274	Superheated	0.01186	0.007835
85	25	0.4515	2.2149	119.99	0.2560	0.2081	1.1258	Superheated	0.01197	0.007963
90	25	0.4469	2.2379	121.03	0.2579	0.2090	1.1243	Superheated	0.01208	0.008092
95	25	0.4423	2.2608	122.08	0.2598	0.2099	1.1229	Superheated	0.01219	0.008220
100	25	0.4379	2.2836	123.13	0.2617	0.2108	1.1215	Superheated	0.01230	0.008348
105	25	0.4336	2.3063	124.19	0.2636	0.2117	1.1202	Superheated	0.01241	0.008476
110	25	0.4294	2.3290	125.25	0.2655	0.2126	1.1189	Superheated	0.01252	0.008604
115	25	0.4252	2.3517	126.31	0.2673	0.2135	1.1177	Superheated	0.01263	0.008732
120	25	0.4212	2.3743	127.38	0.2692	0.2145	1.1165	Superheated	0.01274	0.008861
125	25	0.4172	2.3968	128.46	0.2710	0.2154	1.1153	Superheated	0.01285	0.008989
130	25	0.4134	2.4193	129.54	0.2729	0.2164	1.1142	Superheated	0.01296	0.009117
135	25	0.4096	2.4417	130.62	0.2747	0.2173	1.1131	Superheated	0.01307	0.009245
140	25	0.4058	2.4641	131.71	0.2765	0.2183	1.1121	Superheated	0.01317	0.009374
145	25	0.4022	2.4864	132.81	0.2783	0.2193	1.1111	Superheated	0.01328	0.009502
150	25	0.3986	2.5087	133.90	0.2802	0.2203	1.1101	Superheated	0.01339	0.009630

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=30 psia (15.40 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	30	89.5241	0.0112	-2.96	-0.0073	0.2975	1.5053	Subcooled	0.51191	0.065572
-45	30	89.0271	0.0112	-1.47	-0.0036	0.2986	1.5056	Subcooled	0.48911	0.064774
-40	30	88.5268	0.0113	0.02	-0.0001	0.2998	1.5060	Subcooled	0.46781	0.063982
-35	30	88.0229	0.0114	1.53	0.0035	0.3010	1.5065	Subcooled	0.44786	0.063198
-30	30	87.5154	0.0114	3.03	0.0070	0.3022	1.5071	Subcooled	0.42915	0.062419
-25	30	87.0039	0.0115	4.55	0.0105	0.3034	1.5077	Subcooled	0.41156	0.061646
-20	30	86.4883	0.0116	6.07	0.0140	0.3047	1.5085	Subcooled	0.39499	0.060879
-15	30	85.9682	0.0116	7.59	0.0175	0.3060	1.5094	Subcooled	0.37936	0.060117
-10	30	85.4436	0.0117	9.13	0.0209	0.3073	1.5104	Subcooled	0.36459	0.059360
-5	30	84.9140	0.0118	10.67	0.0243	0.3087	1.5116	Subcooled	0.35060	0.058608
0	30	84.3792	0.0119	12.22	0.0277	0.3101	1.5129	Subcooled	0.33733	0.057861
5	30	83.8388	0.0119	13.77	0.0310	0.3116	1.5144	Subcooled	0.32474	0.057118
10	30	83.2926	0.0120	15.33	0.0344	0.3132	1.5161	Subcooled	0.31275	0.056379
15	30	82.7401	0.0121	16.90	0.0377	0.3147	1.5179	Subcooled	0.30133	0.055644
20	30	0.6373	1.5691	106.34	0.2260	0.2044	1.1637	Superheated	0.01050	0.006315
25	30	0.6288	1.5903	107.36	0.2281	0.2041	1.1598	Superheated	0.01061	0.006442
30	30	0.6206	1.6114	108.38	0.2302	0.2040	1.1562	Superheated	0.01073	0.006569
35	30	0.6127	1.6322	109.40	0.2323	0.2041	1.1530	Superheated	0.01084	0.006696
40	30	0.6050	1.6528	110.42	0.2343	0.2043	1.1500	Superheated	0.01096	0.006823
45	30	0.5976	1.6732	111.44	0.2363	0.2046	1.1472	Superheated	0.01107	0.006951
50	30	0.5905	1.6936	112.47	0.2384	0.2051	1.1446	Superheated	0.01118	0.007078
55	30	0.5835	1.7137	113.49	0.2404	0.2056	1.1421	Superheated	0.01130	0.007206
60	30	0.5768	1.7338	114.52	0.2424	0.2062	1.1398	Superheated	0.01141	0.007333
65	30	0.5702	1.7537	115.56	0.2443	0.2068	1.1377	Superheated	0.01152	0.007461
70	30	0.5638	1.7736	116.59	0.2463	0.2075	1.1356	Superheated	0.01163	0.007589
75	30	0.5576	1.7933	117.63	0.2482	0.2082	1.1337	Superheated	0.01174	0.007716
80	30	0.5516	1.8130	118.67	0.2502	0.2089	1.1318	Superheated	0.01185	0.007844
85	30	0.5457	1.8325	119.72	0.2521	0.2097	1.1300	Superheated	0.01197	0.007972
90	30	0.5399	1.8520	120.77	0.2540	0.2105	1.1283	Superheated	0.01208	0.008100
95	30	0.5343	1.8714	121.82	0.2559	0.2113	1.1267	Superheated	0.01219	0.008228
100	30	0.5289	1.8908	122.88	0.2578	0.2121	1.1252	Superheated	0.01230	0.008356
105	30	0.5235	1.9101	123.95	0.2597	0.2130	1.1237	Superheated	0.01241	0.008484
110	30	0.5183	1.9293	125.01	0.2616	0.2139	1.1222	Superheated	0.01252	0.008612
115	30	0.5132	1.9484	126.08	0.2635	0.2147	1.1209	Superheated	0.01263	0.008740
120	30	0.5083	1.9675	127.16	0.2654	0.2156	1.1195	Superheated	0.01274	0.008868
125	30	0.5034	1.9866	128.24	0.2672	0.2165	1.1183	Superheated	0.01285	0.008996
130	30	0.4986	2.0055	129.33	0.2691	0.2174	1.1170	Superheated	0.01295	0.009124
135	30	0.4940	2.0245	130.41	0.2709	0.2184	1.1158	Superheated	0.01306	0.009252
140	30	0.4894	2.0434	131.51	0.2727	0.2193	1.1147	Superheated	0.01317	0.009380
145	30	0.4849	2.0622	132.61	0.2746	0.2202	1.1135	Superheated	0.01328	0.009509
150	30	0.4805	2.0810	133.71	0.2764	0.2212	1.1125	Superheated	0.01339	0.009637

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=35 psia (22.60 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	35	89.5288	0.0112	-2.96	-0.0073	0.2975	1.5052	Subcooled	0.51210	0.065580
-45	35	89.0319	0.0112	-1.47	-0.0037	0.2986	1.5055	Subcooled	0.48929	0.064783
-40	35	88.5317	0.0113	0.03	-0.0001	0.2998	1.5059	Subcooled	0.46798	0.063992
-35	35	88.0280	0.0114	1.53	0.0035	0.3009	1.5064	Subcooled	0.44803	0.063207
-30	35	87.5207	0.0114	3.04	0.0070	0.3021	1.5069	Subcooled	0.42931	0.062428
-25	35	87.0094	0.0115	4.55	0.0105	0.3034	1.5076	Subcooled	0.41172	0.061655
-20	35	86.4939	0.0116	6.07	0.0140	0.3046	1.5084	Subcooled	0.39515	0.060888
-15	35	85.9741	0.0116	7.60	0.0175	0.3059	1.5093	Subcooled	0.37951	0.060127
-10	35	85.4497	0.0117	9.13	0.0209	0.3073	1.5103	Subcooled	0.36473	0.059370
-5	35	84.9203	0.0118	10.67	0.0243	0.3087	1.5115	Subcooled	0.35074	0.058619
0	35	84.3857	0.0119	12.22	0.0277	0.3101	1.5128	Subcooled	0.33747	0.057872
5	35	83.8456	0.0119	13.77	0.0310	0.3116	1.5142	Subcooled	0.32487	0.057129
10	35	83.2997	0.0120	15.34	0.0344	0.3131	1.5159	Subcooled	0.31289	0.056391
15	35	82.7475	0.0121	16.91	0.0377	0.3147	1.5178	Subcooled	0.30147	0.055656
20	35	82.1886	0.0122	18.48	0.0410	0.3164	1.5198	Subcooled	0.29057	0.054924
25	35	0.7429	1.3461	106.93	0.2244	0.2085	1.1700	Superheated	0.01059	0.006457
30	35	0.7327	1.3647	107.97	0.2265	0.2079	1.1655	Superheated	0.01071	0.006583
35	35	0.7230	1.3832	109.01	0.2286	0.2076	1.1615	Superheated	0.01082	0.006709
40	35	0.7135	1.4014	110.04	0.2307	0.2075	1.1578	Superheated	0.01094	0.006836
45	35	0.7045	1.4195	111.08	0.2328	0.2075	1.1545	Superheated	0.01105	0.006963
50	35	0.6957	1.4374	112.12	0.2348	0.2077	1.1514	Superheated	0.01117	0.007090
55	35	0.6872	1.4552	113.16	0.2369	0.2080	1.1485	Superheated	0.01128	0.007217
60	35	0.6790	1.4728	114.20	0.2389	0.2084	1.1458	Superheated	0.01140	0.007344
65	35	0.6710	1.4903	115.24	0.2409	0.2089	1.1433	Superheated	0.01151	0.007471
70	35	0.6633	1.5077	116.29	0.2429	0.2094	1.1409	Superheated	0.01162	0.007599
75	35	0.6557	1.5250	117.34	0.2448	0.2100	1.1386	Superheated	0.01173	0.007726
80	35	0.6484	1.5422	118.39	0.2468	0.2107	1.1365	Superheated	0.01185	0.007854
85	35	0.6413	1.5593	119.44	0.2487	0.2113	1.1345	Superheated	0.01196	0.007981
90	35	0.6344	1.5763	120.50	0.2507	0.2120	1.1326	Superheated	0.01207	0.008109
95	35	0.6277	1.5932	121.57	0.2526	0.2128	1.1307	Superheated	0.01218	0.008237
100	35	0.6211	1.6101	122.63	0.2545	0.2135	1.1290	Superheated	0.01229	0.008364
105	35	0.6147	1.6269	123.70	0.2564	0.2143	1.1273	Superheated	0.01240	0.008492
110	35	0.6084	1.6436	124.77	0.2583	0.2151	1.1257	Superheated	0.01251	0.008620
115	35	0.6023	1.6603	125.85	0.2602	0.2160	1.1242	Superheated	0.01262	0.008748
120	35	0.5963	1.6769	126.93	0.2621	0.2168	1.1227	Superheated	0.01273	0.008876
125	35	0.5905	1.6935	128.02	0.2639	0.2176	1.1213	Superheated	0.01284	0.009004
130	35	0.5848	1.7100	129.11	0.2658	0.2185	1.1199	Superheated	0.01295	0.009132
135	35	0.5792	1.7264	130.21	0.2676	0.2194	1.1186	Superheated	0.01306	0.009260
140	35	0.5738	1.7428	131.30	0.2695	0.2203	1.1173	Superheated	0.01317	0.009388
145	35	0.5684	1.7592	132.41	0.2713	0.2212	1.1161	Superheated	0.01328	0.009516
150	35	0.5632	1.7755	133.52	0.2731	0.2221	1.1149	Superheated	0.01339	0.009644

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=40 psia (29.05 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	40	89.5334	0.0112	-2.95	-0.0073	0.2975	1.5051	Subcooled	0.51228	0.065589
-45	40	89.0367	0.0112	-1.46	-0.0037	0.2986	1.5054	Subcooled	0.48947	0.064792
-40	40	88.5367	0.0113	0.04	-0.0001	0.2997	1.5058	Subcooled	0.46815	0.064001
-35	40	88.0332	0.0114	1.54	0.0035	0.3009	1.5063	Subcooled	0.44820	0.063216
-30	40	87.5260	0.0114	3.04	0.0070	0.3021	1.5068	Subcooled	0.42948	0.062438
-25	40	87.0149	0.0115	4.56	0.0105	0.3033	1.5075	Subcooled	0.41187	0.061665
-20	40	86.4996	0.0116	6.08	0.0140	0.3046	1.5083	Subcooled	0.39530	0.060898
-15	40	85.9800	0.0116	7.60	0.0174	0.3059	1.5091	Subcooled	0.37966	0.060137
-10	40	85.4558	0.0117	9.14	0.0209	0.3073	1.5102	Subcooled	0.36488	0.059380
-5	40	84.9266	0.0118	10.68	0.0243	0.3086	1.5113	Subcooled	0.35088	0.058629
0	40	84.3923	0.0118	12.22	0.0277	0.3101	1.5126	Subcooled	0.33761	0.057882
5	40	83.8525	0.0119	13.78	0.0310	0.3116	1.5141	Subcooled	0.32501	0.057140
10	40	83.3068	0.0120	15.34	0.0344	0.3131	1.5157	Subcooled	0.31302	0.056402
15	40	82.7548	0.0121	16.91	0.0377	0.3147	1.5176	Subcooled	0.30160	0.055667
20	40	82.1963	0.0122	18.49	0.0410	0.3163	1.5197	Subcooled	0.29070	0.054936
25	40	81.6307	0.0123	20.07	0.0443	0.3180	1.5219	Subcooled	0.28029	0.054208
30	40	0.8479	1.1793	107.54	0.2233	0.2125	1.1759	Superheated	0.01069	0.006599
35	40	0.8361	1.1961	108.60	0.2254	0.2116	1.1710	Superheated	0.01081	0.006724
40	40	0.8247	1.2126	109.66	0.2275	0.2110	1.1665	Superheated	0.01092	0.006850
45	40	0.8137	1.2289	110.71	0.2296	0.2107	1.1624	Superheated	0.01104	0.006976
50	40	0.8032	1.2450	111.76	0.2317	0.2106	1.1587	Superheated	0.01115	0.007103
55	40	0.7930	1.2610	112.82	0.2338	0.2107	1.1553	Superheated	0.01127	0.007229
60	40	0.7832	1.2768	113.87	0.2358	0.2109	1.1521	Superheated	0.01138	0.007356
65	40	0.7737	1.2925	114.93	0.2378	0.2111	1.1492	Superheated	0.01150	0.007483
70	40	0.7645	1.3081	115.98	0.2398	0.2115	1.1465	Superheated	0.01161	0.007610
75	40	0.7555	1.3236	117.04	0.2418	0.2120	1.1439	Superheated	0.01172	0.007737
80	40	0.7469	1.3389	118.10	0.2438	0.2125	1.1415	Superheated	0.01184	0.007864
85	40	0.7385	1.3542	119.17	0.2458	0.2131	1.1392	Superheated	0.01195	0.007991
90	40	0.7303	1.3694	120.23	0.2477	0.2137	1.1370	Superheated	0.01206	0.008119
95	40	0.7223	1.3845	121.30	0.2497	0.2143	1.1349	Superheated	0.01217	0.008246
100	40	0.7146	1.3995	122.38	0.2516	0.2150	1.1330	Superheated	0.01229	0.008374
105	40	0.7070	1.4144	123.45	0.2535	0.2157	1.1311	Superheated	0.01240	0.008501
110	40	0.6996	1.4293	124.53	0.2554	0.2165	1.1293	Superheated	0.01251	0.008629
115	40	0.6925	1.4441	125.62	0.2573	0.2172	1.1276	Superheated	0.01262	0.008756
120	40	0.6855	1.4589	126.71	0.2592	0.2180	1.1260	Superheated	0.01273	0.008884
125	40	0.6786	1.4736	127.80	0.2611	0.2188	1.1244	Superheated	0.01284	0.009012
130	40	0.6720	1.4882	128.89	0.2629	0.2196	1.1229	Superheated	0.01295	0.009140
135	40	0.6654	1.5028	129.99	0.2648	0.2205	1.1215	Superheated	0.01306	0.009268
140	40	0.6591	1.5173	131.10	0.2666	0.2213	1.1201	Superheated	0.01317	0.009395
145	40	0.6528	1.5318	132.21	0.2685	0.2222	1.1187	Superheated	0.01328	0.009523
150	40	0.6467	1.5463	133.32	0.2703	0.2230	1.1174	Superheated	0.01339	0.009651

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=45 psia (34.90 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	45	89.5381	0.0112	-2.94	-0.0073	0.2975	1.5050	Subcooled	0.51247	0.065598
-45	45	89.0415	0.0112	-1.45	-0.0037	0.2986	1.5053	Subcooled	0.48965	0.064800
-40	45	88.5416	0.0113	0.04	-0.0001	0.2997	1.5057	Subcooled	0.46833	0.064010
-35	45	88.0383	0.0114	1.54	0.0035	0.3009	1.5062	Subcooled	0.44837	0.063225
-30	45	87.5313	0.0114	3.05	0.0070	0.3021	1.5067	Subcooled	0.42964	0.062447
-25	45	87.0203	0.0115	4.56	0.0105	0.3033	1.5074	Subcooled	0.41203	0.061675
-20	45	86.5053	0.0116	6.08	0.0140	0.3046	1.5081	Subcooled	0.39545	0.060908
-15	45	85.9859	0.0116	7.61	0.0174	0.3059	1.5090	Subcooled	0.37981	0.060147
-10	45	85.4619	0.0117	9.14	0.0209	0.3072	1.5100	Subcooled	0.36502	0.059391
-5	45	84.9330	0.0118	10.68	0.0243	0.3086	1.5112	Subcooled	0.35103	0.058639
0	45	84.3989	0.0118	12.23	0.0276	0.3100	1.5125	Subcooled	0.33776	0.057893
5	45	83.8593	0.0119	13.78	0.0310	0.3115	1.5139	Subcooled	0.32515	0.057151
10	45	83.3138	0.0120	15.34	0.0343	0.3131	1.5156	Subcooled	0.31316	0.056413
15	45	82.7622	0.0121	16.91	0.0377	0.3146	1.5174	Subcooled	0.30173	0.055679
20	45	82.2040	0.0122	18.49	0.0410	0.3163	1.5195	Subcooled	0.29084	0.054948
25	45	81.6387	0.0122	20.08	0.0443	0.3180	1.5218	Subcooled	0.28042	0.054220
30	45	81.0659	0.0123	21.67	0.0475	0.3198	1.5243	Subcooled	0.27046	0.053495
35	45	0.9522	1.0502	108.18	0.2225	0.2162	1.1816	Superheated	0.01079	0.006741
40	45	0.9386	1.0654	109.25	0.2246	0.2150	1.1761	Superheated	0.01091	0.006866
45	45	0.9256	1.0804	110.33	0.2268	0.2143	1.1711	Superheated	0.01102	0.006991
50	45	0.9131	1.0952	111.40	0.2289	0.2138	1.1667	Superheated	0.01114	0.007117
55	45	0.9011	1.1098	112.46	0.2310	0.2136	1.1627	Superheated	0.01126	0.007243
60	45	0.8895	1.1242	113.53	0.2330	0.2135	1.1590	Superheated	0.01137	0.007369
65	45	0.8783	1.1385	114.60	0.2351	0.2136	1.1556	Superheated	0.01149	0.007495
70	45	0.8675	1.1527	115.67	0.2371	0.2138	1.1524	Superheated	0.01160	0.007622
75	45	0.8571	1.1667	116.74	0.2391	0.2141	1.1494	Superheated	0.01172	0.007748
80	45	0.8470	1.1807	117.81	0.2411	0.2144	1.1467	Superheated	0.01183	0.007875
85	45	0.8371	1.1945	118.88	0.2431	0.2149	1.1441	Superheated	0.01194	0.008002
90	45	0.8276	1.2083	119.96	0.2450	0.2154	1.1416	Superheated	0.01206	0.008129
95	45	0.8184	1.2220	121.04	0.2470	0.2159	1.1393	Superheated	0.01217	0.008256
100	45	0.8094	1.2356	122.12	0.2489	0.2165	1.1371	Superheated	0.01228	0.008383
105	45	0.8006	1.2491	123.20	0.2509	0.2172	1.1350	Superheated	0.01239	0.008511
110	45	0.7921	1.2625	124.29	0.2528	0.2178	1.1331	Superheated	0.01250	0.008638
115	45	0.7838	1.2759	125.38	0.2547	0.2185	1.1312	Superheated	0.01262	0.008765
120	45	0.7757	1.2892	126.47	0.2566	0.2193	1.1294	Superheated	0.01273	0.008893
125	45	0.7678	1.3025	127.57	0.2585	0.2200	1.1276	Superheated	0.01284	0.009020
130	45	0.7601	1.3157	128.67	0.2604	0.2208	1.1260	Superheated	0.01295	0.009148
135	45	0.7526	1.3288	129.78	0.2622	0.2215	1.1244	Superheated	0.01306	0.009276
140	45	0.7452	1.3419	130.89	0.2641	0.2223	1.1229	Superheated	0.01317	0.009403
145	45	0.7380	1.3550	132.00	0.2659	0.2232	1.1214	Superheated	0.01328	0.009531
150	45	0.7310	1.3680	133.12	0.2678	0.2240	1.1200	Superheated	0.01339	0.009659

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=50 psia (40.27 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	50	89.5427	0.0112	-2.94	-0.0073	0.2975	1.5049	Subcooled	0.51265	0.065606
-45	50	89.0463	0.0112	-1.45	-0.0037	0.2986	1.5052	Subcooled	0.48983	0.064809
-40	50	88.5466	0.0113	0.05	-0.0001	0.2997	1.5056	Subcooled	0.46850	0.064019
-35	50	88.0434	0.0114	1.55	0.0035	0.3009	1.5061	Subcooled	0.44853	0.063234
-30	50	87.5366	0.0114	3.06	0.0070	0.3021	1.5066	Subcooled	0.42980	0.062456
-25	50	87.0258	0.0115	4.57	0.0105	0.3033	1.5073	Subcooled	0.41219	0.061684
-20	50	86.5110	0.0116	6.09	0.0140	0.3046	1.5080	Subcooled	0.39561	0.060918
-15	50	85.9918	0.0116	7.61	0.0174	0.3059	1.5089	Subcooled	0.37996	0.060157
-10	50	85.4680	0.0117	9.15	0.0208	0.3072	1.5099	Subcooled	0.36517	0.059401
-5	50	84.9393	0.0118	10.69	0.0242	0.3086	1.5110	Subcooled	0.35117	0.058650
0	50	84.4054	0.0118	12.23	0.0276	0.3100	1.5123	Subcooled	0.33790	0.057904
5	50	83.8661	0.0119	13.79	0.0310	0.3115	1.5138	Subcooled	0.32529	0.057162
10	50	83.3209	0.0120	15.35	0.0343	0.3130	1.5154	Subcooled	0.31329	0.056424
15	50	82.7696	0.0121	16.92	0.0377	0.3146	1.5173	Subcooled	0.30187	0.055690
20	50	82.2116	0.0122	18.49	0.0410	0.3162	1.5193	Subcooled	0.29097	0.054960
25	50	81.6467	0.0122	20.08	0.0442	0.3179	1.5216	Subcooled	0.28055	0.054232
30	50	81.0743	0.0123	21.67	0.0475	0.3197	1.5241	Subcooled	0.27059	0.053508
35	50	80.4938	0.0124	23.28	0.0508	0.3216	1.5269	Subcooled	0.26104	0.052786
40	50	79.9049	0.0125	24.89	0.0540	0.3235	1.5300	Subcooled	0.25188	0.052066
45	50	1.0403	0.9612	109.93	0.2241	0.2183	1.1808	Superheated	0.01101	0.007008
50	50	1.0257	0.9750	111.02	0.2263	0.2174	1.1755	Superheated	0.01113	0.007133
55	50	1.0116	0.9885	112.10	0.2284	0.2167	1.1707	Superheated	0.01124	0.007258
60	50	0.9981	1.0019	113.19	0.2305	0.2164	1.1664	Superheated	0.01136	0.007383
65	50	0.9851	1.0151	114.27	0.2325	0.2162	1.1624	Superheated	0.01148	0.007509
70	50	0.9726	1.0282	115.35	0.2346	0.2162	1.1587	Superheated	0.01159	0.007635
75	50	0.9605	1.0411	116.43	0.2366	0.2163	1.1554	Superheated	0.01171	0.007761
80	50	0.9488	1.0540	117.51	0.2386	0.2165	1.1522	Superheated	0.01182	0.007887
85	50	0.9375	1.0667	118.59	0.2406	0.2168	1.1493	Superheated	0.01193	0.008013
90	50	0.9265	1.0793	119.68	0.2426	0.2172	1.1465	Superheated	0.01205	0.008140
95	50	0.9159	1.0919	120.77	0.2446	0.2176	1.1439	Superheated	0.01216	0.008267
100	50	0.9055	1.1043	121.85	0.2465	0.2181	1.1415	Superheated	0.01228	0.008394
105	50	0.8955	1.1167	122.95	0.2485	0.2187	1.1392	Superheated	0.01239	0.008521
110	50	0.8857	1.1290	124.04	0.2504	0.2193	1.1370	Superheated	0.01250	0.008648
115	50	0.8762	1.1412	125.14	0.2523	0.2199	1.1349	Superheated	0.01261	0.008775
120	50	0.8670	1.1534	126.24	0.2542	0.2205	1.1329	Superheated	0.01272	0.008902
125	50	0.8580	1.1655	127.35	0.2561	0.2212	1.1310	Superheated	0.01283	0.009030
130	50	0.8492	1.1776	128.45	0.2580	0.2219	1.1292	Superheated	0.01295	0.009157
135	50	0.8406	1.1896	129.56	0.2599	0.2227	1.1275	Superheated	0.01306	0.009284
140	50	0.8323	1.2015	130.68	0.2618	0.2234	1.1258	Superheated	0.01317	0.009412
145	50	0.8241	1.2134	131.80	0.2636	0.2242	1.1242	Superheated	0.01328	0.009539
150	50	0.8162	1.2253	132.92	0.2655	0.2250	1.1227	Superheated	0.01339	0.009667

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=60 psia (49.88 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	60	89.5520	0.0112	-2.93	-0.0073	0.2974	1.5047	Subcooled	0.51303	0.065624
-45	60	89.0559	0.0112	-1.44	-0.0037	0.2985	1.5050	Subcooled	0.49019	0.064827
-40	60	88.5565	0.0113	0.06	-0.0001	0.2997	1.5054	Subcooled	0.46885	0.064037
-35	60	88.0536	0.0114	1.56	0.0034	0.3008	1.5058	Subcooled	0.44887	0.063253
-30	60	87.5471	0.0114	3.07	0.0070	0.3020	1.5064	Subcooled	0.43012	0.062475
-25	60	87.0368	0.0115	4.58	0.0105	0.3033	1.5070	Subcooled	0.41250	0.061703
-20	60	86.5223	0.0116	6.10	0.0139	0.3045	1.5078	Subcooled	0.39591	0.060937
-15	60	86.0035	0.0116	7.62	0.0174	0.3058	1.5086	Subcooled	0.38026	0.060177
-10	60	85.4801	0.0117	9.16	0.0208	0.3072	1.5096	Subcooled	0.36546	0.059421
-5	60	84.9519	0.0118	10.70	0.0242	0.3085	1.5108	Subcooled	0.35146	0.058671
0	60	84.4185	0.0118	12.24	0.0276	0.3100	1.5120	Subcooled	0.33818	0.057925
5	60	83.8797	0.0119	13.80	0.0310	0.3114	1.5135	Subcooled	0.32556	0.057184
10	60	83.3351	0.0120	15.36	0.0343	0.3130	1.5151	Subcooled	0.31356	0.056446
15	60	82.7843	0.0121	16.93	0.0376	0.3145	1.5169	Subcooled	0.30213	0.055713
20	60	82.2269	0.0122	18.50	0.0409	0.3162	1.5189	Subcooled	0.29123	0.054983
25	60	81.6626	0.0122	20.09	0.0442	0.3179	1.5212	Subcooled	0.28081	0.054256
30	60	81.0909	0.0123	21.68	0.0475	0.3196	1.5237	Subcooled	0.27084	0.053532
35	60	80.5112	0.0124	23.28	0.0507	0.3215	1.5265	Subcooled	0.26130	0.052811
40	60	79.9231	0.0125	24.90	0.0540	0.3234	1.5295	Subcooled	0.25213	0.052092
45	60	79.3258	0.0126	26.52	0.0572	0.3254	1.5329	Subcooled	0.24333	0.051374
50	60	1.2594	0.7940	110.22	0.2215	0.2258	1.1958	Superheated	0.01110	0.007170
55	60	1.2406	0.8061	111.34	0.2237	0.2242	1.1891	Superheated	0.01122	0.007293
60	60	1.2226	0.8179	112.46	0.2259	0.2230	1.1831	Superheated	0.01134	0.007416
65	60	1.2055	0.8295	113.58	0.2280	0.2221	1.1777	Superheated	0.01146	0.007540
70	60	1.1890	0.8410	114.68	0.2301	0.2215	1.1728	Superheated	0.01157	0.007664
75	60	1.1732	0.8524	115.79	0.2322	0.2212	1.1684	Superheated	0.01169	0.007789
80	60	1.1580	0.8636	116.90	0.2342	0.2210	1.1644	Superheated	0.01181	0.007914
85	60	1.1433	0.8746	118.00	0.2363	0.2210	1.1606	Superheated	0.01192	0.008039
90	60	1.1292	0.8856	119.11	0.2383	0.2211	1.1571	Superheated	0.01204	0.008165
95	60	1.1155	0.8965	120.21	0.2403	0.2213	1.1539	Superheated	0.01215	0.008291
100	60	1.1022	0.9073	121.32	0.2423	0.2215	1.1508	Superheated	0.01227	0.008417
105	60	1.0894	0.9179	122.43	0.2442	0.2219	1.1480	Superheated	0.01238	0.008543
110	60	1.0769	0.9286	123.54	0.2462	0.2223	1.1453	Superheated	0.01249	0.008669
115	60	1.0649	0.9391	124.65	0.2481	0.2227	1.1428	Superheated	0.01261	0.008796
120	60	1.0531	0.9496	125.77	0.2501	0.2232	1.1404	Superheated	0.01272	0.008922
125	60	1.0417	0.9599	126.88	0.2520	0.2238	1.1381	Superheated	0.01283	0.009049
130	60	1.0306	0.9703	128.00	0.2539	0.2244	1.1360	Superheated	0.01294	0.009176
135	60	1.0198	0.9806	129.13	0.2558	0.2250	1.1339	Superheated	0.01306	0.009303
140	60	1.0093	0.9908	130.25	0.2577	0.2256	1.1319	Superheated	0.01317	0.009430
145	60	0.9990	1.0010	131.38	0.2596	0.2263	1.1301	Superheated	0.01328	0.009557
150	60	0.9890	1.0111	132.52	0.2614	0.2270	1.1283	Superheated	0.01339	0.009684

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=70 psia (58.34 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	70	89.5613	0.0112	-2.92	-0.0073	0.2974	1.5045	Subcooled	0.51340	0.065641
-45	70	89.0654	0.0112	-1.43	-0.0037	0.2985	1.5048	Subcooled	0.49054	0.064845
-40	70	88.5664	0.0113	0.07	-0.0001	0.2996	1.5052	Subcooled	0.46919	0.064055
-35	70	88.0639	0.0114	1.57	0.0034	0.3008	1.5056	Subcooled	0.44920	0.063271
-30	70	87.5577	0.0114	3.08	0.0069	0.3020	1.5062	Subcooled	0.43045	0.062494
-25	70	87.0477	0.0115	4.59	0.0104	0.3032	1.5068	Subcooled	0.41282	0.061722
-20	70	86.5336	0.0116	6.11	0.0139	0.3045	1.5075	Subcooled	0.39622	0.060957
-15	70	86.0152	0.0116	7.63	0.0174	0.3058	1.5084	Subcooled	0.38056	0.060197
-10	70	85.4923	0.0117	9.17	0.0208	0.3071	1.5094	Subcooled	0.36575	0.059442
-5	70	84.9645	0.0118	10.71	0.0242	0.3085	1.5105	Subcooled	0.35174	0.058692
0	70	84.4316	0.0118	12.25	0.0276	0.3099	1.5118	Subcooled	0.33846	0.057946
5	70	83.8933	0.0119	13.80	0.0309	0.3114	1.5132	Subcooled	0.32584	0.057205
10	70	83.3492	0.0120	15.37	0.0343	0.3129	1.5148	Subcooled	0.31383	0.056468
15	70	82.7990	0.0121	16.93	0.0376	0.3145	1.5166	Subcooled	0.30240	0.055736
20	70	82.2422	0.0122	18.51	0.0409	0.3161	1.5186	Subcooled	0.29149	0.055006
25	70	81.6786	0.0122	20.09	0.0442	0.3178	1.5208	Subcooled	0.28107	0.054280
30	70	81.1075	0.0123	21.69	0.0475	0.3195	1.5233	Subcooled	0.27110	0.053557
35	70	80.5286	0.0124	23.29	0.0507	0.3214	1.5260	Subcooled	0.26155	0.052836
40	70	79.9412	0.0125	24.90	0.0540	0.3233	1.5291	Subcooled	0.25239	0.052118
45	70	79.3448	0.0126	26.52	0.0572	0.3253	1.5324	Subcooled	0.24358	0.051401
50	70	78.7387	0.0127	28.15	0.0604	0.3274	1.5362	Subcooled	0.23511	0.050685
55	70	78.1221	0.0128	29.80	0.0636	0.3296	1.5403	Subcooled	0.22696	0.049971
60	70	1.4583	0.6857	111.69	0.2217	0.2311	1.2031	Superheated	0.01132	0.007456
65	70	1.4361	0.6963	112.84	0.2239	0.2293	1.1958	Superheated	0.01144	0.007578
70	70	1.4149	0.7068	113.99	0.2261	0.2279	1.1893	Superheated	0.01156	0.007700
75	70	1.3947	0.7170	115.12	0.2282	0.2269	1.1834	Superheated	0.01167	0.007822
80	70	1.3753	0.7271	116.26	0.2303	0.2262	1.1782	Superheated	0.01179	0.007945
85	70	1.3568	0.7370	117.39	0.2324	0.2257	1.1734	Superheated	0.01191	0.008069
90	70	1.3389	0.7469	118.51	0.2345	0.2254	1.1690	Superheated	0.01203	0.008193
95	70	1.3217	0.7566	119.64	0.2365	0.2253	1.1649	Superheated	0.01214	0.008318
100	70	1.3052	0.7662	120.77	0.2385	0.2253	1.1612	Superheated	0.01226	0.008443
105	70	1.2892	0.7757	121.89	0.2405	0.2254	1.1577	Superheated	0.01237	0.008568
110	70	1.2737	0.7851	123.02	0.2425	0.2256	1.1544	Superheated	0.01249	0.008693
115	70	1.2587	0.7945	124.15	0.2445	0.2258	1.1514	Superheated	0.01260	0.008819
120	70	1.2442	0.8037	125.28	0.2465	0.2262	1.1485	Superheated	0.01272	0.008945
125	70	1.2301	0.8129	126.41	0.2484	0.2265	1.1458	Superheated	0.01283	0.009071
130	70	1.2165	0.8221	127.54	0.2503	0.2270	1.1432	Superheated	0.01294	0.009197
135	70	1.2032	0.8311	128.68	0.2522	0.2275	1.1408	Superheated	0.01306	0.009323
140	70	1.1903	0.8401	129.82	0.2542	0.2280	1.1385	Superheated	0.01317	0.009450
145	70	1.1777	0.8491	130.96	0.2560	0.2286	1.1363	Superheated	0.01328	0.009576
150	70	1.1655	0.8580	132.10	0.2579	0.2291	1.1342	Superheated	0.01339	0.009703



# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=80 psia (65.92 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	80	89.5705	0.0112	-2.91	-0.0074	0.2974	1.5043	Subcooled	0.51377	0.065659
-45	80	89.0750	0.0112	-1.42	-0.0038	0.2985	1.5046	Subcooled	0.49090	0.064862
-40	80	88.5762	0.0113	0.08	-0.0002	0.2996	1.5050	Subcooled	0.46954	0.064073
-35	80	88.0741	0.0114	1.58	0.0034	0.3008	1.5054	Subcooled	0.44954	0.063290
-30	80	87.5682	0.0114	3.09	0.0069	0.3019	1.5060	Subcooled	0.43077	0.062513
-25	80	87.0586	0.0115	4.60	0.0104	0.3032	1.5066	Subcooled	0.41313	0.061742
-20	80	86.5449	0.0116	6.12	0.0139	0.3044	1.5073	Subcooled	0.39653	0.060976
-15	80	86.0269	0.0116	7.64	0.0173	0.3057	1.5081	Subcooled	0.38086	0.060216
-10	80	85.5044	0.0117	9.18	0.0208	0.3071	1.5091	Subcooled	0.36605	0.059462
-5	80	84.9771	0.0118	10.72	0.0242	0.3084	1.5102	Subcooled	0.35203	0.058712
0	80	84.4446	0.0118	12.26	0.0275	0.3098	1.5115	Subcooled	0.33874	0.057967
5	80	83.9068	0.0119	13.81	0.0309	0.3113	1.5129	Subcooled	0.32611	0.057227
10	80	83.3632	0.0120	15.37	0.0342	0.3128	1.5145	Subcooled	0.31410	0.056491
15	80	82.8136	0.0121	16.94	0.0376	0.3144	1.5162	Subcooled	0.30267	0.055758
20	80	82.2575	0.0122	18.52	0.0409	0.3160	1.5182	Subcooled	0.29176	0.055029
25	80	81.6945	0.0122	20.10	0.0442	0.3177	1.5204	Subcooled	0.28133	0.054304
30	80	81.1241	0.0123	21.69	0.0474	0.3195	1.5229	Subcooled	0.27136	0.053581
35	80	80.5459	0.0124	23.30	0.0507	0.3213	1.5256	Subcooled	0.26181	0.052861
40	80	79.9593	0.0125	24.91	0.0539	0.3232	1.5286	Subcooled	0.25264	0.052143
45	80	79.3638	0.0126	26.53	0.0571	0.3252	1.5320	Subcooled	0.24384	0.051427
50	80	78.7586	0.0127	28.16	0.0604	0.3273	1.5356	Subcooled	0.23537	0.050713
55	80	78.1430	0.0128	29.80	0.0636	0.3295	1.5397	Subcooled	0.22721	0.049999
60	80	77.5163	0.0129	31.45	0.0668	0.3318	1.5442	Subcooled	0.21934	0.049286
65	80	76.8776	0.0130	33.12	0.0700	0.3343	1.5493	Subcooled	0.21173	0.048572
70	80	1.6516	0.6055	113.25	0.2224	0.2356	1.2087	Superheated	0.01154	0.007743
75	80	1.6260	0.6150	114.42	0.2246	0.2337	1.2010	Superheated	0.01166	0.007862
80	80	1.6018	0.6243	115.58	0.2268	0.2322	1.1941	Superheated	0.01178	0.007983
85	80	1.5787	0.6335	116.74	0.2289	0.2311	1.1879	Superheated	0.01190	0.008104
90	80	1.5565	0.6425	117.90	0.2310	0.2303	1.1824	Superheated	0.01202	0.008227
95	80	1.5353	0.6513	119.05	0.2331	0.2298	1.1773	Superheated	0.01214	0.008350
100	80	1.5149	0.6601	120.19	0.2352	0.2294	1.1727	Superheated	0.01225	0.008473
105	80	1.4953	0.6687	121.34	0.2372	0.2292	1.1684	Superheated	0.01237	0.008597
110	80	1.4764	0.6773	122.49	0.2392	0.2291	1.1644	Superheated	0.01248	0.008721
115	80	1.4582	0.6858	123.63	0.2412	0.2292	1.1607	Superheated	0.01260	0.008845
120	80	1.4406	0.6942	124.78	0.2432	0.2293	1.1573	Superheated	0.01272	0.008970
125	80	1.4236	0.7025	125.93	0.2452	0.2295	1.1541	Superheated	0.01283	0.009095
130	80	1.4071	0.7107	127.07	0.2471	0.2298	1.1510	Superheated	0.01294	0.009221
135	80	1.3911	0.7189	128.22	0.2491	0.2301	1.1482	Superheated	0.01306	0.009346
140	80	1.3755	0.7270	129.37	0.2510	0.2305	1.1455	Superheated	0.01317	0.009472
145	80	1.3605	0.7350	130.53	0.2529	0.2309	1.1429	Superheated	0.01328	0.009598
150	80	1.3458	0.7430	131.68	0.2548	0.2314	1.1405	Superheated	0.01340	0.009724

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=90 psia (72.82 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	90	89.5798	0.0112	-2.89	-0.0074	0.2973	1.5042	Subcooled	0.51414	0.065676
-45	90	89.0846	0.0112	-1.40	-0.0038	0.2984	1.5044	Subcooled	0.49126	0.064880
-40	90	88.5861	0.0113	0.09	-0.0002	0.2996	1.5048	Subcooled	0.46988	0.064091
-35	90	88.0843	0.0114	1.59	0.0034	0.3007	1.5052	Subcooled	0.44987	0.063308
-30	90	87.5788	0.0114	3.10	0.0069	0.3019	1.5057	Subcooled	0.43110	0.062531
-25	90	87.0695	0.0115	4.61	0.0104	0.3031	1.5064	Subcooled	0.41345	0.061761
-20	90	86.5562	0.0116	6.13	0.0139	0.3044	1.5071	Subcooled	0.39683	0.060996
-15	90	86.0386	0.0116	7.65	0.0173	0.3057	1.5079	Subcooled	0.38115	0.060236
-10	90	85.5165	0.0117	9.19	0.0207	0.3070	1.5089	Subcooled	0.36634	0.059482
-5	90	84.9896	0.0118	10.72	0.0241	0.3084	1.5099	Subcooled	0.35231	0.058733
0	90	84.4577	0.0118	12.27	0.0275	0.3098	1.5112	Subcooled	0.33902	0.057989
5	90	83.9203	0.0119	13.82	0.0309	0.3112	1.5126	Subcooled	0.32639	0.057249
10	90	83.3773	0.0120	15.38	0.0342	0.3128	1.5142	Subcooled	0.31437	0.056513
15	90	82.8282	0.0121	16.95	0.0375	0.3143	1.5159	Subcooled	0.30293	0.055781
20	90	82.2727	0.0122	18.53	0.0408	0.3159	1.5179	Subcooled	0.29202	0.055053
25	90	81.7103	0.0122	20.11	0.0441	0.3176	1.5201	Subcooled	0.28159	0.054328
30	90	81.1407	0.0123	21.70	0.0474	0.3194	1.5225	Subcooled	0.27162	0.053606
35	90	80.5632	0.0124	23.30	0.0506	0.3212	1.5252	Subcooled	0.26206	0.052886
40	90	79.9774	0.0125	24.91	0.0539	0.3231	1.5282	Subcooled	0.25289	0.052169
45	90	79.3827	0.0126	26.53	0.0571	0.3251	1.5315	Subcooled	0.24409	0.051454
50	90	78.7784	0.0127	28.16	0.0603	0.3272	1.5351	Subcooled	0.23562	0.050740
55	90	78.1638	0.0128	29.81	0.0635	0.3294	1.5392	Subcooled	0.22746	0.050027
60	90	77.5382	0.0129	31.46	0.0667	0.3317	1.5436	Subcooled	0.21959	0.049315
65	90	76.9006	0.0130	33.12	0.0699	0.3341	1.5486	Subcooled	0.21199	0.048602
70	90	76.2501	0.0131	34.80	0.0731	0.3367	1.5541	Subcooled	0.20463	0.047889
75	90	1.8688	0.5351	113.67	0.2212	0.2418	1.2217	Superheated	0.01165	0.007911
80	90	1.8386	0.5439	114.88	0.2235	0.2393	1.2127	Superheated	0.01177	0.008028
85	90	1.8100	0.5525	116.07	0.2257	0.2374	1.2047	Superheated	0.01189	0.008146
90	90	1.7829	0.5609	117.25	0.2278	0.2360	1.1977	Superheated	0.01201	0.008266
95	90	1.7570	0.5692	118.43	0.2300	0.2349	1.1913	Superheated	0.01213	0.008386
100	90	1.7322	0.5773	119.60	0.2321	0.2341	1.1855	Superheated	0.01225	0.008507
105	90	1.7085	0.5853	120.77	0.2341	0.2335	1.1803	Superheated	0.01237	0.008629
110	90	1.6857	0.5932	121.94	0.2362	0.2331	1.1755	Superheated	0.01248	0.008752
115	90	1.6638	0.6010	123.10	0.2382	0.2328	1.1710	Superheated	0.01260	0.008875
120	90	1.6427	0.6087	124.26	0.2402	0.2327	1.1669	Superheated	0.01272	0.008998
125	90	1.6224	0.6164	125.43	0.2422	0.2327	1.1631	Superheated	0.01283	0.009122
130	90	1.6027	0.6239	126.59	0.2442	0.2328	1.1595	Superheated	0.01295	0.009247
135	90	1.5837	0.6314	127.76	0.2462	0.2329	1.1562	Superheated	0.01306	0.009371
140	90	1.5653	0.6389	128.92	0.2481	0.2332	1.1530	Superheated	0.01318	0.009496
145	90	1.5475	0.6462	130.09	0.2501	0.2334	1.1501	Superheated	0.01329	0.009621
150	90	1.5302	0.6535	131.26	0.2520	0.2338	1.1473	Superheated	0.01340	0.009746

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=100 psia (79.16 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	100	89.5890	0.0112	-2.88	-0.0074	0.2973	1.5040	Subcooled	0.51452	0.065693
-45	100	89.0941	0.0112	-1.39	-0.0038	0.2984	1.5042	Subcooled	0.49162	0.064898
-40	100	88.5960	0.0113	0.10	-0.0002	0.2995	1.5046	Subcooled	0.47023	0.064109
-35	100	88.0944	0.0114	1.60	0.0033	0.3007	1.5050	Subcooled	0.45021	0.063326
-30	100	87.5893	0.0114	3.11	0.0069	0.3019	1.5055	Subcooled	0.43142	0.062550
-25	100	87.0804	0.0115	4.62	0.0104	0.3031	1.5061	Subcooled	0.41376	0.061780
-20	100	86.5674	0.0116	6.14	0.0138	0.3043	1.5068	Subcooled	0.39714	0.061015
-15	100	86.0503	0.0116	7.66	0.0173	0.3056	1.5077	Subcooled	0.38145	0.060256
-10	100	85.5286	0.0117	9.20	0.0207	0.3070	1.5086	Subcooled	0.36663	0.059502
-5	100	85.0021	0.0118	10.73	0.0241	0.3083	1.5097	Subcooled	0.35260	0.058754
0	100	84.4707	0.0118	12.28	0.0275	0.3097	1.5109	Subcooled	0.33930	0.058010
5	100	83.9338	0.0119	13.83	0.0308	0.3112	1.5123	Subcooled	0.32666	0.057270
10	100	83.3913	0.0120	15.39	0.0342	0.3127	1.5138	Subcooled	0.31465	0.056535
15	100	82.8428	0.0121	16.96	0.0375	0.3142	1.5156	Subcooled	0.30320	0.055804
20	100	82.2879	0.0122	18.53	0.0408	0.3159	1.5175	Subcooled	0.29228	0.055076
25	100	81.7262	0.0122	20.12	0.0441	0.3175	1.5197	Subcooled	0.28185	0.054352
30	100	81.1572	0.0123	21.71	0.0474	0.3193	1.5221	Subcooled	0.27187	0.053630
35	100	80.5804	0.0124	23.31	0.0506	0.3211	1.5248	Subcooled	0.26232	0.052911
40	100	79.9954	0.0125	24.92	0.0539	0.3230	1.5277	Subcooled	0.25315	0.052195
45	100	79.4015	0.0126	26.54	0.0571	0.3250	1.5310	Subcooled	0.24434	0.051480
50	100	78.7982	0.0127	28.17	0.0603	0.3270	1.5346	Subcooled	0.23587	0.050767
55	100	78.1846	0.0128	29.81	0.0635	0.3292	1.5386	Subcooled	0.22771	0.050055
60	100	77.5600	0.0129	31.46	0.0667	0.3315	1.5430	Subcooled	0.21984	0.049344
65	100	76.9236	0.0130	33.13	0.0699	0.3340	1.5479	Subcooled	0.21224	0.048632
70	100	76.2743	0.0131	34.80	0.0731	0.3365	1.5534	Subcooled	0.20488	0.047920
75	100	75.6111	0.0132	36.49	0.0762	0.3393	1.5594	Subcooled	0.19776	0.047207
80	100	2.0874	0.4791	114.13	0.2203	0.2479	1.2348	Superheated	0.01176	0.008082
85	100	2.0523	0.4873	115.36	0.2226	0.2449	1.2244	Superheated	0.01189	0.008196
90	100	2.0191	0.4953	116.58	0.2248	0.2426	1.2153	Superheated	0.01201	0.008311
95	100	1.9877	0.5031	117.78	0.2270	0.2407	1.2072	Superheated	0.01213	0.008429
100	100	1.9578	0.5108	118.98	0.2292	0.2393	1.2001	Superheated	0.01225	0.008547
105	100	1.9294	0.5183	120.18	0.2313	0.2383	1.1936	Superheated	0.01237	0.008667
110	100	1.9022	0.5257	121.37	0.2334	0.2374	1.1878	Superheated	0.01248	0.008787
115	100	1.8761	0.5330	122.55	0.2355	0.2368	1.1824	Superheated	0.01260	0.008909
120	100	1.8511	0.5402	123.74	0.2375	0.2364	1.1775	Superheated	0.01272	0.009030
125	100	1.8270	0.5473	124.92	0.2395	0.2361	1.1729	Superheated	0.01283	0.009153
130	100	1.8038	0.5544	126.10	0.2415	0.2360	1.1687	Superheated	0.01295	0.009276
135	100	1.7815	0.5613	127.28	0.2435	0.2359	1.1648	Superheated	0.01307	0.009399
140	100	1.7599	0.5682	128.46	0.2455	0.2360	1.1611	Superheated	0.01318	0.009523
145	100	1.7390	0.5750	129.64	0.2475	0.2361	1.1577	Superheated	0.01330	0.009647
150	100	1.7188	0.5818	130.82	0.2494	0.2363	1.1545	Superheated	0.01341	0.009771

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=125 psia (93.14 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	125	89.6121	0.0112	-2.85	-0.0075	0.2972	1.5035	Subcooled	0.51545	0.065737
-45	125	89.1179	0.0112	-1.37	-0.0039	0.2983	1.5038	Subcooled	0.49252	0.064942
-40	125	88.6206	0.0113	0.13	-0.0003	0.2994	1.5041	Subcooled	0.47110	0.064154
-35	125	88.1198	0.0113	1.63	0.0033	0.3006	1.5045	Subcooled	0.45104	0.063372
-30	125	87.6156	0.0114	3.14	0.0068	0.3018	1.5050	Subcooled	0.43223	0.062597
-25	125	87.1075	0.0115	4.65	0.0103	0.3030	1.5056	Subcooled	0.41455	0.061827
-20	125	86.5956	0.0115	6.16	0.0138	0.3042	1.5062	Subcooled	0.39790	0.061064
-15	125	86.0794	0.0116	7.69	0.0172	0.3055	1.5070	Subcooled	0.38220	0.060306
-10	125	85.5587	0.0117	9.22	0.0206	0.3068	1.5080	Subcooled	0.36736	0.059553
-5	125	85.0334	0.0118	10.76	0.0240	0.3082	1.5090	Subcooled	0.35331	0.058805
0	125	84.5031	0.0118	12.30	0.0274	0.3096	1.5102	Subcooled	0.33999	0.058063
5	125	83.9675	0.0119	13.85	0.0308	0.3110	1.5115	Subcooled	0.32735	0.057324
10	125	83.4263	0.0120	15.41	0.0341	0.3125	1.5131	Subcooled	0.31532	0.056590
15	125	82.8792	0.0121	16.98	0.0374	0.3141	1.5148	Subcooled	0.30386	0.055860
20	125	82.3258	0.0121	18.55	0.0407	0.3157	1.5167	Subcooled	0.29294	0.055134
25	125	81.7656	0.0122	20.14	0.0440	0.3173	1.5188	Subcooled	0.28250	0.054411
30	125	81.1983	0.0123	21.73	0.0473	0.3191	1.5211	Subcooled	0.27252	0.053691
35	125	80.6234	0.0124	23.33	0.0505	0.3209	1.5237	Subcooled	0.26295	0.052974
40	125	80.0403	0.0125	24.94	0.0538	0.3227	1.5266	Subcooled	0.25378	0.052259
45	125	79.4485	0.0126	26.55	0.0570	0.3247	1.5298	Subcooled	0.24497	0.051546
50	125	78.8474	0.0127	28.18	0.0602	0.3268	1.5333	Subcooled	0.23649	0.050835
55	125	78.2362	0.0128	29.82	0.0634	0.3289	1.5372	Subcooled	0.22833	0.050125
60	125	77.6143	0.0129	31.47	0.0666	0.3312	1.5416	Subcooled	0.22046	0.049416
65	125	76.9807	0.0130	33.13	0.0698	0.3336	1.5463	Subcooled	0.21286	0.048707
70	125	76.3346	0.0131	34.81	0.0729	0.3361	1.5516	Subcooled	0.20551	0.047997
75	125	75.6748	0.0132	36.49	0.0761	0.3388	1.5575	Subcooled	0.19840	0.047287
80	125	75.0003	0.0133	38.20	0.0793	0.3417	1.5640	Subcooled	0.19149	0.046575
85	125	74.3095	0.0135	39.91	0.0825	0.3448	1.5713	Subcooled	0.18479	0.045860
90	125	73.6010	0.0136	41.64	0.0856	0.3481	1.5795	Subcooled	0.17826	0.045143
95	125	2.6124	0.3828	116.02	0.2202	0.2600	1.2594	Superheated	0.01213	0.008573
100	125	2.5654	0.3898	117.31	0.2225	0.2562	1.2465	Superheated	0.01225	0.008679
105	125	2.5213	0.3966	118.59	0.2248	0.2532	1.2353	Superheated	0.01237	0.008789
110	125	2.4797	0.4033	119.85	0.2270	0.2509	1.2255	Superheated	0.01249	0.008901
115	125	2.4403	0.4098	121.10	0.2292	0.2490	1.2168	Superheated	0.01261	0.009014
120	125	2.4030	0.4161	122.34	0.2313	0.2475	1.2091	Superheated	0.01273	0.009130
125	125	2.3674	0.4224	123.57	0.2334	0.2463	1.2020	Superheated	0.01285	0.009246
130	125	2.3334	0.4286	124.80	0.2355	0.2453	1.1957	Superheated	0.01297	0.009364
135	125	2.3010	0.4346	126.03	0.2376	0.2446	1.1898	Superheated	0.01309	0.009483
140	125	2.2698	0.4406	127.25	0.2396	0.2441	1.1845	Superheated	0.01320	0.009603
145	125	2.2399	0.4465	128.47	0.2417	0.2437	1.1795	Superheated	0.01332	0.009723
150	125	2.2111	0.4523	129.68	0.2437	0.2434	1.1749	Superheated	0.01344	0.009844

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=150 psia (105.16 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	150	89.6351	0.0112	-2.83	-0.0075	0.2972	1.5030	Subcooled	0.51638	0.065780
-45	150	89.1416	0.0112	-1.34	-0.0039	0.2982	1.5033	Subcooled	0.49342	0.064986
-40	150	88.6451	0.0113	0.16	-0.0003	0.2994	1.5036	Subcooled	0.47196	0.064199
-35	150	88.1452	0.0113	1.66	0.0032	0.3005	1.5040	Subcooled	0.45188	0.063418
-30	150	87.6417	0.0114	3.16	0.0067	0.3017	1.5044	Subcooled	0.43304	0.062643
-25	150	87.1346	0.0115	4.67	0.0102	0.3029	1.5050	Subcooled	0.41534	0.061875
-20	150	86.6236	0.0115	6.19	0.0137	0.3041	1.5057	Subcooled	0.39867	0.061112
-15	150	86.1084	0.0116	7.71	0.0172	0.3054	1.5064	Subcooled	0.38295	0.060355
-10	150	85.5888	0.0117	9.24	0.0206	0.3067	1.5073	Subcooled	0.36809	0.059604
-5	150	85.0645	0.0118	10.78	0.0240	0.3080	1.5083	Subcooled	0.35403	0.058857
0	150	84.5354	0.0118	12.33	0.0274	0.3094	1.5095	Subcooled	0.34069	0.058115
5	150	84.0010	0.0119	13.88	0.0307	0.3109	1.5108	Subcooled	0.32803	0.057378
10	150	83.4612	0.0120	15.43	0.0340	0.3124	1.5123	Subcooled	0.31600	0.056645
15	150	82.9154	0.0121	17.00	0.0374	0.3139	1.5139	Subcooled	0.30453	0.055917
20	150	82.3634	0.0121	18.57	0.0407	0.3155	1.5158	Subcooled	0.29359	0.055192
25	150	81.8049	0.0122	20.15	0.0439	0.3171	1.5179	Subcooled	0.28315	0.054470
30	150	81.2392	0.0123	21.74	0.0472	0.3188	1.5201	Subcooled	0.27316	0.053752
35	150	80.6661	0.0124	23.34	0.0504	0.3206	1.5227	Subcooled	0.26359	0.053036
40	150	80.0849	0.0125	24.95	0.0537	0.3225	1.5255	Subcooled	0.25441	0.052323
45	150	79.4952	0.0126	26.57	0.0569	0.3244	1.5286	Subcooled	0.24560	0.051612
50	150	78.8963	0.0127	28.20	0.0601	0.3265	1.5321	Subcooled	0.23712	0.050903
55	150	78.2875	0.0128	29.83	0.0633	0.3286	1.5359	Subcooled	0.22896	0.050195
60	150	77.6682	0.0129	31.48	0.0665	0.3308	1.5401	Subcooled	0.22109	0.049488
65	150	77.0374	0.0130	33.14	0.0697	0.3332	1.5448	Subcooled	0.21349	0.048781
70	150	76.3944	0.0131	34.81	0.0728	0.3357	1.5499	Subcooled	0.20614	0.048074
75	150	75.7380	0.0132	36.50	0.0760	0.3384	1.5556	Subcooled	0.19903	0.047366
80	150	75.0671	0.0133	38.20	0.0792	0.3412	1.5620	Subcooled	0.19213	0.046657
85	150	74.3804	0.0134	39.91	0.0823	0.3442	1.5691	Subcooled	0.18543	0.045946
90	150	73.6765	0.0136	41.64	0.0855	0.3475	1.5770	Subcooled	0.17891	0.045231
95	150	72.9535	0.0137	43.39	0.0887	0.3510	1.5858	Subcooled	0.17257	0.044514
100	150	72.2096	0.0138	45.15	0.0918	0.3548	1.5957	Subcooled	0.16637	0.043791
105	150	71.4424	0.0140	46.93	0.0950	0.3589	1.6069	Subcooled	0.16032	0.043063
110	150	3.1228	0.3202	118.15	0.2211	0.2697	1.2787	Superheated	0.01252	0.009066
115	150	3.0640	0.3264	119.49	0.2234	0.2655	1.2640	Superheated	0.01264	0.009165
120	150	3.0090	0.3323	120.80	0.2257	0.2621	1.2512	Superheated	0.01276	0.009268
125	150	2.9574	0.3381	122.11	0.2279	0.2594	1.2401	Superheated	0.01288	0.009374
130	150	2.9087	0.3438	123.40	0.2301	0.2572	1.2302	Superheated	0.01300	0.009483
135	150	2.8625	0.3493	124.68	0.2323	0.2554	1.2214	Superheated	0.01312	0.009594
140	150	2.8187	0.3548	125.95	0.2344	0.2539	1.2135	Superheated	0.01324	0.009707
145	150	2.7770	0.3601	127.22	0.2365	0.2528	1.2063	Superheated	0.01336	0.009821
150	150	2.7372	0.3653	128.48	0.2386	0.2518	1.1997	Superheated	0.01347	0.009937

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=175 psia (115.75 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	175	89.6580	0.0112	-2.80	-0.0076	0.2971	1.5026	Subcooled	0.51732	0.065823
-45	175	89.1653	0.0112	-1.31	-0.0040	0.2982	1.5028	Subcooled	0.49431	0.065030
-40	175	88.6695	0.0113	0.18	-0.0004	0.2993	1.5031	Subcooled	0.47283	0.064244
-35	175	88.1704	0.0113	1.68	0.0032	0.3004	1.5035	Subcooled	0.45272	0.063464
-30	175	87.6678	0.0114	3.19	0.0067	0.3016	1.5039	Subcooled	0.43386	0.062690
-25	175	87.1616	0.0115	4.70	0.0102	0.3028	1.5044	Subcooled	0.41613	0.061922
-20	175	86.6515	0.0115	6.22	0.0136	0.3040	1.5051	Subcooled	0.39944	0.061161
-15	175	86.1373	0.0116	7.74	0.0171	0.3053	1.5058	Subcooled	0.38369	0.060405
-10	175	85.6187	0.0117	9.27	0.0205	0.3066	1.5067	Subcooled	0.36882	0.059654
-5	175	85.0956	0.0118	10.81	0.0239	0.3079	1.5077	Subcooled	0.35474	0.058908
0	175	84.5676	0.0118	12.35	0.0273	0.3093	1.5088	Subcooled	0.34139	0.058168
5	175	84.0344	0.0119	13.90	0.0306	0.3107	1.5101	Subcooled	0.32872	0.057432
10	175	83.4958	0.0120	15.46	0.0340	0.3122	1.5115	Subcooled	0.31667	0.056700
15	175	82.9515	0.0121	17.02	0.0373	0.3137	1.5131	Subcooled	0.30519	0.055973
20	175	82.4010	0.0121	18.59	0.0406	0.3153	1.5149	Subcooled	0.29425	0.055249
25	175	81.8439	0.0122	20.17	0.0439	0.3169	1.5169	Subcooled	0.28380	0.054529
30	175	81.2799	0.0123	21.76	0.0471	0.3186	1.5192	Subcooled	0.27380	0.053812
35	175	80.7086	0.0124	23.36	0.0504	0.3204	1.5217	Subcooled	0.26422	0.053098
40	175	80.1293	0.0125	24.97	0.0536	0.3222	1.5244	Subcooled	0.25504	0.052387
45	175	79.5416	0.0126	26.58	0.0568	0.3242	1.5275	Subcooled	0.24622	0.051677
50	175	78.9449	0.0127	28.21	0.0600	0.3262	1.5308	Subcooled	0.23774	0.050970
55	175	78.3385	0.0128	29.84	0.0632	0.3283	1.5345	Subcooled	0.22958	0.050264
60	175	77.7217	0.0129	31.49	0.0664	0.3305	1.5386	Subcooled	0.22171	0.049559
65	175	77.0937	0.0130	33.15	0.0696	0.3328	1.5432	Subcooled	0.21411	0.048854
70	175	76.4537	0.0131	34.82	0.0727	0.3353	1.5482	Subcooled	0.20676	0.048150
75	175	75.8006	0.0132	36.50	0.0759	0.3379	1.5538	Subcooled	0.19965	0.047445
80	175	75.1333	0.0133	38.20	0.0791	0.3407	1.5600	Subcooled	0.19276	0.046738
85	175	74.4506	0.0134	39.91	0.0822	0.3437	1.5668	Subcooled	0.18607	0.046030
90	175	73.7511	0.0136	41.64	0.0854	0.3468	1.5745	Subcooled	0.17956	0.045319
95	175	73.0330	0.0137	43.38	0.0885	0.3503	1.5831	Subcooled	0.17322	0.044605
100	175	72.2946	0.0138	45.14	0.0917	0.3540	1.5927	Subcooled	0.16704	0.043887
105	175	71.5337	0.0140	46.92	0.0949	0.3580	1.6035	Subcooled	0.16100	0.043163
110	175	70.7476	0.0141	48.72	0.0980	0.3625	1.6158	Subcooled	0.15508	0.042432
115	175	69.9332	0.0143	50.54	0.1012	0.3674	1.6298	Subcooled	0.14927	0.041694
120	175	3.6872	0.2712	119.08	0.2203	0.2828	1.3109	Superheated	0.01282	0.009468
125	175	3.6119	0.2769	120.48	0.2227	0.2773	1.2923	Superheated	0.01294	0.009555
130	175	3.5421	0.2823	121.86	0.2251	0.2729	1.2764	Superheated	0.01306	0.009647
135	175	3.4770	0.2876	123.21	0.2274	0.2693	1.2627	Superheated	0.01318	0.009744
140	175	3.4159	0.2928	124.55	0.2296	0.2664	1.2507	Superheated	0.01329	0.009846
145	175	3.3583	0.2978	125.88	0.2318	0.2641	1.2400	Superheated	0.01341	0.009950
150	175	3.3040	0.3027	127.19	0.2340	0.2621	1.2305	Superheated	0.01353	0.010057

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=200 psia (125.26 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft^3]	[ft^3/lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	200	89.6809	0.0112	-2.77	-0.0076	0.2970	1.5021	Subcooled	0.51825	0.065866
-45	200	89.1889	0.0112	-1.28	-0.0040	0.2981	1.5023	Subcooled	0.49521	0.065074
-40	200	88.6939	0.0113	0.21	-0.0005	0.2992	1.5026	Subcooled	0.47370	0.064288
-35	200	88.1956	0.0113	1.71	0.0031	0.3003	1.5030	Subcooled	0.45356	0.063509
-30	200	87.6939	0.0114	3.22	0.0066	0.3015	1.5034	Subcooled	0.43467	0.062736
-25	200	87.1885	0.0115	4.73	0.0101	0.3027	1.5039	Subcooled	0.41692	0.061970
-20	200	86.6793	0.0115	6.24	0.0136	0.3039	1.5045	Subcooled	0.40020	0.061209
-15	200	86.1661	0.0116	7.76	0.0170	0.3052	1.5052	Subcooled	0.38444	0.060454
-10	200	85.6485	0.0117	9.29	0.0204	0.3065	1.5061	Subcooled	0.36955	0.059704
-5	200	85.1265	0.0117	10.83	0.0238	0.3078	1.5070	Subcooled	0.35545	0.058960
0	200	84.5996	0.0118	12.37	0.0272	0.3092	1.5081	Subcooled	0.34209	0.058220
5	200	84.0677	0.0119	13.92	0.0306	0.3106	1.5094	Subcooled	0.32941	0.057485
10	200	83.5304	0.0120	15.48	0.0339	0.3120	1.5108	Subcooled	0.31734	0.056755
15	200	82.9874	0.0121	17.04	0.0372	0.3136	1.5123	Subcooled	0.30586	0.056029
20	200	82.4383	0.0121	18.61	0.0405	0.3151	1.5141	Subcooled	0.29490	0.055306
25	200	81.8828	0.0122	20.19	0.0438	0.3167	1.5160	Subcooled	0.28444	0.054588
30	200	81.3204	0.0123	21.78	0.0470	0.3184	1.5182	Subcooled	0.27444	0.053872
35	200	80.7508	0.0124	23.38	0.0503	0.3202	1.5207	Subcooled	0.26486	0.053160
40	200	80.1734	0.0125	24.98	0.0535	0.3220	1.5233	Subcooled	0.25567	0.052450
45	200	79.5877	0.0126	26.60	0.0567	0.3239	1.5263	Subcooled	0.24685	0.051742
50	200	78.9931	0.0127	28.22	0.0599	0.3259	1.5296	Subcooled	0.23837	0.051037
55	200	78.3891	0.0128	29.86	0.0631	0.3280	1.5332	Subcooled	0.23020	0.050333
60	200	77.7748	0.0129	31.50	0.0663	0.3302	1.5372	Subcooled	0.22233	0.049630
65	200	77.1496	0.0130	33.16	0.0695	0.3325	1.5417	Subcooled	0.21473	0.048928
70	200	76.5125	0.0131	34.83	0.0726	0.3349	1.5466	Subcooled	0.20739	0.048225
75	200	75.8626	0.0132	36.51	0.0758	0.3375	1.5520	Subcooled	0.20028	0.047523
80	200	75.1989	0.0133	38.20	0.0790	0.3402	1.5580	Subcooled	0.19339	0.046819
85	200	74.5201	0.0134	39.91	0.0821	0.3431	1.5647	Subcooled	0.18670	0.046114
90	200	73.8249	0.0135	41.63	0.0853	0.3463	1.5721	Subcooled	0.18020	0.045407
95	200	73.1117	0.0137	43.37	0.0884	0.3496	1.5804	Subcooled	0.17387	0.044696
100	200	72.3786	0.0138	45.13	0.0916	0.3532	1.5897	Subcooled	0.16770	0.043981
105	200	71.6237	0.0140	46.91	0.0947	0.3572	1.6002	Subcooled	0.16167	0.043262
110	200	70.8444	0.0141	48.70	0.0979	0.3615	1.6120	Subcooled	0.15577	0.042536
115	200	70.0379	0.0143	50.52	0.1011	0.3663	1.6255	Subcooled	0.14998	0.041803
120	200	69.2006	0.0145	52.37	0.1043	0.3716	1.6409	Subcooled	0.14429	0.041060
125	200	68.3283	0.0146	54.24	0.1075	0.3775	1.6587	Subcooled	0.13867	0.040307
130	200	4.2537	0.2351	120.13	0.2201	0.2950	1.3420	Superheated	0.01314	0.009883
135	200	4.1605	0.2404	121.59	0.2226	0.2883	1.3194	Superheated	0.01325	0.009955
140	200	4.0748	0.2454	123.01	0.2250	0.2829	1.3003	Superheated	0.01337	0.010035
145	200	3.9952	0.2503	124.42	0.2273	0.2786	1.2840	Superheated	0.01349	0.010122
150	200	3.9211	0.2550	125.80	0.2296	0.2751	1.2699	Superheated	0.01360	0.010215

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=225 psia (133.92 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	225	89.7037	0.0111	-2.74	-0.0077	0.2969	1.5017	Subcooled	0.51919	0.065909
-45	225	89.2125	0.0112	-1.25	-0.0041	0.2980	1.5019	Subcooled	0.49611	0.065118
-40	225	88.7182	0.0113	0.24	-0.0005	0.2991	1.5021	Subcooled	0.47456	0.064333
-35	225	88.2207	0.0113	1.74	0.0030	0.3002	1.5024	Subcooled	0.45440	0.063554
-30	225	87.7198	0.0114	3.24	0.0066	0.3014	1.5029	Subcooled	0.43548	0.062783
-25	225	87.2153	0.0115	4.75	0.0101	0.3026	1.5033	Subcooled	0.41770	0.062017
-20	225	86.7071	0.0115	6.27	0.0135	0.3038	1.5039	Subcooled	0.40097	0.061257
-15	225	86.1948	0.0116	7.79	0.0170	0.3050	1.5046	Subcooled	0.38519	0.060503
-10	225	85.6783	0.0117	9.32	0.0204	0.3063	1.5054	Subcooled	0.37028	0.059754
-5	225	85.1573	0.0117	10.85	0.0238	0.3077	1.5064	Subcooled	0.35617	0.059011
0	225	84.6316	0.0118	12.39	0.0271	0.3090	1.5074	Subcooled	0.34279	0.058272
5	225	84.1008	0.0119	13.94	0.0305	0.3104	1.5086	Subcooled	0.33009	0.057539
10	225	83.5648	0.0120	15.50	0.0338	0.3119	1.5100	Subcooled	0.31802	0.056809
15	225	83.0231	0.0120	17.06	0.0371	0.3134	1.5115	Subcooled	0.30652	0.056084
20	225	82.4755	0.0121	18.63	0.0404	0.3149	1.5132	Subcooled	0.29556	0.055363
25	225	81.9215	0.0122	20.21	0.0437	0.3165	1.5152	Subcooled	0.28509	0.054646
30	225	81.3607	0.0123	21.80	0.0470	0.3182	1.5173	Subcooled	0.27508	0.053932
35	225	80.7928	0.0124	23.39	0.0502	0.3200	1.5197	Subcooled	0.26549	0.053221
40	225	80.2173	0.0125	25.00	0.0534	0.3218	1.5223	Subcooled	0.25630	0.052513
45	225	79.6336	0.0126	26.61	0.0566	0.3236	1.5252	Subcooled	0.24747	0.051807
50	225	79.0411	0.0127	28.23	0.0598	0.3256	1.5284	Subcooled	0.23899	0.051103
55	225	78.4393	0.0127	29.87	0.0630	0.3277	1.5319	Subcooled	0.23082	0.050401
60	225	77.8276	0.0128	31.51	0.0662	0.3298	1.5358	Subcooled	0.22295	0.049700
65	225	77.2050	0.0130	33.17	0.0694	0.3321	1.5401	Subcooled	0.21535	0.049000
70	225	76.5708	0.0131	34.83	0.0725	0.3345	1.5449	Subcooled	0.20801	0.048300
75	225	75.9242	0.0132	36.51	0.0757	0.3370	1.5502	Subcooled	0.20090	0.047600
80	225	75.2639	0.0133	38.20	0.0788	0.3397	1.5560	Subcooled	0.19402	0.046900
85	225	74.5890	0.0134	39.91	0.0820	0.3426	1.5625	Subcooled	0.18733	0.046197
90	225	73.8980	0.0135	41.63	0.0851	0.3457	1.5698	Subcooled	0.18084	0.045493
95	225	73.1894	0.0137	43.37	0.0883	0.3490	1.5778	Subcooled	0.17452	0.044786
100	225	72.4616	0.0138	45.12	0.0914	0.3525	1.5868	Subcooled	0.16836	0.044075
105	225	71.7125	0.0139	46.89	0.0946	0.3564	1.5969	Subcooled	0.16234	0.043360
110	225	70.9399	0.0141	48.68	0.0977	0.3606	1.6083	Subcooled	0.15645	0.042638
115	225	70.1409	0.0143	50.50	0.1009	0.3652	1.6213	Subcooled	0.15068	0.041910
120	225	69.3123	0.0144	52.34	0.1041	0.3703	1.6361	Subcooled	0.14501	0.041174
125	225	68.4500	0.0146	54.20	0.1073	0.3760	1.6531	Subcooled	0.13942	0.040427
130	225	67.5493	0.0148	56.10	0.1105	0.3825	1.6729	Subcooled	0.13390	0.039668
135	225	4.9400	0.2024	119.73	0.2177	0.3161	1.4031	Superheated	0.01337	0.010264
140	225	4.8166	0.2076	121.29	0.2203	0.3061	1.3707	Superheated	0.01348	0.010304
145	225	4.7049	0.2125	122.80	0.2229	0.2983	1.3443	Superheated	0.01359	0.010360
150	225	4.6026	0.2173	124.27	0.2253	0.2921	1.3222	Superheated	0.01370	0.010427



# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=250 psia (141.88 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	250	89.7265	0.0111	-2.71	-0.0078	0.2968	1.5012	Subcooled	0.52012	0.065952
-45	250	89.2360	0.0112	-1.22	-0.0041	0.2979	1.5014	Subcooled	0.49701	0.065161
-40	250	88.7425	0.0113	0.27	-0.0006	0.2990	1.5016	Subcooled	0.47543	0.064377
-35	250	88.2458	0.0113	1.77	0.0030	0.3001	1.5019	Subcooled	0.45523	0.063600
-30	250	87.7457	0.0114	3.27	0.0065	0.3013	1.5023	Subcooled	0.43629	0.062829
-25	250	87.2421	0.0115	4.78	0.0100	0.3025	1.5028	Subcooled	0.41849	0.062064
-20	250	86.7347	0.0115	6.29	0.0135	0.3037	1.5034	Subcooled	0.40174	0.061305
-15	250	86.2234	0.0116	7.81	0.0169	0.3049	1.5040	Subcooled	0.38594	0.060552
-10	250	85.7079	0.0117	9.34	0.0203	0.3062	1.5048	Subcooled	0.37101	0.059804
-5	250	85.1880	0.0117	10.88	0.0237	0.3075	1.5057	Subcooled	0.35688	0.059062
0	250	84.6634	0.0118	12.42	0.0271	0.3089	1.5067	Subcooled	0.34349	0.058324
5	250	84.1338	0.0119	13.97	0.0304	0.3103	1.5079	Subcooled	0.33078	0.057592
10	250	83.5990	0.0120	15.52	0.0338	0.3117	1.5092	Subcooled	0.31869	0.056864
15	250	83.0587	0.0120	17.08	0.0371	0.3132	1.5107	Subcooled	0.30718	0.056140
20	250	82.5125	0.0121	18.65	0.0404	0.3148	1.5124	Subcooled	0.29621	0.055420
25	250	81.9600	0.0122	20.23	0.0436	0.3164	1.5143	Subcooled	0.28573	0.054704
30	250	81.4008	0.0123	21.82	0.0469	0.3180	1.5164	Subcooled	0.27571	0.053992
35	250	80.8346	0.0124	23.41	0.0501	0.3197	1.5187	Subcooled	0.26612	0.053282
40	250	80.2609	0.0125	25.01	0.0533	0.3215	1.5212	Subcooled	0.25692	0.052576
45	250	79.6791	0.0126	26.63	0.0566	0.3234	1.5240	Subcooled	0.24809	0.051872
50	250	79.0888	0.0126	28.25	0.0598	0.3253	1.5272	Subcooled	0.23961	0.051170
55	250	78.4893	0.0127	29.88	0.0629	0.3274	1.5306	Subcooled	0.23144	0.050470
60	250	77.8799	0.0128	31.52	0.0661	0.3295	1.5344	Subcooled	0.22356	0.049771
65	250	77.2600	0.0129	33.18	0.0693	0.3318	1.5386	Subcooled	0.21597	0.049073
70	250	76.6287	0.0130	34.84	0.0724	0.3341	1.5433	Subcooled	0.20863	0.048375
75	250	75.9852	0.0132	36.52	0.0756	0.3366	1.5484	Subcooled	0.20152	0.047678
80	250	75.3284	0.0133	38.21	0.0787	0.3393	1.5541	Subcooled	0.19464	0.046979
85	250	74.6572	0.0134	39.91	0.0819	0.3421	1.5604	Subcooled	0.18796	0.046280
90	250	73.9703	0.0135	41.63	0.0850	0.3451	1.5675	Subcooled	0.18148	0.045579
95	250	73.2663	0.0136	43.36	0.0882	0.3483	1.5753	Subcooled	0.17516	0.044875
100	250	72.5436	0.0138	45.11	0.0913	0.3518	1.5840	Subcooled	0.16901	0.044168
105	250	71.8002	0.0139	46.88	0.0944	0.3556	1.5938	Subcooled	0.16301	0.043457
110	250	71.0340	0.0141	48.67	0.0976	0.3597	1.6048	Subcooled	0.15713	0.042740
115	250	70.2423	0.0142	50.48	0.1008	0.3642	1.6173	Subcooled	0.15138	0.042017
120	250	69.4220	0.0144	52.31	0.1039	0.3691	1.6315	Subcooled	0.14572	0.041286
125	250	68.5695	0.0146	54.17	0.1071	0.3747	1.6478	Subcooled	0.14016	0.040545
130	250	67.6801	0.0148	56.06	0.1103	0.3809	1.6666	Subcooled	0.13467	0.039794
135	250	66.7483	0.0150	57.98	0.1136	0.3880	1.6887	Subcooled	0.12923	0.039028
140	250	65.7667	0.0152	59.94	0.1169	0.3962	1.7150	Subcooled	0.12382	0.038247
145	250	5.5153	0.1813	120.96	0.2183	0.3271	1.4329	Superheated	0.01373	0.010706
150	250	5.3704	0.1862	122.57	0.2210	0.3159	1.3960	Superheated	0.01384	0.010726

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=275 psia (149.26 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	275	89.7492	0.0111	-2.68	-0.0078	0.2968	1.5008	Subcooled	0.52106	0.065995
-45	275	89.2594	0.0112	-1.20	-0.0042	0.2978	1.5009	Subcooled	0.49792	0.065205
-40	275	88.7666	0.0113	0.30	-0.0006	0.2989	1.5011	Subcooled	0.47630	0.064422
-35	275	88.2707	0.0113	1.79	0.0029	0.3000	1.5014	Subcooled	0.45607	0.063645
-30	275	87.7715	0.0114	3.30	0.0064	0.3012	1.5018	Subcooled	0.43711	0.062875
-25	275	87.2687	0.0115	4.80	0.0099	0.3024	1.5023	Subcooled	0.41928	0.062111
-20	275	86.7623	0.0115	6.32	0.0134	0.3036	1.5028	Subcooled	0.40250	0.061353
-15	275	86.2519	0.0116	7.84	0.0168	0.3048	1.5034	Subcooled	0.38668	0.060600
-10	275	85.7374	0.0117	9.37	0.0202	0.3061	1.5042	Subcooled	0.37174	0.059854
-5	275	85.2185	0.0117	10.90	0.0236	0.3074	1.5051	Subcooled	0.35759	0.059112
0	275	84.6951	0.0118	12.44	0.0270	0.3087	1.5061	Subcooled	0.34419	0.058376
5	275	84.1667	0.0119	13.99	0.0304	0.3101	1.5072	Subcooled	0.33146	0.057645
10	275	83.6331	0.0120	15.54	0.0337	0.3116	1.5085	Subcooled	0.31936	0.056918
15	275	83.0941	0.0120	17.10	0.0370	0.3131	1.5100	Subcooled	0.30784	0.056195
20	275	82.5493	0.0121	18.67	0.0403	0.3146	1.5116	Subcooled	0.29686	0.055477
25	275	81.9983	0.0122	20.25	0.0436	0.3162	1.5134	Subcooled	0.28638	0.054762
30	275	81.4407	0.0123	21.84	0.0468	0.3178	1.5154	Subcooled	0.27635	0.054051
35	275	80.8762	0.0124	23.43	0.0500	0.3195	1.5177	Subcooled	0.26675	0.053343
40	275	80.3043	0.0125	25.03	0.0533	0.3213	1.5202	Subcooled	0.25755	0.052638
45	275	79.7245	0.0125	26.64	0.0565	0.3231	1.5229	Subcooled	0.24872	0.051936
50	275	79.1362	0.0126	28.26	0.0597	0.3251	1.5260	Subcooled	0.24023	0.051236
55	275	78.5389	0.0127	29.89	0.0628	0.3271	1.5294	Subcooled	0.23205	0.050537
60	275	77.9320	0.0128	31.53	0.0660	0.3292	1.5331	Subcooled	0.22418	0.049840
65	275	77.3146	0.0129	33.18	0.0692	0.3314	1.5372	Subcooled	0.21658	0.049145
70	275	76.6862	0.0130	34.85	0.0723	0.3337	1.5417	Subcooled	0.20924	0.048449
75	275	76.0457	0.0131	36.52	0.0755	0.3362	1.5467	Subcooled	0.20214	0.047754
80	275	75.3922	0.0133	38.21	0.0786	0.3388	1.5523	Subcooled	0.19526	0.047059
85	275	74.7247	0.0134	39.91	0.0818	0.3416	1.5584	Subcooled	0.18859	0.046362
90	275	74.0419	0.0135	41.63	0.0849	0.3446	1.5652	Subcooled	0.18211	0.045664
95	275	73.3424	0.0136	43.36	0.0880	0.3477	1.5728	Subcooled	0.17580	0.044964
100	275	72.6246	0.0138	45.10	0.0912	0.3511	1.5812	Subcooled	0.16966	0.044260
105	275	71.8868	0.0139	46.87	0.0943	0.3548	1.5907	Subcooled	0.16367	0.043553
110	275	71.1268	0.0141	48.65	0.0975	0.3588	1.6013	Subcooled	0.15781	0.042840
115	275	70.3422	0.0142	50.46	0.1006	0.3632	1.6133	Subcooled	0.15207	0.042122
120	275	69.5300	0.0144	52.28	0.1038	0.3680	1.6270	Subcooled	0.14643	0.041396
125	275	68.6868	0.0146	54.14	0.1070	0.3733	1.6426	Subcooled	0.14089	0.040662
130	275	67.8083	0.0147	56.02	0.1102	0.3793	1.6606	Subcooled	0.13542	0.039917
135	275	66.8892	0.0150	57.93	0.1134	0.3861	1.6816	Subcooled	0.13001	0.039160
140	275	65.9230	0.0152	59.88	0.1167	0.3940	1.7064	Subcooled	0.12464	0.038387
145	275	64.9010	0.0154	61.87	0.1200	0.4032	1.7361	Subcooled	0.11929	0.037596
150	275	6.2627	0.1597	120.59	0.2164	0.3522	1.5094	Superheated	0.01402	0.011171

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=300 psia (156.14 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	300	89.7719	0.0111	-2.65	-0.0079	0.2967	1.5003	Subcooled	0.52200	0.066038
-45	300	89.2828	0.0112	-1.17	-0.0043	0.2977	1.5005	Subcooled	0.49882	0.065249
-40	300	88.7908	0.0113	0.32	-0.0007	0.2988	1.5007	Subcooled	0.47717	0.064466
-35	300	88.2956	0.0113	1.82	0.0029	0.2999	1.5009	Subcooled	0.45691	0.063690
-30	300	87.7972	0.0114	3.32	0.0064	0.3011	1.5013	Subcooled	0.43792	0.062921
-25	300	87.2953	0.0115	4.83	0.0099	0.3023	1.5017	Subcooled	0.42007	0.062158
-20	300	86.7898	0.0115	6.35	0.0133	0.3035	1.5022	Subcooled	0.40327	0.061400
-15	300	86.2803	0.0116	7.87	0.0168	0.3047	1.5029	Subcooled	0.38743	0.060649
-10	300	85.7668	0.0117	9.39	0.0202	0.3060	1.5036	Subcooled	0.37246	0.059903
-5	300	85.2490	0.0117	10.93	0.0236	0.3073	1.5044	Subcooled	0.35830	0.059163
0	300	84.7266	0.0118	12.46	0.0269	0.3086	1.5054	Subcooled	0.34488	0.058428
5	300	84.1994	0.0119	14.01	0.0303	0.3100	1.5065	Subcooled	0.33215	0.057698
10	300	83.6671	0.0120	15.56	0.0336	0.3114	1.5078	Subcooled	0.32004	0.056972
15	300	83.1294	0.0120	17.13	0.0369	0.3129	1.5092	Subcooled	0.30851	0.056251
20	300	82.5859	0.0121	18.69	0.0402	0.3144	1.5108	Subcooled	0.29751	0.055533
25	300	82.0364	0.0122	20.27	0.0435	0.3160	1.5125	Subcooled	0.28702	0.054820
30	300	81.4804	0.0123	21.85	0.0467	0.3176	1.5145	Subcooled	0.27699	0.054110
35	300	80.9176	0.0124	23.45	0.0500	0.3193	1.5167	Subcooled	0.26738	0.053404
40	300	80.3474	0.0124	25.05	0.0532	0.3211	1.5191	Subcooled	0.25817	0.052701
45	300	79.7695	0.0125	26.66	0.0564	0.3229	1.5218	Subcooled	0.24934	0.052000
50	300	79.1833	0.0126	28.28	0.0596	0.3248	1.5248	Subcooled	0.24084	0.051301
55	300	78.5882	0.0127	29.90	0.0628	0.3268	1.5281	Subcooled	0.23267	0.050605
60	300	77.9836	0.0128	31.54	0.0659	0.3289	1.5317	Subcooled	0.22479	0.049910
65	300	77.3689	0.0129	33.19	0.0691	0.3311	1.5357	Subcooled	0.21720	0.049216
70	300	76.7432	0.0130	34.85	0.0722	0.3334	1.5401	Subcooled	0.20986	0.048523
75	300	76.1057	0.0131	36.53	0.0754	0.3358	1.5450	Subcooled	0.20276	0.047830
80	300	75.4555	0.0133	38.21	0.0785	0.3384	1.5504	Subcooled	0.19588	0.047137
85	300	74.7916	0.0134	39.91	0.0817	0.3411	1.5564	Subcooled	0.18921	0.046444
90	300	74.1128	0.0135	41.62	0.0848	0.3440	1.5630	Subcooled	0.18274	0.045749
95	300	73.4176	0.0136	43.35	0.0879	0.3471	1.5704	Subcooled	0.17644	0.045051
100	300	72.7047	0.0138	45.10	0.0910	0.3505	1.5785	Subcooled	0.17031	0.044351
105	300	71.9723	0.0139	46.86	0.0942	0.3540	1.5877	Subcooled	0.16432	0.043648
110	300	71.2184	0.0140	48.64	0.0973	0.3580	1.5980	Subcooled	0.15847	0.042940
115	300	70.4406	0.0142	50.44	0.1005	0.3622	1.6096	Subcooled	0.15275	0.042226
120	300	69.6363	0.0144	52.26	0.1036	0.3669	1.6227	Subcooled	0.14713	0.041506
125	300	68.8020	0.0145	54.11	0.1068	0.3721	1.6376	Subcooled	0.14161	0.040777
130	300	67.9339	0.0147	55.98	0.1100	0.3778	1.6548	Subcooled	0.13617	0.040039
135	300	67.0270	0.0149	57.89	0.1132	0.3844	1.6748	Subcooled	0.13079	0.039289
140	300	66.0754	0.0151	59.83	0.1164	0.3919	1.6983	Subcooled	0.12546	0.038525
145	300	65.0711	0.0154	61.81	0.1197	0.4006	1.7262	Subcooled	0.12015	0.037744
150	300	64.0038	0.0156	63.83	0.1231	0.4109	1.7601	Subcooled	0.11483	0.036943

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=325 psia (162.61 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	325	89.7945	0.0111	-2.63	-0.0079	0.2966	1.4999	Subcooled	0.52294	0.066081
-45	325	89.3061	0.0112	-1.14	-0.0043	0.2977	1.5000	Subcooled	0.49972	0.065292
-40	325	88.8148	0.0113	0.35	-0.0007	0.2987	1.5002	Subcooled	0.47804	0.064510
-35	325	88.3205	0.0113	1.85	0.0028	0.2999	1.5004	Subcooled	0.45775	0.063735
-30	325	87.8228	0.0114	3.35	0.0063	0.3010	1.5008	Subcooled	0.43873	0.062967
-25	325	87.3218	0.0115	4.86	0.0098	0.3022	1.5012	Subcooled	0.42086	0.062204
-20	325	86.8171	0.0115	6.37	0.0133	0.3034	1.5017	Subcooled	0.40404	0.061448
-15	325	86.3087	0.0116	7.89	0.0167	0.3046	1.5023	Subcooled	0.38818	0.060698
-10	325	85.7961	0.0117	9.42	0.0201	0.3058	1.5030	Subcooled	0.37319	0.059953
-5	325	85.2794	0.0117	10.95	0.0235	0.3071	1.5038	Subcooled	0.35902	0.059214
0	325	84.7581	0.0118	12.49	0.0269	0.3085	1.5047	Subcooled	0.34558	0.058480
5	325	84.2320	0.0119	14.03	0.0302	0.3099	1.5058	Subcooled	0.33283	0.057750
10	325	83.7010	0.0119	15.59	0.0335	0.3113	1.5070	Subcooled	0.32071	0.057026
15	325	83.1645	0.0120	17.15	0.0368	0.3127	1.5084	Subcooled	0.30917	0.056306
20	325	82.6224	0.0121	18.71	0.0401	0.3142	1.5100	Subcooled	0.29817	0.055590
25	325	82.0744	0.0122	20.29	0.0434	0.3158	1.5117	Subcooled	0.28766	0.054878
30	325	81.5199	0.0123	21.87	0.0466	0.3174	1.5136	Subcooled	0.27762	0.054169
35	325	80.9587	0.0124	23.46	0.0499	0.3191	1.5157	Subcooled	0.26801	0.053465
40	325	80.3904	0.0124	25.06	0.0531	0.3208	1.5181	Subcooled	0.25880	0.052763
45	325	79.8143	0.0125	26.67	0.0563	0.3226	1.5207	Subcooled	0.24995	0.052063
50	325	79.2301	0.0126	28.29	0.0595	0.3245	1.5237	Subcooled	0.24146	0.051367
55	325	78.6372	0.0127	29.92	0.0627	0.3265	1.5269	Subcooled	0.23328	0.050672
60	325	78.0350	0.0128	31.56	0.0658	0.3286	1.5304	Subcooled	0.22541	0.049979
65	325	77.4227	0.0129	33.20	0.0690	0.3307	1.5343	Subcooled	0.21781	0.049287
70	325	76.7998	0.0130	34.86	0.0721	0.3330	1.5386	Subcooled	0.21047	0.048597
75	325	76.1653	0.0131	36.53	0.0753	0.3354	1.5434	Subcooled	0.20337	0.047906
80	325	75.5183	0.0132	38.22	0.0784	0.3379	1.5486	Subcooled	0.19650	0.047216
85	325	74.8579	0.0134	39.91	0.0815	0.3406	1.5544	Subcooled	0.18983	0.046525
90	325	74.1829	0.0135	41.62	0.0847	0.3435	1.5608	Subcooled	0.18336	0.045832
95	325	73.4921	0.0136	43.35	0.0878	0.3465	1.5680	Subcooled	0.17707	0.045138
100	325	72.7839	0.0137	45.09	0.0909	0.3498	1.5759	Subcooled	0.17095	0.044442
105	325	72.0568	0.0139	46.85	0.0940	0.3533	1.5848	Subcooled	0.16497	0.043742
110	325	71.3088	0.0140	48.62	0.0972	0.3571	1.5947	Subcooled	0.15914	0.043038
115	325	70.5377	0.0142	50.42	0.1003	0.3613	1.6059	Subcooled	0.15343	0.042329
120	325	69.7408	0.0143	52.24	0.1035	0.3658	1.6185	Subcooled	0.14783	0.041613
125	325	68.9152	0.0145	54.08	0.1066	0.3708	1.6329	Subcooled	0.14233	0.040890
130	325	68.0571	0.0147	55.95	0.1098	0.3764	1.6493	Subcooled	0.13691	0.040158
135	325	67.1619	0.0149	57.84	0.1130	0.3827	1.6683	Subcooled	0.13156	0.039416
140	325	66.2241	0.0151	59.77	0.1162	0.3898	1.6906	Subcooled	0.12626	0.038660
145	325	65.2365	0.0153	61.74	0.1195	0.3981	1.7169	Subcooled	0.12099	0.037888
150	325	64.1898	0.0156	63.76	0.1228	0.4078	1.7485	Subcooled	0.11572	0.037098

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=350 psia (168.70 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	350	89.8170	0.0111	-2.60	-0.0080	0.2965	1.4994	Subcooled	0.52388	0.066123
-45	350	89.3293	0.0112	-1.11	-0.0044	0.2976	1.4995	Subcooled	0.50062	0.065335
-40	350	88.8388	0.0113	0.38	-0.0008	0.2987	1.4997	Subcooled	0.47891	0.064554
-35	350	88.3452	0.0113	1.87	0.0027	0.2998	1.4999	Subcooled	0.45860	0.063780
-30	350	87.8484	0.0114	3.38	0.0063	0.3009	1.5002	Subcooled	0.43955	0.063012
-25	350	87.3482	0.0114	4.88	0.0097	0.3021	1.5006	Subcooled	0.42165	0.062251
-20	350	86.8444	0.0115	6.40	0.0132	0.3033	1.5011	Subcooled	0.40481	0.061496
-15	350	86.3369	0.0116	7.92	0.0166	0.3045	1.5017	Subcooled	0.38892	0.060746
-10	350	85.8254	0.0117	9.44	0.0201	0.3057	1.5024	Subcooled	0.37392	0.060002
-5	350	85.3096	0.0117	10.97	0.0234	0.3070	1.5032	Subcooled	0.35973	0.059264
0	350	84.7894	0.0118	12.51	0.0268	0.3083	1.5041	Subcooled	0.34628	0.058531
5	350	84.2645	0.0119	14.06	0.0301	0.3097	1.5051	Subcooled	0.33351	0.057803
10	350	83.7346	0.0119	15.61	0.0335	0.3111	1.5063	Subcooled	0.32138	0.057079
15	350	83.1995	0.0120	17.17	0.0368	0.3126	1.5076	Subcooled	0.30983	0.056361
20	350	82.6588	0.0121	18.74	0.0401	0.3141	1.5091	Subcooled	0.29882	0.055646
25	350	82.1122	0.0122	20.31	0.0433	0.3156	1.5108	Subcooled	0.28830	0.054935
30	350	81.5593	0.0123	21.89	0.0466	0.3172	1.5127	Subcooled	0.27826	0.054228
35	350	80.9997	0.0123	23.48	0.0498	0.3189	1.5148	Subcooled	0.26864	0.053525
40	350	80.4330	0.0124	25.08	0.0530	0.3206	1.5171	Subcooled	0.25942	0.052824
45	350	79.8589	0.0125	26.69	0.0562	0.3224	1.5197	Subcooled	0.25057	0.052127
50	350	79.2767	0.0126	28.30	0.0594	0.3243	1.5225	Subcooled	0.24207	0.051432
55	350	78.6859	0.0127	29.93	0.0626	0.3262	1.5256	Subcooled	0.23389	0.050739
60	350	78.0859	0.0128	31.57	0.0657	0.3283	1.5291	Subcooled	0.22602	0.050048
65	350	77.4762	0.0129	33.21	0.0689	0.3304	1.5329	Subcooled	0.21842	0.049358
70	350	76.8559	0.0130	34.87	0.0720	0.3326	1.5371	Subcooled	0.21108	0.048669
75	350	76.2243	0.0131	36.54	0.0752	0.3350	1.5417	Subcooled	0.20398	0.047981
80	350	75.5806	0.0132	38.22	0.0783	0.3375	1.5468	Subcooled	0.19711	0.047293
85	350	74.9236	0.0133	39.92	0.0814	0.3401	1.5525	Subcooled	0.19045	0.046605
90	350	74.2525	0.0135	41.62	0.0846	0.3430	1.5587	Subcooled	0.18399	0.045916
95	350	73.5658	0.0136	43.35	0.0877	0.3460	1.5657	Subcooled	0.17770	0.045225
100	350	72.8623	0.0137	45.08	0.0908	0.3492	1.5734	Subcooled	0.17158	0.044532
105	350	72.1403	0.0139	46.84	0.0939	0.3526	1.5819	Subcooled	0.16562	0.043835
110	350	71.3980	0.0140	48.61	0.0970	0.3563	1.5915	Subcooled	0.15980	0.043135
115	350	70.6333	0.0142	50.40	0.1002	0.3604	1.6023	Subcooled	0.15410	0.042431
120	350	69.8438	0.0143	52.21	0.1033	0.3648	1.6145	Subcooled	0.14852	0.041720
125	350	69.0265	0.0145	54.05	0.1065	0.3696	1.6282	Subcooled	0.14303	0.041003
130	350	68.1780	0.0147	55.91	0.1096	0.3750	1.6440	Subcooled	0.13764	0.040277
135	350	67.2940	0.0149	57.80	0.1128	0.3811	1.6621	Subcooled	0.13231	0.039541
140	350	66.3693	0.0151	59.72	0.1160	0.3879	1.6832	Subcooled	0.12705	0.038792
145	350	65.3975	0.0153	61.68	0.1193	0.3958	1.7080	Subcooled	0.12181	0.038030
150	350	64.3701	0.0155	63.68	0.1226	0.4050	1.7377	Subcooled	0.11660	0.037250

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=375 psia (174.46 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	375	89.8395	0.0111	-2.57	-0.0080	0.2965	1.4990	Subcooled	0.52482	0.066166
-45	375	89.3525	0.0112	-1.08	-0.0044	0.2975	1.4991	Subcooled	0.50153	0.065379
-40	375	88.8627	0.0113	0.41	-0.0009	0.2986	1.4992	Subcooled	0.47978	0.064598
-35	375	88.3699	0.0113	1.90	0.0027	0.2997	1.4994	Subcooled	0.45944	0.063825
-30	375	87.8739	0.0114	3.40	0.0062	0.3008	1.4997	Subcooled	0.44036	0.063058
-25	375	87.3746	0.0114	4.91	0.0097	0.3020	1.5001	Subcooled	0.42244	0.062297
-20	375	86.8717	0.0115	6.42	0.0131	0.3032	1.5006	Subcooled	0.40557	0.061543
-15	375	86.3650	0.0116	7.94	0.0166	0.3044	1.5011	Subcooled	0.38967	0.060795
-10	375	85.8545	0.0116	9.47	0.0200	0.3056	1.5018	Subcooled	0.37465	0.060052
-5	375	85.3398	0.0117	11.00	0.0234	0.3069	1.5025	Subcooled	0.36044	0.059314
0	375	84.8206	0.0118	12.54	0.0267	0.3082	1.5034	Subcooled	0.34698	0.058582
5	375	84.2969	0.0119	14.08	0.0301	0.3096	1.5044	Subcooled	0.33420	0.057855
10	375	83.7682	0.0119	15.63	0.0334	0.3110	1.5056	Subcooled	0.32205	0.057133
15	375	83.2343	0.0120	17.19	0.0367	0.3124	1.5069	Subcooled	0.31049	0.056415
20	375	82.6950	0.0121	18.76	0.0400	0.3139	1.5083	Subcooled	0.29947	0.055702
25	375	82.1498	0.0122	20.33	0.0432	0.3154	1.5100	Subcooled	0.28895	0.054992
30	375	81.5984	0.0123	21.91	0.0465	0.3170	1.5118	Subcooled	0.27889	0.054287
35	375	81.0404	0.0123	23.50	0.0497	0.3187	1.5139	Subcooled	0.26927	0.053585
40	375	80.4755	0.0124	25.10	0.0529	0.3204	1.5161	Subcooled	0.26004	0.052886
45	375	79.9032	0.0125	26.70	0.0561	0.3222	1.5186	Subcooled	0.25119	0.052190
50	375	79.3229	0.0126	28.32	0.0593	0.3240	1.5214	Subcooled	0.24269	0.051497
55	375	78.7343	0.0127	29.94	0.0625	0.3259	1.5244	Subcooled	0.23450	0.050805
60	375	78.1366	0.0128	31.58	0.0657	0.3280	1.5278	Subcooled	0.22662	0.050116
65	375	77.5293	0.0129	33.22	0.0688	0.3301	1.5315	Subcooled	0.21903	0.049429
70	375	76.9117	0.0130	34.88	0.0719	0.3323	1.5356	Subcooled	0.21169	0.048742
75	375	76.2829	0.0131	36.55	0.0751	0.3346	1.5401	Subcooled	0.20459	0.048056
80	375	75.6423	0.0132	38.23	0.0782	0.3371	1.5451	Subcooled	0.19772	0.047371
85	375	74.9888	0.0133	39.92	0.0813	0.3397	1.5506	Subcooled	0.19107	0.046685
90	375	74.3213	0.0135	41.62	0.0844	0.3424	1.5566	Subcooled	0.18461	0.045998
95	375	73.6387	0.0136	43.34	0.0876	0.3454	1.5634	Subcooled	0.17833	0.045310
100	375	72.9397	0.0137	45.08	0.0907	0.3485	1.5708	Subcooled	0.17222	0.044620
105	375	72.2227	0.0138	46.83	0.0938	0.3519	1.5792	Subcooled	0.16626	0.043928
110	375	71.4860	0.0140	48.60	0.0969	0.3555	1.5884	Subcooled	0.16045	0.043232
115	375	70.7276	0.0141	50.38	0.1000	0.3595	1.5988	Subcooled	0.15477	0.042531
120	375	69.9452	0.0143	52.19	0.1032	0.3638	1.6105	Subcooled	0.14920	0.041826
125	375	69.1359	0.0145	54.02	0.1063	0.3685	1.6238	Subcooled	0.14373	0.041113
130	375	68.2967	0.0146	55.88	0.1095	0.3737	1.6389	Subcooled	0.13836	0.040393
135	375	67.4234	0.0148	57.76	0.1126	0.3795	1.6562	Subcooled	0.13306	0.039664
140	375	66.5113	0.0150	59.67	0.1158	0.3861	1.6762	Subcooled	0.12782	0.038923
145	375	65.5545	0.0153	61.62	0.1191	0.3936	1.6997	Subcooled	0.12263	0.038169
150	375	64.5452	0.0155	63.61	0.1224	0.4023	1.7276	Subcooled	0.11745	0.037399

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=400 psia (179.93 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	400	89.8619	0.0111	-2.54	-0.0081	0.2964	1.4985	Subcooled	0.52576	0.066208
-45	400	89.3757	0.0112	-1.06	-0.0045	0.2974	1.4986	Subcooled	0.50243	0.065422
-40	400	88.8866	0.0113	0.43	-0.0009	0.2985	1.4988	Subcooled	0.48065	0.064642
-35	400	88.3945	0.0113	1.93	0.0026	0.2996	1.4990	Subcooled	0.46028	0.063870
-30	400	87.8993	0.0114	3.43	0.0061	0.3007	1.4992	Subcooled	0.44117	0.063104
-25	400	87.4008	0.0114	4.94	0.0096	0.3019	1.4996	Subcooled	0.42323	0.062344
-20	400	86.8988	0.0115	6.45	0.0131	0.3030	1.5000	Subcooled	0.40634	0.061590
-15	400	86.3931	0.0116	7.97	0.0165	0.3043	1.5005	Subcooled	0.39042	0.060843
-10	400	85.8835	0.0116	9.49	0.0199	0.3055	1.5012	Subcooled	0.37538	0.060101
-5	400	85.3698	0.0117	11.02	0.0233	0.3068	1.5019	Subcooled	0.36115	0.059364
0	400	84.8518	0.0118	12.56	0.0267	0.3081	1.5028	Subcooled	0.34767	0.058633
5	400	84.3291	0.0119	14.10	0.0300	0.3094	1.5037	Subcooled	0.33488	0.057907
10	400	83.8016	0.0119	15.65	0.0333	0.3108	1.5049	Subcooled	0.32272	0.057186
15	400	83.2690	0.0120	17.21	0.0366	0.3123	1.5061	Subcooled	0.31115	0.056470
20	400	82.7310	0.0121	18.78	0.0399	0.3137	1.5076	Subcooled	0.30012	0.055758
25	400	82.1872	0.0122	20.35	0.0432	0.3153	1.5092	Subcooled	0.28959	0.055049
30	400	81.6373	0.0122	21.93	0.0464	0.3168	1.5109	Subcooled	0.27952	0.054345
35	400	81.0810	0.0123	23.52	0.0496	0.3185	1.5129	Subcooled	0.26989	0.053645
40	400	80.5177	0.0124	25.11	0.0529	0.3202	1.5151	Subcooled	0.26066	0.052947
45	400	79.9472	0.0125	26.72	0.0561	0.3219	1.5176	Subcooled	0.25181	0.052253
50	400	79.3689	0.0126	28.33	0.0592	0.3238	1.5203	Subcooled	0.24330	0.051561
55	400	78.7823	0.0127	29.96	0.0624	0.3257	1.5232	Subcooled	0.23511	0.050872
60	400	78.1869	0.0128	31.59	0.0656	0.3277	1.5265	Subcooled	0.22723	0.050184
65	400	77.5820	0.0129	33.23	0.0687	0.3298	1.5301	Subcooled	0.21963	0.049499
70	400	76.9670	0.0130	34.89	0.0718	0.3319	1.5341	Subcooled	0.21229	0.048814
75	400	76.3411	0.0131	36.55	0.0750	0.3342	1.5385	Subcooled	0.20520	0.048131
80	400	75.7035	0.0132	38.23	0.0781	0.3367	1.5434	Subcooled	0.19833	0.047447
85	400	75.0533	0.0133	39.92	0.0812	0.3392	1.5487	Subcooled	0.19168	0.046764
90	400	74.3895	0.0134	41.62	0.0843	0.3419	1.5546	Subcooled	0.18523	0.046080
95	400	73.7109	0.0136	43.34	0.0874	0.3448	1.5611	Subcooled	0.17895	0.045395
100	400	73.0163	0.0137	45.07	0.0905	0.3479	1.5684	Subcooled	0.17285	0.044709
105	400	72.3042	0.0138	46.82	0.0937	0.3512	1.5764	Subcooled	0.16690	0.044020
110	400	71.5730	0.0140	48.58	0.0968	0.3548	1.5854	Subcooled	0.16110	0.043327
115	400	70.8207	0.0141	50.37	0.0999	0.3586	1.5955	Subcooled	0.15543	0.042631
120	400	70.0451	0.0143	52.17	0.1030	0.3628	1.6067	Subcooled	0.14987	0.041930
125	400	69.2436	0.0144	54.00	0.1061	0.3674	1.6195	Subcooled	0.14443	0.041223
130	400	68.4132	0.0146	55.85	0.1093	0.3724	1.6339	Subcooled	0.13907	0.040508
135	400	67.5502	0.0148	57.72	0.1125	0.3781	1.6505	Subcooled	0.13380	0.039785
140	400	66.6502	0.0150	59.63	0.1157	0.3844	1.6696	Subcooled	0.12859	0.039051
145	400	65.7075	0.0152	61.57	0.1189	0.3915	1.6918	Subcooled	0.12343	0.038306
150	400	64.7153	0.0155	63.55	0.1221	0.3998	1.7180	Subcooled	0.11829	0.037545

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=450 psia (190.09 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	450	89.9066	0.0111	-2.48	-0.0082	0.2962	1.4977	Subcooled	0.52764	0.066293
-45	450	89.4217	0.0112	-1.00	-0.0046	0.2973	1.4977	Subcooled	0.50424	0.065508
-40	450	88.9341	0.0112	0.49	-0.0010	0.2983	1.4978	Subcooled	0.48240	0.064730
-35	450	88.4436	0.0113	1.98	0.0025	0.2994	1.4980	Subcooled	0.46196	0.063959
-30	450	87.9499	0.0114	3.48	0.0060	0.3005	1.4982	Subcooled	0.44281	0.063195
-25	450	87.4531	0.0114	4.99	0.0095	0.3017	1.4985	Subcooled	0.42481	0.062436
-20	450	86.9528	0.0115	6.50	0.0130	0.3028	1.4989	Subcooled	0.40788	0.061685
-15	450	86.4489	0.0116	8.02	0.0164	0.3040	1.4994	Subcooled	0.39191	0.060939
-10	450	85.9413	0.0116	9.54	0.0198	0.3053	1.5000	Subcooled	0.37684	0.060199
-5	450	85.4296	0.0117	11.07	0.0232	0.3065	1.5007	Subcooled	0.36258	0.059464
0	450	84.9136	0.0118	12.61	0.0265	0.3078	1.5015	Subcooled	0.34907	0.058735
5	450	84.3932	0.0118	14.15	0.0299	0.3092	1.5024	Subcooled	0.33625	0.058011
10	450	83.8681	0.0119	15.70	0.0332	0.3105	1.5034	Subcooled	0.32406	0.057293
15	450	83.3380	0.0120	17.26	0.0365	0.3119	1.5046	Subcooled	0.31247	0.056578
20	450	82.8026	0.0121	18.82	0.0398	0.3134	1.5060	Subcooled	0.30141	0.055868
25	450	82.2615	0.0122	20.39	0.0430	0.3149	1.5075	Subcooled	0.29087	0.055163
30	450	81.7146	0.0122	21.97	0.0463	0.3165	1.5092	Subcooled	0.28079	0.054461
35	450	81.1614	0.0123	23.55	0.0495	0.3181	1.5111	Subcooled	0.27114	0.053763
40	450	80.6015	0.0124	25.15	0.0527	0.3197	1.5132	Subcooled	0.26190	0.053069
45	450	80.0346	0.0125	26.75	0.0559	0.3215	1.5155	Subcooled	0.25304	0.052378
50	450	79.4601	0.0126	28.36	0.0591	0.3233	1.5181	Subcooled	0.24452	0.051689
55	450	78.8776	0.0127	29.98	0.0622	0.3251	1.5209	Subcooled	0.23633	0.051003
60	450	78.2866	0.0128	31.61	0.0654	0.3271	1.5240	Subcooled	0.22844	0.050319
65	450	77.6864	0.0129	33.26	0.0685	0.3291	1.5275	Subcooled	0.22084	0.049638
70	450	77.0764	0.0130	34.91	0.0717	0.3313	1.5312	Subcooled	0.21350	0.048957
75	450	76.4561	0.0131	36.57	0.0748	0.3335	1.5354	Subcooled	0.20641	0.048278
80	450	75.8244	0.0132	38.24	0.0779	0.3359	1.5400	Subcooled	0.19955	0.047599
85	450	75.1807	0.0133	39.93	0.0810	0.3383	1.5451	Subcooled	0.19290	0.046921
90	450	74.5240	0.0134	41.63	0.0841	0.3410	1.5506	Subcooled	0.18645	0.046243
95	450	73.8532	0.0135	43.34	0.0872	0.3438	1.5568	Subcooled	0.18019	0.045564
100	450	73.1672	0.0137	45.06	0.0903	0.3467	1.5636	Subcooled	0.17410	0.044883
105	450	72.4645	0.0138	46.80	0.0934	0.3499	1.5712	Subcooled	0.16817	0.044201
110	450	71.7437	0.0139	48.56	0.0965	0.3533	1.5796	Subcooled	0.16239	0.043516
115	450	71.0031	0.0141	50.34	0.0996	0.3570	1.5890	Subcooled	0.15674	0.042827
120	450	70.2406	0.0142	52.13	0.1027	0.3610	1.5995	Subcooled	0.15121	0.042135
125	450	69.4540	0.0144	53.95	0.1058	0.3653	1.6113	Subcooled	0.14580	0.041437
130	450	68.6404	0.0146	55.79	0.1090	0.3700	1.6246	Subcooled	0.14048	0.040734
135	450	67.7968	0.0147	57.65	0.1121	0.3753	1.6397	Subcooled	0.13525	0.040022
140	450	66.9192	0.0149	59.54	0.1153	0.3811	1.6571	Subcooled	0.13009	0.039302
145	450	66.0029	0.0152	61.46	0.1185	0.3877	1.6771	Subcooled	0.12499	0.038572
150	450	65.0421	0.0154	63.42	0.1217	0.3952	1.7005	Subcooled	0.11993	0.037829



# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=500 psia (199.37 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	500	89.9511	0.0111	-2.42	-0.0083	0.2961	1.4968	Subcooled	0.52953	0.066377
-45	500	89.4676	0.0112	-0.94	-0.0047	0.2971	1.4968	Subcooled	0.50606	0.065594
-40	500	88.9814	0.0112	0.55	-0.0011	0.2982	1.4969	Subcooled	0.48415	0.064817
-35	500	88.4923	0.0113	2.04	0.0024	0.2993	1.4970	Subcooled	0.46365	0.064048
-30	500	88.0003	0.0114	3.54	0.0059	0.3004	1.4972	Subcooled	0.44444	0.063285
-25	500	87.5051	0.0114	5.04	0.0094	0.3015	1.4975	Subcooled	0.42639	0.062529
-20	500	87.0065	0.0115	6.55	0.0128	0.3026	1.4978	Subcooled	0.40941	0.061778
-15	500	86.5044	0.0116	8.07	0.0163	0.3038	1.4983	Subcooled	0.39341	0.061034
-10	500	85.9986	0.0116	9.59	0.0197	0.3050	1.4988	Subcooled	0.37830	0.060296
-5	500	85.4889	0.0117	11.12	0.0230	0.3063	1.4994	Subcooled	0.36400	0.059564
0	500	84.9751	0.0118	12.66	0.0264	0.3076	1.5002	Subcooled	0.35046	0.058837
5	500	84.4568	0.0118	14.20	0.0297	0.3089	1.5011	Subcooled	0.33761	0.058115
10	500	83.9340	0.0119	15.74	0.0331	0.3102	1.5020	Subcooled	0.32540	0.057398
15	500	83.4063	0.0120	17.30	0.0363	0.3116	1.5032	Subcooled	0.31378	0.056686
20	500	82.8735	0.0121	18.86	0.0396	0.3131	1.5045	Subcooled	0.30271	0.055979
25	500	82.3352	0.0121	20.43	0.0429	0.3146	1.5059	Subcooled	0.29214	0.055276
30	500	81.7912	0.0122	22.01	0.0461	0.3161	1.5075	Subcooled	0.28205	0.054577
35	500	81.2411	0.0123	23.59	0.0493	0.3177	1.5093	Subcooled	0.27239	0.053881
40	500	80.6845	0.0124	25.18	0.0525	0.3193	1.5113	Subcooled	0.26314	0.053190
45	500	80.1210	0.0125	26.78	0.0557	0.3210	1.5135	Subcooled	0.25426	0.052501
50	500	79.5502	0.0126	28.39	0.0589	0.3228	1.5159	Subcooled	0.24574	0.051816
55	500	78.9717	0.0127	30.01	0.0621	0.3246	1.5186	Subcooled	0.23754	0.051133
60	500	78.3850	0.0128	31.64	0.0652	0.3265	1.5216	Subcooled	0.22965	0.050453
65	500	77.7894	0.0129	33.28	0.0683	0.3285	1.5248	Subcooled	0.22204	0.049775
70	500	77.1844	0.0130	34.93	0.0715	0.3306	1.5284	Subcooled	0.21470	0.049099
75	500	76.5693	0.0131	36.58	0.0746	0.3328	1.5324	Subcooled	0.20761	0.048424
80	500	75.9435	0.0132	38.25	0.0777	0.3351	1.5368	Subcooled	0.20075	0.047750
85	500	75.3060	0.0133	39.93	0.0808	0.3375	1.5416	Subcooled	0.19411	0.047076
90	500	74.6561	0.0134	41.63	0.0839	0.3401	1.5468	Subcooled	0.18767	0.046403
95	500	73.9928	0.0135	43.34	0.0870	0.3427	1.5527	Subcooled	0.18142	0.045729
100	500	73.3149	0.0136	45.06	0.0901	0.3456	1.5591	Subcooled	0.17534	0.045055
105	500	72.6212	0.0138	46.79	0.0932	0.3487	1.5662	Subcooled	0.16942	0.044379
110	500	71.9104	0.0139	48.54	0.0962	0.3519	1.5741	Subcooled	0.16366	0.043701
115	500	71.1808	0.0140	50.31	0.0993	0.3554	1.5829	Subcooled	0.15803	0.043020
120	500	70.4307	0.0142	52.10	0.1024	0.3592	1.5926	Subcooled	0.15253	0.042336
125	500	69.6580	0.0144	53.90	0.1055	0.3633	1.6036	Subcooled	0.14714	0.041647
130	500	68.8602	0.0145	55.73	0.1086	0.3678	1.6159	Subcooled	0.14186	0.040954
135	500	68.0345	0.0147	57.58	0.1118	0.3727	1.6298	Subcooled	0.13667	0.040254
140	500	67.1775	0.0149	59.46	0.1149	0.3781	1.6456	Subcooled	0.13155	0.039546
145	500	66.2852	0.0151	61.37	0.1181	0.3842	1.6637	Subcooled	0.12651	0.038829
150	500	65.3527	0.0153	63.30	0.1213	0.3910	1.6847	Subcooled	0.12151	0.038102

# R-134a (1,1,1,2-tetrafluoroethane) Properties in the Subcooled Superheat Regions

P=550 psia (207.86 F)

T	P	ρ	v	h	s	Cp	Cp/Cv	Quality	μ	k
[F]	[psia]	[lb/ft <sup>3</sup> ]	[ft <sup>3</sup> /lb]	[Btu/lb]	[Btu/R-lb]	[Btu/R-lb]	[unitless]	[unitless]	[centipoise]	[Btu/h-ft-R]
-50	550	89.9953	0.0111	-2.37	-0.0084	0.2959	1.4959	Subcooled	0.53142	0.066461
-45	550	89.5132	0.0112	-0.88	-0.0048	0.2970	1.4959	Subcooled	0.50787	0.065679
-40	550	89.0284	0.0112	0.60	-0.0013	0.2980	1.4960	Subcooled	0.48589	0.064904
-35	550	88.5408	0.0113	2.10	0.0023	0.2991	1.4961	Subcooled	0.46534	0.064136
-30	550	88.0503	0.0114	3.59	0.0058	0.3002	1.4962	Subcooled	0.44607	0.063375
-25	550	87.5567	0.0114	5.10	0.0093	0.3013	1.4965	Subcooled	0.42798	0.062620
-20	550	87.0599	0.0115	6.61	0.0127	0.3024	1.4968	Subcooled	0.41095	0.061872
-15	550	86.5595	0.0116	8.12	0.0161	0.3036	1.4972	Subcooled	0.39490	0.061130
-10	550	86.0556	0.0116	9.64	0.0195	0.3048	1.4977	Subcooled	0.37975	0.060393
-5	550	85.5478	0.0117	11.17	0.0229	0.3061	1.4982	Subcooled	0.36542	0.059663
0	550	85.0360	0.0118	12.70	0.0263	0.3073	1.4989	Subcooled	0.35185	0.058938
5	550	84.5200	0.0118	14.24	0.0296	0.3086	1.4997	Subcooled	0.33897	0.058218
10	550	83.9995	0.0119	15.79	0.0329	0.3100	1.5007	Subcooled	0.32674	0.057503
15	550	83.4742	0.0120	17.34	0.0362	0.3113	1.5017	Subcooled	0.31510	0.056793
20	550	82.9439	0.0121	18.90	0.0395	0.3128	1.5029	Subcooled	0.30400	0.056088
25	550	82.4083	0.0121	20.47	0.0427	0.3142	1.5043	Subcooled	0.29342	0.055388
30	550	81.8671	0.0122	22.05	0.0460	0.3157	1.5058	Subcooled	0.28331	0.054691
35	550	81.3200	0.0123	23.63	0.0492	0.3173	1.5075	Subcooled	0.27363	0.053998
40	550	80.7666	0.0124	25.22	0.0524	0.3189	1.5094	Subcooled	0.26437	0.053310
45	550	80.2065	0.0125	26.82	0.0556	0.3206	1.5115	Subcooled	0.25548	0.052624
50	550	79.6394	0.0126	28.42	0.0587	0.3223	1.5138	Subcooled	0.24695	0.051942
55	550	79.0647	0.0126	30.04	0.0619	0.3241	1.5164	Subcooled	0.23874	0.051263
60	550	78.4821	0.0127	31.67	0.0650	0.3260	1.5192	Subcooled	0.23085	0.050586
65	550	77.8910	0.0128	33.30	0.0682	0.3279	1.5223	Subcooled	0.22324	0.049911
70	550	77.2908	0.0129	34.95	0.0713	0.3300	1.5257	Subcooled	0.21590	0.049239
75	550	76.6809	0.0130	36.60	0.0744	0.3321	1.5295	Subcooled	0.20881	0.048568
80	550	76.0606	0.0131	38.27	0.0775	0.3343	1.5336	Subcooled	0.20195	0.047898
85	550	75.4292	0.0133	39.94	0.0806	0.3367	1.5382	Subcooled	0.19531	0.047229
90	550	74.7859	0.0134	41.63	0.0837	0.3392	1.5431	Subcooled	0.18888	0.046561
95	550	74.1297	0.0135	43.34	0.0868	0.3418	1.5487	Subcooled	0.18263	0.045893
100	550	73.4597	0.0136	45.05	0.0898	0.3445	1.5547	Subcooled	0.17656	0.045224
105	550	72.7746	0.0137	46.78	0.0929	0.3475	1.5614	Subcooled	0.17066	0.044554
110	550	72.0733	0.0139	48.53	0.0960	0.3506	1.5688	Subcooled	0.16491	0.043883
115	550	71.3542	0.0140	50.29	0.0991	0.3540	1.5770	Subcooled	0.15930	0.043209
120	550	70.6158	0.0142	52.07	0.1021	0.3576	1.5862	Subcooled	0.15382	0.042533
125	550	69.8561	0.0143	53.86	0.1052	0.3615	1.5963	Subcooled	0.14846	0.041853
130	550	69.0730	0.0145	55.68	0.1083	0.3657	1.6077	Subcooled	0.14321	0.041168
135	550	68.2640	0.0146	57.52	0.1114	0.3703	1.6205	Subcooled	0.13805	0.040479
140	550	67.4261	0.0148	59.39	0.1146	0.3754	1.6350	Subcooled	0.13298	0.039783
145	550	66.5558	0.0150	61.28	0.1177	0.3810	1.6515	Subcooled	0.12799	0.039079
150	550	65.6489	0.0152	63.20	0.1209	0.3873	1.6704	Subcooled	0.12305	0.038366

Pressure – Enthalpy Diagram for Refrigerant 134a (1,1,1,2-tetrafluoroethane)

