

THERMOPHYSICAL PROPERTIES OF REFRIGERANTS

THIS CHAPTER presents tabular data for the thermodynamic and transport properties of refrigerants arranged for the occasional user. Most of the refrigerants have a thermodynamic property chart on pressure-enthalpy coordinates with an abbreviated set of tabular data for the saturated liquid and vapor on the facing page. In addition, tabular data in the superheated vapor region are given for R-134a to assist students working on compression cycle examples.

For each of the cryogenic fluids, a second table of properties is provided for the vapor at a pressure of one standard atmosphere; these tables provide data needed when these gases are used in heat transfer or purge gas applications. For the zeotropic blends, including R-729 (air), tables are incremented in pressure with properties given for the liquid on the bubble line and vapor on the dew line. This arrangement is chosen because pressure is more commonly measured in the field while servicing equipment; it also highlights the difference between the bubble and dew point temperatures—the so-called temperature glide experienced with blends.

For a few fluids there are gaps in some properties at low temperatures due to limitations in the data and/or the models used.

New for the 2001 *ASHRAE Handbook* are R-143a and R-245fa. Most of the CFC refrigerants have been deleted. Tables for R-11, R-13, R-113, R-114, R-141b, R-142b, R-500, R-502, R-503, and R-720 (neon) may be found in the 1997 *ASHRAE Handbook*. R-12 has been retained to assist in making comparisons. Revised formulations have been used for many of the HFC refrigerants; these conform to international standards, where applicable. The formulations used are detailed in the References section.

The reference states used for most of the refrigerants correspond to the American convention of 0 Btu/lb for enthalpy and 0 Btu/lb·°F for entropy for the saturated liquid at -40°F. The exceptions are water and fluids that have very low critical temperatures, such as ethylene and the cryogenics.

These data are intended to help engineers make preliminary comparisons among unfamiliar fluids. For greater detail and a wider range of data, consult the sources listed in the References section.

Refrigerant	Page	Refrigerant	Page
Halocarbon Refrigerants		R-718 (water/steam)	20.32
<i>Methane Series</i>		R-744 (carbon dioxide)	20.34
R-12 (dichlorodifluoromethane)	20.2	Hydrocarbon Refrigerants	
R-22 (chlorodifluoromethane)	20.4	R-50 (methane)	20.36
R-23 (trifluoromethane)	20.6	R-170 (ethane)	20.38
R-32 (difluoromethane)	20.8	R-290 (propane)	20.40
<i>Ethane Series</i>		R-600 (<i>n</i> -butane)	20.42
R-123 (2,2-dichloro-1,1,1-trifluoroethane)	20.10	R-600a (isobutane)	20.44
R-124 (2-chloro-1,1,1,2-tetrafluoroethane)	20.12	R-1150 (ethylene)	20.46
R-125 (pentafluoroethane)	20.14	R-1270 (propylene)	20.48
R-134a (1,1,1,2-tetrafluoroethane)	20.16	Cryogenic Fluids	
R-152a (1,1-difluoroethane)	20.20	R-702 (normal hydrogen)	20.50
R-143a (1,1,1-trifluoroethane)	20.22	R-702p (parahydrogen)	20.52
<i>Propane Series</i>		R-704 (helium)	20.54
R-245fa (1,1,1,3,3-pentafluoropropane)	20.23	R-728 (nitrogen)	20.56
<i>Zeotropic Blends (% by mass)</i>		R-729 (air)	20.58
R-404A [R-125/143a/134a (44/52/4)]	20.24	R-732 (oxygen)	20.60
R-407C [R-32/125/134a (23/25/52)]	20.26	R-740 (argon)	20.62
R-410A [R-32/125 (50/50)]	20.28	Absorption Solutions	
<i>Azeotropic Blends</i>		Ammonia-Water	20.65
R-507A [R-125/143a (50/50)]	20.29	Water-Lithium Bromide	20.65
Inorganic Refrigerants			
R-717 (ammonia)	20.30		

The preparation of this chapter is assigned to TC 3.1, Refrigerants and Secondary Coolants.

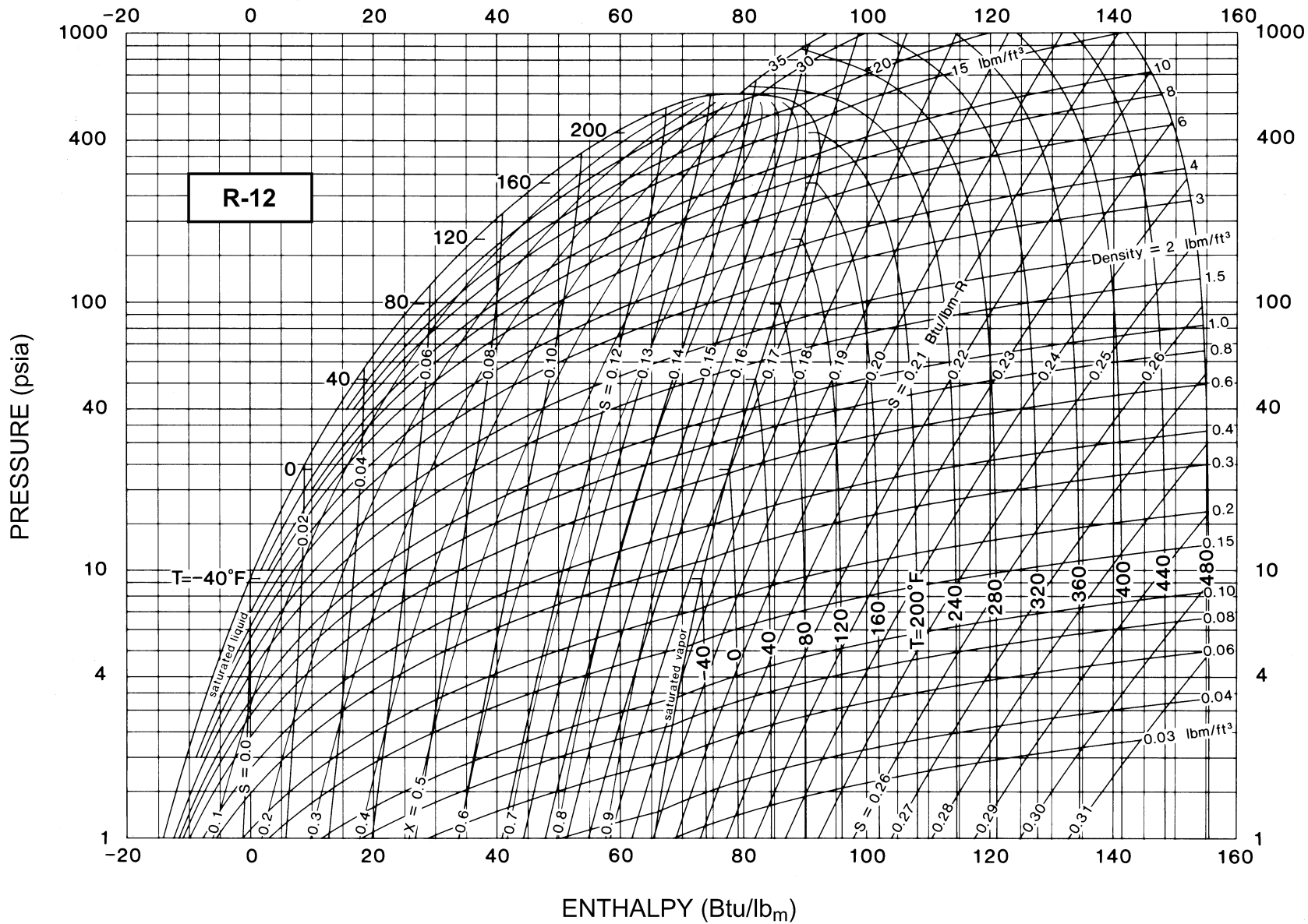


Fig. 1 Pressure-Enthalpy Diagram for Refrigerant 12

Refrigerant 12 (Dichlorodifluoromethane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-150.00	0.155	105.01	176.84	-22.133	60.979	-0.06101	0.20738	0.1955	0.1069	1.1831	3412.	387.7	2.493	0.0163	0.0678	0.00244	26.65	-150.00
-140.00	0.258	104.10	109.67	-20.175	62.044	-0.05479	0.20241	0.1962	0.1090	1.1795	3329.	393.0	2.212	0.0168	0.0663	0.00257	25.77	-140.00
-130.00	0.415	103.18	70.398	-18.209	63.125	-0.04873	0.19798	0.1970	0.1111	1.1764	3247.	398.3	1.981	0.0174	0.0647	0.00270	24.90	-130.00
-120.00	0.644	102.26	46.615	-16.234	64.219	-0.04284	0.19402	0.1979	0.1133	1.1736	3166.	403.3	1.789	0.0179	0.0633	0.00283	24.03	-120.00
-110.00	0.973	101.34	31.744	-14.250	65.326	-0.03708	0.19050	0.1989	0.1154	1.1711	3085.	408.3	1.626	0.0184	0.0618	0.00296	23.17	-110.00
-100.00	1.430	100.41	22.173	-12.255	66.444	-0.03146	0.18735	0.2000	0.1175	1.1691	3005.	413.0	1.487	0.0190	0.0604	0.00310	22.32	-100.00
-90.00	2.052	99.48	15.847	-10.248	67.571	-0.02596	0.18455	0.2013	0.1197	1.1675	2926.	417.5	1.366	0.0195	0.0590	0.00323	21.47	-90.00
-80.00	2.880	98.54	11.565	-8.228	68.705	-0.02057	0.18206	0.2026	0.1218	1.1663	2848.	421.8	1.261	0.0200	0.0577	0.00337	20.63	-80.00
-75.00	3.387	98.06	9.9506	-7.213	69.274	-0.01791	0.18092	0.2033	0.1229	1.1659	2809.	423.8	1.213	0.0203	0.0570	0.00344	20.22	-75.00
-70.00	3.963	97.59	8.6006	-6.194	69.844	-0.01529	0.17985	0.2040	0.1240	1.1655	2770.	425.8	1.167	0.0206	0.0563	0.00352	19.80	-70.00
-65.00	4.616	97.11	7.4658	-5.171	70.415	-0.01268	0.17884	0.2047	0.1252	1.1653	2732.	427.8	1.125	0.0208	0.0557	0.00359	19.39	-65.00
-60.00	5.353	96.63	6.63	-4.145	70.986	-0.01010	0.17788	0.2055	0.1263	1.1653	2693.	429.6	1.084	0.0211	0.0550	0.00366	18.98	-60.00
-55.00	6.181	96.14	5.6943	-3.115	71.558	-0.00754	0.17699	0.2062	0.1274	1.1653	2655.	431.4	1.046	0.0214	0.0544	0.00373	18.57	-55.00
-50.00	7.108	95.66	5.0014	-2.081	72.130	-0.00501	0.17614	0.2070	0.1286	1.1654	2617.	433.1	1.010	0.0216	0.0537	0.00381	18.16	-50.00
-45.00	8.144	8.144	4.4085	-1.043	72.702	-0.00249	0.17535	0.2078	0.1297	1.1657	2579.	434.7	0.976	0.0219	0.0531	0.00388	17.75	-45.00
-40.00	9.295	94.68	3.8992	0.000	73.273	0.00000	0.17460	0.2087	0.1309	1.1662	2541.	436.3	0.943	0.0222	0.0525	0.00396	17.35	-40.00
-35.00	10.571	94.18	3.4599	1.047	73.844	0.00247	0.17389	0.2095	0.1321	1.1667	2503.	437.8	0.912	0.0224	0.0518	0.00403	16.95	-35.00
-30.00	11.982	93.68	3.0797	2.098	74.414	0.00493	0.17323	0.2104	0.1333	1.1674	2466.	439.2	0.882	0.0227	0.0512	0.00411	16.55	-30.00
-25.00	13.536	93.18	2.7494	3.154	74.982	0.00736	0.17261	0.2113	0.1346	1.1683	2428.	440.5	0.854	0.0229	0.0506	0.00418	16.15	-25.00
-21.55b	14.696	92.83	2.5469	3.884	75.373	0.00903	0.17221	0.2119	0.1354	1.1690	2403.	441.3	0.835	0.0231	0.0502	0.00424	15.88	-21.55
-20.00	15.244	92.67	2.4615	4.214	75.549	0.00978	0.17203	0.2122	0.1358	1.1693	2391.	441.7	0.827	0.0232	0.0500	0.00426	15.76	-20.00
-15.00	17.115	92.16	2.2098	5.280	76.115	0.01218	0.17148	0.2131	0.1371	1.1705	2354.	442.8	0.801	0.0235	0.0494	0.00434	15.36	-15.00
-10.00	19.159	91.65	1.9889	6.350	76.678	0.01457	0.17097	0.2141	0.1384	1.1718	2317.	443.9	0.776	0.0237	0.0488	0.00442	14.97	-10.00
-5.00	21.388	91.13	1.7945	7.425	77.239	0.01693	0.17048	0.2151	0.1397	1.1733	2279.	444.8	0.752	0.0240	0.0482	0.00450	14.58	-5.00
0.00	23.812	90.61	1.6230	8.505	77.797	0.01929	0.17003	0.2161	0.1411	1.1750	2243.	445.6	0.729	0.0243	0.0476	0.00458	14.19	0.00
5.00	26.442	90.08	1.4711	9.591	78.352	0.02162	0.16960	0.2171	0.1424	1.1769	2206.	446.4	0.707	0.0245	0.0470	0.00466	13.81	5.00
10.00	29.290	89.55	1.3364	10.682	78.904	0.02395	0.16920	0.2182	0.1439	1.1790	2169.	447.0	0.686	0.0248	0.0464	0.00474	13.43	10.00
15.00	32.365	89.02	1.2165	11.778	79.453	0.02625	0.16883	0.2193	0.1453	1.1813	2132.	447.5	0.666	0.0251	0.0458	0.00482	13.05	15.00
20.00	35.682	88.48	1.1095	12.880	79.998	0.02855	0.16847	0.2204	0.1468	1.1838	2095.	447.9	0.646	0.0253	0.0452	0.00491	12.67	20.00
25.00	39.250	87.93	1.0138	13.988	80.539	0.03083	0.16814	0.2216	0.1483	1.1866	2059.	448.2	0.627	0.0256	0.0447	0.00499	12.29	25.00
30.00	43.083	87.38	0.9281	15.102	81.075	0.03310	0.16783	0.2228	0.1499	1.1896	2022.	448.4	0.609	0.0259	0.0441	0.00508	11.92	30.00
35.00	47.192	86.82	0.8510	16.222	81.606	0.03536	0.16754	0.2240	0.1515	1.1929	1986.	448.5	0.591	0.0261	0.0435	0.00516	11.55	35.00
40.00	51.590	86.25	0.7816	17.348	82.133	0.03761	0.16726	0.2253	0.1532	1.1965	1949.	448.4	0.574	0.0264	0.0429	0.00525	11.18	40.00
45.00	56.289	85.68	0.7190	18.481	82.654	0.03984	0.16700	0.2266	0.1549	1.2004	1913.	448.3	0.557	0.0267	0.0424	0.00534	10.82	45.00
50.00	61.303	85.10	0.6624	19.621	83.169	0.04207	0.16675	0.2279	0.1567	1.2047	1876.	448.0	0.541	0.0270	0.0418	0.00543	10.45	50.00
55.00	66.643	84.52	0.6110	20.767	83.678	0.04428	0.16652	0.2294	0.1585	1.2093	1840.	447.5	0.526	0.0272	0.0413	0.00552	10.09	55.00
60.00	72.323	83.92	0.5645	21.921	84.180	0.04649	0.16630	0.2308	0.1604	1.2143	1803.	447.0	0.511	0.0275	0.0407	0.00562	9.74	60.00
65.00	78.357	83.32	0.5221	23.082	84.675	0.04869	0.16608	0.2323	0.1624	1.2197	1766.	446.3	0.496	0.0278	0.0401	0.00571	9.38	65.00
70.00	84.757	82.71	0.4835	24.251	85.163	0.05088	0.16588	0.2339	0.1645	1.2256	1730.	445.4	0.482	0.0281	0.0396	0.00581	9.03	70.00
75.00	91.536	82.10	0.4482	25.427	85.642	0.05306	0.16568	0.2356	0.1666	1.2319	1693.	444.5	0.468	0.0284	0.0390	0.00591	8.68	75.00
80.00	98.710	81.47	0.4159	26.612	86.113	0.05524	0.16549	0.2373	0.1689	1.2389	1656.	443.3	0.454	0.0287	0.0385	0.00601	8.33	80.00
85.00	106.29	80.83	0.3864	27.805	86.576	0.05740	0.16531	0.2391	0.1712	1.2464	1619.	442.0	0.441	0.0290	0.0379	0.00612	7.99	85.00
90.00	114.29	80.18	0.3593	29.007	87.028	0.05957	0.16512	0.2410	0.1737	1.2546	1582.	440.6	0.428	0.0293	0.0374	0.00623	7.65	90.00
95.00	122.73	79.52	0.3344	30.218	87.470	0.06173	0.16494	0.2430	0.1763	1.2635	1545.	439.0	0.415	0.0296	0.0369	0.00634	7.31	95.00
100.00	131.62	78.85	0.3114	31.439	87.902	0.06388	0.16477	0.2452	0.1791	1.2733	1508.	437.3	0.403	0.0299	0.0363	0.00645	6.98	100.00
105.00	140.97	78.16	0.2903	32.669	88.322	0.06603	0.16459	0.2474	0.1820	1.2839	1470.	435.4	0.391	0.0302	0.0358	0.00657	6.65	105.00
110.00	150.81	77.46	0.2707	33.911	88.729	0.06818	0.16440	0.2498	0.1851	1.2956	1433.	433.3	0.379	0.0306	0.0352	0.00670	6.32	110.00
115.00	161.13	76.75	0.2527	35.163	89.123	0.07032	0.16422	0.2523	0.1884	1.3085	1395.	431.0	0.367	0.0309	0.0347	0.00682	6.00	115.00
120.00	171.97	76.02	0.2359	36.427	89.503	0.07247	0.16403	0.2551	0.1920	1.3226	1357.	428.5	0.356	0.0313	0.0341	0.00696	5.68	120.00
125.00	183.33	75.28	0.2204	37.703	89.868	0.07461	0.16383	0.2580	0.1958	1.3383	1318.	425.9	0.345	0.0316	0.0336	0.00710	5.36	125.00
130.00	195.24	74.51	0.2060	38.992	90.216	0.07676	0.16362	0.2611	0.2000	1.3556	1279.	423.0	0.334	0.0320	0.0331	0.00724	5.05	130.00
135.00	207.70	73.73	0.1926	40.295	90.546	0.07890	0.16341	0.2645	0.2045	1.3750	1240.	420.0	0.323	0.0324	0.0325	0.00740	4.74	135.00
140.00	220.74	72.93	0.1801	41.613	90.857	0.08106	0.16317	0.2683	0.2094	1.3966	1201.	416.7	0.312	0.0328	0.0320	0.00756	4.44	140.00
145.00	234.37	72.10	0.1684	42.947	91.148	0.08321	0.16293	0.2724	0.2149	1.4210	1161.	413.3	0.302	0.0333	0.0315	0.00773	4.14	145.00
150.00	248.61	71.24	0.1575	44.298	91.415	0.08538	0.16266	0.2769	0.2209	1.4486	1120.	409.6	0.291	0.0337	0.0309	0.00792	3.85	150.00
155.00	263.47	70.36	0.1472	45.667	91.657	0.08755	0.16237	0.2819	0.2277	1.4800	1079.	405.6	0.281	0.0342	0.0304	0.00811	3.56	155.00
160.00	278.99	69.45	0.1377	47.056	91.872	0.08973	0.16206	0.2875	0.2353	1.5161	1037.	401.4	0.271	0.				

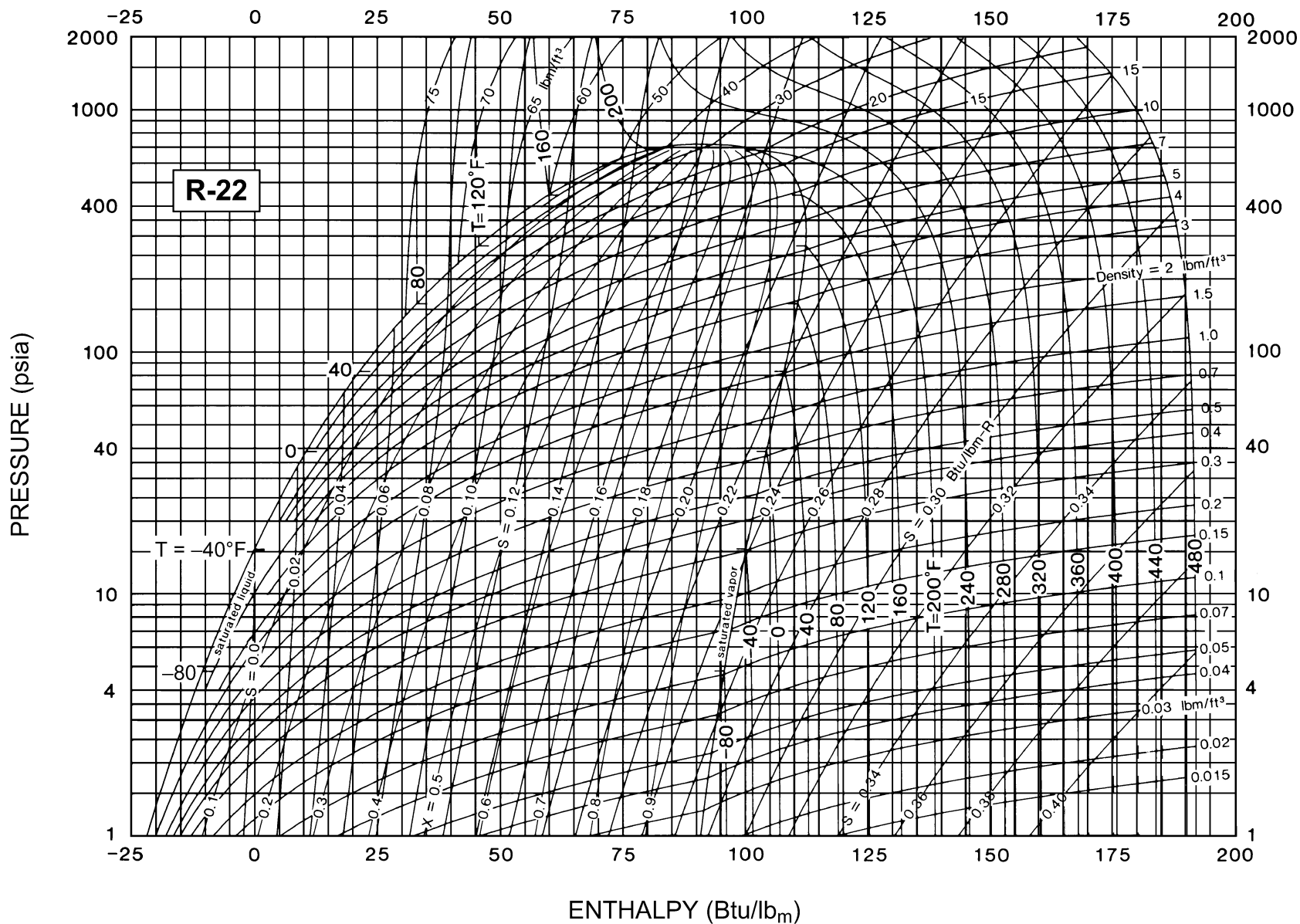


Fig. 2 Pressure-Enthalpy Diagram for Refrigerant 22

Refrigerant 22 (Chlorodifluoromethane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat <i>c_p</i> , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-150.00	0.263	98.28	146.06	-28.119	87.566	-0.07757	0.29600	0.2536	0.1185	1.2437	3716.	469.7	2.093	0.0174	0.0831	0.00255	28.31	-150.00
-140.00	0.436	97.36	90.759	-25.583	88.729	-0.06951	0.28808	0.2536	0.1204	1.2404	3630.	476.2	1.874	0.0180	0.0814	0.00267	27.34	-140.00
-130.00	0.698	96.44	58.384	-23.046	89.899	-0.06170	0.28090	0.2536	0.1223	1.2375	3544.	482.4	1.692	0.0186	0.0797	0.00280	26.36	-130.00
-120.00	1.082	95.52	38.745	-20.509	91.074	-0.05412	0.27439	0.2537	0.1244	1.2350	3458.	488.5	1.537	0.0191	0.0780	0.00293	25.40	-120.00
-110.00	1.629	94.59	26.444	-17.970	92.252	-0.04675	0.26846	0.2540	0.1265	1.2330	3373.	494.2	1.405	0.0197	0.0763	0.00306	24.44	-110.00
-100.00	2.388	93.66	18.511	-15.427	93.430	-0.03959	0.26307	0.2543	0.1288	1.2315	3287.	499.7	1.290	0.0203	0.0747	0.00320	23.49	-100.00
-95.00	2.865	93.19	15.623	-14.154	94.018	-0.03608	0.26055	0.2546	0.1300	1.2310	3245.	502.4	1.238	0.0206	0.0739	0.00327	23.02	-95.00
-90.00	3.417	92.71	13.258	-12.880	94.605	-0.03261	0.25815	0.2549	0.1312	1.2307	3202.	504.9	1.189	0.0208	0.0731	0.00334	22.55	-90.00
-85.00	4.053	92.24	11.309	-11.604	95.191	-0.02918	0.25585	0.2552	0.1324	1.2305	3160.	507.4	1.144	0.0211	0.0723	0.00341	22.08	-85.00
-80.00	4.782	91.76	9.6939	-10.326	95.775	-0.02580	0.25366	0.2556	0.1337	1.2304	3118.	509.8	1.101	0.0214	0.0715	0.00348	21.61	-80.00
-75.00	5.615	91.28	8.3487	-9.046	96.357	-0.02245	0.25155	0.2561	0.1350	1.2305	3075.	512.2	1.060	0.0217	0.0708	0.00355	21.15	-75.00
-70.00	6.561	90.79	7.2222	-7.763	96.937	-0.01915	0.24954	0.2566	0.1363	1.2308	3033.	514.4	1.021	0.0220	0.0700	0.00363	20.68	-70.00
-65.00	7.631	90.31	6.2744	-6.477	97.514	-0.01587	0.24761	0.2571	0.1377	1.2313	2990.	516.5	0.985	0.0223	0.0692	0.00370	20.22	-65.00
-60.00	8.836	89.82	5.4730	-5.189	98.087	-0.01264	0.24577	0.2577	0.1392	1.2320	2948.	518.6	0.951	0.0225	0.0684	0.00378	19.76	-60.00
-55.00	10.190	89.33	4.7924	-3.897	98.657	-0.00943	0.24400	0.2583	0.1406	1.2328	2906.	520.5	0.918	0.0228	0.0677	0.00386	19.30	-55.00
-50.00	11.703	88.83	4.2119	-2.602	99.224	-0.00626	0.24230	0.2591	0.1422	1.2339	2863.	522.4	0.887	0.0231	0.0669	0.00394	18.85	-50.00
-45.00	13.390	88.33	3.7147	-1.303	99.786	-0.00311	0.24067	0.2598	0.1438	1.2352	2821.	524.1	0.857	0.0234	0.0661	0.00402	18.40	-45.00
-41.46b	14.696	87.97	3.4054	-0.381	100.181	-0.00091	0.23955	0.2604	0.1449	1.2362	2791.	525.3	0.837	0.0236	0.0656	0.00407	18.08	-41.46
-40.00	15.262	87.82	3.2872	0.000	100.343	0.00000	0.23910	0.2606	0.1454	1.2367	2778.	525.8	0.829	0.0237	0.0654	0.00410	17.94	-40.00
-35.00	17.336	87.32	2.9181	1.308	100.896	0.00309	0.23759	0.2615	0.1471	1.2384	2736.	527.3	0.802	0.0240	0.0646	0.00418	17.49	-35.00
-30.00	19.624	86.80	2.5984	2.620	101.443	0.00615	0.23615	0.2625	0.1488	1.2404	2694.	528.7	0.776	0.0242	0.0639	0.00426	17.05	-30.00
-25.00	22.142	86.29	2.3204	3.937	101.984	0.00918	0.23475	0.2635	0.1506	1.2426	2651.	530.0	0.751	0.0245	0.0631	0.00435	16.60	-25.00
-20.00	24.906	85.76	2.0778	5.260	102.519	0.01220	0.23341	0.2645	0.1525	1.2451	2609.	531.2	0.728	0.0248	0.0624	0.00444	16.16	-20.00
-15.00	27.929	85.24	1.8656	6.588	103.048	0.01519	0.23211	0.2656	0.1544	1.2479	2566.	532.3	0.705	0.0251	0.0617	0.00452	15.72	-15.00
-10.00	31.230	84.71	1.6792	7.923	103.570	0.01815	0.23086	0.2668	0.1564	1.2510	2524.	533.2	0.683	0.0254	0.0609	0.00461	15.28	-10.00
-5.00	34.824	84.17	1.5150	9.263	104.085	0.02110	0.22965	0.2681	0.1585	1.2544	2481.	534.0	0.662	0.0257	0.0602	0.00471	14.85	-5.00
0.00	38.728	83.63	1.3701	10.610	104.591	0.02403	0.22848	0.2694	0.1607	1.2581	2438.	534.7	0.642	0.0260	0.0595	0.00480	14.41	0.00
5.00	42.960	83.08	1.2417	11.964	105.090	0.02694	0.22735	0.2708	0.1629	1.2622	2396.	535.3	0.622	0.0262	0.0587	0.00489	13.98	5.00
10.00	47.536	82.52	1.1276	13.325	105.580	0.02983	0.22625	0.2722	0.1652	1.2666	2353.	535.7	0.603	0.0265	0.0580	0.00499	13.55	10.00
15.00	52.475	81.96	1.0261	14.694	106.061	0.03270	0.22519	0.2737	0.1676	1.2714	2310.	536.0	0.585	0.0268	0.0573	0.00509	13.13	15.00
20.00	57.795	81.39	0.9354	16.070	106.532	0.03556	0.22415	0.2753	0.1702	1.2767	2268.	536.1	0.568	0.0271	0.0566	0.00519	12.70	20.00
25.00	63.514	80.82	0.8543	17.455	106.994	0.03841	0.22315	0.2770	0.1728	1.2824	2225.	536.1	0.551	0.0274	0.0558	0.00530	12.28	25.00
30.00	69.651	80.24	0.7815	18.848	107.445	0.04124	0.22217	0.2787	0.1755	1.2886	2182.	535.9	0.534	0.0277	0.0551	0.00540	11.86	30.00
35.00	76.225	79.65	0.7161	20.250	107.884	0.04406	0.22121	0.2806	0.1783	1.2953	2139.	535.6	0.518	0.0280	0.0544	0.00551	11.45	35.00
40.00	83.255	79.05	0.6572	21.662	108.313	0.04686	0.22028	0.2825	0.1813	1.3026	2096.	535.1	0.503	0.0283	0.0537	0.00562	11.04	40.00
45.00	90.761	78.44	0.6040	23.083	108.729	0.04966	0.21936	0.2845	0.1844	1.3105	2053.	534.4	0.488	0.0286	0.0530	0.00574	10.63	45.00
50.00	98.763	77.83	0.5558	24.514	109.132	0.05244	0.21847	0.2866	0.1877	1.3191	2010.	533.6	0.473	0.0289	0.0522	0.00586	10.22	50.00
55.00	107.28	77.20	0.5122	25.956	109.521	0.05522	0.21758	0.2889	0.1911	1.3284	1967.	532.6	0.459	0.0292	0.0515	0.00598	9.82	55.00
60.00	116.33	76.57	0.4725	27.409	109.897	0.05798	0.21672	0.2913	0.1947	1.3385	1924.	531.5	0.445	0.0296	0.0508	0.00611	9.41	60.00
65.00	125.94	75.92	0.4364	28.874	110.257	0.06074	0.21586	0.2938	0.1985	1.3495	1880.	530.1	0.432	0.0299	0.0501	0.00625	9.02	65.00
70.00	136.13	75.27	0.4035	30.350	110.602	0.06350	0.21501	0.2964	0.2025	1.3615	1836.	528.6	0.419	0.0302	0.0494	0.00638	8.62	70.00
75.00	146.92	74.60	0.3734	31.839	110.929	0.06625	0.21417	0.2992	0.2067	1.3746	1793.	526.9	0.406	0.0305	0.0487	0.00653	8.23	75.00
80.00	158.33	73.92	0.3459	33.342	111.239	0.06899	0.21333	0.3022	0.2112	1.3889	1749.	525.0	0.394	0.0309	0.0479	0.00668	7.84	80.00
85.00	170.38	73.23	0.3207	34.859	111.530	0.07173	0.21250	0.3054	0.2160	1.4046	1705.	522.9	0.381	0.0312	0.0472	0.00684	7.46	85.00
90.00	183.09	72.52	0.2975	36.391	111.801	0.07447	0.21166	0.3089	0.2212	1.4218	1660.	520.6	0.369	0.0316	0.0465	0.00701	7.08	90.00
95.00	196.50	71.80	0.2762	37.938	112.050	0.07721	0.21083	0.3126	0.2267	1.4407	1615.	518.1	0.358	0.0320	0.0458	0.00718	6.70	95.00
100.00	210.61	71.06	0.2566	39.502	112.276	0.07996	0.20998	0.3166	0.2327	1.4616	1570.	515.4	0.346	0.0324	0.0450	0.00737	6.33	100.00
105.00	225.46	70.30	0.2385	41.084	112.478	0.08270	0.20913	0.3209	0.2391	1.4849	1525.	512.4	0.335	0.0328	0.0443	0.00757	5.96	105.00
110.00	241.06	69.52	0.2217	42.686	112.653	0.08545	0.20827	0.3257	0.2461	1.5107	1479.	509.2	0.324	0.0332	0.0436	0.00778	5.60	110.00
115.00	257.45	68.72	0.2062	44.308	112.799	0.08821	0.20739	0.3309	0.2538	1.5396	1433.	505.8	0.313	0.0336	0.0428	0.00801	5.24	115.00
120.00	274.65	67.90	0.1918	45.952	112.914	0.09098	0.20649	0.3367	0.2623	1.5722	1387.	502.1	0.302	0.0341	0.0421	0.00825	4.88	120.00
125.00	292.69	67.05	0.1785	47.621	112.996	0.09376	0.20557	0.3431	0.2717	1.6090	1340.	498.1	0.292	0.0346	0.0413	0.00851	4.53	125.00
130.00	311.58	66.18	0.1660	49.316	113.040	0.09656	0.20462	0.3504	0.2822	1.6509	1292.	493.9	0.281	0.0351	0.0406	0.00880	4.19	130.00
135.00	331.37	65.27	0.1544	51.041	113.043	0.09937	0.20364	0.3585	0.2941	1.6990	1244.	489.4	0.271	0.0356	0.0399	0.00911	3.85	135.00
140.00	352.08	64.32	0.1435	52.798	113.000	0.10222	0.20261	0.3679	0.3076	1.7548	1195.	484.6	0.260	0.0362	0.0391	0.00946	3.51	140.00
145.00	373.74	63.34	0.1334	54.591	112.907	0.10509	0.20153	0.3787	0.3233	1.8201	1146.	479.5	0.250	0.0369	0.0383	0.00984	3.18	145.00
150.00	396.38	62.31	0.1238	56.425	112.756	0.10800	0.20040	0.3913	0.3416	1.8976	1095.	474.1</						

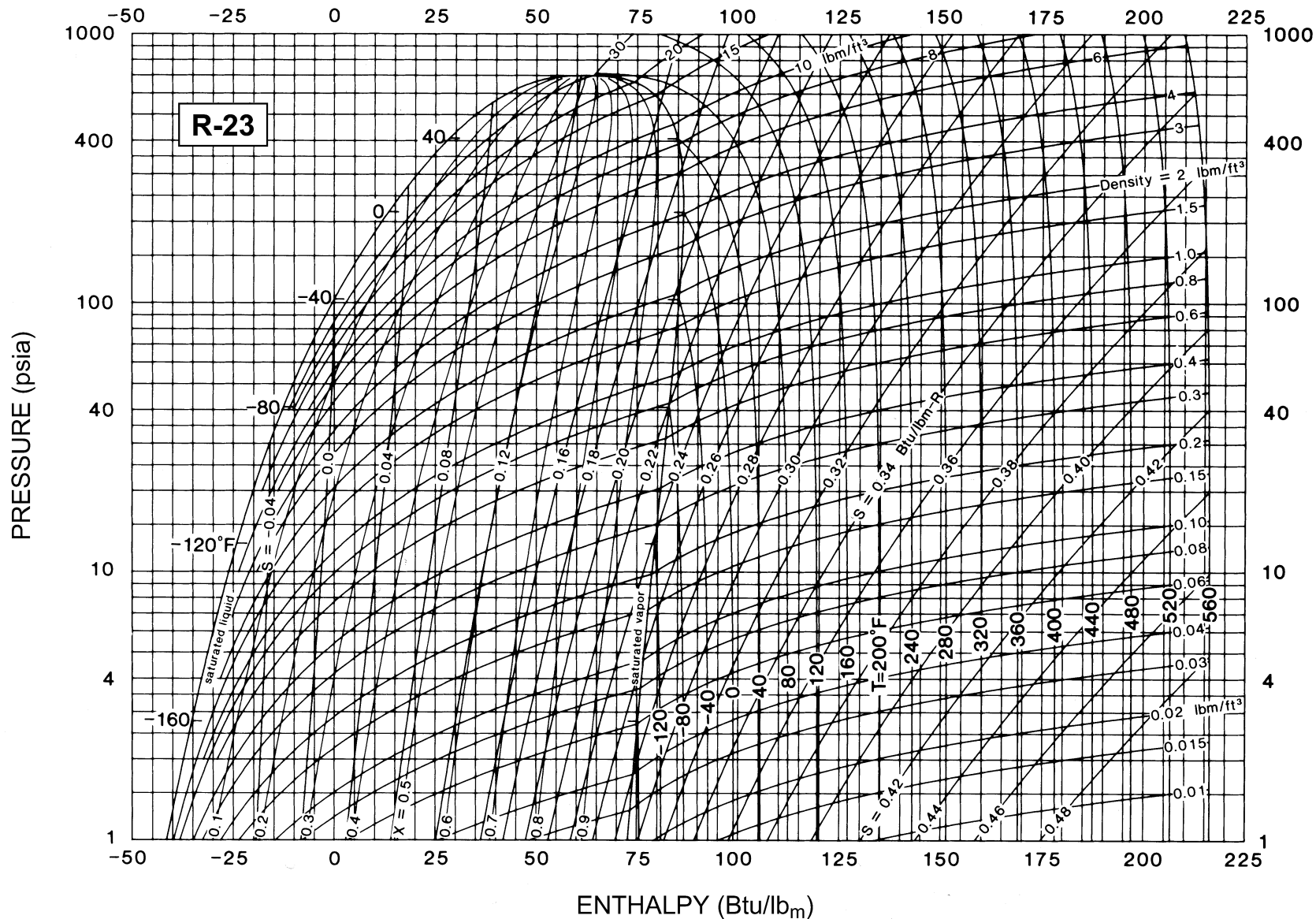


Fig. 3 Pressure-Enthalpy Diagram for Refrigerant 23

Refrigerant 23 (Trifluoromethane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, Volume,		Enthalpy,		Entropy,		Specific Heat <i>c_p</i> ,			Vel. of Sound,		Viscosity,		Thermal Cond.,		Surface Tension, dyne/cm	Temp., °F
		lb/ft ³ Liquid	ft ³ /lb Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-247.23a	0.0085	105.02	3815.	-61.278	64.550	-0.19959	0.39274	0.2974	0.1187	1.3153	3290.	445.3	4.2331	0.01293	0.1489	0.00219	32.34	-247.23
-240.00	0.0169	104.26	1989.	-59.141	65.403	-0.18970	0.37727	0.2934	0.1196	1.3128	3317.	452.3	3.6342	0.01350	0.1412	0.00232	31.51	-240.00
-230.00	0.0402	103.20	875.7	-56.229	66.587	-0.17673	0.35802	0.2893	0.1211	1.3093	3337.	461.7	2.9904	0.01428	0.1318	0.00249	30.36	-230.00
-220.00	0.0878	102.11	418.0	-53.350	67.774	-0.16446	0.34091	0.2866	0.1228	1.3059	3339.	470.8	2.5014	0.01505	0.1237	0.00267	29.20	-220.00
-210.00	0.1785	101.00	213.9	-50.492	68.959	-0.15278	0.32566	0.2850	0.1249	1.3026	3325.	479.4	2.1227	0.01583	0.1166	0.00284	28.05	-210.00
-200.00	0.3407	99.88	116.4	-47.646	70.141	-0.14161	0.31200	0.2843	0.1273	1.2997	3296.	487.7	1.8243	0.01660	0.1103	0.00301	26.90	-200.00
-190.00	0.6155	98.73	66.779	-44.804	71.314	-0.13087	0.29973	0.2842	0.1302	1.2973	3256.	495.6	1.5856	0.01736	0.1048	0.00319	25.76	-190.00
-180.00	1.0587	97.57	40.159	-41.959	72.475	-0.12051	0.28866	0.2847	0.1335	1.2956	3204.	503.0	1.3917	0.01812	0.0998	0.00336	24.61	-180.00
-170.00	1.7438	96.39	25.170	-39.108	73.617	-0.11050	0.27865	0.2855	0.1374	1.2946	3144.	510.0	1.2322	0.01888	0.0953	0.00354	23.47	-170.00
-160.00	2.7636	95.20	16.362	-36.246	74.737	-0.10079	0.26956	0.2867	0.1419	1.2947	3076.	516.5	1.0995	0.01963	0.0913	0.00372	22.34	-160.00
-150.00	4.2314	93.98	10.986	-33.371	75.830	-0.09136	0.26127	0.2881	0.1469	1.2959	3002.	522.5	0.9877	0.02037	0.0876	0.00391	21.21	-150.00
-140.00	6.2822	92.75	7.5919	-30.478	76.891	-0.08219	0.25369	0.2899	0.1526	1.2985	2922.	527.9	0.8925	0.02112	0.0842	0.00410	20.08	-140.00
-130.00	9.0723	91.49	5.3819	-27.567	77.917	-0.07324	0.24673	0.2918	0.1589	1.3025	2838.	532.8	0.8108	0.02185	0.0810	0.00429	18.96	-130.00
-120.00	12.779	90.21	3.9029	-24.634	78.902	-0.06449	0.24032	0.2940	0.1657	1.3081	2749.	537.0	0.7399	0.02259	0.0781	0.00449	17.85	-120.00
-115.72b	14.696	89.66	3.4227	-23.370	79.312	-0.06081	0.23773	0.2951	0.1689	1.3110	2711.	538.6	0.7124	0.02290	0.0769	0.00458	17.38	-115.72
-110.00	17.601	88.91	2.8883	-21.677	79.844	-0.05594	0.23439	0.2965	0.1732	1.3155	2658.	540.6	0.6779	0.02332	0.0754	0.00470	16.75	-110.00
-106.00	19.890	88.38	2.5739	-20.486	80.208	-0.05257	0.23214	0.2976	0.1763	1.3190	2620.	541.9	0.6553	0.02361	0.0743	0.00478	16.31	-106.00
-102.00	22.406	87.85	2.3001	-19.291	80.564	-0.04923	0.22996	0.2987	0.1795	1.3228	2582.	543.0	0.6337	0.02390	0.0733	0.00487	15.87	-102.00
-98.00	25.165	87.31	2.0608	-18.092	80.912	-0.04591	0.22783	0.2999	0.1828	1.3270	2544.	544.0	0.6131	0.02420	0.0723	0.00496	15.43	-98.00
-94.00	28.182	86.77	1.8510	-16.887	81.251	-0.04261	0.22577	0.3011	0.1862	1.3315	2506.	544.9	0.5935	0.02449	0.0714	0.00505	15.00	-94.00
-90.00	31.473	86.22	1.6666	-15.677	81.582	-0.03934	0.22376	0.3024	0.1897	1.3364	2466.	545.7	0.5747	0.02478	0.0704	0.00514	14.57	-90.00
-88.00	33.227	85.95	1.5828	-15.070	81.744	-0.03771	0.22277	0.3030	0.1915	1.3390	2447.	546.0	0.5656	0.02493	0.0699	0.00519	14.35	-88.00
-86.00	35.055	85.67	1.5041	-14.462	81.904	-0.03609	0.22180	0.3037	0.1933	1.3417	2427.	546.3	0.5567	0.02508	0.0695	0.00523	14.14	-86.00
-84.00	36.960	85.39	1.4300	-13.852	82.062	-0.03448	0.22084	0.3044	0.1952	1.3445	2407.	546.6	0.5480	0.02522	0.0690	0.00528	13.92	-84.00
-82.00	38.945	85.11	1.3603	-13.241	82.217	-0.03286	0.21989	0.3051	0.1970	1.3475	2387.	546.8	0.5395	0.02537	0.0685	0.00533	13.71	-82.00
-80.00	41.010	84.83	1.2947	-12.629	82.370	-0.03126	0.21895	0.3059	0.1989	1.3505	2367.	547.1	0.5312	0.02552	0.0681	0.00538	13.49	-80.00
-78.00	43.158	84.55	1.2329	-12.014	82.520	-0.02966	0.21803	0.3066	0.2008	1.3536	2347.	547.2	0.5230	0.02566	0.0676	0.00543	13.28	-78.00
-76.00	45.392	84.26	1.1746	-11.399	82.668	-0.02806	0.21711	0.3074	0.2027	1.3569	2327.	547.4	0.5150	0.02581	0.0672	0.00548	13.07	-76.00
-74.00	47.714	83.98	1.1196	-10.781	82.813	-0.02647	0.21621	0.3082	0.2047	1.3602	2307.	547.5	0.5072	0.02596	0.0668	0.00553	12.86	-74.00
-72.00	50.126	83.69	1.0677	-10.162	82.956	-0.02488	0.21532	0.3090	0.2066	1.3637	2287.	547.6	0.4995	0.02611	0.0663	0.00558	12.64	-72.00
-70.00	52.630	83.40	1.0186	-9.542	83.096	-0.02330	0.21444	0.3099	0.2086	1.3674	2266.	547.6	0.4920	0.02626	0.0659	0.00563	12.43	-70.00
-68.00	55.228	83.11	0.9723	-8.920	83.234	-0.02172	0.21356	0.3107	0.2107	1.3711	2246.	547.6	0.4846	0.02640	0.0655	0.00569	12.22	-68.00
-66.00	57.923	82.82	0.9285	-8.295	83.369	-0.02015	0.21270	0.3116	0.2127	1.3750	2226.	547.6	0.4773	0.02655	0.0650	0.00574	12.01	-66.00
-64.00	60.718	82.52	0.8870	-7.670	83.501	-0.01858	0.21184	0.3125	0.2148	1.3790	2205.	547.6	0.4702	0.02670	0.0646	0.00579	11.80	-64.00
-62.00	63.613	82.23	0.8477	-7.042	83.630	-0.01701	0.21100	0.3135	0.2170	1.3832	2184.	547.5	0.4632	0.02685	0.0642	0.00585	11.59	-62.00
-60.00	66.613	81.93	0.8105	-6.412	83.757	-0.01545	0.21016	0.3144	0.2191	1.3875	2164.	547.3	0.4563	0.02701	0.0638	0.00590	11.39	-60.00
-58.00	69.719	81.63	0.7753	-5.781	83.880	-0.01389	0.20933	0.3154	0.2213	1.3920	2143.	547.1	0.4495	0.02716	0.0634	0.00596	11.18	-58.00
-56.00	72.933	81.32	0.7418	-5.147	84.001	-0.01234	0.20851	0.3164	0.2235	1.3967	2122.	546.9	0.4429	0.02731	0.0630	0.00602	10.97	-56.00
-54.00	76.259	81.02	0.7101	-4.511	84.119	-0.01078	0.20769	0.3175	0.2258	1.4015	2101.	546.7	0.4364	0.02746	0.0625	0.00608	10.77	-54.00
-52.00	79.697	80.71	0.6800	-3.874	84.233	-0.00923	0.20689	0.3186	0.2281	1.4065	2080.	546.4	0.4300	0.02761	0.0621	0.00613	10.56	-52.00
-50.00	83.252	80.40	0.6514	-3.234	84.344	-0.00769	0.20609	0.3197	0.2304	1.4117	2059.	546.1	0.4237	0.02777	0.0617	0.00619	10.36	-50.00
-48.00	86.926	80.09	0.6242	-2.592	84.452	-0.00615	0.20530	0.3208	0.2328	1.4171	2038.	545.7	0.4175	0.02792	0.0613	0.00626	10.15	-48.00
-46.00	90.720	79.78	0.5983	-1.947	84.557	-0.00460	0.20451	0.3220	0.2352	1.4227	2017.	545.3	0.4114	0.02808	0.0609	0.00632	9.95	-46.00
-44.00	94.638	79.46	0.5737	-1.301	84.658	-0.00307	0.20373	0.3233	0.2377	1.4285	1996.	544.9	0.4053	0.02824	0.0605	0.00638	9.74	-44.00
-42.00	98.681	79.14	0.5503	-0.652	84.756	-0.00153	0.20295	0.3245	0.2402	1.4345	1975.	544.4	0.3994	0.02839	0.0601	0.00644	9.54	-42.00
-40.00	102.85	78.82	0.5280	0.000	84.850	0.00000	0.20218	0.3259	0.2427	1.4407	1954.	543.9	0.3936	0.02855	0.0597	0.00651	9.34	-40.00
-36.00	111.59	78.17	0.4865	1.311	85.027	0.00306	0.20066	0.3286	0.2480	1.4539	1911.	542.7	0.3822	0.02887	0.0589	0.00664	8.94	-36.00
-32.00	120.88	77.51	0.4488	2.633	85.189	0.00611	0.19915	0.3316	0.2535	1.4682	1868.	541.3	0.3711	0.02920	0.0581	0.00678	8.54	-32.00
-28.00	130.73	76.83	0.4144	3.966	85.335	0.00916	0.19766	0.3348	0.2593	1.4837	1825.	539.8	0.3603	0.02953	0.0574	0.00692	8.15	-28.00
-24.00	141.17	76.15	0.3831	5.311	85.463	0.01221	0.19618	0.3382	0.2653	1.5005	1781.	538.1	0.3498	0.02987	0.0566	0.00707	7.76	-24.00
-20.00	152.23	75.45	0.3544	6.670	85.573	0.01525	0.19471	0.3419	0.2717	1.5187	1738.	536.2	0.3395	0.03022	0.0558	0.00722	7.37	-20.00
-16.00	163.91	74.73	0.3281	8.042	85.664	0.01829	0.19324	0.3459	0.2784	1.5386	1694.	534.1	0.3295	0.03058	0.0550	0.00738	6.99	-16.00
-12.00	176.25	74.00	0.3040	9.429	85.735	0.02133	0.19178	0.3502	0.2856	1.5604	1649.	531.8	0.3197	0.03094	0.0542	0.00755	6.61	-12.00
-8.00	189.27	73.25	0.2818	10.832	85.783	0.02438	0.19032	0.3549	0.2932	1.5842	1605.	529.3	0.3101	0.03132	0.0535	0.00772	6.23	-8.00
-4.00	202.99	72.48	0.2614	12.253	85.808	0.02743	0.18886	0.3601	0.3014	1.6105	1560.	526.6	0.3007	0.03171	0.0527	0.00790	5.86	-4.00
0.00	217.44	71.69	0.2426	13.691	85.807	0.03050	0.18738	0.3658	0.3102	1.6394	1515.	523.7	0.2915	0.03211	0.0519	0.00809	5.50	0.00
4.00	232.64	70.87	0.2252	15.150	85.780	0.03357</												

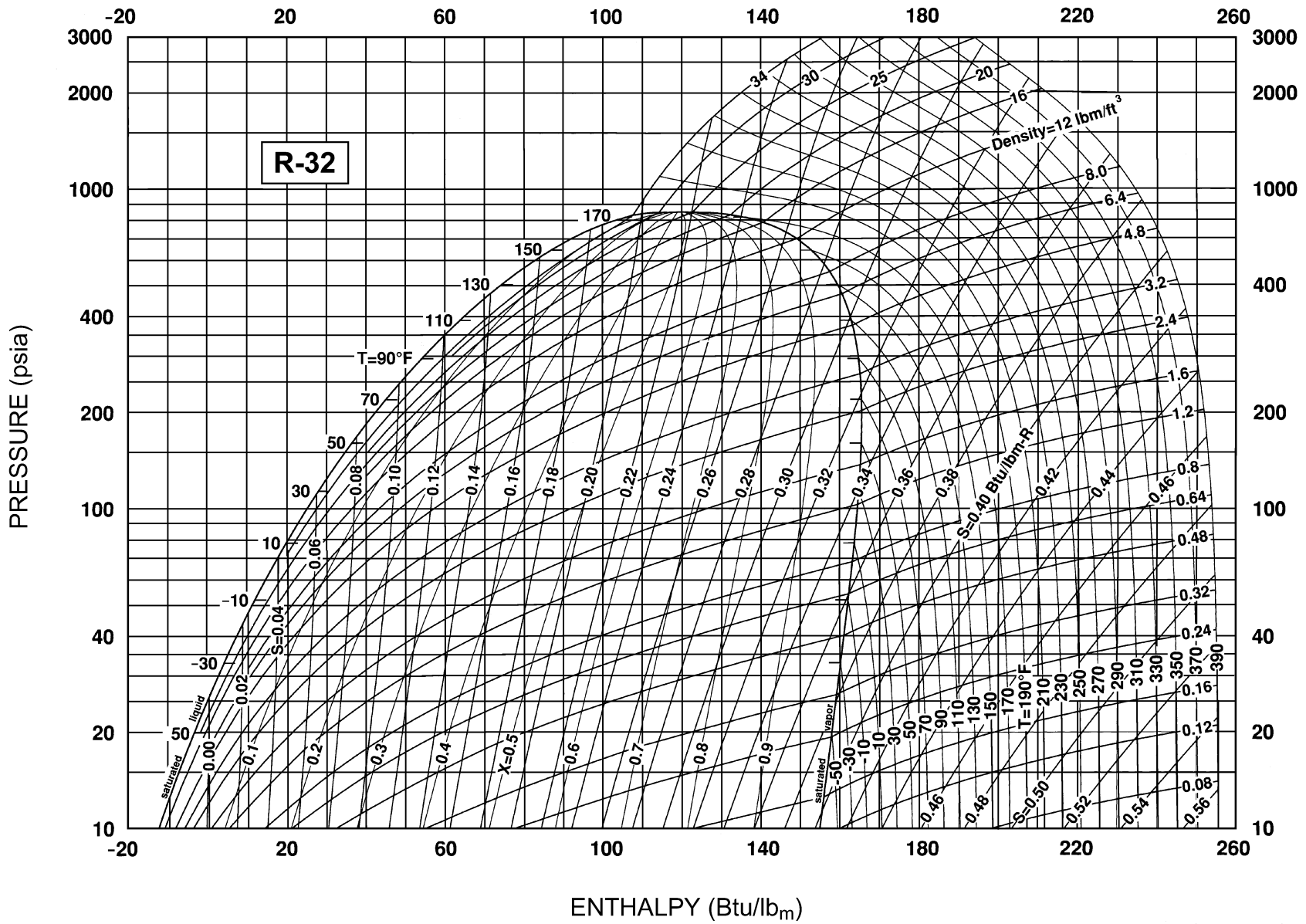


Fig. 4 Pressure-Enthalpy Diagram for Refrigerant 32

Refrigerant 32 (Difluoromethane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³ Liquid	Volume, ft ³ /lb Vapor	Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lbm/ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
				Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-214.26a	0.007	89.23	7270.1	-65.520	133.830	-0.20152	0.61079	0.3806	0.1577	1.3206	4641.	556.4	-	-	-	-	39.01	-214.26
-210.00	0.010	88.87	5150.0	-63.901	134.497	-0.19498	0.59966	0.3798	0.1581	1.3199	4599.	561.0	-	-	-	-	38.47	-210.00
-200.00	0.022	88.03	2413.3	-60.111	136.065	-0.18010	0.57539	0.3781	0.1591	1.3180	4503.	571.6	-	-	-	-	37.22	-200.00
-190.00	0.046	87.18	1207.6	-56.338	137.633	-0.16584	0.55345	0.3766	0.1602	1.3163	4407.	581.9	-	-	-	-	35.97	-190.00
-180.00	0.090	86.33	640.30	-52.578	139.199	-0.15215	0.53358	0.3754	0.1616	1.3146	4311.	591.9	-	-	-	-	34.73	-180.00
-170.00	0.167	85.48	357.44	-48.829	140.760	-0.13898	0.51552	0.3743	0.1633	1.3130	4216.	601.6	-	-	-	-	33.51	-170.00
-160.00	0.295	84.63	208.90	-45.090	142.311	-0.12629	0.49907	0.3735	0.1652	1.3117	4121.	611.0	-	-	-	-	32.29	-160.00
-150.00	0.500	83.77	127.18	-41.358	143.849	-0.11404	0.48404	0.3729	0.1675	1.3106	4026.	620.0	1.387	0.0173	0.1293	0.00350	31.07	-150.00
-140.00	0.816	82.90	80.317	-37.630	145.370	-0.10219	0.47027	0.3726	0.1702	1.3100	3931.	628.6	1.259	0.0179	0.1271	0.00363	29.87	-140.00
-130.00	1.286	82.02	52.414	-33.904	146.869	-0.09072	0.45763	0.3725	0.1734	1.3097	3836.	636.8	1.150	0.0185	0.1249	0.00376	28.68	-130.00
-120.00	1.966	81.14	35.229	-30.177	148.341	-0.07959	0.44598	0.3727	0.1770	1.3100	3742.	644.6	1.055	0.0190	0.1228	0.00390	27.50	-120.00
-110.00	2.923	80.25	24.316	-26.447	149.783	-0.06877	0.43522	0.3731	0.1811	1.3109	3648.	651.9	0.972	0.0196	0.1206	0.00405	26.33	-110.00
-100.00	4.235	79.35	17.190	-22.711	151.189	-0.05824	0.42525	0.3738	0.1858	1.3125	3553.	658.7	0.899	0.0202	0.1184	0.00419	25.17	-100.00
-95.00	5.053	78.90	14.573	-20.840	151.877	-0.05308	0.42054	0.3743	0.1884	1.3136	3506.	662.0	0.865	0.0205	0.1173	0.00427	24.59	-95.00
-90.00	5.996	78.44	12.417	-18.966	152.556	-0.04798	0.41600	0.3748	0.1910	1.3149	3459.	665.1	0.834	0.0207	0.1162	0.00434	24.02	-90.00
-85.00	7.078	77.98	10.633	-17.089	153.223	-0.04295	0.41162	0.3754	0.1938	1.3165	3412.	668.0	0.804	0.0210	0.1151	0.00442	23.45	-85.00
-80.00	8.312	77.52	9.1470	-15.209	153.879	-0.03797	0.40738	0.3760	0.1968	1.3182	3365.	670.9	0.775	0.0213	0.1141	0.00449	22.88	-80.00
-75.00	9.716	77.05	7.9036	-13.325	154.523	-0.03305	0.40329	0.3768	0.1998	1.3203	3318.	673.6	0.748	0.0216	0.1130	0.00457	22.31	-75.00
-70.00	11.304	76.58	6.8579	-11.437	155.155	-0.02818	0.39934	0.3776	0.2030	1.3226	3270.	676.1	0.723	0.0219	0.1119	0.00465	21.75	-70.00
-65.00	13.095	76.11	5.9744	-9.544	155.774	-0.02337	0.39551	0.3785	0.2063	1.3252	3223.	678.5	0.698	0.0222	0.1108	0.00473	21.19	-65.00
-60.97b	14.696	75.72	5.3611	-8.016	156.263	-0.01953	0.39251	0.3793	0.2091	1.3276	3185.	680.3	0.679	0.0224	0.1099	0.00480	20.74	-60.97
-60.00	15.105	75.63	5.2246	-7.647	156.379	-0.01860	0.39180	0.3795	0.2097	1.3282	3176.	680.7	0.675	0.0224	0.1097	0.00482	20.63	-60.00
-55.00	17.354	75.15	4.5854	-5.744	156.971	-0.01389	0.38821	0.3805	0.2133	1.3314	3129.	682.8	0.653	0.0227	0.1086	0.00490	20.08	-55.00
-50.00	19.861	74.66	4.0383	-3.836	157.549	-0.00922	0.38472	0.3817	0.2170	1.3350	3081.	684.8	0.632	0.0230	0.1075	0.00499	19.53	-50.00
-45.00	22.646	74.17	3.5681	-1.921	158.111	-0.00459	0.38134	0.3829	0.2208	1.3390	3034.	686.5	0.611	0.0233	0.1064	0.00508	18.98	-45.00
-40.00	25.731	73.67	3.1625	0.000	158.658	0.00000	0.37805	0.3842	0.2247	1.3433	2986.	688.1	0.592	0.0236	0.1053	0.00516	18.44	-40.00
-35.00	29.137	73.17	2.8114	1.928	159.189	0.00455	0.37486	0.3857	0.2287	1.3481	2939.	689.6	0.573	0.0239	0.1042	0.00526	17.89	-35.00
-30.00	32.887	72.67	2.5062	3.864	159.703	0.00906	0.37175	0.3872	0.2329	1.3532	2891.	690.8	0.555	0.0242	0.1031	0.00535	17.36	-30.00
-25.00	37.003	72.16	2.2402	5.808	160.200	0.01353	0.36872	0.3888	0.2372	1.3589	2843.	691.9	0.538	0.0245	0.1020	0.00545	16.82	-25.00
-20.00	41.511	71.64	2.0076	7.761	160.679	0.01797	0.36577	0.3906	0.2416	1.3651	2795.	692.8	0.521	0.0248	0.1009	0.00555	16.29	-20.00
-15.00	46.433	71.12	1.8034	9.723	161.139	0.02238	0.36289	0.3924	0.2462	1.3718	2747.	693.6	0.505	0.0251	0.0998	0.00565	15.76	-15.00
-10.00	51.796	70.60	1.6237	11.694	161.579	0.02676	0.36008	0.3944	0.2510	1.3790	2699.	694.1	0.490	0.0254	0.0987	0.00575	15.24	-10.00
-5.00	57.625	70.06	1.4652	13.676	161.999	0.03111	0.35733	0.3965	0.2559	1.3869	2651.	694.4	0.475	0.0257	0.0976	0.00586	14.72	-5.00
0.00	63.947	69.52	1.3248	15.669	162.397	0.03543	0.35463	0.3987	0.2610	1.3955	2602.	694.6	0.461	0.0260	0.0964	0.00597	14.20	0.00
5.00	70.789	68.97	1.2002	17.673	162.774	0.03973	0.35199	0.4011	0.2662	1.4047	2553.	694.5	0.447	0.0263	0.0953	0.00609	13.69	5.00
10.00	78.179	68.42	1.0894	19.690	163.127	0.04400	0.34940	0.4037	0.2717	1.4148	2504.	694.3	0.434	0.0266	0.0942	0.00621	13.18	10.00
15.00	86.144	67.86	0.9905	21.719	163.455	0.04825	0.34685	0.4064	0.2774	1.4256	2455.	693.8	0.421	0.0269	0.0930	0.00634	12.67	15.00
20.00	94.715	67.28	0.9021	23.762	163.758	0.05248	0.34434	0.4093	0.2834	1.4375	2406.	693.1	0.408	0.0273	0.0919	0.00647	12.17	20.00
25.00	103.92	66.71	0.8228	25.820	164.034	0.05670	0.34187	0.4124	0.2897	1.4503	2356.	692.2	0.396	0.0276	0.0907	0.00661	11.67	25.00
30.00	113.79	66.12	0.7516	27.893	164.281	0.06090	0.33943	0.4157	0.2963	1.4642	2306.	691.1	0.384	0.0279	0.0895	0.00676	11.18	30.00
35.00	124.35	65.52	0.6874	29.983	164.499	0.06508	0.33701	0.4192	0.3032	1.4794	2256.	689.7	0.372	0.0283	0.0884	0.00691	10.69	35.00
40.00	135.65	64.91	0.6296	32.090	164.686	0.06926	0.33462	0.4230	0.3106	1.4959	2206.	688.1	0.361	0.0286	0.0872	0.00707	10.21	40.00
45.00	147.70	64.29	0.5773	34.215	164.839	0.07342	0.33225	0.4271	0.3184	1.5140	2155.	686.3	0.350	0.0290	0.0860	0.00724	9.73	45.00
50.00	160.54	63.65	0.5298	36.360	164.957	0.07758	0.32989	0.4316	0.3266	1.5337	2104.	684.2	0.339	0.0294	0.0848	0.00743	9.25	50.00
55.00	174.21	63.01	0.4868	38.526	165.039	0.08173	0.32754	0.4363	0.3355	1.5553	2052.	681.9	0.329	0.0297	0.0836	0.00764	8.78	55.00
60.00	188.74	62.35	0.4477	40.714	165.081	0.08588	0.32519	0.4415	0.3450	1.5790	2000.	679.3	0.319	0.0301	0.0823	0.00786	8.32	60.00
65.00	204.17	61.68	0.4120	42.927	165.081	0.09002	0.32284	0.4471	0.3552	1.6052	1947.	676.4	0.309	0.0305	0.0811	0.00811	7.86	65.00
70.00	220.52	60.99	0.3794	45.165	165.036	0.09418	0.32049	0.4533	0.3663	1.6341	1894.	673.2	0.299	0.0310	0.0799	0.00838	7.40	70.00
75.00	237.85	60.28	0.3496	47.431	164.944	0.09833	0.31812	0.4600	0.3783	1.6662	1840.	669.8	0.289	0.0314	0.0786	0.00868	6.96	75.00
80.00	256.18	59.56	0.3223	49.727	164.800	0.10250	0.31573	0.4674	0.3915	1.7019	1785.	666.1	0.280	0.0318	0.0773	0.00901	6.51	80.00
85.00	275.56	58.81	0.2972	52.055	164.602	0.10669	0.31332	0.4756	0.4060	1.7419	1730.	662.1	0.271	0.0323	0.0760	0.00938	6.07	85.00
90.00	296.02	58.04	0.2741	54.419	164.343	0.11089	0.31087	0.4847	0.4221	1.7869	1674.	657.7	0.262	0.0328	0.0747	0.00980	5.64	90.00
95.00	317.61	57.25	0.2529	56.821	164.020	0.11511	0.30838	0.4950	0.4400	1.8378	1617.	653.0	0.253	0.0333	0.0733	0.01028	5.22	95.00
100.00	340.37	56.43	0.2333	59.266	163.627	0.11937	0.30584	0.5066	0.4602	1.8958	1560.	648.0	0.244	0.0338	0.0719	0.01082	4.80	100.00
105.00	364.34	55.58	0.2151	61.758	163.155	0.12366	0.30323	0.5197	0.4831	1.9624	1501.	642.6	0.235	0.0344	0.0705	0.01145	4.39	105.00
110.00	389.58	54.69	0.1983	64.303	162.598	0.12800	0.30054	0.5349	0.5094	2.0397	1441.	636.8	0.227	0.0350	0.0691	0.01218	3.99	110.00
115.00	416.13	53.77	0.1826	66.907	161.945	0.13239	0.29777	0.5525	0.5399	2.1302	1379.	630.5	0.218	0.0356	0.0676	0.01303	3.59	115.00
120.00	444.04	52.80	0.1681															

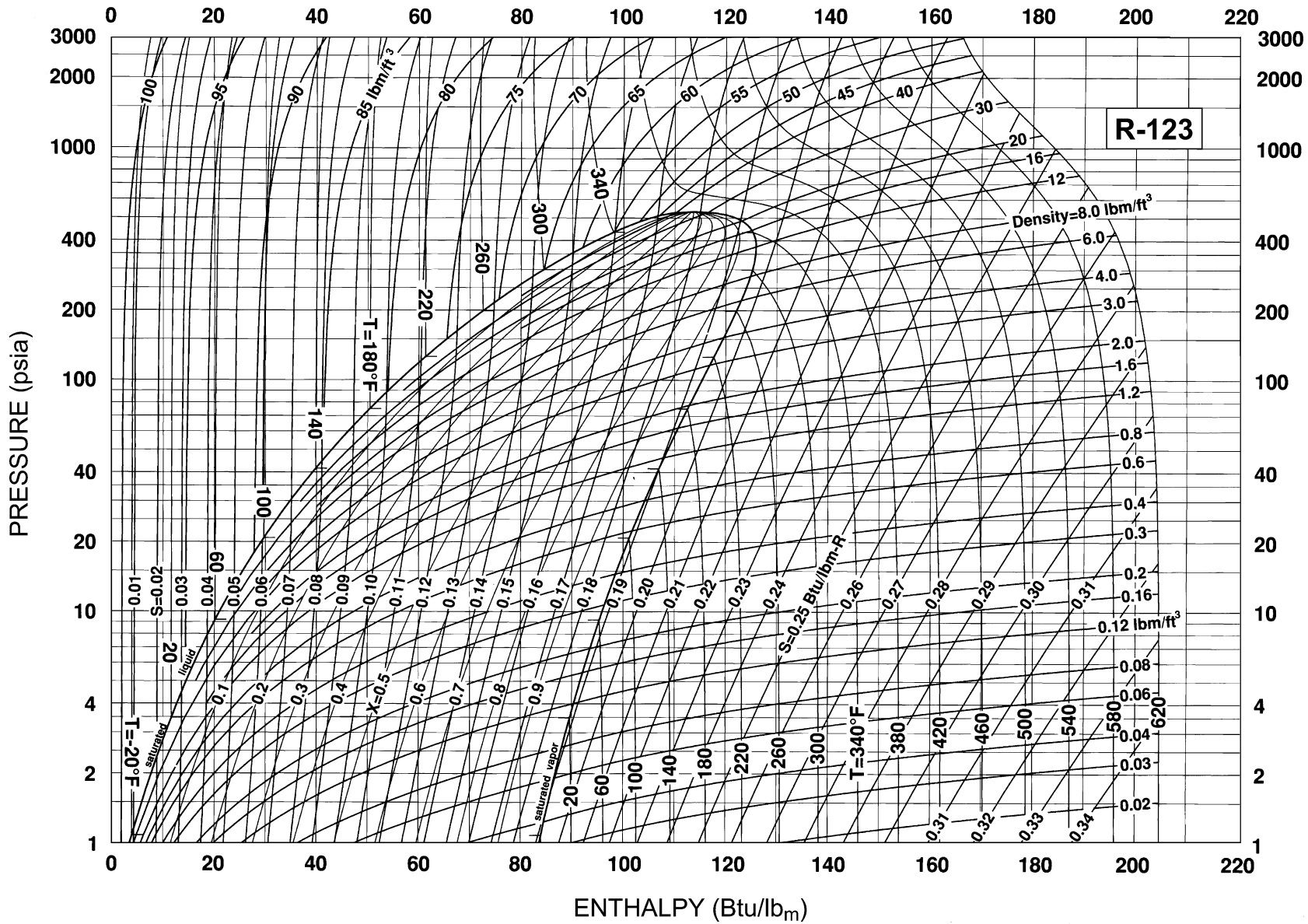


Fig. 5 Pressure-Enthalpy Diagram for Refrigerant 123

Refrigerant 123 (2,2-Dichloro-1,1,1-trifluoroethane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³		Volume, ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat <i>c_p</i> , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, Temp., dyne/cm °F
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	
-140.00	0.003	108.90	7431.6	-22.241	71.783	-0.06050	0.23363	0.2210	0.1181	1.1237	3928.	341.7	7.731	0.0146	0.0645	0.00135	30.50	-140.00	
-130.00	0.006	108.12	3871.0	-20.033	72.974	-0.05370	0.22843	0.2207	0.1203	1.1212	3854.	346.6	6.547	0.0151	0.0636	0.00153	29.75	-130.00	
-120.00	0.011	107.35	2111.6	-17.826	74.187	-0.04710	0.22379	0.2206	0.1226	1.1187	3778.	351.4	5.645	0.0157	0.0628	0.00171	29.01	-120.00	
-110.00	0.020	106.57	1201.0	-15.619	75.421	-0.04070	0.21966	0.2208	0.1248	1.1165	3702.	356.2	4.934	0.0163	0.0619	0.00190	28.27	-110.00	
-100.00	0.036	105.80	709.46	-13.410	76.676	-0.03447	0.21600	0.2211	0.1270	1.1144	3626.	360.8	4.359	0.0168	0.0611	0.00208	27.53	-100.00	
-90.00	0.060	105.03	433.83	-11.195	77.950	-0.02840	0.21275	0.2217	0.1291	1.1124	3549.	365.4	3.885	0.0174	0.0602	0.00226	26.80	-90.00	
-80.00	0.097	104.26	273.77	-8.975	79.244	-0.02247	0.20989	0.2224	0.1313	1.1106	3472.	369.9	3.488	0.0179	0.0593	0.00244	26.07	-80.00	
-70.00	0.154	103.48	177.81	-6.746	80.556	-0.01668	0.20737	0.2233	0.1334	1.1090	3394.	374.3	3.150	0.0185	0.0584	0.00263	25.34	-70.00	
-60.00	0.236	102.70	118.57	-4.509	81.885	-0.01101	0.20516	0.2243	0.1356	1.1075	3317.	378.5	2.860	0.0190	0.0575	0.00281	24.62	-60.00	
-50.00	0.354	101.92	80.999	-2.260	83.231	-0.00545	0.20323	0.2254	0.1377	1.1061	3240.	382.7	2.607	0.0196	0.0565	0.00299	23.91	-50.00	
-40.00	0.519	101.13	56.576	0.000	84.592	0.00000	0.20157	0.2266	0.1398	1.1050	3164.	386.8	2.386	0.0201	0.0555	0.00317	23.19	-40.00	
-30.00	0.744	100.34	40.333	2.272	85.967	0.00535	0.20014	0.2279	0.1420	1.1040	3087.	390.7	2.191	0.0206	0.0546	0.00335	22.48	-30.00	
-20.00	1.046	99.54	29.299	4.558	87.355	0.01061	0.19892	0.2292	0.1441	1.1032	3012.	394.5	2.018	0.0211	0.0536	0.00353	21.78	-20.00	
-10.00	1.445	98.73	21.655	6.857	88.754	0.01578	0.19790	0.2306	0.1463	1.1026	2936.	398.2	1.864	0.0217	0.0526	0.00371	21.08	-10.00	
0.00	1.963	97.92	16.264	9.170	90.163	0.02086	0.19706	0.2320	0.1484	1.1022	2862.	401.7	1.725	0.0222	0.0515	0.00390	20.38	0.00	
5.00	2.274	97.51	14.174	10.332	90.871	0.02337	0.19670	0.2327	0.1495	1.1021	2825.	403.3	1.661	0.0224	0.0510	0.00399	20.03	5.00	
10.00	2.625	97.10	12.396	11.498	91.582	0.02587	0.19638	0.2334	0.1506	1.1020	2788.	405.0	1.601	0.0227	0.0505	0.00408	19.69	10.00	
15.00	3.019	96.69	10.878	12.667	92.294	0.02834	0.19609	0.2341	0.1517	1.1020	2751.	406.6	1.543	0.0229	0.0501	0.00417	19.34	15.00	
20.00	3.460	96.28	9.5779	13.840	93.008	0.03080	0.19585	0.2349	0.1528	1.1020	2714.	408.1	1.488	0.0232	0.0496	0.00426	19.00	20.00	
25.00	3.952	95.86	8.4595	15.017	93.723	0.03324	0.19563	0.2356	0.1540	1.1021	2678.	409.6	1.435	0.0235	0.0491	0.00435	18.66	25.00	
30.00	4.499	95.44	7.4943	16.198	94.440	0.03566	0.19544	0.2364	0.1551	1.1023	2641.	411.0	1.385	0.0237	0.0486	0.00444	18.32	30.00	
35.00	5.106	95.02	6.6586	17.382	95.158	0.03806	0.19529	0.2371	0.1562	1.1025	2605.	412.4	1.337	0.0239	0.0481	0.00453	17.98	35.00	
40.00	5.778	94.60	5.9327	18.570	95.877	0.04045	0.19517	0.2379	0.1574	1.1028	2569.	413.7	1.292	0.0242	0.0476	0.00462	17.64	40.00	
45.00	6.519	94.17	5.3002	19.762	96.597	0.04282	0.19507	0.2387	0.1585	1.1031	2533.	414.9	1.248	0.0244	0.0471	0.00471	17.30	45.00	
50.00	7.334	93.74	4.7474	20.958	97.317	0.04518	0.19500	0.2394	0.1597	1.1035	2498.	416.1	1.207	0.0247	0.0467	0.00481	16.97	50.00	
55.00	8.229	93.31	4.2629	22.158	98.038	0.04752	0.19495	0.2402	0.1609	1.1040	2462.	417.3	1.167	0.0249	0.0462	0.00490	16.63	55.00	
60.00	9.208	92.88	3.8371	23.362	98.760	0.04984	0.19493	0.2410	0.1621	1.1046	2427.	418.3	1.129	0.0252	0.0457	0.00499	16.30	60.00	
65.00	10.278	92.44	3.4617	24.570	99.481	0.05215	0.19493	0.2418	0.1633	1.1052	2392.	419.4	1.092	0.0254	0.0453	0.00508	15.97	65.00	
70.00	11.445	92.01	3.1301	25.782	100.203	0.05444	0.19495	0.2426	0.1645	1.1059	2357.	420.3	1.057	0.0256	0.0448	0.00518	15.64	70.00	
75.00	12.713	91.56	2.8362	26.998	100.924	0.05673	0.19499	0.2434	0.1657	1.1067	2322.	421.2	1.023	0.0259	0.0444	0.00527	15.31	75.00	
80.00	14.090	91.12	2.5753	28.218	101.645	0.05899	0.19505	0.2442	0.1669	1.1075	2287.	422.0	0.991	0.0261	0.0439	0.00537	14.98	80.00	
82.08b	14.696	90.94	2.4753	28.728	101.945	0.05993	0.19508	0.2445	0.1675	1.1079	2273.	422.3	0.978	0.0262	0.0437	0.00540	14.84	82.08	
85.00	15.580	90.67	2.3429	29.443	102.365	0.06124	0.19513	0.2450	0.1682	1.1085	2252.	422.7	0.960	0.0264	0.0435	0.00546	14.65	85.00	
90.00	17.192	90.22	2.1356	30.671	103.085	0.06348	0.19522	0.2458	0.1695	1.1095	2218.	423.3	0.930	0.0266	0.0430	0.00556	14.33	90.00	
95.00	18.931	89.77	1.9503	31.904	103.804	0.06571	0.19534	0.2467	0.1707	1.1106	2184.	423.9	0.901	0.0268	0.0426	0.00565	14.00	95.00	
100.00	20.804	89.31	1.7841	33.141	104.521	0.06792	0.19546	0.2475	0.1720	1.1119	2149.	424.4	0.874	0.0271	0.0422	0.00575	13.68	100.00	
105.00	22.819	88.85	1.6349	34.383	105.238	0.07012	0.19560	0.2484	0.1734	1.1132	2115.	424.8	0.847	0.0273	0.0418	0.00585	13.36	105.00	
110.00	24.980	88.39	1.5006	35.628	105.953	0.07231	0.19576	0.2492	0.1747	1.1146	2081.	425.2	0.822	0.0275	0.0413	0.00595	13.04	110.00	
115.00	27.297	87.92	1.3795	36.879	106.666	0.07449	0.19593	0.2501	0.1761	1.1162	2047.	425.4	0.797	0.0277	0.0409	0.00604	12.72	115.00	
120.00	29.776	87.45	1.2701	38.134	107.377	0.07665	0.19611	0.2510	0.1775	1.1178	2014.	425.6	0.773	0.0280	0.0405	0.00614	12.41	120.00	
125.00	32.425	86.98	1.1710	39.393	108.086	0.07881	0.19630	0.2520	0.1789	1.1196	1980.	425.6	0.751	0.0282	0.0401	0.00625	12.09	125.00	
130.00	35.251	86.50	1.0812	40.657	108.792	0.08095	0.19650	0.2529	0.1803	1.1215	1946.	425.6	0.728	0.0284	0.0397	0.00635	11.78	130.00	
135.00	38.261	86.01	0.9996	41.926	109.497	0.08308	0.19671	0.2539	0.1818	1.1236	1913.	425.5	0.707	0.0287	0.0393	0.00645	11.47	135.00	
140.00	41.464	85.52	0.9253	43.200	110.198	0.08520	0.19693	0.2548	0.1833	1.1258	1879.	425.3	0.687	0.0289	0.0389	0.00656	11.16	140.00	
145.00	44.868	85.03	0.8577	44.479	110.896	0.08732	0.19716	0.2559	0.1848	1.1281	1846.	425.0	0.667	0.0291	0.0385	0.00666	10.85	145.00	
150.00	48.479	84.53	0.7959	45.763	111.591	0.08942	0.19739	0.2569	0.1863	1.1306	1813.	424.6	0.648	0.0293	0.0381	0.00677	10.54	150.00	
160.00	56.360	83.52	0.6876	48.347	112.970	0.09359	0.19788	0.2591	0.1896	1.1362	1746.	423.5	0.611	0.0298	0.0374	0.00699	9.93	160.00	
170.00	65.173	82.49	0.5965	50.953	114.333	0.09773	0.19839	0.2614	0.1929	1.1426	1680.	422.0	0.577	0.0303	0.0366	0.00722	9.33	170.00	
180.00	74.986	81.43	0.5195	53.583	115.678	0.10184	0.19892	0.2638	0.1965	1.1499	1614.	420.1	0.545	0.0307	0.0359	0.00745	8.74	180.00	
190.00	85.868	80.34	0.4539	56.237	117.001	0.10592	0.19945	0.2665	0.2004	1.1583	1548.	417.7	0.515	0.0312	0.0352	0.00769	8.15	190.00	
200.00	97.892	79.23	0.3979	58.918	118.300	0.10997	0.19999	0.2694	0.2045	1.1681	1482.	414.7	0.487	0.0317	0.0345	0.00795	7.57	200.00	
210.00	111.13	78.08	0.3497	61.627	119.572	0.11400	0.20053	0.2726	0.2089	1.1793	1416.	411.3	0.460	0.0322	0.0338	0.00821	7.00	210.00	
220.00	125.66	76.89	0.3080	64.367	120.813	0.11801	0.20106	0.2761	0.2138	1.1925	1349.	407.3	0.435	0.0328	0.0331	0.00849	6.44	220.00	
230.00	141.56	75.66	0.2719	67.141	122.019	0.12201	0.20158	0.2800	0.2191	1.2079	1283.	402.8	0.411	0.0334	0.0324	0.00877	5.88	230.00	
240.00	158.91	74.38	0.2404	69.952	123.184	0.12599	0.20207	0.2845	0.2251	1.2262	1216.	397.6	0.388	0.0340	0.0317	0.00908	5.34	240.00	
250.00	177.80	73.04	0.2128	72.805	124.303	0.12997	0.20254	0.2896	0.2319	1.2482	1148.	391.7	0.367	0.0347					

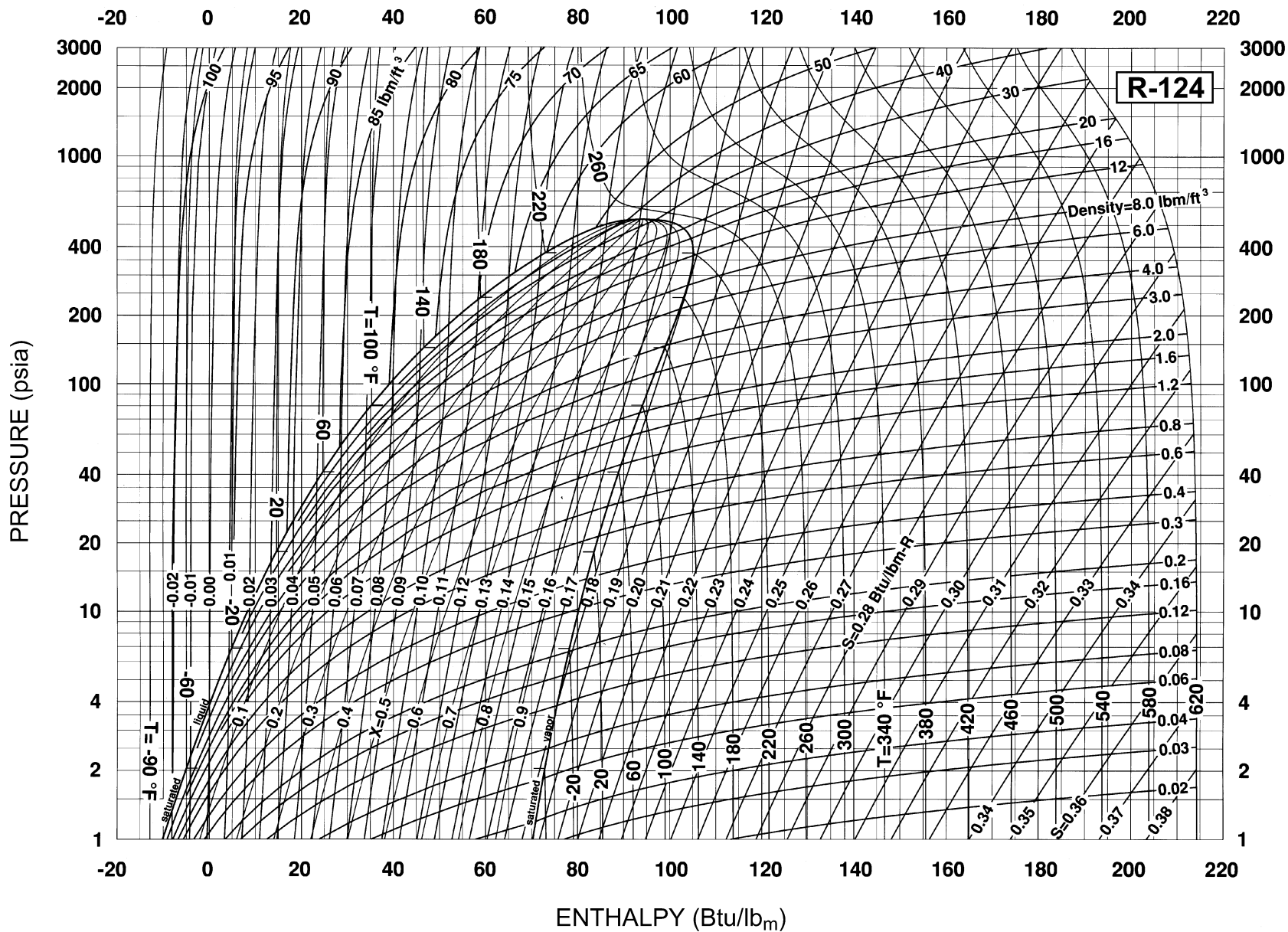


Fig. 6 Pressure-Enthalpy Diagram for Refrigerant 124

Refrigerant 124 (2-Chloro-1,1,1,2-tetrafluoroethane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³ Liquid	Volume, ft ³ /lb Vapor	Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat <i>c_p</i> , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
				Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-150.00	0.030	107.22	800.14	-25.872	61.843	-0.07135	0.21191	0.2276	0.1271	1.1298	3468.	356.9	—	—	—	—	26.26	-150.00
-140.00	0.056	106.32	450.73	-23.590	63.119	-0.06409	0.20715	0.2288	0.1294	1.1274	3386.	362.1	—	—	—	—	25.47	-140.00
-130.00	0.098	105.41	264.79	-21.295	64.415	-0.05703	0.20296	0.2300	0.1317	1.1253	3304.	367.2	—	—	—	—	24.69	-130.00
-120.00	0.165	104.51	161.57	-18.988	65.729	-0.05013	0.19928	0.2313	0.1340	1.1233	3223.	372.2	—	—	—	—	23.92	-120.00
-110.00	0.269	103.59	102.02	-16.668	67.061	-0.04340	0.19605	0.2327	0.1364	1.1215	3142.	377.1	2.921	0.0181	0.0607	0.00337	23.15	-110.00
-100.00	0.424	102.68	66.458	-14.334	68.410	-0.03682	0.19323	0.2341	0.1387	1.1200	3062.	381.8	2.541	0.0186	0.0594	0.00352	22.38	-100.00
-90.00	0.650	101.76	44.529	-11.985	69.773	-0.03038	0.19078	0.2356	0.1411	1.1187	2982.	386.4	2.238	0.0192	0.0581	0.00368	21.62	-90.00
-80.00	0.969	100.83	30.612	-9.621	71.149	-0.02407	0.18866	0.2372	0.1435	1.1176	2902.	390.8	1.992	0.0197	0.0568	0.00384	20.86	-80.00
-70.00	1.411	99.89	21.542	-7.241	72.537	-0.01789	0.18685	0.2387	0.1460	1.1168	2823.	395.0	1.788	0.0202	0.0555	0.00400	20.11	-70.00
-60.00	2.008	98.95	15.485	-4.844	73.935	-0.01182	0.18529	0.2404	0.1485	1.1163	2745.	398.9	1.616	0.0207	0.0543	0.00416	19.36	-60.00
-50.00	2.801	98.00	11.350	-2.431	75.342	-0.00586	0.18398	0.2421	0.1512	1.1162	2667.	402.7	1.469	0.0213	0.0531	0.00433	18.61	-50.00
-45.00	3.284	97.52	9.7829	-1.218	76.047	-0.00292	0.18341	0.2430	0.1525	1.1162	2629.	404.5	1.403	0.0215	0.0525	0.00441	18.24	-45.00
-40.00	3.832	97.03	8.4679	0.000	76.754	0.00000	0.18289	0.2439	0.1539	1.1164	2590.	406.2	1.342	0.0218	0.0519	0.00450	17.88	-40.00
-35.00	4.454	96.55	7.3594	1.222	77.462	0.00289	0.18242	0.2448	0.1553	1.1166	2552.	407.8	1.285	0.0220	0.0513	0.00459	17.51	-35.00
-30.00	5.154	96.06	6.4208	2.449	78.171	0.00576	0.18199	0.2457	0.1567	1.1169	2514.	409.4	1.232	0.0223	0.0507	0.00467	17.14	-30.00
-25.00	5.941	95.57	5.6227	3.681	78.881	0.00861	0.18161	0.2466	0.1581	1.1173	2476.	410.9	1.181	0.0226	0.0502	0.00476	16.78	-25.00
-20.00	6.821	95.08	4.9412	4.918	79.590	0.01143	0.18127	0.2476	0.1596	1.1179	2438.	412.3	1.134	0.0228	0.0496	0.00485	16.41	-20.00
-15.00	7.803	94.58	4.3571	6.159	80.300	0.01424	0.18097	0.2486	0.1611	1.1185	2400.	413.6	1.090	0.0231	0.0490	0.00494	16.05	-15.00
-10.00	8.896	94.08	3.8545	7.406	81.010	0.01702	0.18071	0.2496	0.1626	1.1193	2362.	414.9	1.048	0.0233	0.0485	0.00503	15.69	-10.00
-5.00	10.106	93.57	3.4204	8.657	81.720	0.01978	0.18048	0.2506	0.1642	1.1201	2324.	416.1	1.008	0.0236	0.0479	0.00512	15.33	-5.00
0.00	11.444	93.06	3.0442	9.914	82.429	0.02253	0.18028	0.2516	0.1658	1.1211	2287.	417.1	0.971	0.0238	0.0474	0.00521	14.97	0.00
5.00	12.918	92.55	2.7171	11.176	83.137	0.02525	0.18011	0.2527	0.1674	1.1222	2250.	418.1	0.935	0.0241	0.0468	0.00530	14.62	5.00
10.00	14.537	92.04	2.4317	12.444	83.843	0.02796	0.17998	0.2538	0.1690	1.1235	2212.	419.0	0.902	0.0244	0.0463	0.00539	14.26	10.00
10.47b	14.696	91.99	2.4070	12.563	83.909	0.02821	0.17997	0.2539	0.1692	1.1236	2209.	419.1	0.899	0.0244	0.0462	0.00540	14.23	10.47
15.00	16.312	91.51	2.1820	13.717	84.549	0.03065	0.17987	0.2549	0.1708	1.1249	2175.	419.8	0.870	0.0246	0.0458	0.00549	13.91	15.00
20.00	18.252	90.99	1.9627	14.996	85.253	0.03332	0.17979	0.2560	0.1725	1.1264	2138.	420.5	0.839	0.0249	0.0452	0.00558	13.56	20.00
25.00	20.368	90.46	1.7697	16.281	85.955	0.03597	0.17973	0.2572	0.1743	1.1281	2101.	421.1	0.810	0.0251	0.0447	0.00568	13.21	25.00
30.00	22.670	89.92	1.5993	17.572	86.655	0.03861	0.17969	0.2583	0.1761	1.1300	2064.	421.6	0.782	0.0254	0.0442	0.00577	12.86	30.00
35.00	25.169	89.38	1.4484	18.868	87.352	0.04124	0.17968	0.2595	0.1780	1.1320	2028.	422.0	0.756	0.0256	0.0437	0.00587	12.51	35.00
40.00	27.876	88.84	1.3145	20.171	88.047	0.04385	0.17969	0.2608	0.1799	1.1342	1991.	422.3	0.730	0.0259	0.0431	0.00597	12.16	40.00
45.00	30.802	88.29	1.1953	21.481	88.739	0.04644	0.17971	0.2621	0.1819	1.1365	1955.	422.4	0.706	0.0261	0.0426	0.00607	11.82	45.00
50.00	33.959	87.73	1.0890	22.797	89.427	0.04902	0.17976	0.2634	0.1839	1.1391	1918.	422.4	0.682	0.0264	0.0421	0.00617	11.48	50.00
55.00	37.358	87.17	0.9939	24.119	90.112	0.05159	0.17982	0.2647	0.1859	1.1419	1882.	422.4	0.660	0.0267	0.0416	0.00627	11.14	55.00
60.00	41.011	86.60	0.9087	25.449	90.793	0.05415	0.17989	0.2661	0.1881	1.1450	1845.	422.1	0.638	0.0269	0.0411	0.00637	10.80	60.00
65.00	44.931	86.02	0.8322	26.786	91.470	0.05669	0.17998	0.2675	0.1903	1.1482	1809.	421.8	0.618	0.0272	0.0406	0.00648	10.46	65.00
70.00	49.129	85.44	0.7633	28.129	92.143	0.05922	0.18008	0.2690	0.1925	1.1517	1773.	421.3	0.598	0.0275	0.0401	0.00659	10.12	70.00
75.00	53.619	84.85	0.7011	29.481	92.810	0.06174	0.18019	0.2706	0.1948	1.1556	1737.	420.7	0.578	0.0277	0.0396	0.00669	9.79	75.00
80.00	58.413	84.25	0.6449	30.840	93.472	0.06426	0.18031	0.2721	0.1972	1.1597	1700.	420.0	0.560	0.0280	0.0391	0.00680	9.46	80.00
85.00	63.524	83.65	0.5940	32.207	94.129	0.06676	0.18044	0.2738	0.1997	1.1641	1664.	419.1	0.542	0.0283	0.0386	0.00691	9.13	85.00
90.00	68.966	83.03	0.5478	33.582	94.779	0.06925	0.18058	0.2755	0.2023	1.1689	1628.	418.1	0.524	0.0285	0.0381	0.00703	8.80	90.00
95.00	74.750	82.41	0.5058	34.966	95.423	0.07173	0.18073	0.2773	0.2049	1.1741	1592.	416.9	0.507	0.0288	0.0376	0.00714	8.48	95.00
100.00	80.893	81.77	0.4676	36.358	96.060	0.07420	0.18088	0.2791	0.2077	1.1797	1555.	415.6	0.491	0.0291	0.0372	0.00726	8.15	100.00
105.00	87.406	81.13	0.4327	37.760	96.689	0.07667	0.18103	0.2810	0.2106	1.1858	1519.	414.1	0.475	0.0294	0.0367	0.00738	7.83	105.00
110.00	94.304	80.47	0.4008	39.171	97.311	0.07913	0.18119	0.2831	0.2136	1.1925	1483.	412.4	0.460	0.0297	0.0362	0.00750	7.51	110.00
115.00	101.60	79.81	0.3716	40.592	97.923	0.08158	0.18135	0.2852	0.2167	1.1997	1446.	410.6	0.445	0.0300	0.0357	0.00763	7.20	115.00
120.00	109.31	79.13	0.3448	42.023	98.526	0.08403	0.18151	0.2875	0.2200	1.2075	1410.	408.6	0.431	0.0303	0.0352	0.00776	6.88	120.00
125.00	117.45	78.44	0.3202	43.465	99.120	0.08648	0.18167	0.2898	0.2235	1.2161	1373.	406.4	0.417	0.0306	0.0347	0.00789	6.57	125.00
130.00	126.04	77.73	0.2976	44.918	99.702	0.08892	0.18182	0.2924	0.2271	1.2255	1336.	404.0	0.403	0.0309	0.0343	0.00803	6.26	130.00
135.00	135.08	77.01	0.2767	46.383	100.272	0.09135	0.18197	0.2950	0.2310	1.2358	1299.	401.4	0.389	0.0312	0.0338	0.00817	5.95	135.00
140.00	144.60	76.28	0.2575	47.860	100.830	0.09379	0.18212	0.2979	0.2352	1.2472	1262.	398.7	0.376	0.0316	0.0333	0.00832	5.65	140.00
145.00	154.60	75.52	0.2397	49.351	101.374	0.09622	0.18226	0.3009	0.2396	1.2598	1224.	395.7	0.364	0.0319	0.0328	0.00847	5.35	145.00
150.00	165.12	74.75	0.2232	50.855	101.903	0.09866	0.18239	0.3042	0.2444	1.2737	1186.	392.5	0.351	0.0323	0.0324	0.00862	5.05	150.00
155.00	176.16	73.96	0.2080	52.374	102.416	0.10110	0.18251	0.3078	0.2496	1.2892	1148.	389.1	0.339	0.0327	0.0319	0.00879	4.75	155.00
160.00	187.74	73.14	0.1938	53.909	102.911	0.10354	0.18261	0.3117	0.2552	1.3066	1110.	385.4	0.327	0.0331	0.0314	0.00896	4.46	160.00
165.00	199.87	72.30	0.1806	55.460	103.387	0.10598	0.18270	0.3159	0.2614	1.3262	1071.	381.5	0.315	0.0335	0.0309	0.00915	4.17	165.00
170.00	212.59	71.44	0.1683	57.030	103.841	0.10843	0.18277	0.3206	0.2682	1.3484	1031.	377.4	0.303	0.0339	0.0305	0.00934	3.88	170.00
175.00	225.90	70.54	0.1568	58.619	104.272	0.11089	0.18282	0.3258	0.2757	1.3737	992.	373.0	0.292	0.0344	0.0300			

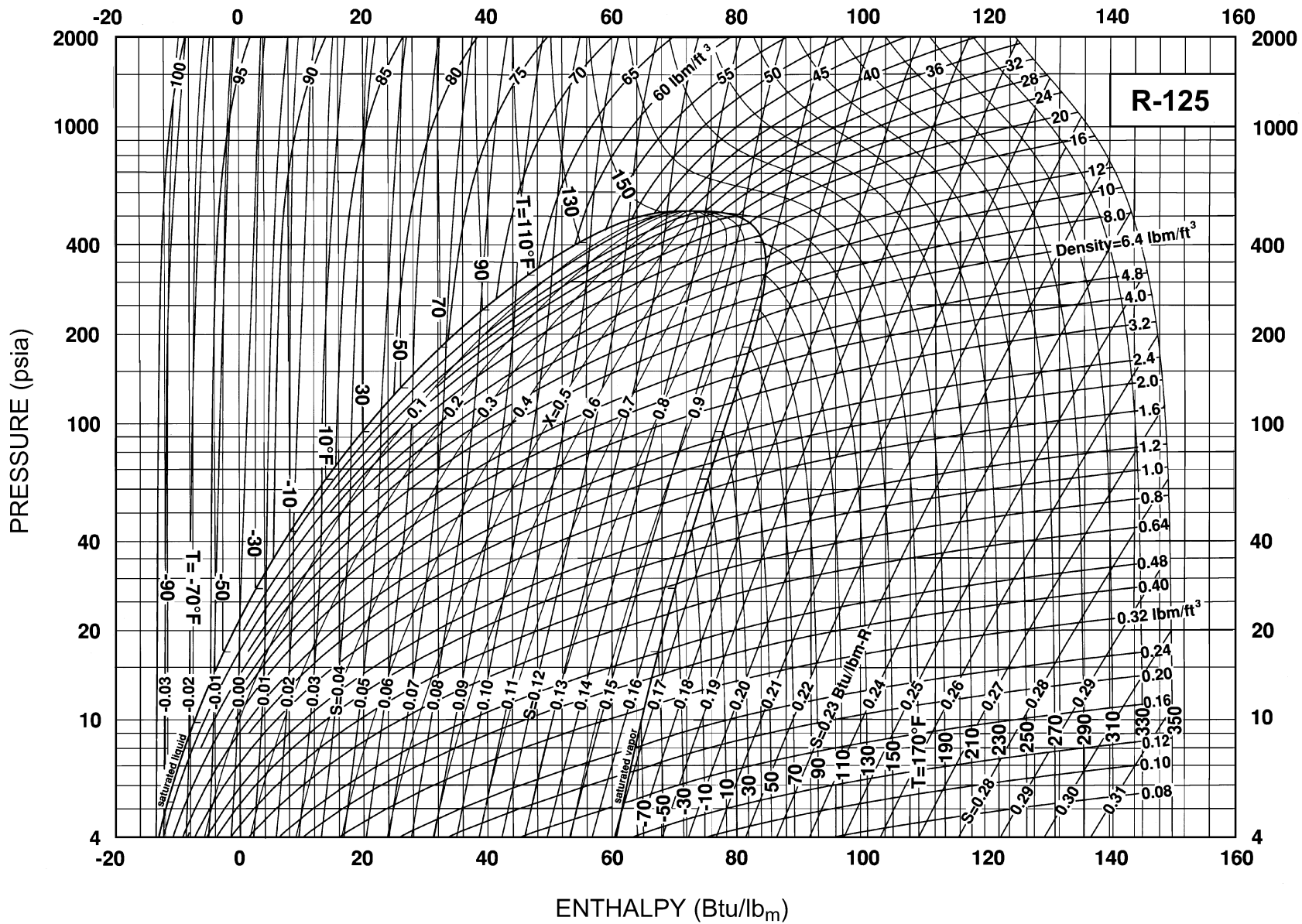


Fig. 7 Pressure-Enthalpy Diagram for Refrigerant 125

Refrigerant 125 (Pentafluoroethane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³		Volume, ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, Temp., dyne/cm °F	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
-149.13a	0.427	105.56	64.848	-28.057	53.649	-0.07717	0.18595	0.2494	0.1360	1.1416	3132.	382.0	2.945	0.0180	0.0696	0.00331	21.79	-149.13		
-145.00	0.526	105.09	53.294	-27.026	54.199	-0.07387	0.18426	0.2495	0.1372	1.1407	3086.	384.2	2.746	0.0182	0.0688	0.00338	21.42	-145.00		
-140.00	0.671	104.52	42.385	-25.778	54.867	-0.06993	0.18234	0.2497	0.1387	1.1398	3031.	386.8	2.536	0.0185	0.0679	0.00347	20.97	-140.00		
-135.00	0.849	103.95	34.002	-24.529	55.540	-0.06606	0.18056	0.2500	0.1402	1.1389	2978.	389.3	2.352	0.0188	0.0669	0.00356	20.53	-135.00		
-130.00	1.065	103.38	27.501	-23.277	56.215	-0.06223	0.17889	0.2504	0.1417	1.1382	2926.	391.7	2.190	0.0191	0.0660	0.00365	20.08	-130.00		
-125.00	1.325	102.81	22.416	-22.024	56.894	-0.05846	0.17735	0.2510	0.1433	1.1376	2875.	394.1	2.046	0.0194	0.0651	0.00374	19.64	-125.00		
-120.00	1.636	102.24	18.405	-20.767	57.575	-0.05474	0.17591	0.2516	0.1449	1.1371	2824.	396.4	1.918	0.0197	0.0642	0.00383	19.20	-120.00		
-115.00	2.005	101.67	15.217	-19.507	58.259	-0.05106	0.17457	0.2522	0.1466	1.1368	2775.	398.7	1.802	0.0200	0.0633	0.00392	18.76	-115.00		
-110.00	2.440	101.10	12.664	-18.244	58.944	-0.04742	0.17333	0.2530	0.1483	1.1366	2726.	400.9	1.698	0.0203	0.0624	0.00402	18.32	-110.00		
-105.00	2.950	100.52	10.605	-16.976	59.631	-0.04382	0.17217	0.2538	0.1500	1.1365	2678.	402.9	1.603	0.0206	0.0615	0.00411	17.89	-105.00		
-100.00	3.544	99.94	8.9339	-15.705	60.318	-0.04026	0.17110	0.2547	0.1518	1.1367	2631.	405.0	1.517	0.0209	0.0607	0.00421	17.46	-100.00		
-95.00	4.232	99.35	7.5682	-14.428	61.007	-0.03674	0.17012	0.2556	0.1537	1.1369	2584.	406.9	1.438	0.0211	0.0599	0.00430	17.03	-95.00		
-90.00	5.026	98.77	6.4454	-13.147	61.696	-0.03326	0.16920	0.2566	0.1556	1.1374	2538.	408.7	1.365	0.0214	0.0590	0.00440	16.60	-90.00		
-85.00	5.935	98.18	5.5170	-11.860	62.384	-0.02981	0.16836	0.2577	0.1576	1.1380	2492.	410.4	1.298	0.0217	0.0582	0.00450	16.17	-85.00		
-80.00	6.973	97.58	4.7449	-10.568	63.073	-0.02638	0.16758	0.2588	0.1596	1.1388	2447.	412.0	1.236	0.0220	0.0574	0.00460	15.75	-80.00		
-75.00	8.152	96.98	4.0995	-9.270	63.760	-0.02299	0.16686	0.2599	0.1617	1.1398	2402.	413.6	1.178	0.0223	0.0566	0.00470	15.33	-75.00		
-70.00	9.485	96.38	3.5572	-7.966	64.446	-0.01963	0.16620	0.2611	0.1639	1.1410	2357.	415.0	1.124	0.0226	0.0558	0.00481	14.91	-70.00		
-65.00	10.986	95.77	3.0993	-6.656	65.131	-0.01630	0.16559	0.2624	0.1661	1.1424	2313.	416.3	1.073	0.0229	0.0550	0.00491	14.49	-65.00		
-60.00	12.670	95.16	2.7109	-5.339	65.813	-0.01299	0.16504	0.2637	0.1684	1.1440	2269.	417.4	1.026	0.0232	0.0542	0.00502	14.07	-60.00		
-55.00	14.551	94.54	2.3799	-4.015	66.494	-0.00971	0.16453	0.2651	0.1707	1.1458	2226.	418.5	0.982	0.0235	0.0535	0.00512	13.66	-55.00		
-54.64b	14.696	94.50	2.3579	-3.919	66.543	-0.00947	0.16449	0.2652	0.1709	1.1459	2223.	418.6	0.979	0.0235	0.0534	0.00513	13.63	-54.64		
-50.00	16.646	93.92	2.0967	-2.684	67.171	-0.00645	0.16407	0.2665	0.1731	1.1478	2182.	419.4	0.940	0.0237	0.0527	0.00523	13.25	-50.00		
-45.00	18.971	93.28	1.8534	-1.346	67.846	-0.00321	0.16365	0.2680	0.1756	1.1501	2139.	420.2	0.901	0.0240	0.0519	0.00534	12.84	-45.00		
-40.00	21.542	92.65	1.6435	0.000	68.517	0.00000	0.16326	0.2695	0.1781	1.1526	2096.	420.9	0.864	0.0243	0.0512	0.00545	12.44	-40.00		
-35.00	24.377	92.00	1.4618	1.354	69.184	0.00319	0.16292	0.2711	0.1807	1.1554	2053.	421.4	0.829	0.0246	0.0504	0.00556	12.03	-35.00		
-30.00	27.493	91.35	1.3039	2.716	69.847	0.00637	0.16261	0.2728	0.1834	1.1584	2011.	421.7	0.795	0.0249	0.0497	0.00568	11.63	-30.00		
-25.00	30.909	90.69	1.1661	4.087	70.506	0.00952	0.16233	0.2745	0.1861	1.1617	1968.	422.0	0.764	0.0252	0.0490	0.00579	11.24	-25.00		
-20.00	34.643	90.02	1.0457	5.466	71.159	0.01266	0.16208	0.2762	0.1889	1.1654	1926.	422.0	0.734	0.0255	0.0482	0.00591	10.84	-20.00		
-15.00	38.715	89.34	0.9399	6.854	71.807	0.01578	0.16185	0.2781	0.1918	1.1694	1883.	421.9	0.705	0.0258	0.0475	0.00603	10.45	-15.00		
-10.00	43.144	88.65	0.8468	8.252	72.449	0.01889	0.16165	0.2800	0.1947	1.1737	1841.	421.7	0.677	0.0261	0.0468	0.00615	10.06	-10.00		
-5.00	47.949	87.95	0.7646	9.660	73.084	0.02198	0.16147	0.2819	0.1978	1.1785	1798.	421.2	0.651	0.0264	0.0460	0.00628	9.67	-5.00		
0.00	53.152	87.24	0.6917	11.077	73.712	0.02505	0.16132	0.2840	0.2009	1.1836	1756.	420.6	0.626	0.0267	0.0453	0.00641	9.29	0.00		
5.00	58.773	86.52	0.6271	12.505	74.333	0.02812	0.16118	0.2861	0.2042	1.1893	1713.	419.8	0.602	0.0271	0.0446	0.00653	8.91	5.00		
10.00	64.834	85.79	0.5695	13.944	74.945	0.03117	0.16105	0.2884	0.2075	1.1954	1671.	418.9	0.579	0.0274	0.0439	0.00667	8.53	10.00		
15.00	71.355	85.05	0.5180	15.394	75.549	0.03421	0.16094	0.2907	0.2110	1.2021	1628.	417.7	0.557	0.0277	0.0432	0.00680	8.16	15.00		
20.00	78.359	84.29	0.4720	16.856	76.142	0.03724	0.16084	0.2932	0.2146	1.2095	1585.	416.3	0.535	0.0281	0.0425	0.00694	7.79	20.00		
25.00	85.868	83.51	0.4307	18.329	76.725	0.04026	0.16075	0.2958	0.2184	1.2176	1542.	414.7	0.515	0.0284	0.0418	0.00709	7.42	25.00		
30.00	93.906	82.73	0.3936	19.816	77.297	0.04328	0.16067	0.2985	0.2224	1.2265	1499.	412.9	0.495	0.0287	0.0411	0.00722	7.06	30.00		
35.00	102.49	81.92	0.3601	21.316	77.856	0.04629	0.16059	0.3014	0.2266	1.2363	1456.	410.9	0.476	0.0291	0.0404	0.00736	6.70	35.00		
40.00	111.66	81.10	0.3298	22.829	78.402	0.04929	0.16051	0.3044	0.2311	1.2471	1413.	408.7	0.457	0.0294	0.0397	0.00750	6.34	40.00		
45.00	121.42	80.25	0.3024	24.357	78.933	0.05229	0.16043	0.3077	0.2358	1.2592	1369.	406.2	0.439	0.0298	0.0390	0.00765	5.99	45.00		
50.00	131.81	79.39	0.2775	25.901	79.448	0.05528	0.16035	0.3112	0.2409	1.2726	1325.	403.5	0.422	0.0301	0.0383	0.00781	5.64	50.00		
55.00	142.85	78.50	0.2549	27.460	79.946	0.05828	0.16026	0.3150	0.2463	1.2876	1281.	400.5	0.405	0.0305	0.0376	0.00798	5.29	55.00		
60.00	154.56	77.59	0.2343	29.037	80.424	0.06127	0.16016	0.3190	0.2522	1.3044	1236.	397.2	0.388	0.0309	0.0369	0.00816	4.95	60.00		
65.00	166.97	76.65	0.2155	30.633	80.882	0.06427	0.16004	0.3235	0.2587	1.3235	1191.	393.7	0.372	0.0314	0.0362	0.00834	4.62	65.00		
70.00	180.12	75.69	0.1982	32.248	81.316	0.06727	0.15991	0.3284	0.2658	1.3451	1145.	389.8	0.357	0.0319	0.0355	0.00854	4.29	70.00		
75.00	194.02	74.68	0.1824	33.885	81.724	0.07029	0.15976	0.3337	0.2736	1.3699	1099.	385.7	0.341	0.0324	0.0348	0.00875	3.96	75.00		
80.00	208.71	73.65	0.1679	35.544	82.103	0.07331	0.15958	0.3398	0.2825	1.3985	1053.	381.2	0.326	0.0329	0.0341	0.00898	3.64	80.00		
85.00	224.22	72.57	0.1545	37.229	82.450	0.07634	0.15937	0.3466	0.2925	1.4318	1006.	376.4	0.312	0.0334	0.0334	0.00922	3.32	85.00		
90.00	240.58	71.44	0.1421	38.942	82.761	0.07940	0.15911	0.3543	0.3040	1.4710	958.	371.3	0.297	0.0339	0.0327	0.00949	3.01	90.00		
95.00	257.83	70.26	0.1307	40.686	83.030	0.08247	0.15881	0.3632	0.3174	1.5176	910.	365.7	0.283	0.0344	0.0320	0.00979	2.71	95.00		
100.00	276.00	69.02	0.1201	42.466	83.252	0.08558	0.15846	0.3737	0.3332	1.5739	861.	359.8	0.269	0.0349	0.0313	0.01012	2.41	100.00		
105.00	295.13	67.71	0.1101	44.285	83.419	0.08872	0.15803	0.3862	0.3523	1.6431	810.	353.5	0.255	0.0354	0.0306	0.01050	2.12	105.00		
110.00	315.25	66.32	0.1009	46.150	83.521	0.09191	0.15752	0.4016	0.3758	1.7299	759.	346.7	0.241	0.0360	0.0299	0.01093	1.84	110.00		
115.00	336.42	64.82	0.0922	48.070	83.545	0.09517	0.15690	0.4208	0.4058	1.8417	707.	339.5	0.227	0.0366	0.0292	0.01143	1.56	115.00		
120.00	358.69	63.20	0.0840	50.056	83.474	0.09849	0.15614	0.4458	0.4452	1.9905	653.	331.7	0.213	0.0373	0.0285	0.01203	1.30	120.00		
125.00	382.10	61.42	0.0762	52.125	83.282	0.10193	0.15522	0.4800	0.4997	2.1979	59									

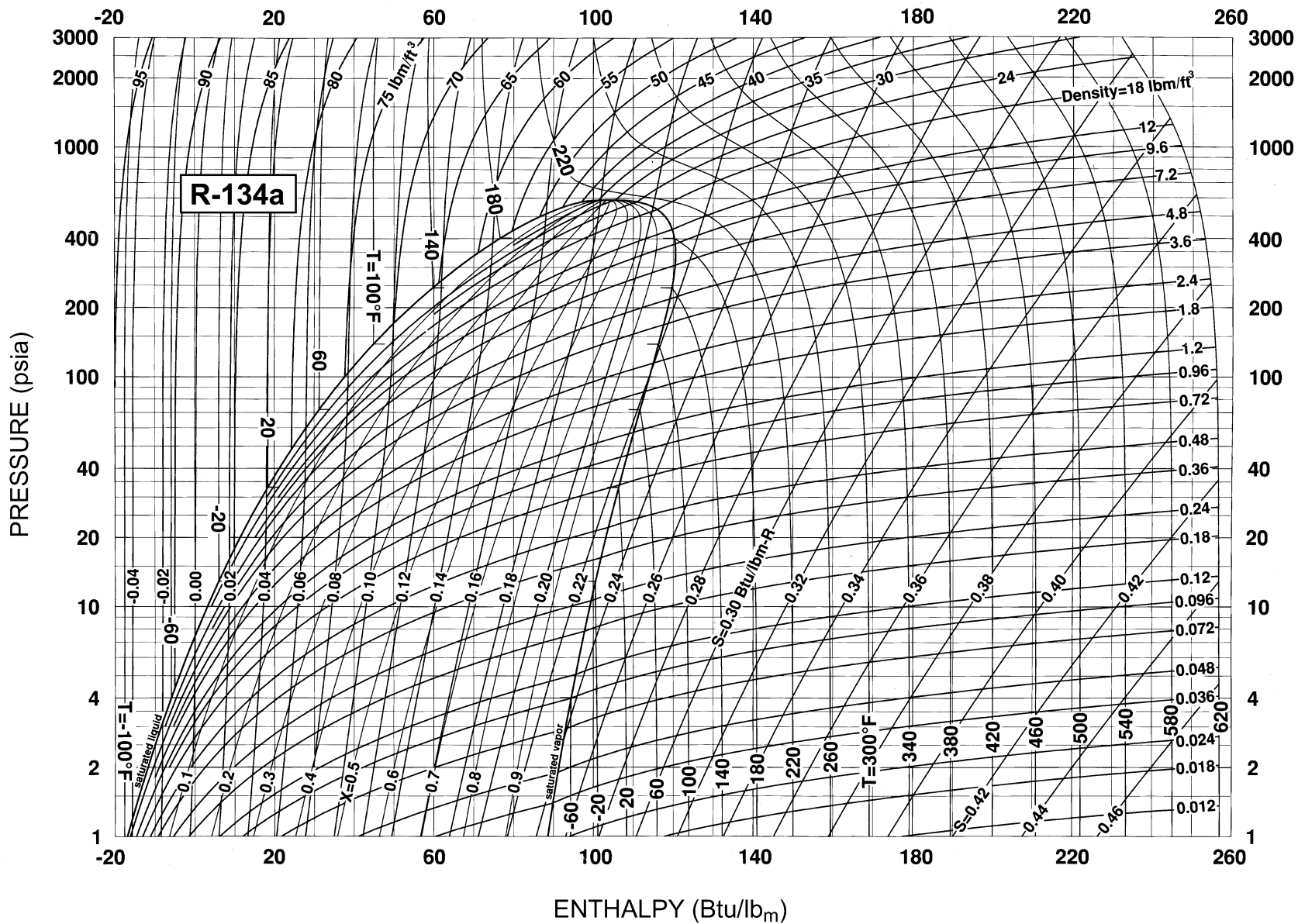


Fig. 8 Pressure-Enthalpy Diagram for Refrigerant 134a

Refrigerant 134a (1,1,1,2-Tetrafluoroethane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, Volume, lb/ft ³ , ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat <i>c_p</i> , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, Temp., dyne/cm °F	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-153.94a	0.057	99.33	568.59	-32.992	80.362	-0.09154	0.27923	0.2829	0.1399	1.1637	3674.	416.0	5.262	0.0156	0.0840	0.00178	28.07	-153.94
-150.00	0.072	98.97	452.12	-31.878	80.907	-0.08791	0.27629	0.2830	0.1411	1.1623	3638.	418.3	4.790	0.0159	0.0832	0.00188	27.69	-150.00
-140.00	0.129	98.05	260.63	-29.046	82.304	-0.07891	0.26941	0.2834	0.1443	1.1589	3545.	424.2	3.880	0.0164	0.0813	0.00214	26.74	-140.00
-130.00	0.221	97.13	156.50	-26.208	83.725	-0.07017	0.26329	0.2842	0.1475	1.1559	3452.	429.9	3.238	0.0170	0.0794	0.00240	25.79	-130.00
-120.00	0.365	96.20	97.481	-23.360	85.168	-0.06166	0.25784	0.2853	0.1508	1.1532	3360.	435.5	2.762	0.0176	0.0775	0.00265	24.85	-120.00
-110.00	0.583	95.27	62.763	-20.500	86.629	-0.05337	0.25300	0.2866	0.1540	1.1509	3269.	440.8	2.396	0.0182	0.0757	0.00291	23.92	-110.00
-100.00	0.903	94.33	41.637	-17.626	88.107	-0.04527	0.24871	0.2881	0.1573	1.1490	3178.	446.0	2.105	0.0187	0.0739	0.00317	22.99	-100.00
-90.00	1.359	93.38	28.381	-14.736	89.599	-0.03734	0.24490	0.2898	0.1607	1.1475	3087.	450.9	1.869	0.0193	0.0722	0.00343	22.07	-90.00
-80.00	1.993	92.42	19.825	-11.829	91.103	-0.02959	0.24152	0.2916	0.1641	1.1465	2998.	455.6	1.673	0.0199	0.0705	0.00369	21.16	-80.00
-75.00	2.392	91.94	16.711	-10.368	91.858	-0.02577	0.23998	0.2925	0.1658	1.1462	2954.	457.8	1.587	0.0201	0.0696	0.00382	20.71	-75.00
-70.00	2.854	91.46	14.161	-8.903	92.614	-0.02198	0.23854	0.2935	0.1676	1.1460	2909.	460.0	1.509	0.0204	0.0688	0.00395	20.26	-70.00
-65.00	3.389	90.97	12.060	-7.432	93.372	-0.01824	0.23718	0.2945	0.1694	1.1459	2866.	462.1	1.436	0.0207	0.0680	0.00408	19.81	-65.00
-60.00	4.002	90.49	10.321	-5.957	94.131	-0.01452	0.23590	0.2955	0.1713	1.1460	2822.	464.1	1.369	0.0210	0.0671	0.00420	19.36	-60.00
-55.00	4.703	90.00	8.8733	-4.476	94.890	-0.01085	0.23470	0.2965	0.1731	1.1462	2778.	466.0	1.306	0.0212	0.0663	0.00433	18.92	-55.00
-50.00	5.501	89.50	7.6621	-2.989	95.650	-0.00720	0.23358	0.2976	0.1751	1.1466	2735.	467.8	1.248	0.0215	0.0655	0.00446	18.47	-50.00
-45.00	6.406	89.00	6.6438	-1.498	96.409	-0.00358	0.23252	0.2987	0.1770	1.1471	2691.	469.6	1.193	0.0218	0.0647	0.00460	18.03	-45.00
-40.00	7.427	88.50	5.7839	0.000	97.167	0.00000	0.23153	0.2999	0.1790	1.1478	2648.	471.2	1.142	0.0221	0.0639	0.00473	17.60	-40.00
-35.00	8.576	88.00	5.0544	1.503	97.924	0.00356	0.23060	0.3010	0.1811	1.1486	2605.	472.8	1.095	0.0223	0.0632	0.00486	17.16	-35.00
-30.00	9.862	87.49	4.4330	3.013	98.679	0.00708	0.22973	0.3022	0.1832	1.1496	2563.	474.2	1.050	0.0226	0.0624	0.00499	16.73	-30.00
-25.00	11.299	86.98	3.9014	4.529	99.433	0.01058	0.22892	0.3035	0.1853	1.1508	2520.	475.6	1.007	0.0229	0.0616	0.00512	16.30	-25.00
-20.00	12.898	86.47	3.4449	6.051	100.184	0.01406	0.22816	0.3047	0.1875	1.1521	2477.	476.8	0.968	0.0231	0.0608	0.00525	15.87	-20.00
-15.00	14.671	85.95	3.0514	7.580	100.932	0.01751	0.22744	0.3060	0.1898	1.1537	2435.	477.9	0.930	0.0234	0.0601	0.00538	15.44	-15.00
-14.93b	14.696	85.94	3.0465	7.600	100.942	0.01755	0.22743	0.3061	0.1898	1.1537	2434.	477.9	0.929	0.0234	0.0601	0.00538	15.44	-14.93
-10.00	16.632	85.43	2.7109	9.115	101.677	0.02093	0.22678	0.3074	0.1921	1.1554	2393.	478.9	0.894	0.0237	0.0593	0.00552	15.02	-10.00
-5.00	18.794	84.90	2.4154	10.657	102.419	0.02433	0.22615	0.3088	0.1945	1.1573	2350.	479.8	0.860	0.0240	0.0586	0.00565	14.60	-5.00
0.00	21.171	84.37	2.1579	12.207	103.156	0.02771	0.22557	0.3102	0.1969	1.1595	2308.	480.5	0.828	0.0242	0.0578	0.00578	14.18	0.00
5.00	23.777	83.83	1.9330	13.764	103.889	0.03107	0.22502	0.3117	0.1995	1.1619	2266.	481.1	0.798	0.0245	0.0571	0.00592	13.76	5.00
10.00	26.628	83.29	1.7357	15.328	104.617	0.03440	0.22451	0.3132	0.2021	1.1645	2224.	481.6	0.769	0.0248	0.0564	0.00605	13.35	10.00
15.00	29.739	82.74	1.5623	16.901	105.339	0.03772	0.22403	0.3147	0.2047	1.1674	2182.	482.0	0.741	0.0250	0.0556	0.00619	12.94	15.00
20.00	33.124	82.19	1.4094	18.481	106.056	0.04101	0.22359	0.3164	0.2075	1.1705	2140.	482.2	0.715	0.0253	0.0549	0.00632	12.53	20.00
25.00	36.800	81.63	1.2742	20.070	106.767	0.04429	0.22317	0.3181	0.2103	1.1740	2098.	482.2	0.689	0.0256	0.0542	0.00646	12.12	25.00
30.00	40.784	81.06	1.1543	21.667	107.471	0.04755	0.22278	0.3198	0.2132	1.1777	2056.	482.2	0.665	0.0258	0.0535	0.00660	11.72	30.00
35.00	45.092	80.49	1.0478	23.274	108.167	0.05079	0.22241	0.3216	0.2163	1.1818	2014.	481.9	0.642	0.0261	0.0528	0.00674	11.32	35.00
40.00	49.741	79.90	0.9528	24.890	108.856	0.05402	0.22207	0.3235	0.2194	1.1862	1973.	481.5	0.620	0.0264	0.0521	0.00688	10.92	40.00
45.00	54.749	79.32	0.8680	26.515	109.537	0.05724	0.22174	0.3255	0.2226	1.1910	1931.	481.0	0.598	0.0267	0.0514	0.00703	10.53	45.00
50.00	60.134	78.72	0.7920	28.150	110.209	0.06044	0.22144	0.3275	0.2260	1.1961	1889.	480.3	0.578	0.0270	0.0507	0.00717	10.14	50.00
55.00	65.913	78.11	0.7238	29.796	110.871	0.06362	0.22115	0.3297	0.2294	1.2018	1847.	479.4	0.558	0.0273	0.0500	0.00732	9.75	55.00
60.00	72.105	77.50	0.6625	31.452	111.524	0.06680	0.22088	0.3319	0.2331	1.2079	1805.	478.3	0.539	0.0275	0.0493	0.00747	9.36	60.00
65.00	78.729	76.87	0.6072	33.120	112.165	0.06996	0.22062	0.3343	0.2368	1.2145	1763.	477.0	0.520	0.0278	0.0486	0.00762	8.98	65.00
70.00	85.805	76.24	0.5572	34.799	112.796	0.07311	0.22037	0.3368	0.2408	1.2217	1721.	475.6	0.503	0.0281	0.0479	0.00777	8.60	70.00
75.00	93.351	75.59	0.5120	36.491	113.414	0.07626	0.22013	0.3394	0.2449	1.2296	1679.	474.0	0.485	0.0284	0.0472	0.00793	8.23	75.00
80.00	101.39	74.94	0.4710	38.195	114.019	0.07939	0.21989	0.3422	0.2492	1.2382	1636.	472.2	0.469	0.0287	0.0465	0.00809	7.86	80.00
85.00	109.93	74.27	0.4338	39.913	114.610	0.08252	0.21966	0.3451	0.2537	1.2475	1594.	470.1	0.453	0.0291	0.0458	0.00825	7.49	85.00
90.00	119.01	73.58	0.3999	41.645	115.186	0.08565	0.21944	0.3482	0.2585	1.2578	1551.	467.9	0.437	0.0294	0.0451	0.00842	7.13	90.00
95.00	128.65	72.88	0.3690	43.392	115.746	0.08877	0.21921	0.3515	0.2636	1.2690	1509.	465.4	0.422	0.0297	0.0444	0.00860	6.77	95.00
100.00	138.85	72.17	0.3407	45.155	116.289	0.09188	0.21898	0.3551	0.2690	1.2813	1466.	462.7	0.407	0.0301	0.0437	0.00878	6.41	100.00
105.00	149.65	71.44	0.3148	46.934	116.813	0.09500	0.21875	0.3589	0.2747	1.2950	1423.	459.8	0.393	0.0304	0.0431	0.00897	6.06	105.00
110.00	161.07	70.69	0.2911	48.731	117.317	0.09811	0.21851	0.3630	0.2809	1.3101	1380.	456.7	0.378	0.0308	0.0424	0.00916	5.71	110.00
115.00	173.14	69.93	0.2693	50.546	117.799	0.10123	0.21826	0.3675	0.2875	1.3268	1337.	453.2	0.365	0.0312	0.0417	0.00936	5.36	115.00
120.00	185.86	69.14	0.2493	52.382	118.258	0.10435	0.21800	0.3723	0.2948	1.3456	1294.	449.6	0.351	0.0316	0.0410	0.00958	5.03	120.00
125.00	199.28	68.32	0.2308	54.239	118.690	0.10748	0.21772	0.3775	0.3026	1.3666	1250.	445.6	0.338	0.0320	0.0403	0.00981	4.69	125.00
130.00	213.41	67.49	0.2137	56.119	119.095	0.11062	0.21742	0.3833	0.3112	1.3903	1206.	441.4	0.325	0.0324	0.0396	0.01005	4.36	130.00
135.00	228.28	66.62	0.1980	58.023	119.468	0.11376	0.21709	0.3897	0.3208	1.4173	1162.	436.8	0.313	0.0329	0.0389	0.01031	4.04	135.00
140.00	243.92	65.73	0.1833	59.954	119.807	0.11692	0.21673	0.3968	0.3315	1.4481	1117.	432.0	0.301	0.0334	0.0382	0.01058	3.72	140.00
145.00	260.36	64.80	0.1697	61.915	120.108	0.12010	0.21634	0.4048	0.3435	1.4837	1072.	426.8	0.288	0.0339	0.0375	0.01089	3.40	145.00
150.00	277.61	63.83	0.1571	63.908	120.366	0.12330	0.21591	0.4138	0.3571	1.5250	1027.	421.2	0.276	0.0344	0.0368	0.01122	3.09	150.00
155.00	295.73	62.82	0.1453	65.936	120.576	0.12653	0.21542	0.4242	0.3729									

Refrigerant 134a Properties of Superheated Vapor

Pressure = 14.696 psia Saturation temperature = -14.92°F					Pressure = 25.00 psia Saturation temperature = 7.22°F					Pressure = 50.00 psia Saturation temperature = 40.29°F				
Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s	Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s	Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated					Saturated					Saturated				
Liquid	85.7972	7.53	0.01739	2451.2	Liquid	83.4823	14.32	0.03224	2263.9	Liquid	79.8125	24.79	0.05377	1982.3
Vapor	0.3283	100.81	0.22713	478.0	Vapor	0.5426	104.07	0.22446	481.5	Vapor	1.0545	108.74	0.22170	481.7
0.00	0.3158	103.62	0.23335	487.2										
20.00	0.3008	107.45	0.24149	499.0	20.00	0.5245	106.60	0.22982	489.9	60.00	0.9982	113.00	0.23005	496.2
40.00	0.2874	111.34	0.24944	510.2	40.00	0.4991	110.61	0.23800	502.4	80.00	0.9489	117.32	0.23822	509.8
60.00	0.2753	115.31	0.25723	521.0	60.00	0.4765	114.66	0.24596	514.1	100.00	0.9055	121.68	0.24614	522.5
80.00	0.2642	119.35	0.26486	531.5	80.00	0.4563	118.78	0.25373	525.4	120.00	0.8670	126.07	0.25385	534.5
100.00	0.2541	123.47	0.27236	541.6	100.00	0.4379	122.96	0.26135	536.2	140.00	0.8322	130.51	0.26139	545.8
120.00	0.2448	127.68	0.27974	551.4	120.00	0.4212	127.22	0.26881	546.6	160.00	0.8008	135.01	0.26877	556.7
140.00	0.2362	131.96	0.28700	561.0	140.00	0.4058	131.55	0.27615	556.7	180.00	0.7718	139.57	0.27601	567.2
160.00	0.2282	136.32	0.29416	570.4	160.00	0.3916	135.95	0.28337	566.5	200.00	0.7454	144.20	0.28313	577.4
180.00	0.2208	140.77	0.30122	579.5	180.00	0.3786	140.43	0.29048	576.0	220.00	0.7208	148.89	0.29014	587.2
200.00	0.2139	145.30	0.30819	588.5	200.00	0.3663	144.98	0.29750	585.3	240.00	0.6980	153.65	0.29704	596.8
220.00	0.2074	149.90	0.31507	597.3	220.00	0.3549	149.61	0.30441	594.4	260.00	0.6768	158.48	0.30385	606.1
240.00	0.2013	154.59	0.32187	606.0	240.00	0.3443	154.32	0.31124	603.3	280.00	0.6569	163.38	0.31056	615.2
260.00	0.1955	159.36	0.32858	614.5	260.00	0.3343	159.10	0.31798	612.0	300.00	0.6383	168.35	0.31719	624.1
280.00	0.1901	164.20	0.33522	622.8	280.00	0.3248	163.96	0.32464	620.6					
300.00	0.1850	169.12	0.34178	631.1	300.00	0.3160	168.90	0.33122	629.0					
Pressure = 75.00 psia Saturation temperature = 62.24°F					Pressure = 100.00 psia Saturation temperature = 79.17°F					Pressure = 125.00 psia Saturation temperature = 93.15°F				
Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s	Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s	Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated					Saturated					Saturated				
Liquid	77.1862	31.98	0.06775	1793.6	Liquid	75.0245	37.69	0.07840	1646.8	Liquid	73.1279	42.53	0.08715	1524.7
Vapor	1.5686	111.67	0.22042	478.1	Vapor	2.0917	113.78	0.21960	472.8	Vapor	2.6279	115.41	0.21898	466.7
80.00	1.4873	115.74	0.22809	492.7	80.00	2.0858	113.98	0.21998	473.6					
100.00	1.4092	120.30	0.23639	507.7	100.00	1.9576	118.80	0.22874	491.6	100.00	2.5638	117.16	0.22212	473.9
120.00	1.3416	124.85	0.24439	521.6	120.00	1.8509	123.55	0.23709	507.8	120.00	2.4025	122.16	0.23090	492.9
140.00	1.2822	129.43	0.25215	534.5	140.00	1.7597	128.29	0.24512	522.4	140.00	2.2694	127.08	0.23924	509.7
160.00	1.2294	134.04	0.25971	546.6	160.00	1.6800	133.02	0.25288	536.0	160.00	2.1561	131.96	0.24725	525.0
180.00	1.1817	138.69	0.26710	558.2	180.00	1.6094	137.78	0.26044	548.8	180.00	2.0577	136.83	0.25498	539.0
200.00	1.1383	143.39	0.27434	569.2	200.00	1.5463	142.57	0.26781	560.8	200.00	1.9710	141.71	0.26250	552.2
220.00	1.0984	148.15	0.28145	579.8	220.00	1.4891	147.40	0.27502	572.3	220.00	1.8935	146.62	0.26983	564.6
240.00	1.0620	152.97	0.28843	590.1	240.00	1.4368	152.27	0.28210	583.3	240.00	1.8233	151.56	0.27700	576.4
260.00	1.0280	157.85	0.29531	600.0	260.00	1.3886	157.21	0.28905	593.9	260.00	1.7592	156.55	0.28402	587.6
280.00	0.9966	162.79	0.30208	609.7	280.00	1.3444	162.19	0.29588	604.1	280.00	1.7006	161.59	0.29093	598.4
300.00	0.9671	167.80	0.30876	619.0	300.00	1.3031	167.24	0.30261	614.0	300.00	1.6463	166.67	0.29771	608.8
320.00	0.9398	172.87	0.31535	628.2	320.00	1.2647	172.35	0.30925	623.6	320.00	1.5959	171.82	0.30440	618.9
340.00	0.9138	178.01	0.32186	637.1	340.00	1.2287	177.52	0.31579	632.9	340.00	1.5492	177.02	0.31098	628.7
360.00	0.8895	183.21	0.32828	645.9	360.00	1.1950	182.75	0.32225	642.1	360.00	1.5055	182.27	0.31747	638.2
380.00	0.8665	188.48	0.33463	654.5	380.00	1.1633	188.04	0.32863	651.0	380.00	1.4644	187.59	0.32388	647.5
400.00	0.8448	193.82	0.34091	662.9	400.00	1.1334	193.39	0.33494	659.8	400.00	1.4258	192.97	0.33021	656.6
Pressure = 150.00 psia Saturation temperature = 105.17°F					Pressure = 175.00 psia Saturation temperature = 115.76°F					Pressure = 200.00 psia Saturation temperature = 125.27°F				
Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s	Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s	Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated					Saturated					Saturated				
Liquid	71.4013	46.78	0.09464	1419.1	Liquid	69.7902	50.62	0.10126	1325.3	Liquid	68.2602	54.14	0.10721	1240.5
Vapor	3.1801	116.71	0.21844	460.0	Vapor	3.7511	117.76	0.21794	453.0	Vapor	4.3437	118.61	0.21743	445.6
120.00	3.0077	120.64	0.22530	476.6	120.00	3.6836	118.95	0.21999	458.4					
140.00	2.8181	125.78	0.23403	496.0	140.00	3.4148	124.38	0.22921	481.3	140.00	4.0726	122.86	0.22460	465.2
160.00	2.6620	130.83	0.24231	513.3	160.00	3.2025	129.64	0.23783	500.9	160.00	3.7850	128.36	0.23363	487.8
180.00	2.5295	135.83	0.25026	528.9	180.00	3.0271	134.79	0.24602	518.3	180.00	3.5561	133.70	0.24210	507.2
200.00	2.4146	140.82	0.25794	543.3	200.00	2.8785	139.90	0.25388	534.0	200.00	3.3656	138.94	0.25018	524.5
220.00	2.3132	145.82	0.26539	556.7	220.00	2.7494	144.99	0.26148	548.5	220.00	3.2036	144.14	0.25793	540.2
240.00	2.2223	150.83	0.27267	569.3	240.00	2.6349	150.08	0.26887	562.1	240.00	3.0623	149.31	0.26544	554.7
260.00	2.1401	155.88	0.27978	581.3	260.00	2.5328	155.19	0.27607	574.8	260.00	2.9371	154.50	0.27274	568.3
280.00	2.0658	160.97	0.28675	592.7	280.00	2.4403	160.34	0.28312	586.9	280.00	2.8247	159.69	0.27987	581.1
300.00	1.9971	166.10	0.29360	603.7	300.00	2.3558	165.51	0.29003	598.5	300.00	2.7234	164.92	0.28684	593.2
320.00	1.9338	171.28	0.30033	614.2	320.00	2.2785	170.73	0.29681	609.5	320.00	2.6305	170.18	0.29368	604.8
340.00	1.8751	176.51	0.30696	624.5	340.00	2.2071	176.00	0.30348	620.2	340.00	2.5455	175.49	0.30039	615.9
360.00	1.8208	181.80	0.31349	634.4	360.00	2.1411	181.32	0.31004	630.5	360.00	2.4668	180.83	0.30700	626.7
380.00	1.7695	187.14	0.31993	644.0	380.00	2.0795	186.69	0.31651	640.5	380.00	2.3934	186.23	0.31350	637.0
400.00	1.7216	192.54	0.32628	653.4	400.00	2.0216	192.11	0.32290	650.3	400.00	2.3254	191.68	0.31991	647.1
420.00	1.6766	198.00	0.33256	662.6	420.00	1.9675	197.59	0.32920	659.7	420.00	2.2614	197.18	0.32624	656.9
440.00	1.6341	203.51	0.33876	671.6	440.00	1.9164	203.12	0.33542	669.0	440.00	2.2017	202.73	0.33248	666.4
460.00	1.5940	209.08	0.34488	680.4	460.00	1.8683	208.71	0.34156	678.0	460.00	2.1453	208.34	0.33864	675.7
480.00	1.5558	214.71	0.35094	689.0	480.00	1.8228	214.36	0.34763	686.9	480.00	2.0920	214.00	0.34473	684.8
500.00	1.5197	220.40	0.35692	697.4	500.00	1.7797	220.05	0.35363	695.6	500.00	2.0417	219.71	0.35075	693.7

*Temperatures are on the ITS-90 scale

Refrigerant 134a Properties of Superheated Vapor (Concluded)

Pressure = 225.00 psia
Saturation temperature = 133.93°F

Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated				
Liquid	66.7870	57.42	0.11266	1162.8
Vapor	4.9609	119.30	0.21690	438.1
140.00	4.8123	121.16	0.22002	447.3
160.00	4.4191	126.99	0.22959	473.6
180.00	4.1206	132.54	0.23840	495.5
200.00	3.8796	137.94	0.24671	514.6
220.00	3.6784	143.25	0.25465	531.6
240.00	3.5058	148.52	0.26229	547.2
260.00	3.3542	153.78	0.26970	561.6
280.00	3.2202	159.04	0.27691	575.1
300.00	3.0995	164.32	0.28395	587.9
320.00	2.9899	169.62	0.29084	600.0
340.00	2.8897	174.97	0.29761	611.7
360.00	2.7978	180.35	0.30425	622.8
380.00	2.7122	185.77	0.31079	633.6
400.00	2.6330	191.24	0.31723	644.0
420.00	2.5592	196.77	0.32358	654.0
440.00	2.4900	202.34	0.32984	663.9
460.00	2.4249	207.96	0.33603	673.4
480.00	2.3636	213.64	0.34213	682.8
500.00	2.3057	219.36	0.34816	691.9

Pressure = 300.00 psia
Saturation temperature = 156.16°F

Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated				
Liquid	62.5436	66.23	0.12686	959.8
Vapor	6.9967	120.54	0.21505	414.2
160.00	6.8168	121.92	0.21730	422.0
180.00	6.1118	128.55	0.22782	455.8
200.00	5.6239	134.61	0.23715	482.1
220.00	5.2494	140.39	0.24578	504.3
240.00	4.9472	146.00	0.25393	523.7
260.00	4.6939	151.52	0.26171	541.1
280.00	4.4758	157.00	0.26921	557.0
300.00	4.2852	162.45	0.27649	571.8
320.00	4.1160	167.90	0.28357	585.7
340.00	3.9631	173.37	0.29049	598.8
360.00	3.8247	178.85	0.29727	611.2
380.00	3.6981	184.37	0.30392	623.1
400.00	3.5816	189.92	0.31045	634.6
420.00	3.4737	195.51	0.31688	645.6
440.00	3.3735	201.15	0.32321	656.3
460.00	3.2799	206.83	0.32945	666.6
480.00	3.1922	212.55	0.33561	676.7
500.00	3.1098	218.32	0.34169	686.5

Pressure = 375.00 psia
Saturation temperature = 174.46°F

Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated				
Liquid	58.2974	74.09	0.13908	785.9
Vapor	9.4209	120.69	0.21256	389.0
180.00	8.9498	123.10	0.21634	403.8
200.00	7.8311	130.54	0.22781	444.1
220.00	7.1211	137.08	0.23758	474.0
240.00	6.6028	143.19	0.24644	498.5
260.00	6.1926	149.07	0.25473	519.6
280.00	5.8555	154.82	0.26260	538.4
300.00	5.5694	160.49	0.27016	555.5
320.00	5.3212	166.11	0.27747	571.3
340.00	5.1022	171.72	0.28457	586.0
360.00	4.9066	177.32	0.29149	599.8
380.00	4.7300	182.94	0.29826	612.9
400.00	4.5692	188.58	0.30490	625.4
420.00	4.4217	194.24	0.31141	637.4
440.00	4.2857	199.94	0.31782	648.9
460.00	4.1596	205.68	0.32413	660.1
480.00	4.0421	211.46	0.33034	670.8
500.00	3.9323	217.28	0.33647	681.3

Pressure = 250.00 psia
Saturation temperature = 141.89°F

Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated				
Liquid	65.3526	60.50	0.11770	1090.7
Vapor	5.6060	119.84	0.21634	430.3
160.00	5.1189	125.49	0.22560	458.2
180.00	4.7275	131.31	0.23484	483.1
200.00	4.4239	136.89	0.24343	504.2
220.00	4.1756	142.34	0.25156	522.8
240.00	3.9664	147.71	0.25935	539.5
260.00	3.7854	153.05	0.26688	554.9
280.00	3.6265	158.37	0.27418	569.2
300.00	3.4847	163.71	0.28129	582.6
320.00	3.3571	169.06	0.28824	595.3
340.00	3.2408	174.44	0.29506	607.4
360.00	3.1342	179.85	0.30175	618.9
380.00	3.0359	185.31	0.30832	630.1
400.00	2.9451	190.81	0.31479	640.8
420.00	2.8604	196.35	0.32117	651.2
440.00	2.7813	201.94	0.32745	661.3
460.00	2.7072	207.58	0.33365	671.1
480.00	2.6374	213.27	0.33977	680.7
500.00	2.5717	219.02	0.34582	690.1

Pressure = 325.00 psia
Saturation temperature = 162.62°F

Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated				
Liquid	61.1446	68.92	0.13110	899.5
Vapor	7.7526	120.71	0.21431	405.9
180.00	6.9220	126.96	0.22423	440.3
200.00	6.2928	133.36	0.23408	470.2
220.00	5.8341	139.34	0.24301	494.5
240.00	5.4723	145.10	0.25136	515.5
260.00	5.1741	150.73	0.25930	534.0
280.00	4.9208	156.29	0.26692	550.9
300.00	4.7017	161.81	0.27428	566.4
320.00	4.5082	167.31	0.28144	580.9
340.00	4.3352	172.82	0.28841	594.5
360.00	4.1790	178.35	0.29524	607.4
380.00	4.0368	183.90	0.30193	619.7
400.00	3.9063	189.48	0.30849	631.5
420.00	3.7859	195.09	0.31495	642.8
440.00	3.6743	200.75	0.32131	653.8
460.00	3.5703	206.44	0.32757	664.4
480.00	3.4731	212.19	0.33375	674.7
500.00	3.3819	217.97	0.33984	684.7

Pressure = 400.00 psia
Saturation temperature = 197.93°F

Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated				
Liquid	56.8213	76.60	0.14289	731.8
Vapor	10.3541	120.50	0.21152	380.4
180.00	10.3454	120.53	0.21158	380.6
200.00	8.7370	128.93	0.22451	429.5
220.00	7.8399	135.85	0.23484	463.0
240.00	7.2145	142.18	0.24403	489.7
260.00	6.7351	148.21	0.25252	512.3
280.00	6.3472	154.06	0.26055	532.1
300.00	6.0221	159.81	0.26821	550.0
320.00	5.7425	165.49	0.27560	566.5
340.00	5.4977	171.15	0.28277	581.7
360.00	5.2802	176.80	0.28975	596.0
380.00	5.0848	182.45	0.29656	609.5
400.00	4.9075	188.12	0.30323	622.4
420.00	4.7454	193.82	0.30978	634.7
440.00	4.5964	199.54	0.31621	646.5
460.00	4.4584	205.30	0.32254	657.9
480.00	4.3303	211.09	0.32878	669.0
500.00	4.2107	216.93	0.33492	679.6

Pressure = 275.00 psia
Saturation temperature = 149.27°F

Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated				
Liquid	63.9423	63.43	0.12241	1023.4
Vapor	6.2831	120.25	0.21572	422.3
160.00	5.9060	123.82	0.22155	441.2
180.00	5.3869	129.98	0.23133	469.9
200.00	5.0031	135.78	0.24026	493.4
220.00	4.6978	141.38	0.24862	513.7
240.00	4.4465	146.87	0.25658	531.7
260.00	4.2314	152.30	0.26423	548.0
280.00	4.0446	157.69	0.27162	563.1
300.00	3.8803	163.08	0.27881	577.2
320.00	3.7317	168.49	0.28583	590.5
340.00	3.5987	173.91	0.29270	603.1
360.00	3.4764	179.36	0.29943	615.1
380.00	3.3646	184.84	0.30604	626.6
400.00	3.2612	190.37	0.31254	637.7
420.00	3.1653	195.93	0.31894	648.4
440.00	3.0758	201.55	0.32525	658.8
460.00	2.9922	207.20	0.33147	668.9
480.00	2.9136	212.91	0.33761	678.7
500.00	2.8397	218.67	0.34368	688.3

Pressure = 350.00 psia
Saturation temperature = 168.71°F

Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated				
Liquid	59.7334	71.54	0.13516	841.7
Vapor	8.5577	120.76	0.21349	397.5
180.00	7.8491	125.18	0.22046	423.2
200.00	7.0242	132.01	0.23098	457.6
220.00	6.4561	138.24	0.24029	484.4
240.00	6.0219	144.17	0.24888	507.1
260.00	5.6728	149.91	0.25698	526.9
280.00	5.3805	155.56	0.26472	544.7
300.00	5.1295	161.15	0.27218	561.0
320.00	4.9098	166.72	0.27941	576.1
340.00	4.7148	172.27	0.28644	590.2
360.00	4.5396	177.84	0.29332	603.6
380.00	4.3807	183.42	0.30005	616.3
400.00	4.2355	189.03	0.30665	628.4
420.00	4.1019	194.67	0.31313	640.1
440.00	3.9784	200.35	0.31952	651.4
460.00	3.8636	206.06	0.32580	662.2
480.00	3.7564	211.82	0.33199	672.8
500.00	3.6561	217.62	0.33811	683.0

Pressure = 600.00 psia
Saturation temperature = n/a (supercritical)

Temp.,* °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Vel. Sound, ft/s
Saturated				
Liquid				
Vapor				
220.00	19.6784	118.27	0.20421	340.3
240.00	14.2159	131.50	0.22343	409.1
260.00	12.2674	139.92	0.23530	449.7
280.00	11.0672	147.15	0.24522	480.8
300.00	10.2049	153.83	0.25413	506.7
320.00	9.5351	160.21	0.26241	529.2
340.00	8.9895	166.39	0.27024	549.2
360.00	8.5305	172.45	0.27774	567.5
380.00	8.1351	178.45	0.28496	584.4
400.00	7.7885	184.40	0.29197	600.1
420.00	7.4804	190.34	0.29879	615.0
440.00	7.2035	196.26	0.30546	629.0
460.00	6.9523	202.20	0.31224	642.4
480.00	6.7229	208.15	0.31838	655.3
500.00	6.5118	214.12	0.32467	667.6

*temperatures are on the ITS-90 scale

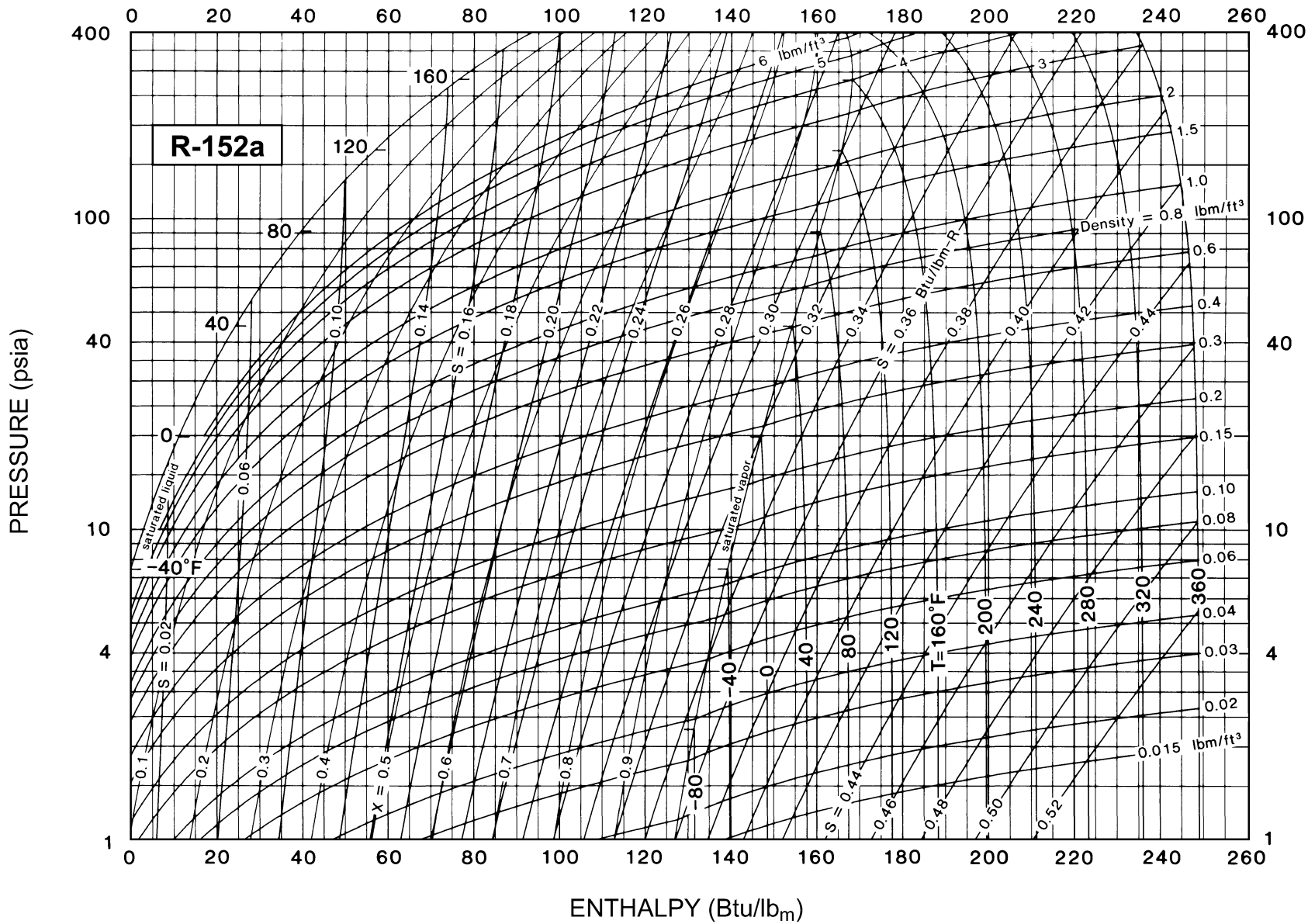


Fig. 9 Pressure-Enthalpy Diagram for Refrigerant 152a

Refrigerant 152a (1,1-Difluoroethane) Properties of Saturated Liquid and Saturated Vapor

Table with 20 columns: Temp.,* °F; Pres-sure, psia; Density, lb/ft³; Volume, ft³/lb; Enthalpy, Btu/lb; Entropy, Btu/lb·°F; Specific Heat, Btu/lb·°F; Cp/Cv; Vel. of Sound, ft/s; Viscosity, lbm/ft·h; Thermal Cond., Btu/h·ft·°F; Surface Tension, dyne/cm; Temp., °F. Rows range from -181.46a to 235.87c.

*Temperatures are on the ITS-90 scale

a = triple point

b = normal boiling point

c = critical point

Refrigerant 143a (1,1,1-Trifluoroethane) Properties of Saturated Liquid and Saturated Vapor

Table with 19 columns: Temp.,* °F, Pressure, psia, Density, lb/ft³, Volume, ft³/lb, Enthalpy, Btu/lb, Entropy, Btu/lb·°F, Specific Heat, Btu/lb·°F, Cp/Cv, Vel. of Sound, ft/s, Viscosity, lbm/ft·h, Thermal Cond., Btu/h·ft·°F, Surface Tension, dyne/cm, Temp., °F. Rows range from -169.26a to 162.87c.

*Temperatures are on the ITS-90 scale

a = triple point

b = normal boiling point

c = critical point

Refrigerant 245fa (1,1,1,3,3-Pentafluoropropane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-50.00	0.574	94.47	56.869	-2.904	95.409	-0.00700	0.23298	0.2888	0.1739	1.0960	3355.	406.4	3.679	0.0190	0.0609	0.00448	22.94	-50.00
-45.00	0.698	94.07	47.310	-1.456	96.260	-0.00349	0.23216	0.2904	0.1754	1.0955	3295.	408.5	3.396	0.0193	0.0603	0.00457	22.60	-45.00
-40.00	0.844	93.67	39.573	0.000	97.115	0.00000	0.23141	0.2919	0.1769	1.0951	3237.	410.6	3.148	0.0195	0.0597	0.00466	22.26	-40.00
-35.00	1.015	93.27	33.275	1.463	97.974	0.00346	0.23073	0.2932	0.1784	1.0947	3182.	412.6	2.929	0.0197	0.0591	0.00475	21.92	-35.00
-30.00	1.214	92.86	28.121	2.933	98.838	0.00690	0.23011	0.2945	0.1799	1.0944	3129.	414.6	2.736	0.0200	0.0585	0.00485	21.58	-30.00
-25.00	1.445	92.46	23.880	4.409	99.705	0.01032	0.22956	0.2957	0.1814	1.0942	3078.	416.5	2.563	0.0202	0.0579	0.00494	21.24	-25.00
-20.00	1.712	92.05	20.373	5.891	100.576	0.01371	0.22906	0.2969	0.1830	1.0940	3028.	418.4	2.407	0.0204	0.0573	0.00503	20.89	-20.00
-15.00	2.018	91.64	17.458	7.378	101.450	0.01707	0.22862	0.2980	0.1845	1.0938	2980.	420.3	2.267	0.0207	0.0567	0.00513	20.55	-15.00
-10.00	2.368	91.22	15.024	8.871	102.327	0.02041	0.22824	0.2991	0.1861	1.0937	2932.	422.1	2.140	0.0209	0.0561	0.00523	20.20	-10.00
-5.00	2.767	90.81	12.982	10.370	103.208	0.02372	0.22791	0.3002	0.1877	1.0937	2886.	423.8	2.024	0.0212	0.0555	0.00532	19.85	-5.00
0.00	3.220	90.39	11.262	11.874	104.091	0.02701	0.22762	0.3013	0.1893	1.0937	2841.	425.5	1.918	0.0214	0.0549	0.00542	19.50	0.00
5.00	3.732	89.97	9.8066	13.384	104.977	0.03027	0.22739	0.3024	0.1909	1.0938	2797.	427.1	1.820	0.0216	0.0544	0.00552	19.15	5.00
10.00	4.309	89.55	8.5702	14.899	105.865	0.03351	0.22719	0.3034	0.1926	1.0940	2753.	428.6	1.731	0.0219	0.0538	0.00562	18.80	10.00
15.00	4.956	89.12	7.5157	16.420	106.755	0.03673	0.22704	0.3045	0.1942	1.0942	2710.	430.1	1.648	0.0221	0.0532	0.00572	18.45	15.00
20.00	5.680	88.69	6.6129	17.946	107.648	0.03993	0.22693	0.3057	0.1959	1.0945	2668.	431.5	1.571	0.0223	0.0527	0.00582	18.10	20.00
25.00	6.488	88.26	5.8371	19.478	108.542	0.04310	0.22686	0.3068	0.1976	1.0948	2626.	432.9	1.499	0.0226	0.0521	0.00592	17.75	25.00
30.00	7.386	87.83	5.1682	21.016	109.437	0.04625	0.22683	0.3079	0.1994	1.0953	2584.	434.1	1.432	0.0228	0.0516	0.00602	17.39	30.00
35.00	8.381	87.39	4.5894	22.560	110.334	0.04939	0.22683	0.3091	0.2011	1.0958	2543.	435.3	1.370	0.0230	0.0510	0.00613	17.04	35.00
40.00	9.482	86.95	4.0870	24.109	111.232	0.05250	0.22686	0.3103	0.2029	1.0964	2503.	436.4	1.312	0.0233	0.0505	0.00623	16.68	40.00
45.00	10.694	86.50	3.6494	25.665	112.130	0.05559	0.22692	0.3115	0.2047	1.0970	2462.	437.5	1.257	0.0235	0.0500	0.00634	16.33	45.00
50.00	12.028	86.06	3.2672	27.227	113.030	0.05867	0.22701	0.3128	0.2065	1.0978	2422.	438.4	1.206	0.0237	0.0494	0.00644	15.97	50.00
55.00	13.490	85.61	2.9324	28.795	113.930	0.06172	0.22714	0.3140	0.2084	1.0986	2382.	439.3	1.157	0.0240	0.0489	0.00655	15.62	55.00
58.81b	14.696	85.26	2.7047	29.995	114.616	0.06404	0.22725	0.3150	0.2098	1.0993	2352.	439.9	1.122	0.0242	0.0485	0.00663	15.34	58.81
60.00	15.089	85.15	2.6382	30.370	114.829	0.06476	0.22728	0.3153	0.2103	1.0995	2342.	440.0	1.112	0.0242	0.0484	0.00666	15.26	60.00
65.00	16.834	84.69	2.3789	31.952	115.729	0.06778	0.22746	0.3167	0.2122	1.1005	2303.	440.7	1.069	0.0244	0.0479	0.00677	14.90	65.00
70.00	18.735	84.23	2.1499	33.540	116.629	0.07079	0.22766	0.3180	0.2142	1.1017	2263.	441.3	1.028	0.0247	0.0474	0.00688	14.55	70.00
75.00	20.800	83.76	1.9471	35.136	117.528	0.07378	0.22788	0.3194	0.2161	1.1029	2224.	441.8	0.989	0.0249	0.0469	0.00699	14.19	75.00
80.00	23.038	83.29	1.7670	36.738	118.427	0.07675	0.22812	0.3208	0.2182	1.1042	2185.	442.1	0.952	0.0252	0.0464	0.00710	13.83	80.00
85.00	25.461	82.82	1.6066	38.348	119.324	0.07971	0.22838	0.3223	0.2202	1.1056	2146.	442.4	0.917	0.0254	0.0459	0.00722	13.48	85.00
90.00	28.077	82.34	1.4636	39.965	120.220	0.08265	0.22866	0.3238	0.2223	1.1072	2107.	442.6	0.884	0.0256	0.0454	0.00733	13.12	90.00
95.00	30.897	81.85	1.3357	41.590	121.115	0.08559	0.22896	0.3253	0.2245	1.1089	2068.	442.6	0.852	0.0259	0.0449	0.00745	12.77	95.00
100.00	33.931	81.36	1.2210	43.223	122.008	0.08850	0.22927	0.3269	0.2266	1.1107	2030.	442.6	0.822	0.0261	0.0444	0.00756	12.41	100.00
105.00	37.189	80.87	1.1181	44.864	122.899	0.09141	0.22960	0.3285	0.2289	1.1127	1991.	442.4	0.793	0.0263	0.0439	0.00768	12.06	105.00
110.00	40.684	80.37	1.0254	46.513	123.787	0.09430	0.22995	0.3302	0.2311	1.1148	1952.	442.1	0.765	0.0266	0.0434	0.00780	11.70	110.00
115.00	44.425	79.86	0.9418	48.170	124.673	0.09718	0.23031	0.3319	0.2335	1.1171	1914.	441.7	0.739	0.0268	0.0429	0.00792	11.35	115.00
120.00	48.424	79.35	0.8663	49.837	125.556	0.10006	0.23068	0.3337	0.2358	1.1195	1875.	441.1	0.713	0.0271	0.0425	0.00804	11.00	120.00
125.00	52.692	78.83	0.7979	51.512	126.436	0.10292	0.23106	0.3355	0.2383	1.1222	1837.	440.4	0.689	0.0273	0.0420	0.00817	10.64	125.00
130.00	57.241	78.30	0.7359	53.196	127.312	0.10577	0.23146	0.3374	0.2408	1.1250	1799.	439.6	0.665	0.0276	0.0415	0.00829	10.29	130.00
135.00	62.083	77.77	0.6795	54.890	128.184	0.10861	0.23186	0.3393	0.2434	1.1281	1760.	438.7	0.643	0.0278	0.0411	0.00842	9.94	135.00
140.00	67.230	77.22	0.6282	56.593	129.051	0.11144	0.23227	0.3413	0.2460	1.1314	1722.	437.6	0.621	0.0281	0.0406	0.00855	9.59	140.00
145.00	72.693	76.67	0.5814	58.306	129.914	0.11426	0.23269	0.3434	0.2488	1.1350	1684.	436.3	0.600	0.0283	0.0401	0.00868	9.25	145.00
150.00	78.485	76.12	0.5387	60.030	130.771	0.11708	0.23311	0.3456	0.2516	1.1389	1645.	434.9	0.580	0.0286	0.0397	0.00881	8.90	150.00
155.00	84.620	75.55	0.4996	61.764	131.623	0.11989	0.23354	0.3478	0.2545	1.1430	1607.	433.4	0.560	0.0289	0.0392	0.00895	8.56	155.00
160.00	91.109	74.97	0.4638	63.510	132.468	0.12269	0.23397	0.3501	0.2575	1.1476	1568.	431.6	0.541	0.0292	0.0387	0.00908	8.21	160.00
165.00	97.965	74.39	0.4309	65.266	133.306	0.12548	0.23440	0.3526	0.2607	1.1525	1530.	429.7	0.523	0.0294	0.0383	0.00922	7.87	165.00
170.00	105.20	73.79	0.4007	67.035	134.136	0.12827	0.23484	0.3551	0.2640	1.1578	1492.	427.7	0.505	0.0297	0.0378	0.00937	7.53	170.00
175.00	112.83	73.18	0.3729	68.815	134.959	0.13106	0.23528	0.3578	0.2674	1.1637	1453.	425.4	0.488	0.0300	0.0374	0.00951	7.20	175.00
180.00	120.87	72.56	0.3473	70.609	135.772	0.13384	0.23571	0.3606	0.2710	1.1700	1415.	423.0	0.471	0.0303	0.0369	0.00966	6.86	180.00
185.00	129.34	71.93	0.3236	72.415	136.576	0.13662	0.23615	0.3636	0.2748	1.1770	1376.	420.4	0.455	0.0306	0.0365	0.00982	6.53	185.00
190.00	138.23	71.28	0.3017	74.236	137.369	0.13940	0.23658	0.3667	0.2788	1.1846	1338.	417.6	0.439	0.0309	0.0360	0.00998	6.20	190.00
195.00	147.58	70.62	0.2814	76.071	138.150	0.14218	0.23700	0.3701	0.2830	1.1930	1299.	414.5	0.424	0.0313	0.0356	0.01014	5.87	195.00
200.00	157.40	69.94	0.2627	77.921	138.918	0.14495	0.23742	0.3736	0.2875	1.2023	1260.	411.3	0.409	0.0316	0.0351	0.01031	5.55	200.00
205.00	167.69	69.25	0.2452	79.787	139.673	0.14773	0.23783	0.3774	0.2923	1.2126	1221.	407.9	0.394	0.0320	0.0347	0.01049	5.23	205.00
210.00	178.49	68.53	0.2290	81.670	140.412	0.15051	0.23823	0.3814	0.2975	1.2241	1182.	404.2	0.380	0.0324	0.0342	0.01067	4.91	210.00
215.00	189.79	67.80	0.2139	83.570	141.134	0.15329	0.23861	0.3858	0.3030	1.2370	1143.	400.2	0.366	0.0327	0.0337	0.01086	4.60	215.00
220.00	201.63	67.05	0.1998	85.490	141.837	0.15608	0.23898	0.3905	0.3091	1.2514	1103.	396.0	0.353	0.0332	0.0333	0.01106	4.29	220.00
225.00	214.01	66.27	0.1867	87.430	142.520	0.15887	0.23933	0.3957										

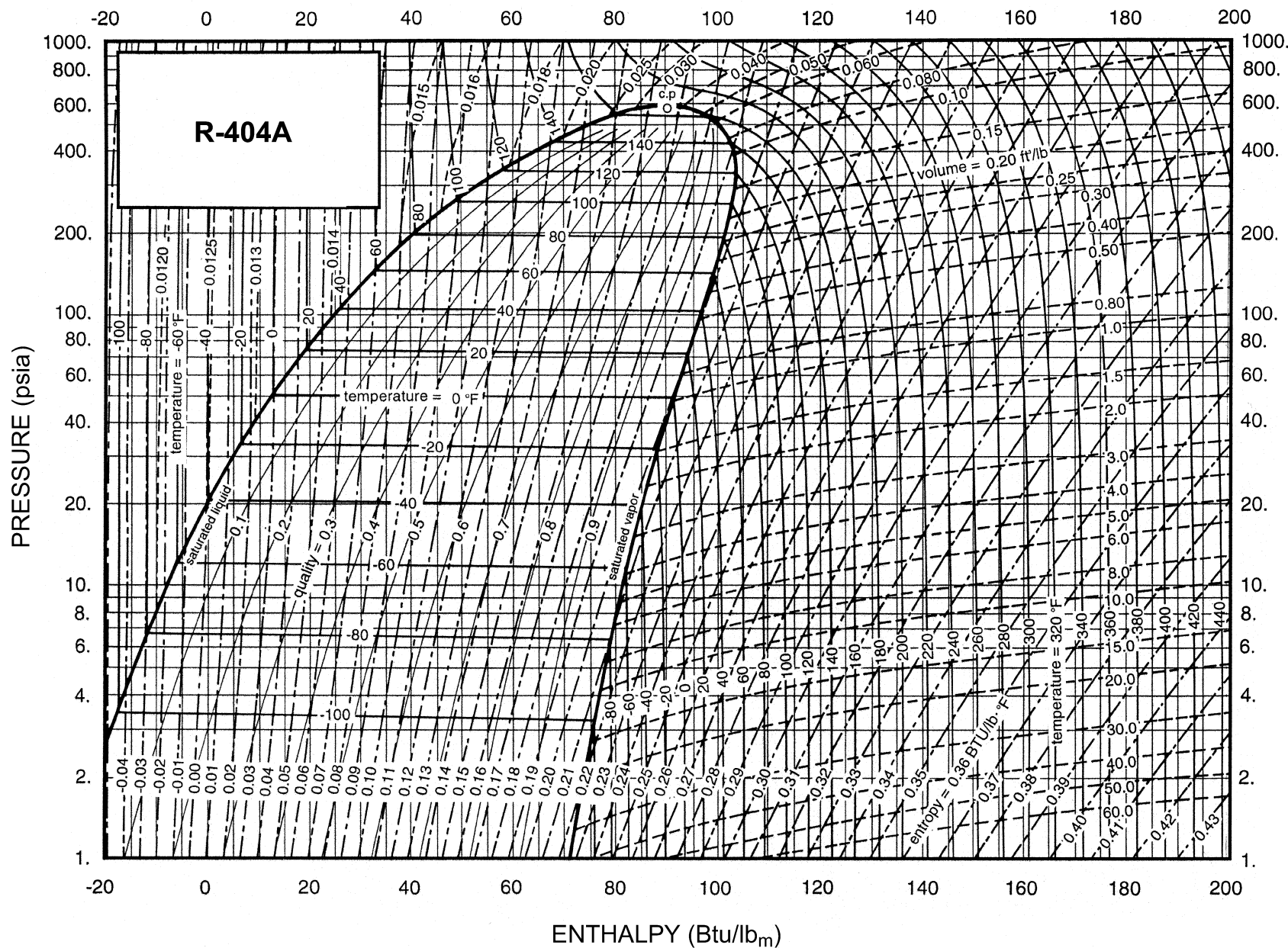


Fig. 10 Pressure-Enthalpy Diagram for Refrigerant 404A
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Refrigerant 404A [R-125/143a/134a (44/52/4)] Properties of Liquid on the Bubble Line and Vapor on the Dew Line

Pressure, psia	Temp., °F		Density, Volume, lb/ft ³ , ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Pressure, psia
	Bubble	Dew	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
1.00	-130.39	-128.34	89.49	36.1508	-25.77	71.14	-0.06894	0.22484	0.2751	0.1549	1.161	3077.	439.4	1.6838	0.0178	0.0701	0.00360	17.40	1.00
1.50	-120.83	-118.88	88.56	24.7288	-23.13	72.51	-0.06105	0.22074	0.2766	0.1584	1.160	2987.	444.2	1.5074	0.0183	0.0684	0.00378	16.90	1.50
2.00	-113.63	-111.76	87.86	18.8932	-21.14	73.55	-0.05522	0.21796	0.2779	0.1610	1.159	2921.	447.7	1.3938	0.0187	0.0671	0.00391	16.51	2.00
2.50	-107.80	-105.98	87.29	15.3350	-19.51	74.39	-0.05057	0.21588	0.2790	0.1633	1.159	2867.	450.4	1.3116	0.0191	0.0661	0.00403	16.19	2.50
3.00	-102.86	-101.09	86.81	12.9318	-18.13	75.11	-0.04667	0.21424	0.2801	0.1652	1.158	2822.	452.6	1.2478	0.0193	0.0652	0.00412	15.92	3.00
4.00	-94.72	-93.02	86.00	9.8828	-15.84	76.30	-0.04033	0.21175	0.2819	0.1685	1.158	2749.	456.1	1.1529	0.0198	0.0638	0.00429	15.47	4.00
5.00	-88.09	-86.45	85.34	8.0221	-13.97	77.26	-0.03525	0.20991	0.2835	0.1712	1.159	2689.	458.7	1.0837	0.0202	0.0627	0.00442	15.09	5.00
6.00	-82.47	-80.87	84.78	6.7646	-12.37	78.08	-0.03099	0.20847	0.2849	0.1737	1.159	2639.	460.8	1.0299	0.0205	0.0618	0.00451	14.77	6.00
7.00	-77.56	-75.99	84.28	5.8562	-10.97	78.80	-0.02730	0.20729	0.2862	0.1758	1.160	2596.	462.5	0.9860	0.0207	0.0610	0.00462	14.48	7.00
8.00	-73.18	-71.65	83.84	5.1681	-9.71	79.43	-0.02403	0.20630	0.2874	0.1778	1.161	2557.	463.9	0.9493	0.0210	0.0603	0.00471	14.22	8.00
10.00	-65.59	-64.12	83.06	4.1930	-7.52	80.53	-0.01843	0.20472	0.2895	0.1813	1.162	2491.	466.2	0.8902	0.0214	0.0591	0.00488	13.77	10.00
12.00	-59.13	-57.70	82.39	3.5336	-5.64	81.47	-0.01371	0.20349	0.2914	0.1844	1.164	2434.	467.9	0.8440	0.0217	0.0581	0.00503	13.38	12.00
14.00	-53.48	-52.08	81.79	3.0571	-3.99	82.28	-0.00962	0.20250	0.2931	0.1872	1.166	2385.	469.3	0.8063	0.0220	0.0572	0.00516	13.04	14.00
14.70b	-51.66	-50.27	81.60	2.9207	-3.45	82.55	-0.00831	0.20220	0.2937	0.1881	1.166	2369.	469.7	0.7947	0.0221	0.0569	0.00520	12.93	14.70
16.00	-48.43	-47.06	81.26	2.6959	-2.50	83.01	-0.00599	0.20168	0.2947	0.1898	1.168	2341.	470.3	0.7745	0.0223	0.0564	0.00527	12.73	16.00
18.00	-43.85	-42.51	80.77	2.4125	-1.14	83.66	-0.00273	0.20098	0.2962	0.1922	1.169	2302.	471.2	0.7473	0.0225	0.0557	0.00538	12.45	18.00
20.00	-39.65	-38.34	80.32	2.1840	0.10	84.26	0.00025	0.20038	0.2977	0.1945	1.171	2265.	471.8	0.7234	0.0227	0.0551	0.00548	12.18	20.00
22.00	-35.77	-34.48	79.90	1.9956	1.26	84.81	0.00298	0.19985	0.2990	0.1966	1.173	2232.	472.3	0.7022	0.0230	0.0545	0.00558	11.94	22.00
24.00	-32.16	-30.89	79.50	1.8376	2.35	85.32	0.00552	0.19938	0.3003	0.1986	1.175	2201.	472.7	0.6831	0.0231	0.0540	0.00566	11.71	24.00
26.00	-28.77	-27.52	79.13	1.7031	3.37	85.79	0.00789	0.19896	0.3015	0.2006	1.177	2172.	473.1	0.6659	0.0233	0.0535	0.00575	11.50	26.00
28.00	-25.58	-24.35	78.78	1.5872	4.33	86.24	0.01011	0.19858	0.3027	0.2024	1.179	2144.	473.3	0.6502	0.0235	0.0530	0.00583	11.29	28.00
30.00	-22.56	-21.35	78.44	1.4862	5.25	86.66	0.01221	0.19824	0.3038	0.2042	1.181	2118.	473.4	0.6357	0.0237	0.0526	0.00590	11.10	30.00
32.00	-19.69	-18.49	78.12	1.3974	6.13	87.05	0.01419	0.19793	0.3049	0.2059	1.183	2093.	473.5	0.6224	0.0238	0.0521	0.00598	10.92	32.00
34.00	-16.96	-15.77	77.81	1.3186	6.96	87.43	0.01607	0.19764	0.3060	0.2076	1.185	2070.	473.6	0.6100	0.0240	0.0517	0.00605	10.74	34.00
36.00	-14.35	-13.18	77.51	1.2484	7.77	87.78	0.01787	0.19738	0.3071	0.2093	1.187	2048.	473.5	0.5984	0.0241	0.0514	0.00611	10.57	36.00
38.00	-11.85	-10.69	77.22	1.1852	8.54	88.12	0.01959	0.19713	0.3081	0.2108	1.189	2026.	473.5	0.5876	0.0243	0.0510	0.00617	10.41	38.00
40.00	-9.44	-8.30	76.94	1.1282	9.28	88.45	0.02123	0.19690	0.3091	0.2124	1.191	2005.	473.4	0.5774	0.0244	0.0507	0.00624	10.25	40.00
42.00	-7.13	-5.99	76.68	1.0764	10.00	88.76	0.02281	0.19669	0.3101	0.2139	1.193	1985.	473.3	0.5677	0.0244	0.0503	0.00638	10.10	42.00
44.00	-4.90	-3.77	76.41	1.0291	10.69	89.06	0.02433	0.19649	0.3110	0.2154	1.195	1966.	473.1	0.5586	0.0245	0.0500	0.00644	9.96	44.00
46.00	-2.74	-1.63	76.16	0.9858	11.36	89.35	0.02579	0.19630	0.3120	0.2168	1.197	1948.	472.9	0.5500	0.0247	0.0497	0.00650	9.82	46.00
48.00	-0.66	0.44	75.91	0.9460	12.02	89.62	0.02721	0.19612	0.3129	0.2183	1.199	1930.	472.7	0.5418	0.0248	0.0494	0.00656	9.68	48.00
50.00	1.36	2.45	75.67	0.9092	12.65	89.89	0.02858	0.19595	0.3138	0.2197	1.202	1912.	472.5	0.5340	0.0249	0.0491	0.00661	9.55	50.00
55.00	6.15	7.22	75.10	0.8286	14.16	90.52	0.03181	0.19557	0.3160	0.2231	1.207	1871.	471.8	0.5159	0.0252	0.0485	0.00675	9.23	55.00
60.00	10.62	11.67	74.55	0.7610	15.58	91.09	0.03482	0.19523	0.3182	0.2263	1.212	1833.	471.0	0.4996	0.0255	0.0478	0.00688	8.93	60.00
65.00	14.82	15.85	74.04	0.7035	16.92	91.63	0.03763	0.19493	0.3203	0.2295	1.217	1796.	470.2	0.4849	0.0257	0.0473	0.00700	8.66	65.00
70.00	18.78	19.79	73.54	0.6538	18.20	92.12	0.04028	0.19466	0.3223	0.2326	1.223	1762.	469.2	0.4714	0.0260	0.0467	0.00712	8.39	70.00
75.00	22.53	23.52	73.06	0.6106	19.41	92.59	0.04278	0.19441	0.3244	0.2357	1.228	1730.	468.2	0.4589	0.0262	0.0462	0.00723	8.14	75.00
80.00	26.09	27.07	72.61	0.5725	20.58	93.02	0.04516	0.19417	0.3264	0.2387	1.234	1699.	467.1	0.4473	0.0264	0.0457	0.00735	7.91	80.00
85.00	29.50	30.46	72.16	0.5388	21.69	93.43	0.04742	0.19396	0.3283	0.2416	1.239	1669.	466.0	0.4366	0.0267	0.0452	0.00746	7.68	85.00
90.00	32.75	33.70	71.73	0.5087	22.76	93.82	0.04958	0.19376	0.3303	0.2445	1.245	1641.	464.8	0.4265	0.0269	0.0448	0.00756	7.46	90.00
95.00	35.87	36.81	71.32	0.4816	23.80	94.18	0.05165	0.19357	0.3322	0.2474	1.251	1613.	463.6	0.4170	0.0271	0.0444	0.00767	7.25	95.00
100.00	38.87	39.79	70.91	0.4572	24.80	94.53	0.05364	0.19339	0.3341	0.2503	1.257	1587.	462.3	0.4081	0.0273	0.0440	0.00777	7.05	100.00
110.00	44.55	45.45	70.13	0.4147	26.71	95.16	0.05739	0.19305	0.3380	0.2559	1.269	1537.	459.7	0.3917	0.0276	0.0432	0.00798	6.67	110.00
120.00	49.86	50.73	69.39	0.3790	28.51	95.74	0.06089	0.19274	0.3418	0.2616	1.282	1490.	457.0	0.3768	0.0280	0.0425	0.00818	6.32	120.00
130.00	54.84	55.69	68.67	0.3487	30.22	96.26	0.06418	0.19245	0.3457	0.2673	1.296	1446.	454.2	0.3632	0.0284	0.0418	0.00838	5.99	130.00
140.00	59.55	60.37	67.97	0.3225	31.85	96.74	0.06728	0.19217	0.3496	0.2730	1.310	1403.	451.3	0.3508	0.0287	0.0412	0.00858	5.68	140.00
150.00	64.01	64.81	67.30	0.2996	33.41	97.17	0.07022	0.19189	0.3535	0.2789	1.324	1363.	448.3	0.3392	0.0291	0.0406	0.00877	5.38	150.00
160.00	68.25	69.04	66.64	0.2795	34.91	97.57	0.07302	0.19163	0.3576	0.2848	1.340	1325.	445.3	0.3285	0.0294	0.0400	0.00897	5.10	160.00
170.00	72.30	73.07	66.00	0.2616	36.36	97.93	0.07570	0.19136	0.3617	0.2909	1.356	1288.	442.2	0.3184	0.0297	0.0395	0.00917	4.84	170.00
180.00	76.18	76.93	65.37	0.2457	37.75	98.25	0.07826	0.19110	0.3659	0.2972	1.373	1252.	439.1	0.3090	0.0301	0.0390	0.00937	4.58	180.00
190.00	79.89	80.63	64.75	0.2313	39.11	98.55	0.08073	0.19083	0.3703	0.3036	1.391	1218.	436.0	0.3000	0.0304	0.0385	0.00958	4.34	190.00
200.00	83.47	84.18	64.14	0.2183	40.42	98.82	0.08311	0.19057	0.3748	0.3103	1.410	1185.	432.7	0.2916	0.0307	0.0380	0.00979	4.11	200.00
220.00	90.23	90.91	62.95	0.1957	42.95	99.29	0.08762	0.19002	0.3844	0.3246	1.452	1121.	426.2	0.2759	0.0314	0.0371	0.01022	3.68	220.00
240.00	96.54	97.20	61.78	0.1767	45.36	99.66	0.09187	0.18944	0.3948	0.3402	1.499	1060.	419.5	0.2615	0.0320	0.0362	0.01067	3.28	240.00
260.00	102.47	103.10	60.62	0.1604	47.67	99.94	0.09590	0.18883	0.4063	0.3577	1.553	1002.	412.7	0.2482	0.0327	0.0354	0.01116	2.91</	

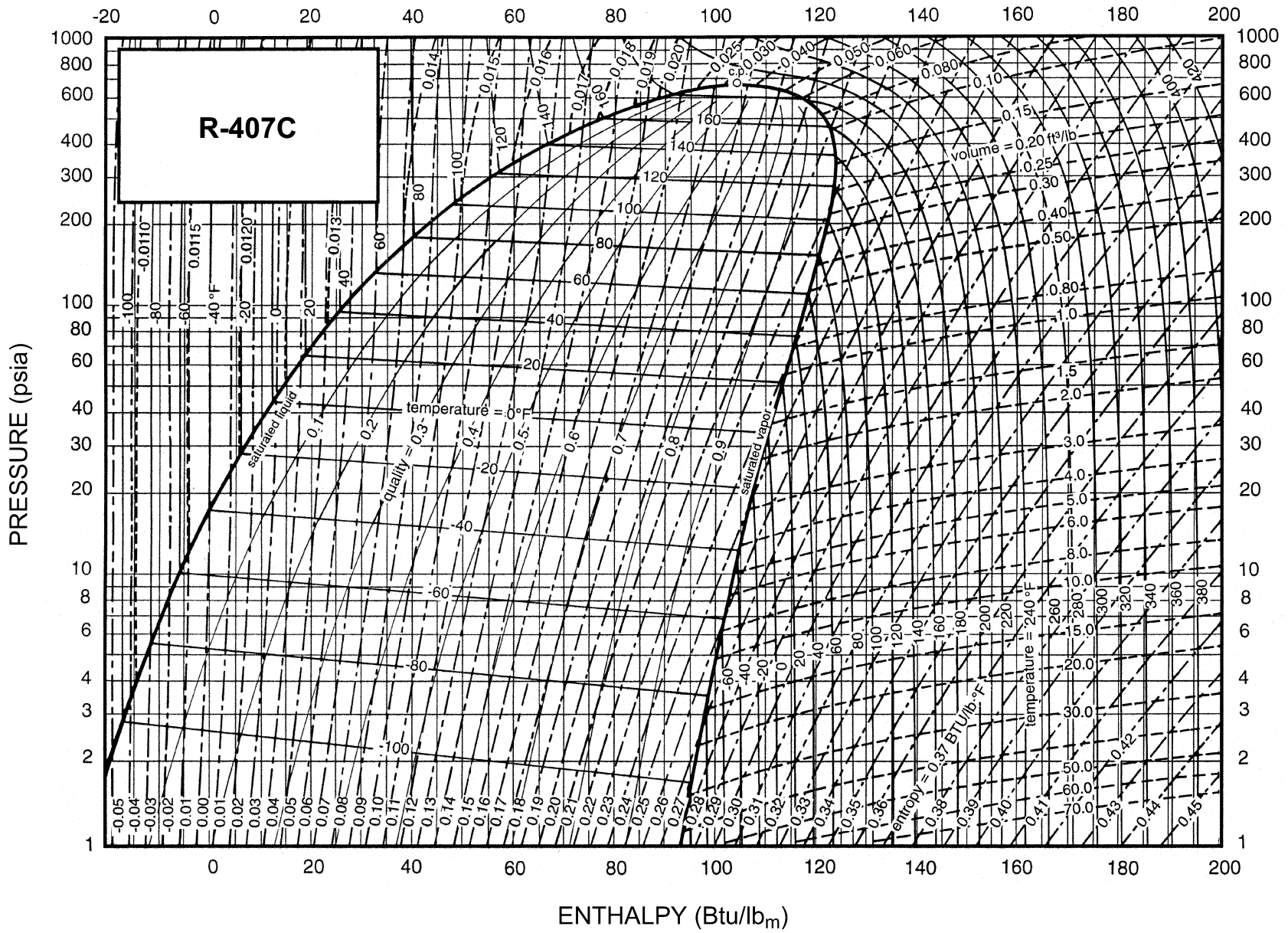


Fig. 11 Pressure-Enthalpy Diagram for Refrigerant 407C
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Refrigerant 407C [R-32/125/134a (23/25/52)] Properties of Liquid on the Bubble Line and Vapor on the Dew Line

Pressure, psia	Temp., °F		Density, lb/ft³		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat <i>c_p</i> , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Pres- Tension, sure, dyne/cm psia	
	Bubble	Dew	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
1.00	-125.91	-111.58	94.30	43.0639	-26.04	93.36	-0.06927	0.28125	0.2970	0.1565	1.182	3366.	484.2	1.9459	0.0194	0.0873	0.00354	25.71	1.00
1.50	-116.25	-102.11	93.35	29.4288	-23.17	94.74	-0.06079	0.27589	0.2979	0.1596	1.181	3273.	489.4	1.7307	0.0199	0.0854	0.00373	24.72	1.50
2.00	-108.99	-95.00	92.63	22.4684	-21.00	95.79	-0.05455	0.27221	0.2987	0.1620	1.181	3204.	493.2	1.5942	0.0203	0.0841	0.00388	23.98	2.00
2.50	-103.11	-89.24	92.05	18.2270	-19.24	96.63	-0.04958	0.26941	0.2994	0.1641	1.180	3148.	496.1	1.4962	0.0207	0.0829	0.00400	23.39	2.50
3.00	-98.14	-84.36	91.56	15.3639	-17.75	97.34	-0.04543	0.26717	0.3000	0.1658	1.180	3101.	498.5	1.4209	0.0209	0.0820	0.00410	22.88	3.00
4.00	-89.95	-76.34	90.74	11.7335	-15.29	98.51	-0.03870	0.26373	0.3012	0.1688	1.180	3025.	502.3	1.3095	0.0214	0.0805	0.00427	22.06	4.00
5.00	-83.30	-69.82	90.06	9.5196	-13.28	99.46	-0.03332	0.26113	0.3022	0.1714	1.181	2964.	505.2	1.2290	0.0217	0.0793	0.00441	21.40	5.00
6.00	-77.65	-64.29	89.49	8.0243	-11.57	100.26	-0.02882	0.25905	0.3032	0.1737	1.182	2912.	507.5	1.1666	0.0221	0.0782	0.00453	20.84	6.00
7.00	-72.73	-59.47	88.99	6.9445	-10.07	100.96	-0.02493	0.25733	0.3041	0.1757	1.182	2867.	509.4	1.1161	0.0223	0.0773	0.00463	20.36	7.00
8.00	-68.34	-55.17	88.54	6.1270	-8.74	101.58	-0.02150	0.25587	0.3049	0.1776	1.183	2828.	511.1	1.0739	0.0226	0.0766	0.00473	19.93	8.00
8.00	-60.75	-47.73	87.75	4.9691	-6.41	102.64	-0.01563	0.25348	0.3064	0.1809	1.185	2759.	513.7	1.0063	0.0230	0.0752	0.00489	19.19	10.00
12.00	-54.29	-41.40	87.07	4.1866	-4.43	103.54	-0.01070	0.25158	0.3078	0.1839	1.187	2702.	515.7	0.9537	0.0233	0.0741	0.00503	18.56	12.00
14.00	-48.64	-35.86	86.47	3.6213	-2.68	104.32	-0.00644	0.25000	0.3091	0.1866	1.189	2651.	517.3	0.9110	0.0236	0.0731	0.00515	18.02	14.00
14.70b	-46.82	-34.08	86.28	3.4596	-2.12	104.56	-0.00508	0.24951	0.3095	0.1875	1.189	2635.	517.8	0.8978	0.0237	0.0728	0.00519	17.84	14.70
16.00	-43.59	-30.92	85.94	3.1932	-1.12	105.00	-0.00267	0.24867	0.3103	0.1890	1.191	2606.	518.6	0.8751	0.0239	0.0722	0.00526	17.53	16.00
18.00	-39.03	-26.45	85.45	2.8573	0.30	105.62	-0.00072	0.24751	0.3114	0.1914	1.193	2566.	519.7	0.8443	0.0242	0.0714	0.00537	17.10	18.00
20.00	-34.85	-22.36	85.00	2.5866	1.61	106.19	0.00380	0.24649	0.3125	0.1935	1.194	2529.	520.6	0.8174	0.0244	0.0707	0.00546	16.70	20.00
22.00	-30.98	-18.57	84.57	2.3635	2.82	106.70	0.00663	0.24558	0.3135	0.1956	1.196	2495.	521.3	0.7936	0.0246	0.0700	0.00555	16.34	22.00
24.00	-27.38	-15.05	84.18	2.1764	3.95	107.18	0.00925	0.24476	0.3145	0.1975	1.198	2463.	521.9	0.7723	0.0248	0.0694	0.00563	16.00	24.00
26.00	-24.01	-11.74	83.81	2.0172	5.02	107.62	0.01169	0.24402	0.3155	0.1994	1.200	2434.	522.4	0.7530	0.0250	0.0688	0.00571	15.69	26.00
28.00	-20.83	-8.64	83.46	1.8800	6.02	108.04	0.01398	0.24333	0.3164	0.2012	1.202	2406.	522.9	0.7355	0.0252	0.0683	0.00578	15.39	28.00
30.00	-17.83	-5.70	83.12	1.7605	6.98	108.43	0.01613	0.24270	0.3173	0.2029	1.204	2379.	523.2	0.7193	0.0254	0.0678	0.00585	15.11	30.00
32.00	-14.98	-2.91	82.80	1.6555	7.88	108.79	0.01817	0.24212	0.3182	0.2045	1.206	2354.	523.5	0.7044	0.0255	0.0673	0.00592	14.85	32.00
34.00	-12.26	-0.25	82.49	1.5624	8.75	109.14	0.02011	0.24158	0.3190	0.2062	1.208	2331.	523.7	0.6906	0.0257	0.0669	0.00598	14.60	34.00
36.00	-9.67	2.29	82.20	1.4793	9.58	109.47	0.02195	0.24107	0.3198	0.2077	1.210	2308.	523.9	0.6778	0.0258	0.0664	0.00604	14.36	36.00
38.00	-7.18	4.72	81.92	1.4047	10.38	109.78	0.02371	0.24059	0.3207	0.2092	1.212	2286.	524.0	0.6657	0.0260	0.0660	0.00610	14.13	38.00
40.00	-4.79	7.06	81.64	1.3372	11.15	110.08	0.02539	0.24014	0.3215	0.2107	1.214	2265.	524.1	0.6544	0.0261	0.0656	0.00616	13.92	40.00
42.00	-2.50	9.30	81.38	1.2760	11.89	110.36	0.02700	0.23972	0.3223	0.2122	1.216	2245.	524.1	0.6438	0.0262	0.0652	0.00622	13.71	42.00
44.00	-0.28	11.47	81.12	1.2202	12.60	110.64	0.02856	0.23932	0.3230	0.2136	1.218	2226.	524.1	0.6337	0.0264	0.0648	0.00627	13.51	44.00
46.00	1.86	13.56	80.87	1.1690	13.30	110.90	0.03005	0.23893	0.3238	0.2150	1.220	2207.	524.1	0.6241	0.0265	0.0645	0.00632	13.31	46.00
48.00	3.92	15.58	80.63	1.1220	13.97	111.15	0.03149	0.23857	0.3245	0.2163	1.222	2189.	524.1	0.6151	0.0266	0.0641	0.00637	13.13	48.00
50.00	5.93	17.53	80.39	1.0786	14.62	111.39	0.03289	0.23822	0.3253	0.2177	1.224	2171.	524.0	0.6064	0.0267	0.0638	0.00642	12.95	50.00
55.00	10.68	22.18	79.83	0.9835	16.17	111.96	0.03618	0.23741	0.3271	0.2209	1.229	2130.	523.7	0.5865	0.0270	0.0630	0.00654	12.52	55.00
60.00	15.11	26.50	79.30	0.9037	17.63	112.48	0.03924	0.23668	0.3289	0.2240	1.234	2091.	523.3	0.5686	0.0273	0.0623	0.00666	12.13	60.00
65.00	19.27	30.56	78.79	0.8358	19.01	112.95	0.04210	0.23601	0.3306	0.2271	1.239	2054.	522.8	0.5524	0.0275	0.0616	0.00677	11.76	65.00
70.00	23.19	34.39	78.31	0.7772	20.31	113.40	0.04478	0.23540	0.3323	0.2300	1.244	2020.	522.3	0.5376	0.0277	0.0610	0.00687	11.42	70.00
75.00	26.90	38.01	77.85	0.7263	21.55	113.81	0.04731	0.23483	0.3340	0.2329	1.249	1987.	521.6	0.5239	0.0280	0.0603	0.00697	11.10	75.00
80.00	30.43	41.46	77.41	0.6814	22.73	114.19	0.04971	0.23429	0.3356	0.2357	1.255	1956.	520.9	0.5113	0.0282	0.0598	0.00707	10.79	80.00
85.00	33.80	44.74	76.98	0.6417	23.87	114.55	0.05200	0.23379	0.3372	0.2384	1.260	1927.	520.2	0.4996	0.0284	0.0592	0.00716	10.50	85.00
90.00	37.02	47.88	76.57	0.6062	24.96	114.89	0.05418	0.23332	0.3388	0.2411	1.265	1898.	519.3	0.4886	0.0286	0.0587	0.00725	10.22	90.00
95.00	40.11	50.89	76.17	0.5744	26.01	115.21	0.05626	0.23287	0.3404	0.2438	1.270	1871.	518.5	0.4783	0.0288	0.0582	0.00734	9.96	95.00
100.00	43.08	53.78	75.78	0.5456	27.02	115.51	0.05826	0.23245	0.3420	0.2464	1.276	1845.	517.6	0.4686	0.0290	0.0577	0.00743	9.71	100.00
110.00	48.70	59.24	75.03	0.4956	28.96	116.07	0.06203	0.23165	0.3452	0.2516	1.287	1795.	515.7	0.4508	0.0294	0.0568	0.00760	9.23	110.00
120.00	53.95	64.35	74.32	0.4537	30.78	116.56	0.06555	0.23092	0.3483	0.2567	1.298	1748.	513.8	0.4347	0.0297	0.0559	0.00776	8.80	120.00
130.00	58.87	69.13	73.64	0.4180	32.50	117.01	0.06884	0.23024	0.3515	0.2618	1.309	1704.	511.7	0.4201	0.0300	0.0551	0.00792	8.39	130.00
140.00	63.53	73.65	72.99	0.3872	34.14	117.41	0.07194	0.22960	0.3546	0.2669	1.321	1662.	509.5	0.4066	0.0304	0.0543	0.00808	8.01	140.00
150.00	67.94	77.93	72.36	0.3604	35.71	117.78	0.07488	0.22899	0.3578	0.2720	1.333	1623.	507.3	0.3943	0.0307	0.0536	0.00824	7.65	150.00
160.00	72.13	81.99	71.75	0.3368	37.21	118.11	0.07767	0.22841	0.3610	0.2771	1.346	1585.	505.0	0.3828	0.0310	0.0529	0.00840	7.32	160.00
170.00	76.14	85.87	71.16	0.3159	38.66	118.41	0.08034	0.22785	0.3643	0.2823	1.359	1548.	502.7	0.3720	0.0313	0.0522	0.00855	7.00	170.00
180.00	79.97	89.58	70.58	0.2972	40.06	118.68	0.08289	0.22731	0.3676	0.2875	1.373	1513.	500.4	0.3619	0.0316	0.0516	0.00871	6.69	180.00
190.00	83.65	93.13	70.01	0.2804	41.41	118.93	0.08533	0.22679	0.3709	0.2928	1.387	1479.	498.0	0.3525	0.0319	0.0510	0.00886	6.41	190.00
200.00	87.18	96.55	69.46	0.2653	42.72	119.15	0.08769	0.22628	0.3744	0.2982	1.401	1447.	495.5	0.3435	0.0322	0.0504	0.00902	6.13	200.00
220.00	93.88	103.00	68.38	0.2389	45.23	119.53	0.09215	0.22529	0.3815	0.3094	1.432	1385.	490.5	0.3269	0.0328	0.0493	0.00934	5.62	220.00
240.00	100.14	109.02	67.33	0.2167	47.61	119.83	0.09633	0.22433	0.3890	0.3211	1.465	1326.	485.5	0.3119	0.0334	0.0482	0.00968	5.15	240.00
260.00	106.02	114.67	66.31	0.1978	49.89	120.06	0.10028	0.22338	0.3969	0.3335	1.502	1270.							

Refrigerant 410A [R-32/125 (50/50)] Properties of Liquid on the Bubble Line and Vapor on the Dew Line

Pressure, psia	Temp., °F		Density, lb/ft ³	Volume, ft ³ /lb	Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Pres- sure, psia
	Bubble	Dew			Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor			
											c_p/c_v								
1.00	-135.75	-135.69	92.11	47.5564	-30.50	99.85	-0.08227	0.32010	0.3135	0.1564	1.228	3466.	518.2	1.4851	0.0193	0.0993	0.00369	24.83	1.00
1.50	-126.58	-126.52	91.19	32.5257	-27.62	101.14	-0.07352	0.31303	0.3137	0.1596	1.227	3373.	524.1	1.3443	0.0199	0.0973	0.00383	23.86	1.50
2.00	-119.70	-119.64	90.50	24.8468	-25.46	102.11	-0.06710	0.30811	0.3140	0.1622	1.227	3305.	528.3	1.2532	0.0203	0.0959	0.00393	23.15	2.00
2.50	-114.12	-114.06	89.93	20.1648	-23.71	102.89	-0.06199	0.30435	0.3144	0.1644	1.227	3250.	531.6	1.1869	0.0206	0.0948	0.00402	22.57	2.50
3.00	-109.40	-109.34	89.45	17.0030	-22.22	103.54	-0.05773	0.30131	0.3147	0.1664	1.227	3204.	534.3	1.1352	0.0209	0.0938	0.00410	22.08	3.00
4.00	-101.65	-101.58	88.66	12.9918	-19.78	104.61	-0.05083	0.29658	0.3155	0.1699	1.228	3130.	538.5	1.0580	0.0214	0.0923	0.00422	21.28	4.00
5.00	-95.34	-95.28	88.00	10.5444	-17.79	105.47	-0.04532	0.29297	0.3162	0.1730	1.229	3070.	541.7	1.0013	0.0218	0.0910	0.00433	20.64	5.00
6.00	-90.00	-89.93	87.45	8.8907	-16.09	106.19	-0.04071	0.29006	0.3169	0.1757	1.231	3019.	544.3	0.9569	0.0221	0.0899	0.00441	20.10	6.00
7.00	-85.33	-85.26	86.96	7.6962	-14.61	106.82	-0.03674	0.28762	0.3175	0.1782	1.232	2975.	546.5	0.9206	0.0224	0.0890	0.00449	19.63	7.00
8.00	-81.18	-81.11	86.52	6.7915	-13.29	107.37	-0.03323	0.28554	0.3182	0.1804	1.233	2937.	548.3	0.8901	0.0226	0.0882	0.00456	19.21	8.00
10.00	-74.00	-73.92	85.76	5.5099	-11.00	108.31	-0.02724	0.28208	0.3194	0.1845	1.236	2870.	551.3	0.8408	0.0231	0.0868	0.00469	18.49	10.00
12.00	-67.89	-67.81	85.10	4.6435	-9.04	109.10	-0.02222	0.27930	0.3206	0.1882	1.239	2814.	553.6	0.8019	0.0234	0.0857	0.00480	17.88	12.00
14.00	-62.54	-62.46	84.52	4.0174	-7.32	109.78	-0.01788	0.27698	0.3217	0.1916	1.241	2764.	555.4	0.7701	0.0238	0.0846	0.00489	17.36	14.00
14.70b	-60.83	-60.74	84.33	3.8382	-6.77	110.00	-0.01649	0.27625	0.3221	0.1926	1.242	2749.	556.0	0.7602	0.0239	0.0843	0.00492	17.19	14.70
16.00	-57.78	-57.69	84.00	3.5431	-5.79	110.38	-0.01404	0.27498	0.3228	0.1946	1.244	2721.	556.9	0.7432	0.0241	0.0837	0.00498	16.89	16.00
18.00	-53.46	-53.37	83.53	3.1709	-4.39	110.92	-0.01059	0.27324	0.3238	0.1975	1.247	2681.	558.2	0.7199	0.0243	0.0829	0.00506	16.47	18.00
20.00	-49.51	-49.42	83.09	2.8708	-3.11	111.40	-0.00746	0.27169	0.3248	0.2002	1.249	2645.	559.3	0.6995	0.0246	0.0822	0.00513	16.09	20.00
22.00	-45.86	-45.76	82.68	2.6236	-1.92	111.84	-0.00458	0.27030	0.3257	0.2027	1.252	2612.	560.1	0.6814	0.0248	0.0815	0.00520	15.73	22.00
24.00	-42.46	-42.36	82.30	2.4162	-0.81	112.25	-0.00192	0.26903	0.3267	0.2051	1.255	2581.	560.9	0.6650	0.0250	0.0808	0.00527	15.41	24.00
26.00	-39.28	-39.18	81.94	2.2397	0.24	112.63	0.00056	0.26788	0.3276	0.2074	1.257	2552.	561.5	0.6502	0.0252	0.0802	0.00533	15.10	26.00
28.00	-36.28	-36.18	81.60	2.0876	1.22	112.98	0.00288	0.26681	0.3284	0.2096	1.260	2525.	562.1	0.6366	0.0254	0.0797	0.00539	14.81	28.00
30.00	-33.45	-33.34	81.27	1.9551	2.15	113.31	0.00507	0.26583	0.3293	0.2117	1.262	2499.	562.5	0.6241	0.0255	0.0791	0.00544	14.55	30.00
32.00	-30.76	-30.65	80.96	1.8387	3.04	113.61	0.00714	0.26490	0.3302	0.2137	1.265	2475.	562.9	0.6125	0.0257	0.0786	0.00550	14.29	32.00
34.00	-28.20	-28.09	80.67	1.7354	3.89	113.91	0.00910	0.26404	0.3310	0.2157	1.267	2451.	563.2	0.6017	0.0259	0.0781	0.00555	14.05	34.00
36.00	-25.75	-25.64	80.38	1.6433	4.70	114.18	0.01097	0.26323	0.3318	0.2176	1.270	2429.	563.5	0.5916	0.0260	0.0777	0.00560	13.82	36.00
38.00	-23.41	-23.29	80.11	1.5605	5.48	114.44	0.01275	0.26247	0.3326	0.2194	1.272	2408.	563.7	0.5822	0.0262	0.0772	0.00565	13.60	38.00
40.00	-21.16	-21.04	79.84	1.4857	6.23	114.69	0.01445	0.26174	0.3334	0.2212	1.275	2387.	563.9	0.5733	0.0263	0.0768	0.00569	13.39	40.00
42.00	-19.00	-18.88	79.59	1.4178	6.96	114.92	0.01609	0.26106	0.3342	0.2230	1.278	2367.	564.0	0.5648	0.0264	0.0764	0.00574	13.19	42.00
44.00	-16.91	-16.79	79.34	1.3558	7.66	115.15	0.01766	0.26040	0.3349	0.2247	1.280	2348.	564.1	0.5569	0.0266	0.0760	0.00578	12.99	44.00
46.00	-14.90	-14.77	79.10	1.2991	8.33	115.36	0.01918	0.25978	0.3357	0.2263	1.283	2330.	564.2	0.5493	0.0267	0.0757	0.00583	12.81	46.00
48.00	-12.95	-12.82	78.87	1.2469	8.99	115.57	0.02064	0.25919	0.3365	0.2280	1.285	2312.	564.2	0.5421	0.0268	0.0753	0.00587	12.63	48.00
50.00	-11.07	-10.94	78.64	1.1988	9.63	115.77	0.02205	0.25861	0.3372	0.2296	1.288	2295.	564.2	0.5352	0.0269	0.0749	0.00591	12.45	50.00
55.00	-6.59	-6.46	78.10	1.0932	11.14	116.22	0.02538	0.25728	0.3390	0.2334	1.294	2254.	564.1	0.5193	0.0272	0.0741	0.00601	12.04	55.00
60.00	-2.42	-2.29	77.58	1.0047	12.56	116.64	0.02848	0.25607	0.3408	0.2372	1.300	2216.	563.9	0.5049	0.0275	0.0733	0.00610	11.66	60.00
65.00	1.49	1.63	77.10	0.9293	13.90	117.02	0.03137	0.25496	0.3426	0.2407	1.306	2180.	563.6	0.4919	0.0274	0.0726	0.00625	11.31	65.00
70.00	5.17	5.32	76.63	0.8644	15.17	117.38	0.03408	0.25392	0.3443	0.2442	1.313	2146.	563.1	0.4799	0.0277	0.0719	0.00635	10.97	70.00
75.00	8.66	8.81	76.19	0.8078	16.38	117.70	0.03665	0.25296	0.3460	0.2476	1.319	2114.	562.6	0.4688	0.0279	0.0712	0.00644	10.66	75.00
80.00	11.98	12.13	75.77	0.7580	17.53	118.00	0.03907	0.25206	0.3477	0.2509	1.325	2083.	562.0	0.4585	0.0281	0.0706	0.00652	10.37	80.00
85.00	15.14	15.30	75.36	0.7139	18.64	118.28	0.04138	0.25121	0.3494	0.2541	1.332	2054.	561.4	0.4489	0.0284	0.0700	0.00661	10.09	85.00
90.00	18.17	18.32	74.96	0.6746	19.70	118.54	0.04358	0.25040	0.3511	0.2573	1.338	2026.	560.7	0.4399	0.0286	0.0694	0.00669	9.82	90.00
95.00	21.06	21.22	74.58	0.6392	20.72	118.78	0.04569	0.24964	0.3527	0.2604	1.345	1999.	560.0	0.4315	0.0288	0.0689	0.00678	9.57	95.00
100.00	23.85	24.01	74.21	0.6073	21.70	119.01	0.04771	0.24891	0.3544	0.2634	1.351	1973.	559.2	0.4235	0.0290	0.0683	0.00686	9.32	100.00
110.00	29.12	29.28	73.49	0.5518	23.58	119.42	0.05152	0.24755	0.3577	0.2695	1.364	1923.	557.6	0.4087	0.0294	0.0673	0.00702	8.87	110.00
120.00	34.03	34.20	72.82	0.5052	25.35	119.78	0.05506	0.24630	0.3609	0.2755	1.378	1876.	555.8	0.3954	0.0297	0.0664	0.00718	8.45	120.00
130.00	38.65	38.82	72.17	0.4656	27.02	120.10	0.05838	0.24513	0.3642	0.2814	1.392	1832.	554.0	0.3832	0.0301	0.0655	0.00734	8.05	130.00
140.00	43.00	43.18	71.55	0.4314	28.61	120.38	0.06151	0.24403	0.3675	0.2873	1.406	1790.	552.0	0.3720	0.0305	0.0646	0.00750	7.69	140.00
150.00	47.13	47.31	70.95	0.4017	30.13	120.62	0.06447	0.24299	0.3708	0.2932	1.421	1751.	550.0	0.3617	0.0308	0.0638	0.00766	7.34	150.00
160.00	51.05	51.23	70.37	0.3755	31.59	120.84	0.06729	0.24201	0.3742	0.2992	1.436	1712.	548.0	0.3520	0.0311	0.0631	0.00782	7.02	160.00
170.00	54.79	54.98	69.80	0.3523	32.99	121.03	0.06997	0.24106	0.3776	0.3052	1.452	1675.	545.9	0.3430	0.0315	0.0623	0.00798	6.71	170.00
180.00	58.37	58.56	69.25	0.3315	34.35	121.19	0.07254	0.24016	0.3811	0.3112	1.468	1640.	543.7	0.3345	0.0318	0.0616	0.00815	6.42	180.00
190.00	61.80	61.99	68.72	0.3129	35.65	121.34	0.07500	0.23929	0.3846	0.3174	1.484	1606.	541.5	0.3265	0.0321	0.0609	0.00832	6.15	190.00
200.00	65.10	65.29	68.19	0.2961	36.92	121.46	0.07737	0.23844	0.3882	0.3237	1.502	1573.	539.3	0.3189	0.0324	0.0603	0.00850	5.88	200.00
220.00	71.34	71.54	67.18	0.2668	39.34	121.64	0.08186	0.23682	0.3956	0.3366	1.538	1509.	534.7	0.3049	0.0330	0.0590	0.00886	5.39	220.00
240.00	77.16	77.36	66.20	0.2423	41.65	121.76	0.08607	0.23528	0.4034	0.3503	1.577	1449.	530.0	0.2921	0.0336	0.0578	0.00925	4.94	240.00
260.00	82.63	82.83	65.24	0.2213	4														

Refrigerant 507A [R-125/143a (50/50)] Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure**, psia	Density, lb/ft ³		Volume, ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat <i>c_p</i> , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-150.00	0.410	92.02	81.746	-30.900	66.427	-0.08508	0.22923	0.2709	0.1468	1.1649	3246.	424.1	2.131	0.0169	0.0730	0.00321	18.41	-150.00		
-145.00	0.526	91.54	64.705	-29.545	67.130	-0.08074	0.22650	0.2713	0.1485	1.1636	3196.	427.0	1.985	0.0172	0.0720	0.00330	18.16	-145.00		
-140.00	0.668	91.06	51.673	-28.187	67.837	-0.07646	0.22394	0.2717	0.1502	1.1625	3147.	429.8	1.856	0.0174	0.0710	0.00339	17.90	-140.00		
-135.00	0.842	90.57	41.614	-26.827	68.548	-0.07224	0.22153	0.2723	0.1520	1.1615	3098.	432.5	1.742	0.0177	0.0701	0.00348	17.64	-135.00		
-130.00	1.051	90.08	33.780	-25.464	69.262	-0.06807	0.21927	0.2730	0.1538	1.1606	3050.	435.2	1.639	0.0180	0.0692	0.00357	17.37	-130.00		
-125.00	1.303	89.59	27.627	-24.097	69.979	-0.06396	0.21715	0.2737	0.1556	1.1598	3002.	437.8	1.546	0.0182	0.0682	0.00367	17.10	-125.00		
-120.00	1.603	89.10	22.757	-22.726	70.699	-0.05989	0.21516	0.2745	0.1575	1.1591	2955.	440.3	1.461	0.0185	0.0673	0.00376	16.83	-120.00		
-115.00	1.959	88.61	18.872	-21.351	71.421	-0.05588	0.21329	0.2754	0.1593	1.1586	2908.	442.7	1.384	0.0188	0.0664	0.00386	16.56	-115.00		
-110.00	2.377	88.12	15.751	-19.971	72.145	-0.05191	0.21153	0.2763	0.1613	1.1582	2862.	445.1	1.314	0.0190	0.0656	0.00395	16.28	-110.00		
-105.00	2.866	87.62	13.226	-18.586	72.871	-0.04798	0.20989	0.2774	0.1632	1.1580	2816.	447.4	1.249	0.0193	0.0647	0.00405	16.00	-105.00		
-100.00	3.434	87.12	11.170	-17.196	73.599	-0.04409	0.20835	0.2784	0.1652	1.1579	2771.	449.6	1.190	0.0196	0.0638	0.00415	15.72	-100.00		
-95.00	4.090	86.62	9.4858	-15.800	74.327	-0.04024	0.20691	0.2796	0.1673	1.1580	2725.	451.6	1.134	0.0198	0.0630	0.00425	15.43	-95.00		
-90.00	4.846	86.11	8.0970	-14.398	75.055	-0.03642	0.20556	0.2807	0.1694	1.1583	2680.	453.6	1.083	0.0201	0.0622	0.00435	15.14	-90.00		
-85.00	5.710	85.61	6.9457	-12.990	75.784	-0.03265	0.20429	0.2820	0.1715	1.1587	2636.	455.5	1.035	0.0204	0.0614	0.00446	14.85	-85.00		
-80.00	6.695	85.10	5.9860	-11.576	76.512	-0.02890	0.20311	0.2833	0.1737	1.1593	2591.	457.3	0.991	0.0206	0.0605	0.00456	14.55	-80.00		
-75.00	7.812	84.58	5.1819	-10.155	77.239	-0.02519	0.20200	0.2846	0.1760	1.1601	2547.	459.0	0.949	0.0209	0.0597	0.00467	14.25	-75.00		
-70.00	9.072	84.06	4.5048	-8.727	77.965	-0.02151	0.20097	0.2860	0.1783	1.1611	2503.	460.6	0.910	0.0211	0.0590	0.00478	13.95	-70.00		
-65.00	10.490	83.54	3.9319	-7.292	78.690	-0.01786	0.20000	0.2874	0.1807	1.1623	2459.	462.0	0.873	0.0215	0.0582	0.00489	13.65	-65.00		
-60.00	12.078	83.01	3.4449	-5.850	79.412	-0.01423	0.19910	0.2889	0.1831	1.1637	2415.	463.3	0.838	0.0218	0.0574	0.00500	13.34	-60.00		
-55.00	13.851	82.48	3.0292	-4.399	80.132	-0.01064	0.19825	0.2904	0.1856	1.1653	2372.	464.5	0.805	0.0220	0.0566	0.00511	13.03	-55.00		
-52.80b	14.695	82.25	2.8653	-3.757	80.449	-0.00906	0.19790	0.2911	0.1868	1.1661	2353.	465.0	0.791	0.0221	0.0563	0.00516	12.89	-52.80		
-50.00	15.822	81.95	2.6728	-2.941	80.849	-0.00707	0.19747	0.2920	0.1882	1.1671	2328.	465.6	0.774	0.0223	0.0559	0.00523	12.72	-50.00		
-45.00	18.008	81.41	2.3661	-1.475	81.563	-0.00352	0.19673	0.2937	0.1908	1.1692	2285.	466.5	0.745	0.0225	0.0551	0.00535	12.41	-45.00		
-40.00	20.423	80.86	2.1010	0.000	82.273	0.00000	0.19604	0.2953	0.1936	1.1716	2242.	467.3	0.717	0.0228	0.0544	0.00546	12.09	-40.00		
-35.00	23.083	80.31	1.8712	1.484	82.979	0.00350	0.19540	0.2971	0.1963	1.1742	2199.	467.9	0.690	0.0230	0.0537	0.00558	11.77	-35.00		
-30.00	26.005	79.75	1.6712	2.976	83.679	0.00698	0.19481	0.2989	0.1992	1.1771	2156.	468.4	0.665	0.0233	0.0529	0.00571	11.45	-30.00		
-25.00	29.205	79.19	1.4965	4.478	84.375	0.01044	0.19425	0.3008	0.2022	1.1802	2113.	468.7	0.640	0.0235	0.0522	0.00583	11.13	-25.00		
-20.00	32.701	78.62	1.3434	5.990	85.065	0.01387	0.19373	0.3027	0.2052	1.1837	2070.	468.9	0.617	0.0238	0.0515	0.00596	10.81	-20.00		
-15.00	36.512	78.04	1.2089	7.511	85.749	0.01730	0.19324	0.3047	0.2083	1.1876	2027.	468.9	0.595	0.0241	0.0508	0.00609	10.48	-15.00		
-10.00	40.653	77.46	1.0904	9.043	86.425	0.02070	0.19279	0.3067	0.2115	1.1918	1984.	468.7	0.574	0.0244	0.0501	0.00622	10.15	-10.00		
-5.00	45.146	76.87	0.9855	10.585	87.095	0.02409	0.19237	0.3089	0.2149	1.1964	1941.	468.4	0.554	0.0244	0.0494	0.00642	9.82	-5.00		
0.00	50.007	76.26	0.8926	12.138	87.756	0.02746	0.19197	0.3111	0.2183	1.2015	1898.	467.8	0.534	0.0247	0.0487	0.00656	9.49	0.00		
5.00	55.257	75.66	0.8099	13.703	88.409	0.03081	0.19159	0.3135	0.2219	1.2070	1855.	467.1	0.515	0.0250	0.0480	0.00670	9.16	5.00		
10.00	60.916	75.04	0.7362	15.279	89.053	0.03416	0.19124	0.3159	0.2255	1.2130	1811.	466.2	0.497	0.0253	0.0473	0.00685	8.83	10.00		
15.00	67.002	74.41	0.6704	16.868	89.687	0.03749	0.19091	0.3184	0.2294	1.2195	1768.	465.1	0.480	0.0257	0.0466	0.00699	8.49	15.00		
20.00	73.538	73.77	0.6114	18.469	90.310	0.04081	0.19059	0.3211	0.2334	1.2267	1725.	463.8	0.463	0.0260	0.0459	0.00714	8.16	20.00		
25.00	80.544	73.12	0.5585	20.083	90.921	0.04412	0.19029	0.3238	0.2375	1.2345	1682.	462.3	0.447	0.0263	0.0452	0.00730	7.83	25.00		
30.00	88.040	72.46	0.5108	21.711	91.519	0.04743	0.19000	0.3268	0.2419	1.2431	1638.	460.6	0.431	0.0266	0.0445	0.00746	7.49	30.00		
35.00	96.049	71.78	0.4678	23.354	92.105	0.05072	0.18971	0.3299	0.2465	1.2526	1594.	458.7	0.416	0.0270	0.0439	0.00763	7.16	35.00		
40.00	104.59	71.09	0.4289	25.011	92.675	0.05401	0.18944	0.3331	0.2514	1.2629	1550.	456.5	0.401	0.0273	0.0432	0.00781	6.82	40.00		
45.00	113.69	70.39	0.3937	26.684	93.230	0.05730	0.18916	0.3366	0.2565	1.2744	1506.	454.1	0.386	0.0277	0.0425	0.00799	6.49	45.00		
50.00	123.38	69.67	0.3617	28.374	93.768	0.06058	0.18889	0.3403	0.2620	1.2871	1462.	451.4	0.372	0.0281	0.0419	0.00818	6.15	50.00		
55.00	133.66	68.93	0.3326	30.082	94.287	0.06386	0.18862	0.3443	0.2678	1.3011	1417.	448.5	0.359	0.0284	0.0412	0.00838	5.82	55.00		
60.00	144.57	68.17	0.3061	31.808	94.786	0.06714	0.18834	0.3485	0.2741	1.3168	1372.	445.4	0.346	0.0288	0.0405	0.00859	5.49	60.00		
65.00	156.14	67.39	0.2819	33.553	95.263	0.07042	0.18804	0.3532	0.2809	1.3343	1327.	441.9	0.333	0.0292	0.0399	0.00882	5.16	65.00		
70.00	168.38	66.60	0.2597	35.319	95.716	0.07371	0.18774	0.3582	0.2882	1.3540	1282.	438.2	0.320	0.0297	0.0392	0.00906	4.83	70.00		
75.00	181.33	65.77	0.2393	37.108	96.143	0.07700	0.18742	0.3636	0.2963	1.3763	1236.	434.2	0.308	0.0301	0.0385	0.00932	4.50	75.00		
80.00	195.01	64.92	0.2207	38.921	96.540	0.08030	0.18708	0.3697	0.3052	1.4017	1189.	429.8	0.296	0.0306	0.0379	0.00959	4.18	80.00		
85.00	209.45	64.04	0.2034	40.760	96.906	0.08362	0.18671	0.3764	0.3152	1.4307	1142.	425.2	0.284	0.0311	0.0372	0.00990	3.86	85.00		
90.00	224.68	63.13	0.1876	42.627	97.235	0.08695	0.18630	0.3839	0.3264	1.4643	1095.	420.2	0.272	0.0316	0.0365	0.01023	3.54	90.00		
95.00	240.72	62.18	0.1729	44.526	97.525	0.09030	0.18586	0.3923	0.3391	1.5034	1046.	414.8	0.261	0.0321	0.0358	0.01059	3.23	95.00		
100.00	257.62	61.18	0.1593	46.459	97.768	0.09368	0.18536	0.4020	0.3538	1.5495	997.	409.1	0.249	0.0327	0.0352	0.01100	2.92	100.00		
105.00	275.40	60.14	0.1466	48.430	97.961	0.09709	0.18481	0.4133	0.3710	1.6045	948.	403.0	0.238	0.0334	0.0345	0.01146	2.61	105.00		
110.00	294.10	59.05	0.1348	50.444	98.093	0.10054	0.18419	0.4265	0.3915	1.6713	897.	396.4	0.227	0.0341	0.0338	0.01197	2.31	110.00		
115.00	313.75	57.89	0.1238	52.508	98.157	0.10404	0.18348	0.4424	0.4163	1.7537	846.	389.4	0.216	0.0348	0.0331	0.01257	2.02	115.00		
120.00	334.41	56.65	0.1135	54.630	98.138	0.10760	0.18266	0.4620	0.4473	1.8578	793.	382.0	0.205	0.0357	0.0324	0.01325	1.74	120.00		
125.00	356.10	55.32	0.1037	56.819	98.020	0.11123	0.18171	0.4868	0.4870	1.9931										

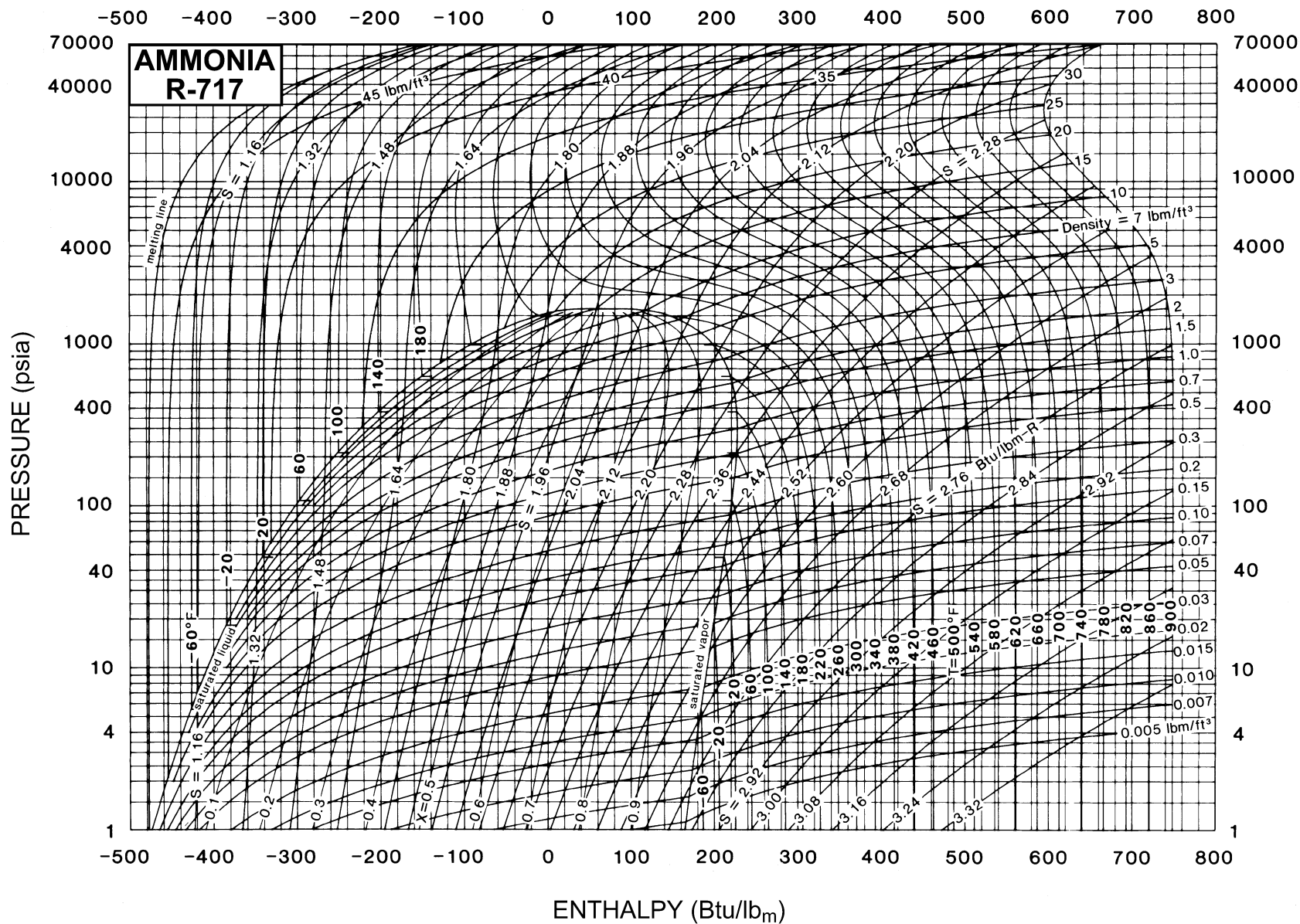


Fig. 12 Pressure-Enthalpy Diagram for Refrigerant 717 (Ammonia)

Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 717 (Ammonia) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, Volume, lb/ft ³ , ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-107.78a	0.883	45.75	249.92	-69.830	568.765	-0.18124	1.63351	1.0044	0.4930	1.3252	6969.	1161.8	1.354	0.0165	0.4735	0.01135	62.26	-107.78
-100.00	1.237	45.47	182.19	-61.994	572.260	-0.15922	1.60421	1.0100	0.4959	1.3262	6830.	1173.8	1.232	0.0168	0.4647	0.01138	60.47	-100.00
-90.00	1.864	45.09	124.12	-51.854	576.688	-0.13142	1.56886	1.0176	0.5003	1.3278	6666.	1188.6	1.099	0.0171	0.4534	0.01143	58.19	-90.00
-80.00	2.739	44.71	86.546	-41.637	581.035	-0.10416	1.53587	1.0254	0.5056	1.3296	6513.	1202.9	0.986	0.0175	0.4422	0.01149	55.94	-80.00
-70.00	3.937	44.31	61.647	-31.341	585.288	-0.07741	1.50503	1.0331	0.5118	1.3319	6367.	1216.7	0.891	0.0179	0.4310	0.01158	53.73	-70.00
-60.00	5.544	43.91	44.774	-20.969	589.439	-0.05114	1.47614	1.0406	0.5190	1.3346	6228.	1229.7	0.810	0.0182	0.4198	0.01168	51.54	-60.00
-50.00	7.659	43.50	33.105	-10.521	593.476	-0.02534	1.44900	1.0478	0.5271	1.3379	6092.	1242.2	0.741	0.0186	0.4088	0.01180	49.39	-50.00
-40.00	10.398	43.08	24.881	0.000	597.387	0.00000	1.42347	1.0549	0.5364	1.3419	5959.	1253.9	0.680	0.0190	0.3978	0.01193	47.26	-40.00
-30.00	13.890	42.66	18.983	10.592	601.162	0.02491	1.39938	1.0617	0.5467	1.3465	5827.	1264.9	0.628	0.0194	0.3870	0.01209	45.17	-30.00
-27.99b	14.696	42.57	18.007	12.732	601.904	0.02987	1.39470	1.0631	0.5490	1.3475	5801.	1267.1	0.618	0.0195	0.3849	0.01212	44.75	-27.99
-25.00	15.962	42.45	16.668	15.914	602.995	0.03720	1.38784	1.0651	0.5524	1.3491	5762.	1270.2	0.604	0.0196	0.3817	0.01217	44.14	-25.00
-20.00	18.279	42.23	14.684	21.253	604.789	0.04939	1.37660	1.0684	0.5583	1.3520	5697.	1275.2	0.582	0.0198	0.3764	0.01226	43.11	-20.00
-15.00	20.858	42.01	12.976	26.609	606.544	0.06148	1.36567	1.0716	0.5646	1.3550	5632.	1280.0	0.561	0.0200	0.3711	0.01236	42.09	-15.00
-10.00	23.723	41.79	11.502	31.982	608.257	0.07347	1.35502	1.0749	0.5711	1.3584	5567.	1284.7	0.541	0.0202	0.3658	0.01246	41.08	-10.00
-5.00	26.895	41.57	10.226	37.372	609.928	0.08536	1.34463	1.0782	0.5781	1.3619	5503.	1289.1	0.522	0.0204	0.3606	0.01256	40.08	-5.00
0.00	30.397	41.34	9.1159	42.779	611.554	0.09715	1.33450	1.0814	0.5853	1.3657	5438.	1293.3	0.505	0.0206	0.3555	0.01267	39.08	0.00
5.00	34.253	41.12	8.1483	48.203	613.135	0.10885	1.32462	1.0847	0.5929	1.3698	5373.	1297.3	0.488	0.0208	0.3503	0.01279	38.10	5.00
10.00	38.487	40.89	7.3020	53.644	614.669	0.12045	1.31496	1.0880	0.6009	1.3742	5308.	1301.1	0.472	0.0210	0.3453	0.01291	37.12	10.00
15.00	43.126	40.66	6.5597	59.103	616.154	0.13197	1.30552	1.0914	0.6092	1.3789	5243.	1304.7	0.457	0.0212	0.3402	0.01304	36.15	15.00
20.00	48.194	40.43	5.9067	64.579	617.590	0.14340	1.29629	1.0948	0.6179	1.3840	5178.	1308.0	0.443	0.0214	0.3352	0.01317	35.19	20.00
25.00	53.720	40.20	5.3307	70.072	618.974	0.15474	1.28726	1.0983	0.6271	1.3894	5113.	1311.1	0.429	0.0216	0.3302	0.01331	34.23	25.00
30.00	59.730	39.96	4.8213	75.585	620.305	0.16599	1.27842	1.1019	0.6366	1.3951	5048.	1314.0	0.416	0.0218	0.3253	0.01345	33.29	30.00
35.00	66.255	39.72	4.3695	81.116	621.582	0.17717	1.26975	1.1056	0.6465	1.4012	4982.	1316.6	0.404	0.0220	0.3204	0.01360	32.35	35.00
40.00	73.322	39.48	3.9680	86.666	622.803	0.18827	1.26125	1.1094	0.6569	1.4078	4916.	1319.0	0.392	0.0222	0.3155	0.01376	31.42	40.00
45.00	80.962	39.24	3.6102	92.237	623.967	0.19929	1.25291	1.1134	0.6678	1.4147	4850.	1321.1	0.381	0.0224	0.3107	0.01392	30.50	45.00
50.00	89.205	38.99	3.2906	97.828	625.072	0.21024	1.24472	1.1175	0.6791	1.4222	4784.	1323.0	0.370	0.0227	0.3059	0.01409	29.59	50.00
55.00	98.083	38.75	3.0045	103.441	626.115	0.22111	1.23667	1.1218	0.6909	1.4301	4717.	1324.6	0.360	0.0229	0.3012	0.01426	28.69	55.00
60.00	107.63	38.50	2.7479	109.076	627.097	0.23192	1.22875	1.1266	0.703	1.438	4650.	1325.9	0.350	0.0231	0.2965	0.01445	27.79	60.00
65.00	117.87	38.25	2.5172	114.734	628.013	0.24266	1.22095	1.131	0.716	1.447	4583.	1327.0	0.340	0.0233	0.2918	0.01464	26.90	65.00
70.00	128.85	37.99	2.3094	120.417	628.864	0.25334	1.21327	1.136	0.730	1.457	4515.	1327.8	0.331	0.0235	0.2872	0.01483	26.03	70.00
75.00	140.59	37.73	2.1217	126.126	629.647	0.26396	1.20570	1.141	0.744	1.467	4447.	1328.3	0.322	0.0237	0.2825	0.01504	25.16	75.00
80.00	153.13	37.47	1.9521	131.861	630.359	0.27452	1.19823	1.147	0.758	1.478	4378.	1328.6	0.313	0.0239	0.2780	0.01525	24.30	80.00
85.00	166.51	37.21	1.7983	137.624	630.999	0.28503	1.19085	1.153	0.774	1.490	4309.	1328.5	0.305	0.0241	0.2734	0.01548	23.44	85.00
90.00	180.76	36.94	1.6588	143.417	631.564	0.29549	1.18356	1.159	0.790	1.502	4240.	1328.2	0.297	0.0244	0.2689	0.01571	22.60	90.00
95.00	195.91	36.67	1.5319	149.241	632.052	0.30590	1.17634	1.166	0.807	1.515	4170.	1327.5	0.289	0.0246	0.2644	0.01595	21.77	95.00
100.00	212.01	36.40	1.4163	155.098	632.460	0.31626	1.16920	1.173	0.824	1.529	4099.	1326.6	0.282	0.0248	0.2600	0.01620	20.94	100.00
105.00	229.09	36.12	1.3108	160.990	632.785	0.32659	1.16211	1.180	0.843	1.544	4028.	1325.3	0.274	0.0250	0.2556	0.01646	20.13	105.00
110.00	247.19	35.83	1.2144	166.919	633.025	0.33688	1.15508	1.188	0.862	1.561	3956.	1323.7	0.267	0.0253	0.2512	0.01673	19.32	110.00
115.00	266.34	35.55	1.1262	172.887	633.175	0.34713	1.14809	1.197	0.883	1.578	3884.	1321.8	0.260	0.0255	0.2468	0.01702	18.53	115.00
120.00	286.60	35.26	1.0452	178.896	633.232	0.35736	1.14115	1.206	0.905	1.597	3811.	1319.5	0.254	0.0257	0.2424	0.01732	17.74	120.00
125.00	307.98	34.96	0.9710	184.949	633.193	0.36757	1.13423	1.216	0.928	1.617	3737.	1316.9	0.247	0.0260	0.2381	0.01763	16.96	125.00
130.00	330.54	34.66	0.9026	191.049	633.053	0.37775	1.12733	1.227	0.952	1.638	3662.	1313.9	0.241	0.0262	0.2338	0.01795	16.19	130.00
135.00	354.32	34.35	0.8397	197.199	632.807	0.38792	1.12044	1.239	0.978	1.662	3587.	1310.6	0.235	0.0265	0.2295	0.01829	15.44	135.00
140.00	379.36	34.04	0.7817	203.403	632.451	0.39808	1.11356	1.251	1.006	1.687	3511.	1306.9	0.229	0.0267	0.2253	0.01865	14.69	140.00
145.00	405.70	33.72	0.7280	209.663	631.978	0.40824	1.10666	1.265	1.035	1.715	3434.	1302.8	0.223	0.0270	0.2210	0.01903	13.95	145.00
150.00	433.38	33.39	0.6785	215.984	631.383	0.41840	1.09975	1.280	1.067	1.745	3356.	1298.3	0.217	0.0273	0.2168	0.01943	13.22	150.00
155.00	462.45	33.06	0.6325	222.370	630.659	0.42857	1.09281	1.296	1.101	1.778	3277.	1293.4	0.211	0.0276	0.2125	0.01986	12.51	155.00
160.00	492.95	32.72	0.5899	228.827	629.798	0.43875	1.08582	1.313	1.138	1.813	3198.	1288.1	0.206	0.0279	0.2083	0.02031	11.80	160.00
165.00	524.94	32.37	0.5504	235.359	628.791	0.44896	1.07878	1.333	1.178	1.853	3117.	1282.4	0.200	0.0282	0.2041	0.02079	11.10	165.00
170.00	558.45	32.01	0.5136	241.973	627.630	0.45919	1.07167	1.354	1.222	1.896	3035.	1276.2	0.195	0.0285	0.1999	0.02130	10.42	170.00
175.00	593.53	31.64	0.4793	248.675	626.302	0.46947	1.06447	1.377	1.270	1.944	2952.	1269.6	0.190	0.0288	0.1957	0.02185	9.75	175.00
180.00	630.24	31.26	0.4473	255.472	624.797	0.47980	1.05717	1.403	1.322	1.998	2868.	1262.4	0.185	0.0292	0.1916	0.02245	9.09	180.00
185.00	668.63	30.87	0.4174	262.374	623.100	0.49019	1.04974	1.432	1.381	2.058	2783.	1254.8	0.179	0.0296	0.1874	0.02310	8.44	185.00
190.00	708.74	30.47	0.3895	269.390	621.195	0.50066	1.04217	1.465	1.446	2.126	2696.	1246.7	0.174	0.0300	0.1832	0.02381	7.80	190.00
195.00	750.64	30.05	0.3633	276.530	619.064	0.51121	1.03443	1.502	1.519	2.203	2608.	1238.0	0.169	0.0304	0.1790	0.02458	7.18	195.00
200.00	794.38	29.62	0.3387	283.809	616.686	0.52188	1.02649	1.543	1.602	2.290	2519.	1228.7	0.165	0.0309	0.1748	0.02545	6.56	200.00
205.00	840.03	29.17	0.3156	2														

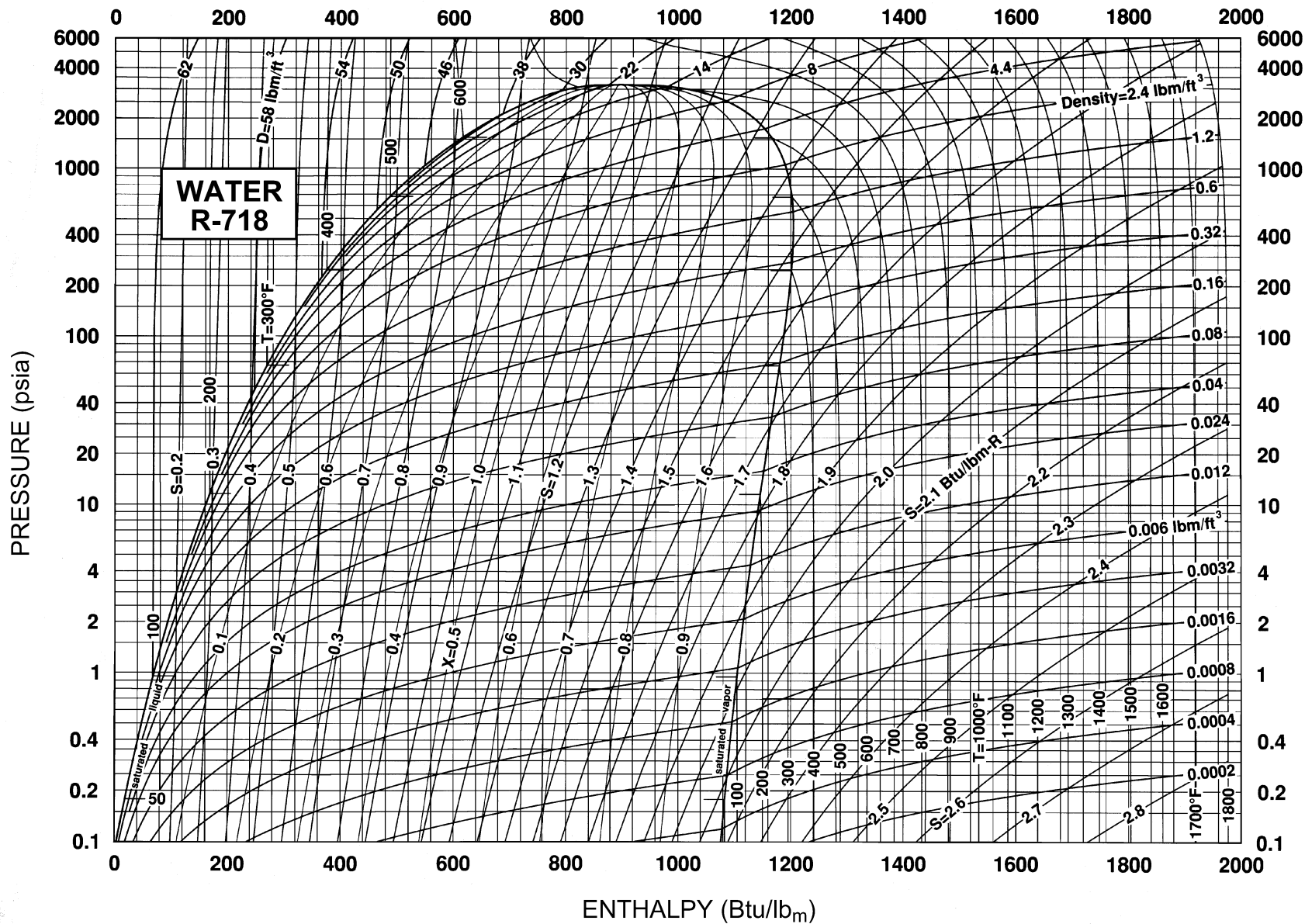


Fig. 13 Pressure-Enthalpy Diagram for Refrigerant 718 (Water/Steam)

Refrigerant 718 (Water/Steam) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat <i>c_p</i> , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lbm/ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
32.02a	0.089	62.42	3299.7	0.00	1075.92	0.0000	2.1882	1.0086	0.4504	1.3285	4601.	1342.	4.333	0.0223	0.3244	0.00987	75.65	32.02
40.00	0.122	62.42	2443.3	8.04	1079.42	0.0162	2.1604	1.0055	0.4514	1.3282	4670.	1352.	3.738	0.0226	0.3293	0.01001	75.02	40.00
50.00	0.178	62.41	1702.8	18.08	1083.79	0.0361	2.1271	1.0028	0.4528	1.3278	4748.	1365.	3.159	0.0229	0.3353	0.01019	74.22	50.00
60.00	0.256	62.36	1206.0	28.10	1088.15	0.0556	2.0954	1.0010	0.4543	1.3275	4815.	1378.	2.712	0.0232	0.3413	0.01038	73.40	60.00
70.00	0.363	62.30	867.11	38.10	1092.50	0.0746	2.0653	0.9999	0.4558	1.3273	4874.	1391.	2.359	0.0236	0.3471	0.01058	72.57	70.00
80.00	0.507	62.21	632.38	48.10	1096.83	0.0933	2.0366	0.9993	0.4574	1.3272	4924.	1403.	2.074	0.0240	0.3527	0.01079	71.71	80.00
90.00	0.699	62.11	467.40	58.09	1101.15	0.1117	2.0093	0.9990	0.4591	1.3271	4967.	1416.	1.841	0.0244	0.3579	0.01101	70.84	90.00
100.00	0.951	61.99	349.84	68.08	1105.44	0.1297	1.9832	0.9989	0.4609	1.3272	5003.	1428.	1.648	0.0248	0.3628	0.01124	69.96	100.00
110.00	1.277	61.86	264.97	78.07	1109.71	0.1474	1.9583	0.9991	0.4628	1.3273	5033.	1440.	1.486	0.0252	0.3672	0.01148	69.05	110.00
120.00	1.695	61.71	202.95	88.06	1113.95	0.1648	1.9346	0.9993	0.4648	1.3276	5056.	1452.	1.348	0.0256	0.3713	0.01172	68.13	120.00
130.00	2.226	61.55	157.09	98.06	1118.17	0.1819	1.9118	0.9997	0.4671	1.3280	5075.	1463.	1.230	0.0260	0.3750	0.01198	67.19	130.00
140.00	2.893	61.38	122.82	108.06	1122.35	0.1987	1.8901	1.0003	0.4696	1.3285	5088.	1475.	1.128	0.0265	0.3783	0.01225	66.24	140.00
150.00	3.723	61.19	96.930	118.07	1126.49	0.2152	1.8693	1.0009	0.4723	1.3291	5097.	1486.	1.040	0.0269	0.3813	0.01253	65.27	150.00
160.00	4.747	61.00	77.184	128.08	1130.59	0.2315	1.8493	1.0016	0.4753	1.3299	5101.	1497.	0.962	0.0273	0.3839	0.01282	64.28	160.00
170.00	6.000	60.79	61.980	138.11	1134.65	0.2476	1.8302	1.0025	0.4787	1.3309	5101.	1508.	0.894	0.0278	0.3862	0.01312	63.28	170.00
180.00	7.520	60.58	50.169	148.14	1138.65	0.2634	1.8118	1.0035	0.4824	1.3320	5098.	1518.	0.834	0.0282	0.3881	0.01343	62.26	180.00
190.00	9.350	60.35	40.916	158.19	1142.60	0.2789	1.7942	1.0046	0.4865	1.3333	5090.	1528.	0.780	0.0287	0.3898	0.01375	61.23	190.00
200.00	11.538	60.12	33.609	168.24	1146.48	0.2943	1.7772	1.0059	0.4911	1.3348	5080.	1538.	0.732	0.0291	0.3912	0.01409	60.19	200.00
210.00	14.136	59.88	27.794	178.31	1150.30	0.3094	1.7609	1.0073	0.4961	1.3366	5066.	1547.	0.690	0.0296	0.3924	0.01444	59.13	210.00
211.95b	14.696	59.83	26.802	180.28	1151.04	0.3124	1.7578	1.0076	0.4971	1.3369	5063.	1549.	0.682	0.0297	0.3926	0.01451	58.92	211.95
220.00	17.201	59.63	23.133	188.40	1154.05	0.3244	1.7451	1.0088	0.5016	1.3386	5049.	1557.	0.651	0.0300	0.3934	0.01480	58.05	220.00
230.00	20.795	59.37	19.377	198.51	1157.72	0.3391	1.7299	1.0106	0.5077	1.3408	5029.	1565.	0.616	0.0305	0.3941	0.01517	56.96	230.00
240.00	24.986	59.10	16.314	208.63	1161.31	0.3537	1.7153	1.0125	0.5145	1.3434	5007.	1574.	0.585	0.0310	0.3947	0.01556	55.86	240.00
250.00	29.844	58.82	13.815	218.78	1164.81	0.3680	1.7011	1.0147	0.5218	1.3464	4981.	1582.	0.556	0.0314	0.3951	0.01596	54.74	250.00
260.00	35.447	58.53	11.759	228.95	1168.21	0.3823	1.6874	1.0170	0.5299	1.3496	4953.	1590.	0.530	0.0319	0.3953	0.01638	53.62	260.00
270.00	41.878	58.24	10.058	239.14	1171.52	0.3963	1.6741	1.0196	0.5387	1.3533	4923.	1597.	0.506	0.0324	0.3953	0.01680	52.47	270.00
280.00	49.222	57.94	8.6431	249.37	1174.71	0.4102	1.6612	1.0224	0.5483	1.3574	4890.	1604.	0.484	0.0328	0.3952	0.01725	51.32	280.00
290.00	57.574	57.63	7.4600	259.62	1177.79	0.4239	1.6487	1.0254	0.5586	1.3620	4855.	1611.	0.464	0.0333	0.3949	0.01770	50.16	290.00
300.00	67.029	57.31	6.4658	269.91	1180.75	0.4375	1.6365	1.0287	0.5698	1.3671	4817.	1617.	0.445	0.0338	0.3944	0.01817	48.98	300.00
310.00	77.691	56.99	5.6263	280.23	1183.58	0.4510	1.6246	1.0323	0.5818	1.3727	4777.	1623.	0.428	0.0342	0.3939	0.01866	47.79	310.00
320.00	89.667	56.65	4.9142	290.60	1186.28	0.4643	1.6131	1.0362	0.5947	1.3790	4735.	1628.	0.412	0.0347	0.3931	0.01916	46.59	320.00
330.00	103.07	56.31	4.3075	301.00	1188.84	0.4775	1.6018	1.0404	0.6085	1.3858	4691.	1633.	0.397	0.0351	0.3923	0.01967	45.38	330.00
340.00	118.02	55.95	3.7884	311.45	1191.25	0.4906	1.5908	1.0449	0.6231	1.3934	4644.	1638.	0.383	0.0356	0.3912	0.02020	44.16	340.00
350.00	134.63	55.59	3.3425	321.95	1193.51	0.5036	1.5800	1.0497	0.6386	1.4018	4596.	1642.	0.370	0.0361	0.3901	0.02074	42.93	350.00
360.00	153.03	55.22	2.9580	332.50	1195.61	0.5164	1.5694	1.0550	0.6551	1.4109	4546.	1645.	0.358	0.0365	0.3888	0.02130	41.69	360.00
370.00	173.36	54.85	2.6252	343.11	1197.54	0.5292	1.5591	1.0606	0.6725	1.4210	4493.	1648.	0.347	0.0370	0.3873	0.02187	40.45	370.00
380.00	195.74	54.46	2.3361	353.77	1199.29	0.5419	1.5489	1.0666	0.6910	1.4320	4438.	1651.	0.337	0.0375	0.3857	0.02246	39.19	380.00
390.00	220.33	54.06	2.0841	364.50	1200.86	0.5545	1.5388	1.0732	0.7105	1.4441	4382.	1653.	0.327	0.0379	0.3839	0.02307	37.93	390.00
400.00	247.26	53.65	1.8638	375.30	1202.24	0.5670	1.5290	1.0802	0.7311	1.4573	4323.	1655.	0.318	0.0384	0.3819	0.02369	36.66	400.00
410.00	276.68	53.23	1.6706	386.17	1203.42	0.5795	1.5192	1.0878	0.7529	1.4718	4263.	1656.	0.309	0.0389	0.3798	0.02433	35.38	410.00
420.00	308.76	52.80	1.5006	397.12	1204.38	0.5919	1.5096	1.0959	0.7761	1.4876	4200.	1656.	0.300	0.0393	0.3776	0.02499	34.10	420.00
430.00	343.64	52.36	1.3505	408.15	1205.13	0.6042	1.5000	1.1047	0.8007	1.5050	4136.	1656.	0.292	0.0398	0.3751	0.02568	32.81	430.00
440.00	381.48	51.91	1.2177	419.27	1205.64	0.6165	1.4906	1.1143	0.8268	1.5240	4069.	1655.	0.285	0.0403	0.3725	0.02638	31.51	440.00
450.00	422.46	51.45	1.0999	430.49	1205.91	0.6287	1.4811	1.1246	0.8547	1.5448	4000.	1654.	0.278	0.0407	0.3696	0.02711	30.22	450.00
460.00	466.75	50.97	0.9951	441.81	1205.93	0.6409	1.4718	1.1358	0.8846	1.5678	3930.	1652.	0.271	0.0412	0.3666	0.02786	28.92	460.00
470.00	514.52	50.48	0.9015	453.24	1205.68	0.6531	1.4625	1.1479	0.9167	1.5930	3857.	1650.	0.264	0.0417	0.3633	0.02865	27.61	470.00
480.00	565.95	49.98	0.8179	464.78	1205.13	0.6652	1.4531	1.1612	0.9513	1.6208	3782.	1647.	0.258	0.0422	0.3599	0.02947	26.30	480.00
490.00	621.23	49.46	0.7429	476.46	1204.29	0.6774	1.4438	1.1757	0.9888	1.6515	3706.	1643.	0.252	0.0427	0.3562	0.03033	25.00	490.00
500.00	680.55	48.92	0.6756	488.27	1203.13	0.6895	1.4344	1.1916	1.0295	1.6856	3626.	1638.	0.246	0.0432	0.3522	0.03124	23.69	500.00
510.00	744.11	48.37	0.6149	500.23	1201.62	0.7017	1.4250	1.2091	1.0741	1.7235	3545.	1632.	0.240	0.0438	0.3481	0.03220	22.38	510.00
520.00	812.10	47.80	0.5601	512.35	1199.75	0.7138	1.4155	1.2285	1.1231	1.7658	3461.	1626.	0.235	0.0443	0.3436	0.03323	21.08	520.00
530.00	884.74	47.20	0.5105	524.65	1197.49	0.7260	1.4059	1.2500	1.1772	1.8133	3375.	1619.	0.229	0.0449	0.3389	0.03434	19.77	530.00
540.00	962.24	46.59	0.4655	537.14	1194.80	0.7383	1.3962	1.2740	1.2374	1.8667	3286.	1611.	0.224	0.0455	0.3340	0.03554	18.47	540.00
550.00	1044.8	45.95	0.4247	549.84	1191.66	0.7506	1.3863	1.3011	1.3048	1.9274	3195.	1601.	0.219	0.0461	0.3288	0.03685	17.18	550.00
560.00	1132.7	45.29	0.3874	562.77	1188.02	0.7630	1.3762	1.3317	1.3810	1.9966	3101.	1591.	0.214	0.0467	0.3233	0.03830	15.89	560.00
570.00	1226.2	44.60	0.3534	575.97	1183.83	0.7755	1.3658	1.3668	1.4677	2.0763	3003.	1580.	0.209	0.0474	0.3177	0.03992	14.61	570.00
580.00	1325.5	43.88	0.3223	589.44	1179.04	0.7881	1.3552	1.4072	1.5675	2.1687	2903.	1567.	0.204	0.0481	0.3118	0.04175		

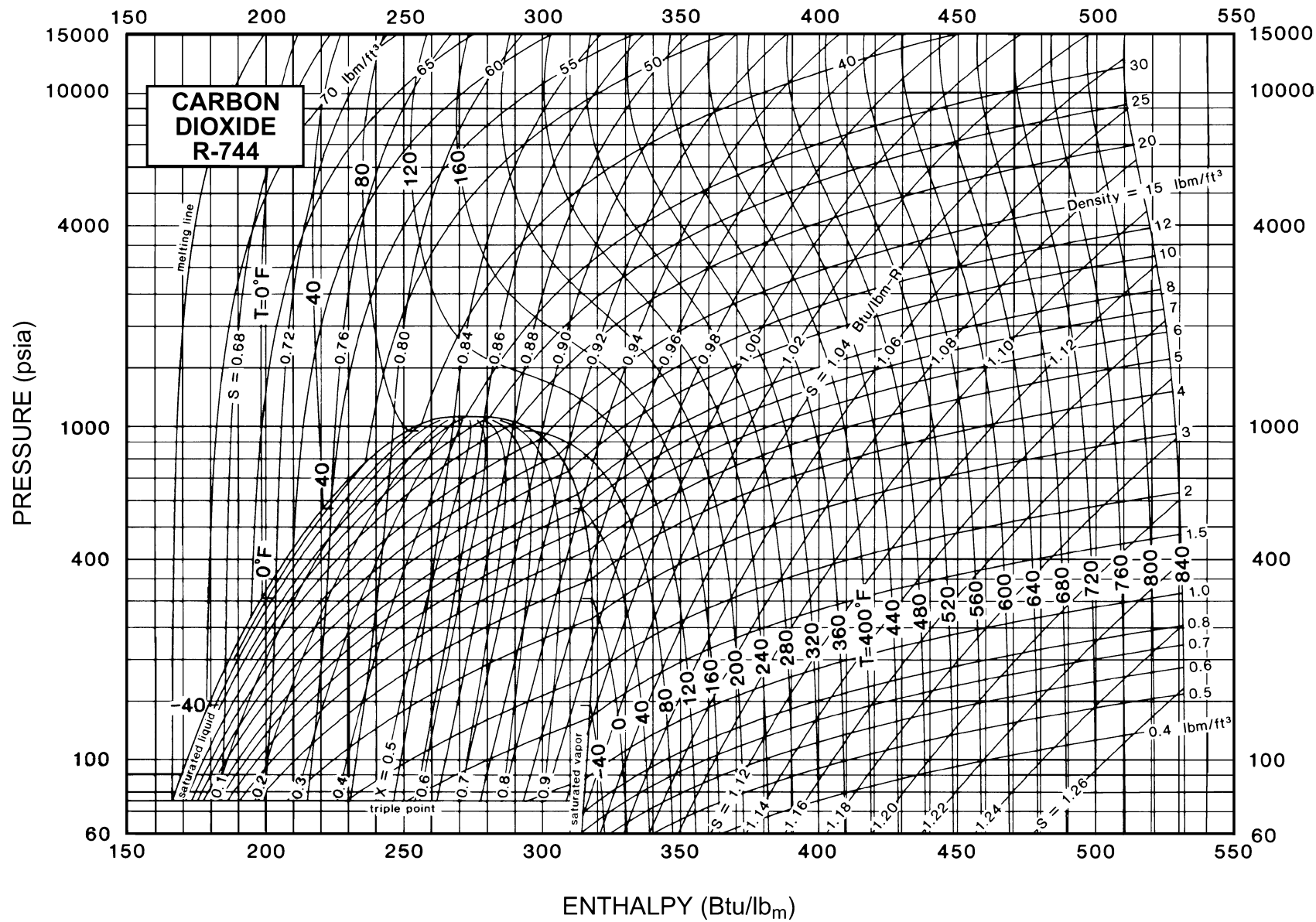


Fig. 14 Pressure-Enthalpy Diagram for Refrigerant 744 (Carbon Dioxide)

Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 744 (Carbon Dioxide) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³ Liquid	Volume, ft ³ /lb Vapor	Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, Temp., dyne/cm °F	
				Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-69.80a	75.124	73.57	1.1641	-14.140	136.598	-0.03449	0.35215	0.4668	0.2172	1.4442	3202.	730.9	0.621	0.0265	0.1044	0.00637	17.16	-69.80
-65.00	84.234	72.97	1.0434	-11.886	137.013	-0.02881	0.34847	0.4684	0.2212	1.4534	3138.	731.9	0.593	0.0268	0.1024	0.00650	16.49	-65.00
-60.00	94.573	72.33	0.9336	-9.532	137.417	-0.02294	0.34473	0.4703	0.2257	1.4638	3073.	732.7	0.565	0.0272	0.1003	0.00664	15.81	-60.00
-55.00	105.84	71.69	0.8375	-7.167	137.790	-0.01714	0.34107	0.4724	0.2304	1.4754	3007.	733.2	0.539	0.0276	0.0982	0.00678	15.12	-55.00
-50.00	118.08	71.04	0.7532	-4.791	138.130	-0.01138	0.33749	0.4749	0.2355	1.4882	2941.	733.5	0.514	0.0279	0.0962	0.00693	14.45	-50.00
-48.00	123.26	70.77	0.7224	-3.837	138.257	-0.00909	0.33608	0.4760	0.2377	1.4937	2915.	733.5	0.505	0.0281	0.0954	0.00699	14.18	-48.00
-46.00	128.61	70.51	0.6930	-2.881	138.379	-0.00681	0.33467	0.4771	0.2399	1.4994	2889.	733.5	0.496	0.0283	0.0945	0.00706	13.91	-46.00
-44.00	134.13	70.24	0.6651	-1.923	138.494	-0.00453	0.33328	0.4783	0.2422	1.5054	2862.	733.5	0.486	0.0284	0.0937	0.00712	13.65	-44.00
-42.00	139.82	69.97	0.6386	-0.963	138.604	-0.00226	0.33189	0.4795	0.2445	1.5116	2836.	733.4	0.477	0.0286	0.0929	0.00718	13.38	-42.00
-40.00	145.69	69.70	0.6132	0.000	138.708	0.00000	0.33052	0.4808	0.2470	1.5180	2809.	733.3	0.469	0.0287	0.0921	0.00725	13.12	-40.00
-38.00	151.74	69.42	0.5891	0.965	138.806	0.00226	0.32915	0.4821	0.2495	1.5247	2783.	733.1	0.460	0.0289	0.0913	0.00732	12.86	-38.00
-36.00	157.98	69.15	0.5661	1.933	138.898	0.00451	0.32779	0.4836	0.2520	1.5317	2756.	732.9	0.452	0.0290	0.0905	0.00739	12.60	-36.00
-34.00	164.40	68.87	0.5442	2.904	138.983	0.00675	0.32643	0.4850	0.2547	1.5390	2730.	732.6	0.443	0.0292	0.0897	0.00746	12.34	-34.00
-32.00	171.02	68.59	0.5233	3.877	139.062	0.00899	0.32509	0.4866	0.2574	1.5466	2703.	732.3	0.435	0.0293	0.0889	0.00753	12.08	-32.00
-30.00	177.83	68.31	0.5033	4.854	139.134	0.01123	0.32375	0.4882	0.2603	1.5545	2677.	732.0	0.427	0.0295	0.0881	0.00760	11.82	-30.00
-28.00	184.83	68.02	0.4842	5.833	139.199	0.01346	0.32241	0.4899	0.2632	1.5628	2650.	731.6	0.420	0.0297	0.0873	0.00768	11.56	-28.00
-26.00	192.04	67.74	0.4659	6.816	139.258	0.01568	0.32108	0.4917	0.2662	1.5714	2623.	731.1	0.412	0.0298	0.0865	0.00775	11.31	-26.00
-24.00	199.46	67.45	0.4485	7.802	139.309	0.01790	0.31975	0.4935	0.2694	1.5804	2596.	730.6	0.405	0.0300	0.0857	0.00783	11.06	-24.00
-22.00	207.08	67.16	0.4318	8.791	139.353	0.02012	0.31843	0.4955	0.2726	1.5898	2569.	730.1	0.397	0.0302	0.0849	0.00791	10.80	-22.00
-20.00	214.91	66.86	0.4158	9.784	139.389	0.02234	0.31711	0.4975	0.2760	1.5996	2542.	729.5	0.390	0.0303	0.0841	0.00799	10.55	-20.00
-18.00	222.97	66.56	0.4005	10.781	139.418	0.02455	0.31580	0.4996	0.2795	1.6099	2515.	728.9	0.383	0.0305	0.0833	0.00807	10.30	-18.00
-16.00	231.24	66.27	0.3859	11.781	139.438	0.02675	0.31448	0.5018	0.2831	1.6206	2488.	728.2	0.376	0.0307	0.0825	0.00816	10.05	-16.00
-14.00	239.73	65.96	0.3718	12.786	139.451	0.02896	0.31317	0.5042	0.2869	1.6318	2461.	727.5	0.369	0.0308	0.0818	0.00825	9.81	-14.00
-12.00	248.45	65.66	0.3584	13.794	139.455	0.03116	0.31186	0.5066	0.2908	1.6435	2433.	726.7	0.363	0.0310	0.0810	0.00834	9.56	-12.00
-10.00	257.40	65.35	0.3455	14.807	139.450	0.03336	0.31055	0.5091	0.2949	1.6557	2405.	725.9	0.356	0.0312	0.0802	0.00843	9.32	-10.00
-8.00	266.58	65.04	0.3331	15.824	139.437	0.03556	0.30924	0.5118	0.2991	1.6685	2378.	725.0	0.350	0.0314	0.0794	0.00853	9.07	-8.00
-6.00	276.01	64.72	0.3212	16.846	139.415	0.03776	0.30793	0.5146	0.3035	1.6820	2350.	724.1	0.343	0.0315	0.0786	0.00863	8.83	-6.00
-4.00	285.67	64.40	0.3098	17.873	139.383	0.03996	0.30662	0.5175	0.3082	1.6960	2321.	723.1	0.337	0.0317	0.0778	0.00873	8.59	-4.00
-2.00	295.58	64.08	0.2989	18.905	139.342	0.04216	0.30531	0.5206	0.3130	1.7108	2293.	722.1	0.331	0.0319	0.0771	0.00883	8.35	-2.00
0.00	305.74	63.76	0.2884	19.942	139.291	0.04435	0.30399	0.5238	0.3180	1.7262	2264.	721.0	0.325	0.0321	0.0763	0.00894	8.11	0.00
2.00	316.15	63.43	0.2782	20.985	139.230	0.04655	0.30267	0.5272	0.3233	1.7425	2235.	719.8	0.319	0.0323	0.0755	0.00905	7.88	2.00
4.00	326.82	63.09	0.2685	22.033	139.158	0.04875	0.30135	0.5307	0.3288	1.7596	2206.	718.6	0.313	0.0325	0.0747	0.00916	7.64	4.00
6.00	337.75	62.76	0.2591	23.088	139.075	0.05095	0.30003	0.5345	0.3346	1.7776	2176.	717.4	0.307	0.0327	0.0740	0.00928	7.41	6.00
8.00	348.94	62.42	0.2501	24.148	138.981	0.05315	0.29869	0.5384	0.3406	1.7965	2146.	716.1	0.302	0.0329	0.0732	0.00941	7.18	8.00
10.00	360.41	62.07	0.2414	25.215	138.876	0.05535	0.29736	0.5425	0.3470	1.8166	2116.	714.7	0.296	0.0331	0.0724	0.00953	6.95	10.00
12.00	372.14	61.72	0.2331	26.289	138.758	0.05756	0.29601	0.5469	0.3537	1.8377	2085.	713.2	0.291	0.0333	0.0716	0.00967	6.72	12.00
14.00	384.16	61.36	0.2250	27.369	138.628	0.05977	0.29466	0.5514	0.3607	1.8601	2054.	711.8	0.286	0.0335	0.0709	0.00981	6.50	14.00
16.00	396.45	61.00	0.2173	28.457	138.485	0.06198	0.29329	0.5563	0.3681	1.8837	2023.	710.2	0.280	0.0338	0.0701	0.00995	6.27	16.00
18.00	409.03	60.63	0.2098	29.552	138.328	0.06420	0.29192	0.5614	0.3759	1.9089	1991.	708.6	0.275	0.0340	0.0693	0.01010	6.05	18.00
20.00	421.91	60.26	0.2025	30.656	138.158	0.06642	0.29054	0.5669	0.3841	1.9356	1959.	706.9	0.270	0.0342	0.0685	0.01026	5.83	20.00
22.00	435.07	59.89	0.1956	31.768	137.973	0.06865	0.28915	0.5726	0.3928	1.9640	1926.	705.2	0.265	0.0345	0.0677	0.01042	5.61	22.00
24.00	448.54	59.50	0.1888	32.889	137.772	0.07089	0.28774	0.5787	0.4021	1.9942	1894.	703.4	0.260	0.0347	0.0670	0.01059	5.39	24.00
26.00	462.30	59.11	0.1823	34.019	137.556	0.07313	0.28632	0.5853	0.4120	2.0266	1861.	701.6	0.255	0.0350	0.0662	0.01077	5.17	26.00
28.00	476.38	58.71	0.1760	35.159	137.323	0.07538	0.28488	0.5922	0.4225	2.0611	1827.	699.7	0.250	0.0352	0.0654	0.01096	4.96	28.00
30.00	490.77	58.31	0.1699	36.309	137.072	0.07764	0.28342	0.5997	0.4337	2.0982	1794.	697.7	0.245	0.0355	0.0646	0.01116	4.75	30.00
32.00	505.48	57.90	0.1640	37.470	136.803	0.07991	0.28195	0.6076	0.4457	2.1380	1760.	695.7	0.240	0.0358	0.0638	0.01137	4.54	32.00
34.00	520.51	57.48	0.1583	38.643	136.514	0.08220	0.28045	0.6162	0.4586	2.1808	1726.	693.6	0.236	0.0361	0.0631	0.01160	4.33	34.00
36.00	535.86	57.05	0.1528	39.828	136.206	0.08449	0.27893	0.6254	0.4725	2.2271	1692.	691.4	0.231	0.0364	0.0623	0.01183	4.13	36.00
38.00	551.55	56.61	0.1475	41.025	135.875	0.08680	0.27739	0.6353	0.4875	2.2771	1657.	689.1	0.227	0.0367	0.0615	0.01208	3.92	38.00
40.00	567.58	56.16	0.1423	42.237	135.522	0.08912	0.27582	0.6460	0.5038	2.3314	1623.	686.8	0.222	0.0370	0.0607	0.01235	3.72	40.00
42.00	583.95	55.71	0.1373	43.464	135.145	0.09147	0.27422	0.6577	0.5215	2.3905	1588.	684.4	0.217	0.0373	0.0599	0.01263	3.53	42.00
44.00	600.67	55.24	0.1324	44.706	134.741	0.09383	0.27259	0.6704	0.5408	2.4551	1553.	681.9	0.213	0.0377	0.0591	0.01294	3.33	44.00
46.00	617.75	54.76	0.1276	45.965	134.310	0.09621	0.27092	0.6843	0.5620	2.5260	1518.	679.3	0.209	0.0381	0.0583	0.01326	3.14	46.00
48.00	635.18	54.27	0.1230	47.242	133.850	0.09861	0.26921	0.6996	0.5854	2.6040	1482.	676.7	0.204	0.0384	0.0575	0.01362	2.94	48.00
50.00	652.99	53.76	0.1185	48.539	133.357	0.10104	0.26746	0.7164	0.6113	2.6903	1447.	673.9	0.200	0.0388	0.0567	0.01400	2.76	50.00
52.00	671.16	53.24	0.1141	49.858	132.830	0.10350	0.26566	0.7352	0.6402	2.7863	1411.	671.0	0.195	0.0393	0.0559	0.01441	2.57	52.00
54.00	689.72	52.70	0.1099	51.200	132.266	0.10599	0.26381	0.7562	0.6725	2.8937	1375.	668.1	0.191					

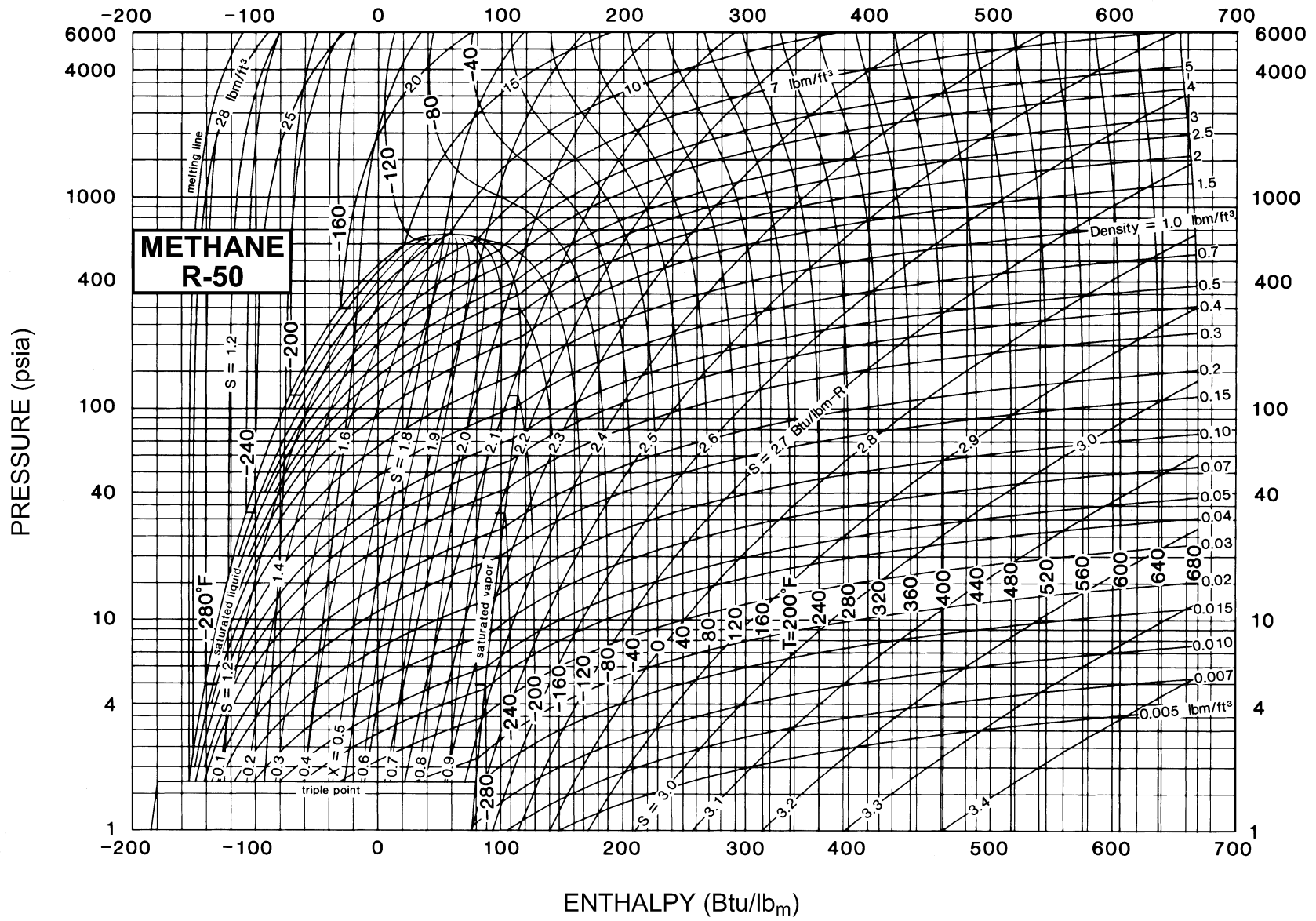


Fig. 15 Pressure-Enthalpy Diagram for Refrigerant 50 (Methane)
 Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 50 (Methane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, Volume, lb/ft ³ , ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, Temp., dyne/cm °F	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-296.42a	1.696	28.18	63.884	-30.898	203.250	-0.16968	1.26461	0.8049	0.5043	1.3410	5048.	817.3	0.709	0.0085	0.1584	0.00590	18.76	-296.42
-290.00	2.635	27.89	42.619	-25.716	206.228	-0.13858	1.22845	0.8081	0.5071	1.3440	4941.	831.7	0.443	0.0091	0.1197	0.00537	17.78	-290.00
-280.00	4.891	27.41	24.167	-17.593	210.749	-0.09216	1.17874	0.8144	0.5127	1.3505	4770.	852.7	0.379	0.0097	0.1156	0.00578	16.30	-280.00
-270.00	8.466	26.93	14.619	-9.396	215.095	-0.04789	1.13569	0.8219	0.5198	1.3594	4594.	871.6	0.328	0.0102	0.1113	0.00620	14.87	-270.00
-260.00	13.822	26.43	9.3292	-1.111	219.231	-0.00551	1.09801	0.8307	0.5287	1.3712	4414.	888.5	0.287	0.0107	0.1069	0.00664	13.48	-260.00
-250.00	21.476	25.92	6.2231	7.279	223.120	0.03522	1.06465	0.8409	0.5398	1.3868	4231.	903.2	0.254	0.0113	0.1024	0.00710	12.14	-250.00
-258.67b	14.696	26.37	8.8187	0.000	219.763	0.00000	1.09335	0.8320	0.5300	1.3731	4390.	890.6	0.282	0.0108	0.1063	0.00670	13.30	-258.67
-245.00	26.341	25.66	5.1555	11.517	224.960	0.05503	1.04932	0.8467	0.5462	1.3963	4137.	909.7	0.239	0.0116	0.1001	0.00734	11.49	-245.00
-240.00	31.996	25.39	4.3071	15.788	226.724	0.07451	1.03475	0.8529	0.5534	1.4070	4043.	915.5	0.226	0.0119	0.0979	0.00759	10.85	-240.00
-235.00	38.517	25.12	3.6261	20.095	228.407	0.09368	1.02087	0.8598	0.5613	1.4191	3948.	920.8	0.214	0.0121	0.0956	0.00785	10.23	-235.00
-230.00	45.984	24.84	3.0742	24.439	230.002	0.11256	1.00760	0.8672	0.5701	1.4329	3851.	925.4	0.202	0.0124	0.0933	0.00811	9.62	-230.00
-225.00	54.475	24.56	2.6230	28.824	231.505	0.13117	0.99486	0.8754	0.5800	1.4484	3753.	929.4	0.192	0.0127	0.0910	0.00839	9.02	-225.00
-220.00	64.073	24.27	2.2512	33.255	232.908	0.14955	0.98258	0.8845	0.5909	1.4660	3655.	932.7	0.182	0.0131	0.0887	0.00868	8.43	-220.00
-215.00	74.859	23.97	1.9423	37.734	234.206	0.16770	0.97071	0.8945	0.6032	1.4860	3554.	935.4	0.173	0.0134	0.0864	0.00898	7.86	-215.00
-210.00	86.918	23.67	1.6839	42.267	235.391	0.18566	0.95918	0.9057	0.6170	1.5087	3452.	937.4	0.164	0.0137	0.0841	0.00929	7.31	-210.00
-205.00	100.33	23.36	1.4662	46.858	236.456	0.20345	0.94793	0.9181	0.6325	1.5346	3349.	938.7	0.156	0.0140	0.0818	0.00962	6.76	-205.00
-200.00	115.19	23.04	1.2817	51.514	237.390	0.22109	0.93691	0.9322	0.6502	1.5643	3244.	939.3	0.149	0.0144	0.0795	0.00997	6.23	-200.00
-195.00	131.58	22.71	1.1243	56.241	238.185	0.23862	0.92605	0.9480	0.6703	1.5984	3137.	939.2	0.141	0.0147	0.0773	0.01033	5.72	-195.00
-190.00	149.59	22.37	0.9893	61.047	238.828	0.25605	0.91531	0.9661	0.6935	1.6378	3028.	938.3	0.135	0.0151	0.0750	0.01072	5.22	-190.00
-185.00	169.30	22.01	0.8728	65.940	239.308	0.27343	0.90461	0.9868	0.7202	1.6837	2917.	936.7	0.128	0.0155	0.0727	0.01113	4.74	-185.00
-180.00	190.81	21.64	0.7718	70.932	239.607	0.29078	0.89390	1.011	0.7515	1.7375	2804.	934.3	0.122	0.0159	0.0704	0.01157	4.27	-180.00
-175.00	214.22	21.26	0.6836	76.035	239.709	0.30815	0.88311	1.039	0.7886	1.8014	2688.	931.1	0.116	0.0163	0.0681	0.01204	3.82	-175.00
-170.00	239.62	20.86	0.6064	81.263	239.590	0.32557	0.87215	1.072	0.8329	1.8780	2570.	927.1	0.110	0.0168	0.0658	0.01256	3.38	-170.00
-165.00	267.11	20.44	0.5383	86.636	239.224	0.34312	0.86095	1.112	0.8868	1.9714	2448.	922.2	0.104	0.0173	0.0635	0.01314	2.96	-165.00
-160.00	296.80	19.99	0.4781	92.177	238.576	0.36085	0.84938	1.160	0.9538	2.0871	2322.	916.4	0.099	0.0178	0.0612	0.01378	2.56	-160.00
-155.00	328.79	19.52	0.4243	97.917	237.600	0.37885	0.83733	1.221	1.039	2.2340	2193.	909.7	0.094	0.0183	0.0589	0.01452	2.17	-155.00
-150.00	363.20	19.01	0.3761	103.898	236.236	0.39725	0.82460	1.299	1.151	2.4258	2058.	901.9	0.088	0.0190	0.0565	0.01538	1.80	-150.00
-140.00	439.83	17.84	0.2929	116.835	231.967	0.43590	0.79606	1.553	1.523	3.0583	1768.	882.8	0.078	0.0205	0.0517	0.01776	1.13	-140.00
-130.00	527.92	16.34	0.2216	131.950	224.363	0.47950	0.75982	2.175	2.478	4.6351	1435.	857.4	0.067	0.0227	0.0469	0.02236	0.55	-130.00
-120.00	629.39	13.83	0.1511	153.364	207.529	0.53971	0.69917	6.640	9.528	15.490	995.	814.0	0.052	0.0272	0.0456	0.04087	0.10	-120.00
-116.65c	667.06	10.15	0.0985	178.791	178.791	0.61244	0.61244	∞	∞	∞	0.	0.0	-	-	∞	∞	0.00	-116.65

*Temperatures are on the ITS-90 scale a = triple point b = normal boiling point c = critical point

Refrigerant 50 (Methane) Properties of Gas at 14.696 psia (one standard atmosphere)

Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	Specific Heat c_p , Btu/lb·°F	c_p/c_v	Vel. of Sound, ft/s	Viscosity, lb _m /ft·h	Thermal Cond., Btu/h·ft·°F
-258.7a	0.1134	219.76	1.0933	0.5300	1.373	890.6	0.0108	0.00670
-250.00	0.1082	224.33	1.1156	0.5235	1.368	912.4	0.0112	0.00700
-240.00	0.1028	229.54	1.1398	0.5183	1.363	936.5	0.0118	0.00737
-230.00	0.0980	234.70	1.1628	0.5145	1.359	959.7	0.0123	0.00774
-220.00	0.0936	239.83	1.1847	0.5116	1.356	982.2	0.0128	0.00811
-200.00	0.0860	250.02	1.2255	0.5077	1.351	1025.2	0.0138	0.00887
-180.00	0.0796	260.14	1.2631	0.5052	1.347	1066.1	0.0149	0.00963
-160.00	0.0741	270.23	1.2979	0.5038	1.345	1105.2	0.0159	0.01039
-140.00	0.0694	280.30	1.3305	0.5030	1.342	1142.6	0.0169	0.01116
-120.00	0.0652	290.36	1.3610	0.5029	1.340	1178.6	0.0179	0.01193
-100.00	0.0615	300.42	1.3898	0.5034	1.338	1213.2	0.0189	0.01267
-80.00	0.0582	310.50	1.4170	0.5044	1.335	1246.6	0.0199	0.01343
-60.00	0.0552	320.60	1.4430	0.5060	1.333	1278.8	0.0208	0.01419
-40.00	0.0526	330.74	1.4677	0.5082	1.330	1309.8	0.0218	0.01497
-20.00	0.0501	340.93	1.4914	0.5110	1.326	1339.8	0.0227	0.01576
0.00	0.0479	351.18	1.5142	0.5145	1.323	1368.7	0.0236	0.01656
20.00	0.0459	361.51	1.5362	0.5185	1.319	1396.6	0.0245	0.01738
40.00	0.0441	371.93	1.5575	0.5232	1.315	1423.6	0.0254	0.01822
60.00	0.0424	382.45	1.5781	0.5285	1.310	1449.8	0.0263	0.01908
80.00	0.0408	393.07	1.5982	0.5343	1.305	1475.1	0.0272	0.01996
100.00	0.0393	403.82	1.6178	0.5406	1.300	1499.7	0.0280	0.02087
120.00	0.0379	414.70	1.6369	0.5474	1.295	1523.5	0.0289	0.02180
140.00	0.0367	425.72	1.6556	0.5547	1.290	1546.7	0.0297	0.02275
160.00	0.0355	436.89	1.6739	0.5624	1.285	1569.3	0.0306	0.02373
180.00	0.0344	448.22	1.6919	0.5704	1.280	1591.3	0.0314	0.02473
200.00	0.0333	459.71	1.7096	0.5788	1.274	1612.8	0.0322	0.02576
220.00	0.0323	471.37	1.7270	0.5875	1.269	1633.9	0.0330	0.02680
240.00	0.0314	483.21	1.7441	0.5964	1.264	1654.5	0.0337	0.02787
260.00	0.0305	495.23	1.7611	0.6055	1.259	1674.7	0.0345	0.02896
280.00	0.0297	507.43	1.7778	0.6148	1.254	1694.6	0.0353	0.03008
300.00	0.0289	519.82	1.7943	0.6243	1.249	1714.1	0.0360	0.03121
320.00	0.0282	532.40	1.8107	0.6339	1.244	1733.3	0.0368	0.03236
340.00	0.0275	545.18	1.8269	0.6436	1.239	1752.2	0.0375	0.03353
360.00	0.0268	558.15	1.8429	0.6534	1.235	1770.9	0.0382	0.03472
380.00	0.0262	571.32	1.8587	0.6633	1.231	1789.3	0.0389	0.03592
400.00	0.0256	584.68	1.8745	0.6732	1.226	1807.4	0.0397	0.03714
420.00	0.0250	598.24	1.8901	0.6831	1.222	1825.4	0.0404	0.03837
440.00	0.0244	612.00	1.9055	0.6931	1.218	1843.1	0.0411	0.03962
460.00	0.0239	625.97	1.9209	0.7031	1.215	1860.6	0.0417	0.04088
480.00	0.0234	640.13	1.9361	0.7130	1.211	1877.9	0.0424	0.04216
500.00	0.0229	654.49	1.9512	0.7230	1.207	1895.1	0.0431	0.04345

a = saturated vapor at the normal boiling point

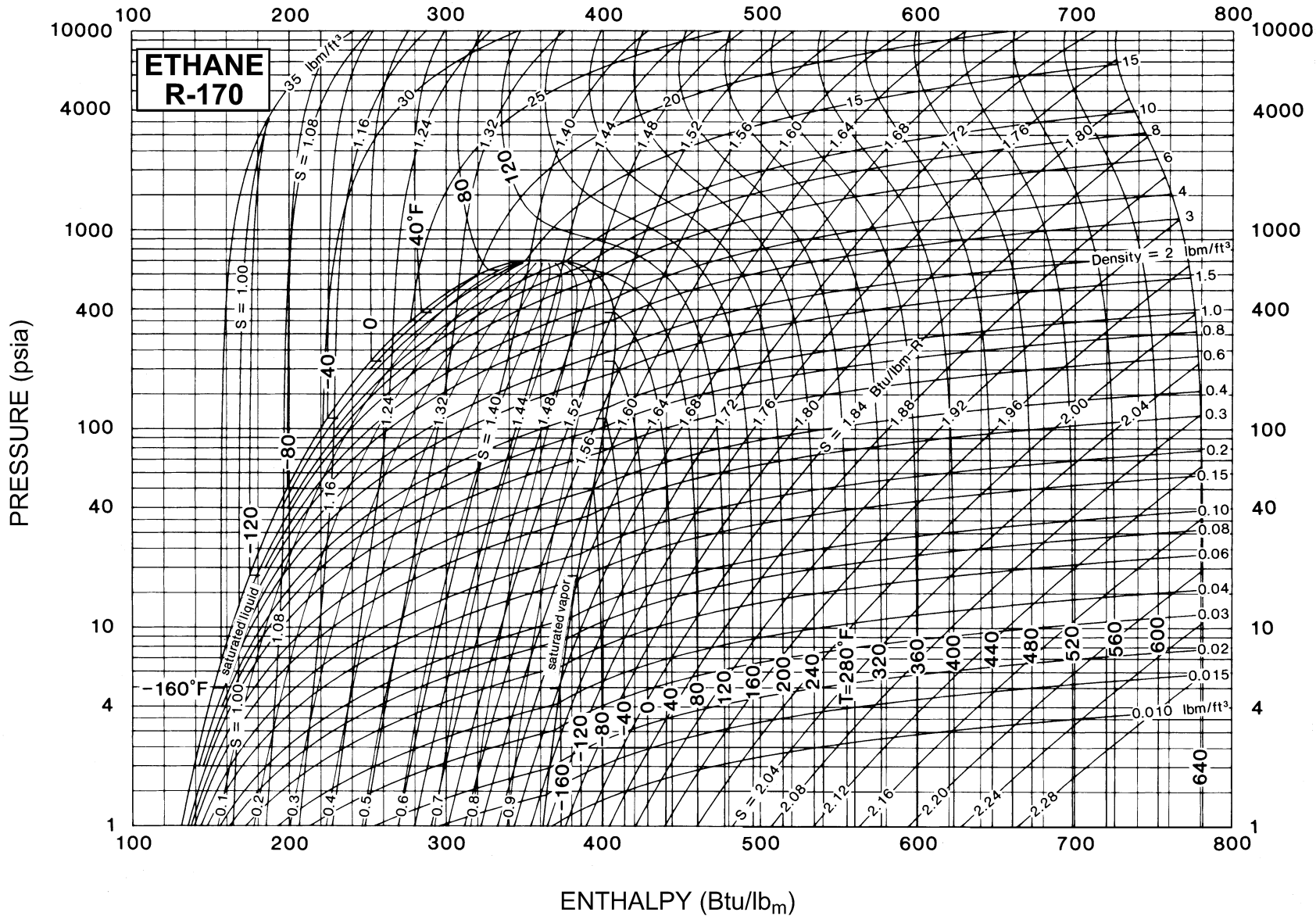


Fig. 16 Pressure-Enthalpy Diagram for Refrigerant 170 (Ethane)

Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 170 (Ethane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, Volume, lb/ft ³ ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, Temp., dyne/cm °F	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-250.00	0.031	38.90	2432.6	-68.960	174.898	-0.25844	0.90461	0.5617	0.2845	1.2964	5975.	670.6	1.290	0.0092	0.1351	0.00256	27.27	-250.00
-245.00	0.046	38.71	1655.0	-66.153	176.373	-0.24521	0.88455	0.5608	0.2840	1.2955	5908.	678.4	1.202	0.0094	0.1336	0.00266	26.80	-245.00
-240.00	0.068	38.52	1148.9	-63.352	177.855	-0.23231	0.86573	0.5599	0.2833	1.2947	5842.	686.0	1.125	0.0096	0.1320	0.00276	26.34	-240.00
-235.00	0.099	38.33	812.62	-60.555	179.344	-0.21972	0.84806	0.5590	0.2824	1.2940	5775.	693.6	1.055	0.0098	0.1305	0.00287	25.87	-235.00
-230.00	0.140	38.13	584.87	-57.762	180.839	-0.20743	0.83145	0.5582	0.2814	1.2935	5707.	701.1	0.992	0.0100	0.1290	0.00297	25.41	-230.00
-225.00	0.196	37.94	427.81	-54.972	182.339	-0.19542	0.81584	0.5575	0.2804	1.2930	5640.	708.5	0.936	0.0102	0.1274	0.00307	24.94	-225.00
-220.00	0.269	37.75	317.69	-52.186	183.842	-0.18367	0.80114	0.5570	0.2794	1.2925	5573.	715.8	0.884	0.0104	0.1258	0.00318	24.48	-220.00
-215.00	0.365	37.55	239.25	-49.401	185.348	-0.17217	0.78728	0.5567	0.2786	1.2921	5505.	722.9	0.838	0.0106	0.1243	0.00329	24.01	-215.00
-210.00	0.488	37.36	182.56	-46.618	186.854	-0.16091	0.77421	0.5565	0.2779	1.2918	5438.	729.9	0.795	0.0108	0.1227	0.00339	23.55	-210.00
-205.00	0.643	37.16	141.02	-43.835	188.360	-0.14988	0.76187	0.5565	0.2775	1.2914	5370.	736.7	0.756	0.0110	0.1211	0.00350	23.09	-205.00
-200.00	0.839	36.96	110.19	-41.051	189.863	-0.13906	0.75020	0.5568	0.2774	1.2911	5302.	743.4	0.720	0.0112	0.1195	0.00362	22.63	-200.00
-195.00	1.082	36.76	87.029	-38.265	191.361	-0.12844	0.73916	0.5572	0.2776	1.2908	5234.	749.8	0.687	0.0114	0.1179	0.00373	22.16	-195.00
-190.00	1.381	36.56	69.431	-35.477	192.854	-0.11801	0.72870	0.5578	0.2783	1.2905	5166.	756.1	0.656	0.0116	0.1163	0.00384	21.70	-190.00
-185.00	1.744	36.36	55.916	-32.685	194.340	-0.10775	0.71878	0.5586	0.2793	1.2902	5098.	762.2	0.627	0.0118	0.1147	0.00396	21.25	-185.00
-180.00	2.183	36.16	45.433	-29.888	195.818	-0.09767	0.70937	0.5596	0.2808	1.2900	5030.	768.0	0.601	0.0120	0.1131	0.00408	20.79	-180.00
-175.00	2.708	35.96	37.222	-27.085	197.286	-0.08775	0.70043	0.5607	0.2826	1.2898	4962.	773.6	0.576	0.0122	0.1115	0.00420	20.33	-175.00
-170.00	3.331	35.75	30.735	-24.276	198.743	-0.07798	0.69193	0.5620	0.2849	1.2897	4893.	779.0	0.553	0.0124	0.1099	0.00433	19.87	-170.00
-165.00	4.066	35.55	25.565	-21.460	200.189	-0.06835	0.68384	0.5635	0.2877	1.2898	4825.	784.1	0.531	0.0126	0.1084	0.00445	19.42	-165.00
-160.00	4.927	35.34	21.413	-18.635	201.621	-0.05886	0.67614	0.5652	0.2908	1.2899	4757.	789.1	0.511	0.0129	0.1068	0.00458	18.96	-160.00
-155.00	5.928	35.13	18.052	-15.801	203.041	-0.04950	0.66879	0.5670	0.2943	1.2902	4688.	793.8	0.492	0.0131	0.1052	0.00471	18.51	-155.00
-150.00	7.084	34.92	15.312	-12.958	204.445	-0.04026	0.66179	0.5690	0.2982	1.2907	4619.	798.2	0.474	0.0133	0.1036	0.00484	18.06	-150.00
-145.00	8.414	34.71	13.063	-10.103	205.835	-0.03114	0.65510	0.5712	0.3024	1.2914	4550.	802.5	0.456	0.0135	0.1021	0.00498	17.61	-145.00
-140.00	9.934	34.50	11.206	-7.236	207.208	-0.02213	0.64871	0.5735	0.3069	1.2923	4481.	806.5	0.440	0.0137	0.1005	0.00512	17.16	-140.00
-135.00	11.661	34.29	9.620	-4.357	208.565	-0.01322	0.64259	0.5759	0.3118	1.2935	4412.	810.2	0.425	0.0139	0.0990	0.00526	16.71	-135.00
-130.00	13.617	34.07	8.3715	-1.465	209.904	-0.00441	0.63674	0.5785	0.3169	1.2950	4343.	813.8	0.410	0.0141	0.0974	0.00541	16.26	-130.00
-127.48b	14.696	33.96	7.8007	0.000	210.573	0.00000	0.63389	0.5799	0.3196	1.2959	4308.	815.5	0.403	0.0142	0.0966	0.00548	16.04	-127.48
-125.00	15.819	33.85	7.2866	1.441	211.225	0.00430	0.63114	0.5813	0.3223	1.2968	4274.	817.1	0.396	0.0143	0.0959	0.00555	15.82	-125.00
-120.00	18.288	33.63	6.3699	4.363	212.527	0.01293	0.62577	0.5843	0.3280	1.2989	4204.	820.1	0.383	0.0146	0.0943	0.00571	15.37	-120.00
-115.00	21.046	33.41	5.5913	7.300	213.809	0.02147	0.62062	0.5874	0.3339	1.3013	4135.	822.9	0.370	0.0148	0.0928	0.00586	14.93	-115.00
-110.00	24.113	33.18	4.9269	10.254	215.070	0.02993	0.61567	0.5906	0.3401	1.3042	4065.	825.5	0.358	0.0150	0.0913	0.00602	14.49	-110.00
-105.00	27.513	32.95	4.3574	13.225	216.311	0.03831	0.61092	0.5941	0.3465	1.3074	3995.	827.8	0.346	0.0152	0.0898	0.00618	14.05	-105.00
-100.00	31.267	32.73	3.8670	16.215	217.529	0.04662	0.60634	0.5977	0.3531	1.3110	3925.	829.8	0.335	0.0154	0.0883	0.00635	13.62	-100.00
-95.00	35.400	32.49	3.4431	19.224	218.724	0.05487	0.60194	0.6015	0.3599	1.3151	3854.	831.6	0.324	0.0157	0.0868	0.00652	13.18	-95.00
-90.00	39.933	32.26	3.0750	22.254	219.895	0.06305	0.59769	0.6056	0.3670	1.3197	3784.	833.1	0.314	0.0159	0.0853	0.00669	12.75	-90.00
-85.00	44.893	32.02	2.7544	25.305	221.042	0.07117	0.59359	0.6098	0.3743	1.3247	3713.	834.3	0.304	0.0161	0.0839	0.00687	12.32	-85.00
-80.00	50.302	31.78	2.4740	28.378	222.162	0.07923	0.58963	0.6142	0.3819	1.3303	3642.	835.3	0.295	0.0164	0.0824	0.00706	11.89	-80.00
-75.00	56.186	31.54	2.2279	31.475	223.255	0.08725	0.58580	0.6189	0.3897	1.3364	3571.	836.0	0.286	0.0166	0.0810	0.00724	11.46	-75.00
-70.00	62.570	31.29	2.0112	34.595	224.320	0.09521	0.58209	0.6238	0.3978	1.3432	3500.	836.4	0.277	0.0168	0.0795	0.00744	11.04	-70.00
-65.00	69.479	31.04	1.8197	37.742	225.355	0.10313	0.57850	0.6290	0.4062	1.3506	3428.	836.4	0.268	0.0171	0.0781	0.00764	10.62	-65.00
-60.00	76.940	30.78	1.6501	40.915	226.359	0.11101	0.57500	0.6345	0.4149	1.3588	3356.	836.2	0.260	0.0173	0.0767	0.00784	10.20	-60.00
-55.00	84.978	30.53	1.4993	44.117	227.331	0.11885	0.57159	0.6402	0.4239	1.3677	3283.	835.7	0.252	0.0176	0.0753	0.00806	9.78	-55.00
-50.00	93.620	30.26	1.3650	47.348	228.268	0.12665	0.56828	0.6464	0.4334	1.3775	3211.	834.8	0.244	0.0178	0.0739	0.00828	9.37	-50.00
-45.00	102.89	30.00	1.2449	50.610	229.169	0.13443	0.56503	0.6528	0.4433	1.3883	3138.	833.6	0.236	0.0181	0.0725	0.00850	8.96	-45.00
-40.00	112.82	29.72	1.1372	53.905	230.032	0.14218	0.56186	0.6597	0.4536	1.4001	3064.	832.1	0.229	0.0184	0.0712	0.00874	8.55	-40.00
-35.00	123.44	29.45	1.0405	57.234	230.854	0.14991	0.55874	0.6671	0.4645	1.4131	2990.	830.2	0.222	0.0186	0.0698	0.00898	8.15	-35.00
-30.00	134.77	29.17	0.9534	60.599	231.634	0.15762	0.55568	0.6749	0.4760	1.4274	2916.	828.0	0.215	0.0189	0.0685	0.00923	7.75	-30.00
-25.00	146.84	28.88	0.8747	64.002	232.368	0.16531	0.55265	0.6833	0.4882	1.4431	2841.	825.4	0.208	0.0192	0.0671	0.00950	7.35	-25.00
-20.00	159.68	28.59	0.8035	67.446	233.053	0.17300	0.54966	0.6923	0.5012	1.4606	2766.	822.5	0.202	0.0195	0.0658	0.00977	6.96	-20.00
-15.00	173.31	28.29	0.7389	70.933	233.687	0.18069	0.54670	0.7020	0.5151	1.4800	2690.	819.1	0.196	0.0198	0.0645	0.01006	6.57	-15.00
-10.00	187.78	27.98	0.6802	74.465	234.264	0.18837	0.54374	0.7125	0.5301	1.5015	2613.	815.4	0.189	0.0202	0.0632	0.01035	6.18	-10.00
-5.00	203.10	27.66	0.6267	78.047	234.782	0.19607	0.54079	0.7239	0.5463	1.5256	2536.	811.3	0.183	0.0205	0.0619	0.01067	5.80	-5.00
0.00	219.31	27.34	0.5778	81.680	235.234	0.20378	0.53783	0.7364	0.5639	1.5527	2458.	806.7	0.177	0.0209	0.0606	0.01100	5.42	0.00
5.00	236.45	27.01	0.5330	85.370	235.615	0.21151	0.53485	0.7502	0.5832	1.5832	2379.	801.7	0.171	0.0212	0.0593	0.01135	5.05	5.00
10.00	254.53	26.67	0.4919	89.121	235.920	0.21927	0.53183	0.7654	0.6046	1.6179	2299.	796.3	0.166	0.0216	0.0581	0.01173	4.68	10.00
15.00	273.60	26.31	0.4542	92.938	236.139	0.22707	0.52876	0.7825	0.6284	1.6575	2218.	790.4	0.160	0.0220	0.0568	0.01212	4.32	15.00
20.00	293.69	25.95	0.4194	96.827	236.265	0.23492	0.52562	0.8016	0.6552	1.7032	2135.	784.0	0.154	0.0225	0.0556	0.01255	3.96	20.00
25.00	314.83	25.57	0.3872	100.797	236.287	0.24												

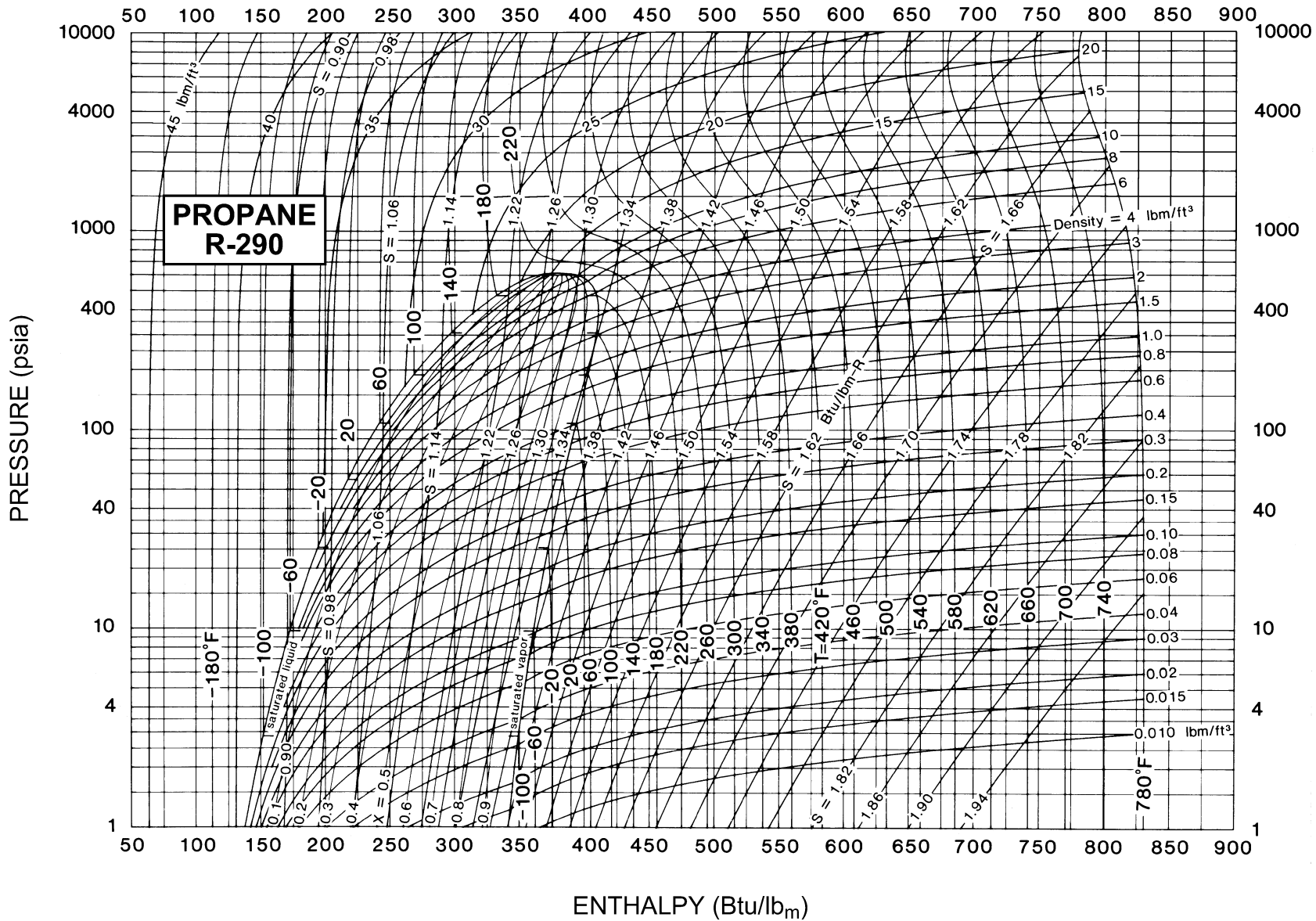


Fig. 17 Pressure-Enthalpy Diagram for Refrigerant 290 (Propane)

Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 290 (Propane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³		Volume, ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-200.00	0.020	42.05	3140.2	-80.254	137.547	-0.23938	0.59946	0.4748	0.2597	1.2104	5655.	595.1	1.806	0.0099	0.1051	0.00287	28.59	-200.00		
-190.00	0.040	41.70	1639.9	-75.496	140.152	-0.22140	0.57835	0.4770	0.2639	1.2066	5532.	605.4	1.595	0.0102	0.1033	0.00308	27.74	-190.00		
-180.00	0.075	41.35	903.80	-70.714	142.794	-0.20399	0.55951	0.4793	0.2682	1.2031	5411.	615.4	1.422	0.0106	0.1014	0.00330	26.90	-180.00		
-170.00	0.135	40.99	522.49	-65.908	145.468	-0.18710	0.54268	0.4819	0.2726	1.1998	5290.	625.2	1.278	0.0109	0.0995	0.00351	26.06	-170.00		
-160.00	0.231	40.64	315.21	-61.074	148.175	-0.17069	0.52762	0.4847	0.2771	1.1967	5170.	634.6	1.157	0.0113	0.0975	0.00374	25.23	-160.00		
-150.00	0.380	40.28	197.57	-56.212	150.910	-0.15474	0.51416	0.4877	0.2819	1.1938	5051.	643.8	1.053	0.0116	0.0956	0.00397	24.39	-150.00		
-145.00	0.482	40.10	158.46	-53.769	152.287	-0.14691	0.50797	0.4893	0.2843	1.1925	4991.	648.3	1.007	0.0118	0.0946	0.00408	23.98	-145.00		
-140.00	0.605	39.92	128.13	-51.318	153.671	-0.13918	0.50211	0.4910	0.2868	1.1912	4932.	652.7	0.963	0.0119	0.0936	0.00420	23.56	-140.00		
-135.00	0.753	39.74	104.41	-48.858	155.061	-0.13155	0.49657	0.4927	0.2893	1.1900	4872.	657.0	0.923	0.0121	0.0926	0.00432	23.15	-135.00		
-130.00	0.931	39.56	85.699	-46.389	156.457	-0.12401	0.49133	0.4945	0.2919	1.1889	4813.	661.2	0.885	0.0123	0.0916	0.00444	22.74	-130.00		
-125.00	1.143	39.37	70.830	-43.911	157.857	-0.11655	0.48638	0.4964	0.2946	1.1879	4754.	665.3	0.850	0.0125	0.0906	0.00456	22.33	-125.00		
-120.00	1.393	39.19	58.927	-41.424	159.262	-0.10917	0.48169	0.4983	0.2973	1.1869	4695.	669.3	0.816	0.0126	0.0896	0.00468	21.92	-120.00		
-115.00	1.686	39.01	49.331	-38.927	160.672	-0.10188	0.47726	0.5003	0.3001	1.1860	4636.	673.2	0.785	0.0128	0.0886	0.00480	21.51	-115.00		
-110.00	2.029	38.82	41.543	-36.419	162.086	-0.09466	0.47307	0.5024	0.3030	1.1853	4577.	677.1	0.755	0.0130	0.0877	0.00493	21.10	-110.00		
-105.00	2.427	38.64	35.182	-33.900	163.503	-0.08751	0.46910	0.5045	0.3060	1.1846	4518.	680.8	0.727	0.0132	0.0867	0.00505	20.70	-105.00		
-100.00	2.886	38.45	29.955	-31.370	164.924	-0.08043	0.46536	0.5067	0.3090	1.1840	4459.	684.4	0.701	0.0133	0.0857	0.00518	20.29	-100.00		
-95.00	3.414	38.27	25.636	-28.829	166.348	-0.07342	0.46182	0.5090	0.3121	1.1834	4401.	687.9	0.676	0.0135	0.0847	0.00531	19.89	-95.00		
-90.00	4.017	38.08	22.046	-26.276	167.774	-0.06648	0.45848	0.5114	0.3153	1.1830	4342.	691.2	0.652	0.0137	0.0837	0.00544	19.49	-90.00		
-85.00	4.704	37.89	19.046	-23.710	169.202	-0.05959	0.45532	0.5138	0.3185	1.1827	4283.	694.5	0.629	0.0138	0.0827	0.00557	19.08	-85.00		
-80.00	5.482	37.70	16.528	-21.132	170.631	-0.05277	0.45234	0.5164	0.3219	1.1825	4225.	697.6	0.608	0.0140	0.0817	0.00570	18.68	-80.00		
-75.00	6.360	37.51	14.403	-18.541	172.062	-0.04600	0.44952	0.5190	0.3253	1.1825	4166.	700.6	0.587	0.0142	0.0808	0.00583	18.29	-75.00		
-70.00	7.347	37.32	12.601	-15.937	173.493	-0.03928	0.44687	0.5216	0.3288	1.1825	4108.	703.5	0.568	0.0144	0.0798	0.00596	17.89	-70.00		
-65.00	8.452	37.12	11.067	-13.318	174.925	-0.03262	0.44436	0.5244	0.3324	1.1826	4049.	706.2	0.549	0.0145	0.0788	0.00610	17.49	-65.00		
-60.00	9.684	36.93	9.7549	-10.685	176.356	-0.02601	0.44200	0.5273	0.3361	1.1829	3990.	708.8	0.531	0.0147	0.0779	0.00624	17.10	-60.00		
-55.00	11.053	36.73	8.6283	-8.037	177.788	-0.01944	0.43978	0.5302	0.3399	1.1833	3932.	711.2	0.514	0.0149	0.0769	0.00637	16.70	-55.00		
-50.00	12.571	36.53	7.6570	-5.374	179.218	-0.01292	0.43769	0.5332	0.3437	1.1838	3873.	713.5	0.498	0.0150	0.0760	0.00651	16.31	-50.00		
-45.00	14.247	36.33	6.8166	-2.695	180.646	-0.00644	0.43572	0.5364	0.3477	1.1845	3815.	715.6	0.482	0.0152	0.0750	0.00665	15.92	-45.00		
-43.75b	14.691	36.28	6.6248	-2.024	181.002	-0.00483	0.43524	0.5372	0.3487	1.1847	3800.	716.1	0.479	0.0153	0.0748	0.00669	15.82	-43.75		
-40.00	16.092	36.13	6.0867	0.000	182.073	0.00000	0.43386	0.5396	0.3518	1.1853	3756.	717.5	0.467	0.0154	0.0741	0.00680	15.53	-40.00		
-35.00	18.118	35.93	5.4506	2.712	183.497	0.00640	0.43212	0.5429	0.3559	1.1863	3697.	719.3	0.453	0.0156	0.0732	0.00694	15.15	-35.00		
-30.00	20.336	35.73	4.8943	5.442	184.918	0.01276	0.43048	0.5464	0.3602	1.1874	3639.	721.0	0.439	0.0157	0.0723	0.00709	14.76	-30.00		
-25.00	22.758	35.52	4.4062	8.189	186.337	0.01909	0.42895	0.5499	0.3646	1.1887	3580.	722.4	0.426	0.0159	0.0713	0.00724	14.38	-25.00		
-20.00	25.397	35.32	3.9767	10.955	187.751	0.02539	0.42751	0.5535	0.3690	1.1902	3521.	723.7	0.413	0.0161	0.0704	0.00739	13.99	-20.00		
-15.00	28.264	35.11	3.5976	13.739	189.160	0.03165	0.42616	0.5573	0.3736	1.1918	3462.	724.8	0.401	0.0163	0.0695	0.00754	13.61	-15.00		
-10.00	31.371	34.90	3.2621	16.543	190.565	0.03788	0.42489	0.5612	0.3783	1.1936	3403.	725.7	0.389	0.0164	0.0686	0.00769	13.23	-10.00		
-5.00	34.733	34.68	2.9642	19.368	191.964	0.04409	0.42370	0.5651	0.3832	1.1957	3344.	726.4	0.378	0.0166	0.0677	0.00785	12.86	-5.00		
0.00	38.361	34.47	2.6990	22.212	193.357	0.05027	0.42260	0.5693	0.3881	1.1979	3285.	726.9	0.367	0.0168	0.0668	0.00801	12.48	0.00		
5.00	42.269	34.25	2.4625	25.078	194.742	0.05643	0.42156	0.5735	0.3932	1.2004	3226.	727.2	0.356	0.0170	0.0660	0.00817	12.11	5.00		
10.00	46.471	34.03	2.2508	27.966	196.121	0.06256	0.42059	0.5779	0.3984	1.2031	3167.	727.3	0.346	0.0172	0.0651	0.00834	11.74	10.00		
15.00	50.980	33.80	2.0610	30.877	197.491	0.06867	0.41968	0.5825	0.4038	1.2061	3108.	727.2	0.336	0.0174	0.0642	0.00850	11.37	15.00		
20.00	55.809	33.58	1.8904	33.811	198.851	0.07476	0.41884	0.5872	0.4094	1.2094	3049.	726.9	0.326	0.0175	0.0634	0.00868	11.00	20.00		
25.00	60.972	33.35	1.7368	36.768	200.202	0.08084	0.41805	0.5920	0.4151	1.2130	2989.	726.3	0.317	0.0177	0.0625	0.00885	10.64	25.00		
30.00	66.485	33.12	1.5980	39.751	201.542	0.08690	0.41731	0.5971	0.4210	1.2169	2930.	725.5	0.308	0.0179	0.0617	0.00903	10.27	30.00		
35.00	72.361	32.88	1.4725	42.759	202.870	0.09294	0.41662	0.6023	0.4271	1.2212	2870.	724.5	0.299	0.0181	0.0609	0.00921	9.91	35.00		
40.00	78.614	32.64	1.3586	45.794	204.185	0.09898	0.41597	0.6077	0.4334	1.2258	2810.	723.2	0.291	0.0183	0.0600	0.00940	9.55	40.00		
45.00	85.259	32.40	1.2552	48.856	205.487	0.10500	0.41536	0.6133	0.4399	1.2309	2750.	721.7	0.283	0.0185	0.0592	0.00959	9.20	45.00		
50.00	92.311	32.15	1.1611	51.946	206.773	0.11101	0.41479	0.6192	0.4466	1.2364	2690.	719.9	0.275	0.0188	0.0584	0.00979	8.84	50.00		
55.00	99.785	31.90	1.0753	55.065	208.044	0.11702	0.41425	0.6253	0.4537	1.2425	2630.	717.9	0.267	0.0190	0.0576	0.00999	8.49	55.00		
60.00	107.70	31.65	0.9968	58.215	209.296	0.12302	0.41374	0.6316	0.4610	1.2490	2570.	715.5	0.259	0.0192	0.0568	0.01020	8.15	60.00		
65.00	116.06	31.39	0.9250	61.396	210.530	0.12902	0.41325	0.6383	0.4687	1.2563	2510.	712.9	0.252	0.0194	0.0561	0.01042	7.80	65.00		
70.00	124.89	31.12	0.8592	64.609	211.742	0.13501	0.41279	0.6452	0.4767	1.2641	2449.	710.0	0.245	0.0197	0.0553	0.01064	7.46	70.00		
75.00	134.21	30.85	0.7988	67.856	212.932	0.14101	0.41234	0.6525	0.4851	1.2728	2388.	706.9	0.238	0.0199	0.0545	0.01087	7.12	75.00		
80.00	144.02	30.58	0.7432	71.138	214.098	0.14701	0.41190	0.6602	0.4940	1.2823	2327.	703.4	0.231	0.0202	0.0538	0.01111	6.78	80.00		
85.00	154.35	30.30	0.6919	74.456	215.237	0.15301	0.41148	0.6683	0.5034	1.2928	2266.	699.5	0.224	0.0204	0.0530	0.01136	6.45	85.00		
90.00	165.21	30.01	0.6446	77.813	216.347	0.15902	0.41105	0.6768	0.5133	1.3043	2205.	695.4	0.218	0.0207	0.0523	0.01161	6.12	90.00		
95.00	176.63	29.72	0.6009	81.209	217.426	0.16505	0.41062	0.6858	0.5239	1.3171	2144.	690.9	0.211	0.0210	0.0515	0.01188	5.79	95.00		
100.00	188.61	29.42	0.5604	84.647	218.470															

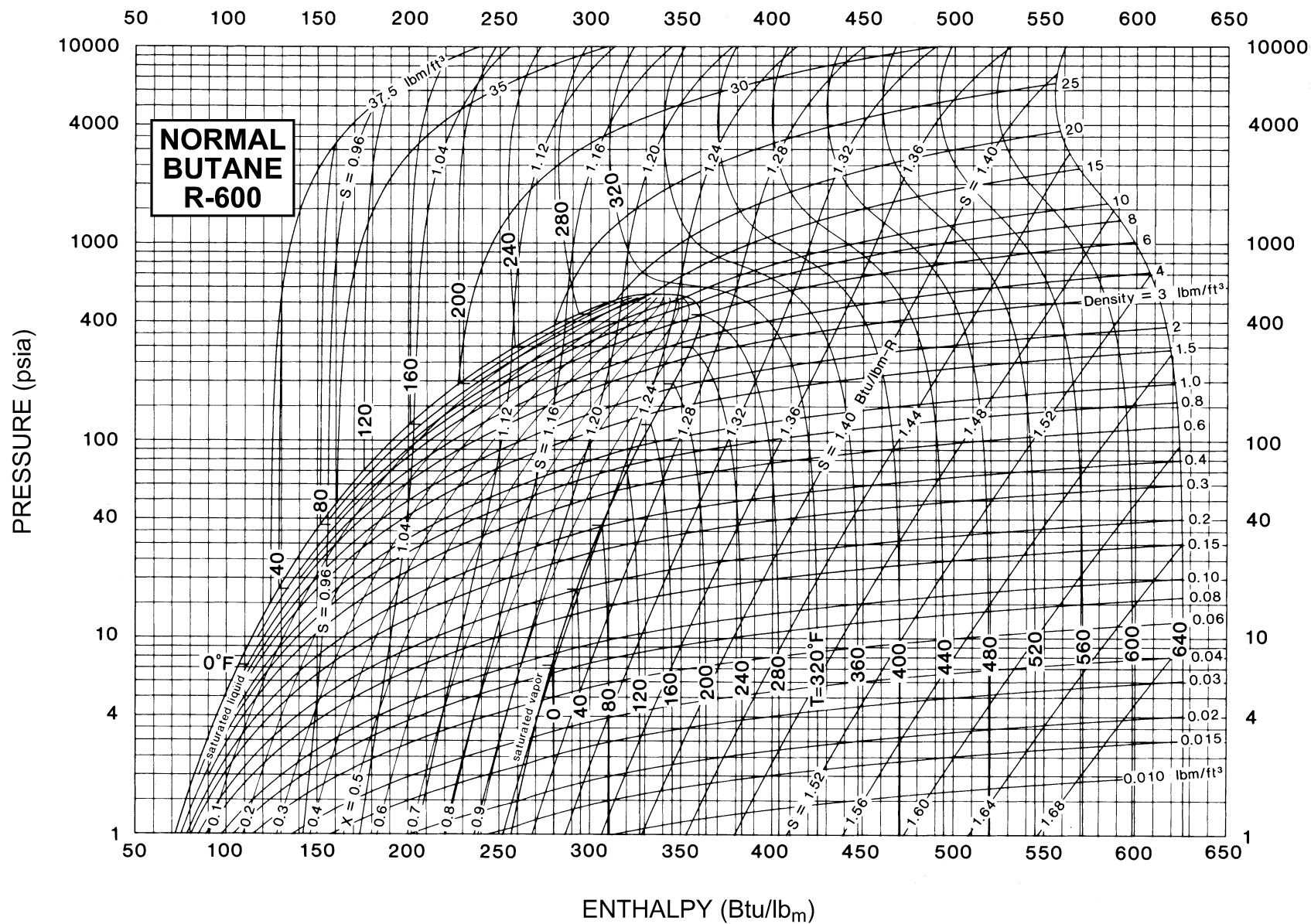


Fig. 18 Pressure-Enthalpy Diagram for Refrigerant 600 (*n*-Butane)

Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 600 (*n*-Butane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³ Liquid	Volume, ft ³ /lb Vapor	Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
				Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-150.00	0.021	43.72	2684.3	-54.039	145.704	-0.14907	0.49600	0.4804	0.2930	1.1323	4976.	547.5	1.945	0.0109	0.0991	0.00362	28.19	-150.00
-140.00	0.038	43.39	1539.1	-49.233	148.646	-0.13379	0.48526	0.4807	0.2971	1.1304	4906.	555.7	1.738	0.0112	0.0967	0.00381	27.41	-140.00
-130.00	0.066	43.06	918.21	-44.422	151.625	-0.11897	0.47574	0.4815	0.3012	1.1286	4833.	563.7	1.564	0.0115	0.0944	0.00399	26.64	-130.00
-120.00	0.110	42.74	567.75	-39.601	154.639	-0.10456	0.46732	0.4829	0.3055	1.1268	4757.	571.6	1.417	0.0118	0.0922	0.00419	25.87	-120.00
-110.00	0.178	42.41	362.61	-34.763	157.690	-0.09052	0.45989	0.4848	0.3099	1.1251	4678.	579.2	1.291	0.0121	0.0901	0.00439	25.11	-110.00
-100.00	0.278	42.08	238.50	-29.901	160.775	-0.07682	0.45335	0.4873	0.3145	1.1236	4597.	586.6	1.182	0.0124	0.0881	0.00459	24.35	-100.00
-90.00	0.422	41.75	161.12	-25.013	163.894	-0.06341	0.44763	0.4903	0.3192	1.1221	4514.	593.8	1.087	0.0127	0.0862	0.00480	23.59	-90.00
-80.00	0.626	41.41	111.54	-20.092	167.046	-0.05028	0.44264	0.4938	0.3241	1.1208	4428.	600.8	1.004	0.0130	0.0843	0.00502	22.85	-80.00
-70.00	0.906	41.08	78.954	-15.134	170.229	-0.03739	0.43832	0.4976	0.3292	1.1196	4341.	607.5	0.930	0.0133	0.0826	0.00524	22.10	-70.00
-60.00	1.284	40.74	57.038	-10.135	173.442	-0.02473	0.43461	0.5019	0.3344	1.1185	4252.	614.0	0.865	0.0136	0.0809	0.00547	21.36	-60.00
-50.00	1.785	40.40	41.981	-5.091	176.684	-0.01227	0.43146	0.5065	0.3399	1.1177	4162.	620.1	0.806	0.0139	0.0793	0.00571	20.63	-50.00
-45.00	2.090	40.23	36.251	-2.552	178.314	-0.00611	0.43007	0.5089	0.3427	1.1173	4116.	623.1	0.779	0.0141	0.0785	0.00583	20.26	-45.00
-40.00	2.437	40.06	31.432	0.000	179.951	0.00000	0.42881	0.5114	0.3456	1.1170	4070.	625.9	0.754	0.0143	0.0777	0.00595	19.90	-40.00
-35.00	2.829	39.89	27.360	2.565	181.594	0.00607	0.42766	0.5139	0.3485	1.1168	4024.	628.7	0.729	0.0144	0.0769	0.00608	19.54	-35.00
-30.00	3.271	39.71	23.905	5.142	183.244	0.01210	0.42662	0.5165	0.3515	1.1166	3977.	631.4	0.706	0.0146	0.0762	0.00621	19.18	-30.00
-25.00	3.768	39.54	20.961	7.734	184.898	0.01809	0.42569	0.5192	0.3545	1.1164	3930.	634.1	0.684	0.0148	0.0754	0.00634	18.82	-25.00
-20.00	4.325	39.36	18.444	10.339	186.559	0.02404	0.42485	0.5219	0.3576	1.1163	3883.	636.6	0.663	0.0149	0.0747	0.00647	18.46	-20.00
-15.00	4.945	39.19	16.283	12.957	188.224	0.02996	0.42412	0.5247	0.3608	1.1163	3836.	639.0	0.643	0.0151	0.0740	0.00660	18.10	-15.00
-10.00	5.636	39.01	14.421	15.590	189.894	0.03584	0.42347	0.5275	0.3640	1.1163	3789.	641.3	0.623	0.0153	0.0733	0.00674	17.75	-10.00
-5.00	6.402	38.83	12.810	18.238	191.569	0.04169	0.42292	0.5304	0.3673	1.1164	3741.	643.6	0.605	0.0154	0.0726	0.00687	17.40	-5.00
0.00	7.249	38.66	11.413	20.901	193.248	0.04750	0.42245	0.5334	0.3706	1.1166	3693.	645.7	0.587	0.0156	0.0719	0.00701	17.04	0.00
5.00	8.182	38.48	10.197	23.578	194.930	0.05329	0.42205	0.5364	0.3740	1.1168	3645.	647.7	0.570	0.0158	0.0712	0.00715	16.69	5.00
10.00	9.209	38.30	9.1351	26.271	196.617	0.05904	0.42174	0.5395	0.3774	1.1171	3597.	649.6	0.554	0.0159	0.0705	0.00730	16.34	10.00
15.00	10.335	38.12	8.2048	28.980	198.307	0.06477	0.42150	0.5426	0.3810	1.1175	3549.	651.4	0.539	0.0161	0.0698	0.00745	16.00	15.00
20.00	11.567	37.93	7.3877	31.704	200.000	0.07046	0.42132	0.5457	0.3845	1.1180	3500.	653.1	0.524	0.0163	0.0691	0.00760	15.65	20.00
25.00	12.912	37.75	6.6678	34.444	201.696	0.07613	0.42122	0.5489	0.3882	1.1185	3452.	654.6	0.509	0.0165	0.0685	0.00775	15.31	25.00
30.00	14.376	37.56	6.0318	37.202	203.394	0.08178	0.42118	0.5522	0.3919	1.1191	3403.	656.1	0.495	0.0166	0.0678	0.00790	14.96	30.00
31.04b	14.696	37.52	5.9091	37.776	203.747	0.08295	0.42118	0.5529	0.3927	1.1193	3393.	656.4	0.492	0.0167	0.0677	0.00793	14.89	31.04
35.00	15.967	37.38	5.4684	39.975	205.095	0.08740	0.42120	0.5555	0.3957	1.1198	3354.	657.4	0.482	0.0168	0.0672	0.00806	14.62	35.00
40.00	17.692	37.19	4.9681	42.766	206.797	0.09299	0.42127	0.5588	0.3995	1.1206	3305.	658.6	0.469	0.0170	0.0665	0.00822	14.28	40.00
45.00	19.558	37.00	4.5228	45.574	208.501	0.09857	0.42140	0.5623	0.4035	1.1215	3256.	659.6	0.456	0.0172	0.0659	0.00838	13.94	45.00
50.00	21.573	36.81	4.1254	48.399	210.206	0.10412	0.42159	0.5657	0.4075	1.1225	3207.	660.5	0.444	0.0174	0.0652	0.00854	13.61	50.00
55.00	23.745	36.61	3.7699	51.242	211.912	0.10965	0.42182	0.5692	0.4115	1.1236	3158.	661.3	0.432	0.0176	0.0646	0.00871	13.27	55.00
60.00	26.082	36.42	3.4512	54.103	213.618	0.11516	0.42211	0.5728	0.4157	1.1248	3108.	662.0	0.421	0.0178	0.0639	0.00888	12.94	60.00
65.00	28.591	36.22	3.1649	56.983	215.325	0.12065	0.42244	0.5765	0.4199	1.1261	3059.	662.4	0.410	0.0179	0.0633	0.00905	12.61	65.00
70.00	31.281	36.03	2.9071	59.881	217.031	0.12612	0.42281	0.5802	0.4242	1.1276	3009.	662.8	0.400	0.0181	0.0627	0.00923	12.28	70.00
75.00	34.160	35.83	2.6746	62.798	218.736	0.13157	0.42322	0.5839	0.4286	1.1291	2960.	663.0	0.389	0.0183	0.0621	0.00941	11.95	75.00
80.00	37.236	35.63	2.4644	65.734	220.440	0.13701	0.42367	0.5878	0.4331	1.1308	2910.	663.0	0.379	0.0185	0.0614	0.00959	11.63	80.00
85.00	40.518	35.42	2.2741	68.689	222.142	0.14243	0.42416	0.5917	0.4377	1.1326	2860.	662.9	0.369	0.0187	0.0608	0.00978	11.30	85.00
90.00	44.015	35.22	2.1013	71.665	223.843	0.14783	0.42468	0.5956	0.4424	1.1346	2810.	662.6	0.360	0.0189	0.0602	0.00996	10.98	90.00
95.00	47.735	35.01	1.9443	74.660	225.541	0.15322	0.42523	0.5997	0.4472	1.1367	2760.	662.1	0.351	0.0191	0.0596	0.01016	10.66	95.00
100.00	51.688	34.80	1.8013	77.677	227.236	0.15860	0.42581	0.6038	0.4521	1.1390	2710.	661.5	0.342	0.0194	0.0590	0.01035	10.34	100.00
105.00	55.882	34.59	1.6708	80.714	228.927	0.16396	0.42643	0.6081	0.4571	1.1415	2660.	660.7	0.333	0.0196	0.0584	0.01055	10.03	105.00
110.00	60.326	34.37	1.5517	83.773	230.614	0.16931	0.42707	0.6124	0.4622	1.1442	2610.	659.7	0.325	0.0198	0.0578	0.01075	9.71	110.00
115.00	65.030	34.15	1.4426	86.853	232.296	0.17465	0.42773	0.6168	0.4675	1.1470	2559.	658.6	0.316	0.0200	0.0572	0.01096	9.40	115.00
120.00	70.002	33.93	1.3426	89.956	233.974	0.17998	0.42842	0.6213	0.4729	1.1501	2509.	657.2	0.308	0.0202	0.0566	0.01117	9.09	120.00
125.00	75.253	33.71	1.2508	93.081	235.645	0.18530	0.42912	0.6260	0.4785	1.1534	2458.	655.7	0.300	0.0204	0.0560	0.01138	8.78	125.00
130.00	80.792	33.48	1.1664	96.229	237.309	0.19061	0.42985	0.6307	0.4842	1.1570	2408.	653.9	0.293	0.0207	0.0554	0.01160	8.48	130.00
135.00	86.628	33.25	1.0887	99.401	238.965	0.19591	0.43059	0.6356	0.4900	1.1609	2357.	651.9	0.285	0.0209	0.0548	0.01182	8.17	135.00
140.00	92.771	33.02	1.0170	102.597	240.614	0.20120	0.43134	0.6407	0.4961	1.1650	2306.	649.8	0.278	0.0211	0.0542	0.01205	7.87	140.00
145.00	99.230	32.78	0.9508	105.818	242.253	0.20649	0.43211	0.6459	0.5024	1.1695	2256.	647.4	0.271	0.0214	0.0536	0.01228	7.58	145.00
150.00	106.02	32.54	0.8896	109.064	243.881	0.21177	0.43289	0.6512	0.5089	1.1744	2205.	644.7	0.264	0.0216	0.0530	0.01251	7.28	150.00
160.00	120.61	32.05	0.7804	115.635	247.104	0.22233	0.43447	0.6625	0.5226	1.1853	2103.	638.8	0.250	0.0221	0.0518	0.01300	6.69	160.00
170.00	136.64	31.54	0.6863	122.317	250.273	0.23287	0.43607	0.6747	0.5375	1.1982	2000.	631.8	0.237	0.0227	0.0507	0.01350	6.12	170.00
180.00	154.18	31.01	0.6047	129.118	253.376	0.24342	0.43766	0.6880	0.5538	1.2135	1897.	623.8	0.224	0.0232	0.0496	0.01403	5.56	180.00
190.00	173.32	30.45	0.5337	136.044	256.399	0.25399	0.43923	0.7027	0.5719	1.2318	1794.	614.6	0.212	0.0238	0.0484	0.01458	5.01	190.00
200.00	194.17	29.87	0.4715	143.108	259.328													

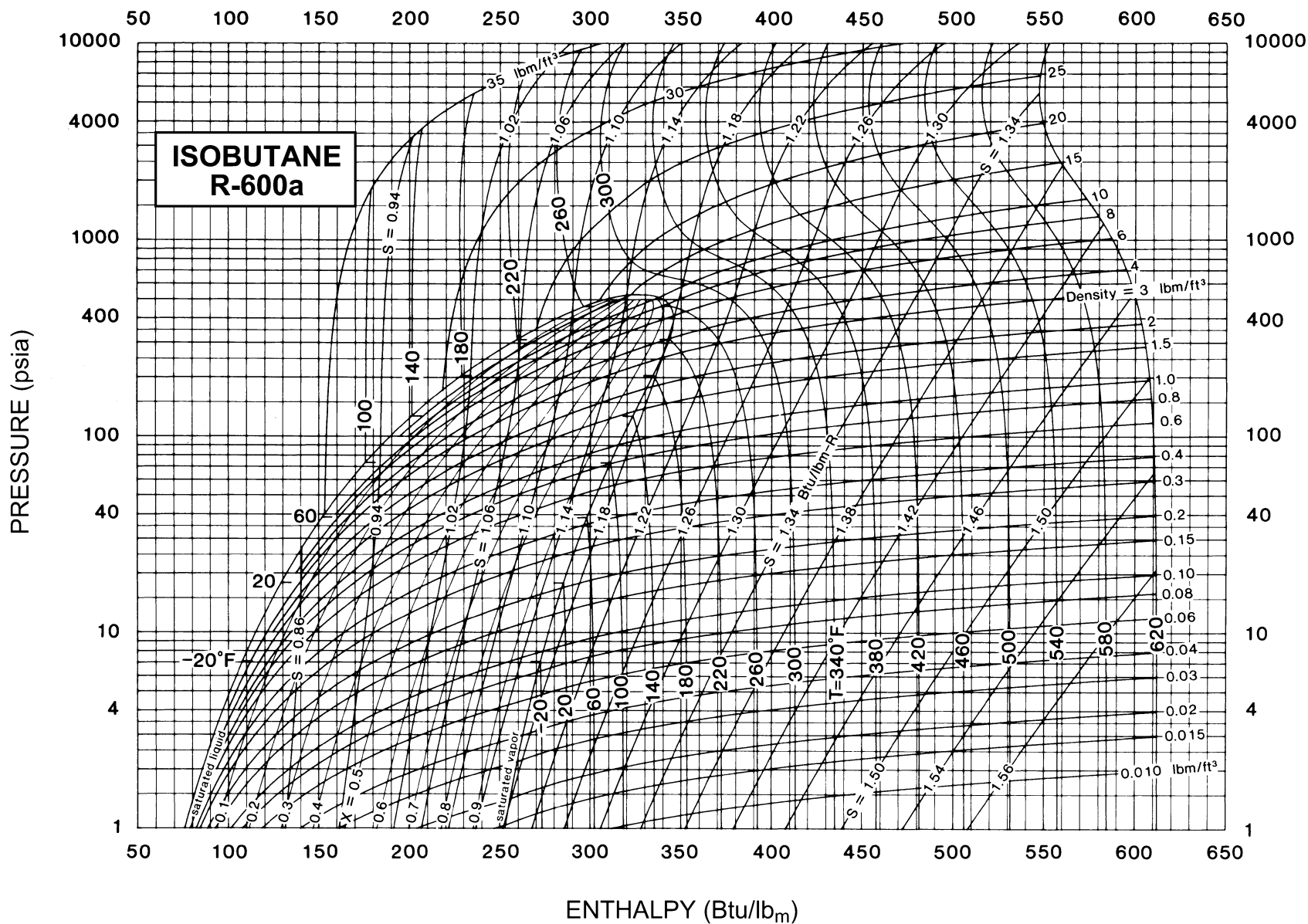


Fig. 19 Pressure-Enthalpy Diagram for Refrigerant 600a (Isobutane)

Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 600a (Isobutane) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft ³ Liquid	Volume, ft ³ /lb Vapor	Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c _p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, dyne/cm	Temp., °F
				Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
-150.00	0.047	42.76	1221.5	-52.324	136.454	-0.14411	0.46554	0.4486	0.2693	1.1460	4760.	550.6	2.313	0.0108	0.0799	0.00345	25.67	-150.00
-140.00	0.082	42.42	723.13	-47.814	139.156	-0.12978	0.45514	0.4532	0.2747	1.1431	4675.	558.5	2.041	0.0111	0.0800	0.00363	24.95	-140.00
-130.00	0.137	42.08	444.42	-43.259	141.903	-0.11575	0.44595	0.4579	0.2801	1.1404	4589.	566.3	1.814	0.0114	0.0798	0.00382	24.24	-130.00
-120.00	0.222	41.74	282.54	-38.656	144.694	-0.10200	0.43783	0.4626	0.2856	1.1379	4503.	573.8	1.623	0.0117	0.0794	0.00402	23.53	-120.00
-110.00	0.348	41.40	185.21	-34.005	147.527	-0.08850	0.43068	0.4675	0.2911	1.1356	4417.	581.1	1.462	0.0120	0.0789	0.00422	22.82	-110.00
-100.00	0.530	41.06	124.83	-29.304	150.399	-0.07525	0.42441	0.4724	0.2968	1.1336	4329.	588.2	1.323	0.0123	0.0783	0.00442	22.11	-100.00
-90.00	0.787	40.72	86.295	-24.554	153.309	-0.06222	0.41894	0.4775	0.3026	1.1317	4242.	595.1	1.204	0.0126	0.0775	0.00464	21.40	-90.00
-80.00	1.140	40.37	61.046	-19.751	156.255	-0.04941	0.41419	0.4827	0.3086	1.1301	4153.	601.6	1.099	0.0130	0.0766	0.00486	20.70	-80.00
-70.00	1.617	40.02	44.103	-14.896	159.234	-0.03679	0.41009	0.4880	0.3148	1.1288	4064.	607.9	1.008	0.0133	0.0755	0.00509	20.00	-70.00
-60.00	2.246	39.67	32.481	-9.987	162.245	-0.02436	0.40659	0.4934	0.3212	1.1277	3974.	613.9	0.928	0.0136	0.0744	0.00533	19.30	-60.00
-50.00	3.063	39.32	24.346	-5.022	165.285	-0.01210	0.40363	0.4990	0.3277	1.1269	3883.	619.5	0.856	0.0139	0.0732	0.00557	18.60	-50.00
-45.00	3.554	39.14	21.207	-2.518	166.815	-0.00603	0.40234	0.5018	0.3311	1.1266	3837.	622.2	0.823	0.0141	0.0726	0.00570	18.26	-45.00
-40.00	4.106	38.96	18.544	0.000	168.352	0.00000	0.40117	0.5047	0.3345	1.1263	3791.	624.8	0.792	0.0143	0.0719	0.00583	17.91	-40.00
-35.00	4.726	38.78	16.275	2.533	169.895	0.00599	0.40010	0.5076	0.3380	1.1262	3745.	627.3	0.763	0.0144	0.0713	0.00596	17.57	-35.00
-30.00	5.418	38.60	14.334	5.081	171.444	0.01195	0.39915	0.5106	0.3416	1.1261	3698.	629.7	0.735	0.0146	0.0706	0.00609	17.22	-30.00
-25.00	6.189	38.41	12.667	7.644	172.998	0.01787	0.39830	0.5136	0.3452	1.1260	3651.	632.0	0.709	0.0148	0.0699	0.00622	16.88	-25.00
-20.00	7.046	38.23	11.231	10.222	174.559	0.02376	0.39754	0.5166	0.3489	1.1261	3605.	634.1	0.684	0.0150	0.0693	0.00636	16.54	-20.00
-15.00	7.994	38.04	9.9881	12.816	176.124	0.02962	0.39688	0.5197	0.3526	1.1262	3557.	636.2	0.660	0.0151	0.0686	0.00650	16.19	-15.00
-10.00	9.039	37.86	8.9093	15.426	177.695	0.03544	0.39631	0.5228	0.3564	1.1264	3510.	638.2	0.637	0.0153	0.0678	0.00664	15.85	-10.00
-5.00	10.190	37.67	7.9695	18.052	179.270	0.04124	0.39583	0.5260	0.3602	1.1267	3463.	640.0	0.616	0.0155	0.0671	0.00679	15.51	-5.00
0.00	11.453	37.48	7.1485	20.694	180.849	0.04700	0.39542	0.5292	0.3642	1.1271	3415.	641.7	0.595	0.0157	0.0664	0.00693	15.17	0.00
5.00	12.835	37.29	6.4288	23.352	182.433	0.05274	0.39510	0.5325	0.3682	1.1276	3367.	643.3	0.575	0.0158	0.0657	0.00708	14.84	5.00
10.00	14.344	37.10	5.7960	26.027	184.020	0.05845	0.39485	0.5358	0.3722	1.1281	3319.	644.8	0.556	0.0160	0.0650	0.00724	14.50	10.00
11.10b	14.694	37.06	5.6670	26.619	184.371	0.05971	0.39480	0.5366	0.3731	1.1283	3308.	645.1	0.552	0.0161	0.0648	0.00727	14.43	11.10
15.00	15.987	36.91	5.2381	28.720	185.612	0.06414	0.39467	0.5392	0.3764	1.1288	3271.	646.1	0.538	0.0162	0.0642	0.00739	14.16	15.00
20.00	17.773	36.72	4.7448	31.430	187.206	0.06979	0.39455	0.5427	0.3806	1.1295	3222.	647.3	0.521	0.0164	0.0635	0.00755	13.83	20.00
25.00	19.708	36.52	4.3075	34.157	188.803	0.07543	0.39451	0.5462	0.3849	1.1304	3174.	648.3	0.504	0.0166	0.0628	0.00771	13.50	25.00
30.00	21.802	36.32	3.9187	36.902	190.403	0.08104	0.39452	0.5497	0.3892	1.1313	3125.	649.3	0.488	0.0168	0.0620	0.00787	13.16	30.00
35.00	24.063	36.12	3.5722	39.666	192.005	0.08664	0.39460	0.5534	0.3936	1.1324	3076.	650.0	0.473	0.0170	0.0613	0.00803	12.83	35.00
40.00	26.498	35.92	3.2627	42.448	193.609	0.09221	0.39473	0.5571	0.3982	1.1336	3027.	650.6	0.458	0.0172	0.0606	0.00820	12.50	40.00
45.00	29.117	35.72	2.9855	45.249	195.214	0.09776	0.39491	0.5608	0.4028	1.1349	2978.	651.1	0.444	0.0174	0.0598	0.00837	12.17	45.00
50.00	31.928	35.52	2.7368	48.070	196.821	0.10329	0.39515	0.5647	0.4075	1.1363	2928.	651.4	0.431	0.0176	0.0591	0.00855	11.85	50.00
55.00	34.940	35.31	2.5130	50.910	198.429	0.10881	0.39543	0.5686	0.4122	1.1379	2879.	651.5	0.418	0.0178	0.0584	0.00872	11.52	55.00
60.00	38.163	35.10	2.3112	53.770	200.036	0.11430	0.39576	0.5726	0.4171	1.1396	2829.	651.5	0.405	0.0180	0.0577	0.00890	11.20	60.00
65.00	41.604	34.89	2.1290	56.650	201.644	0.11978	0.39613	0.5767	0.4221	1.1415	2779.	651.3	0.393	0.0182	0.0570	0.00908	10.87	65.00
70.00	45.273	34.68	1.9641	59.551	203.251	0.12525	0.39655	0.5808	0.4272	1.1435	2729.	650.9	0.381	0.0184	0.0562	0.00927	10.55	70.00
75.00	49.179	34.46	1.8145	62.474	204.857	0.13070	0.39700	0.5851	0.4324	1.1457	2679.	650.3	0.370	0.0186	0.0555	0.00946	10.23	75.00
80.00	53.332	34.25	1.6785	65.417	206.461	0.13614	0.39749	0.5894	0.4377	1.1481	2629.	649.5	0.359	0.0189	0.0548	0.00965	9.92	80.00
85.00	57.741	34.03	1.5548	68.383	208.062	0.14157	0.39801	0.5939	0.4431	1.1507	2578.	648.6	0.348	0.0191	0.0541	0.00984	9.60	85.00
90.00	62.417	33.80	1.4419	71.371	209.661	0.14698	0.39856	0.5985	0.4487	1.1536	2528.	647.4	0.338	0.0193	0.0535	0.01004	9.28	90.00
95.00	67.367	33.58	1.3387	74.383	211.256	0.15239	0.39914	0.6032	0.4544	1.1566	2477.	646.0	0.328	0.0195	0.0528	0.01024	8.97	95.00
100.00	72.603	33.35	1.2443	77.418	212.847	0.15778	0.39975	0.6080	0.4602	1.1600	2426.	644.4	0.319	0.0198	0.0521	0.01044	8.66	100.00
105.00	78.135	33.11	1.1578	80.477	214.432	0.16317	0.40039	0.6130	0.4663	1.1636	2375.	642.6	0.309	0.0200	0.0514	0.01065	8.35	105.00
110.00	83.971	32.88	1.0783	83.561	216.011	0.16855	0.40104	0.6181	0.4725	1.1675	2324.	640.5	0.300	0.0203	0.0508	0.01086	8.04	110.00
115.00	90.123	32.64	1.0053	86.670	217.583	0.17392	0.40172	0.6234	0.4789	1.1718	2273.	638.3	0.291	0.0205	0.0501	0.01108	7.74	115.00
120.00	96.600	32.39	0.9379	89.806	219.147	0.17929	0.40241	0.6288	0.4856	1.1764	2222.	635.7	0.283	0.0208	0.0495	0.01129	7.44	120.00
125.00	103.41	32.15	0.8758	92.967	220.701	0.18465	0.40311	0.6345	0.4924	1.1815	2171.	632.9	0.275	0.0211	0.0488	0.01152	7.13	125.00
130.00	110.57	31.90	0.8184	96.157	222.245	0.19001	0.40383	0.6403	0.4996	1.1870	2119.	629.9	0.266	0.0213	0.0482	0.01174	6.84	130.00
135.00	118.09	31.64	0.7653	99.375	223.777	0.19537	0.40456	0.6464	0.5070	1.1930	2067.	626.6	0.259	0.0216	0.0476	0.01197	6.54	135.00
140.00	125.98	31.38	0.7161	102.621	225.296	0.20073	0.40529	0.6527	0.5148	1.1996	2016.	623.0	0.251	0.0219	0.0470	0.01221	6.25	140.00
145.00	134.25	31.11	0.6704	105.898	226.799	0.20609	0.40603	0.6593	0.5229	1.2068	1964.	619.1	0.243	0.0222	0.0464	0.01245	5.96	145.00
150.00	142.90	30.84	0.6280	109.206	228.286	0.21145	0.40676	0.6662	0.5315	1.2148	1911.	615.0	0.236	0.0225	0.0458	0.01269	5.67	150.00
160.00	161.44	30.28	0.5517	115.920	231.201	0.22219	0.40822	0.6811	0.5500	1.2333	1807.	605.7	0.222	0.0232	0.0446	0.01319	5.10	160.00
170.00	181.69	29.69	0.4852	122.775	234.023	0.23297	0.40963	0.6978	0.5711	1.2561	1701.	595.1	0.209	0.0239	0.0434	0.01371	4.54	170.00
180.00	203.75	29.08	0.4270	129.783	236.728	0.24379	0.41097	0.7167	0.5954	1.2846	1594.	583.1	0.196	0.0246	0.0423	0.01426	4.00	180.00
190.00	227.73	28.42	0.3757	136.962	239.287	0.25468	0.41218	0.7386	0.6241	1.3209	1486.	569.6	0.183	0.0254	0.0411	0.01484	3.47	190.00
200.00	253.76	27.73	0.3302	144.332	241.663													

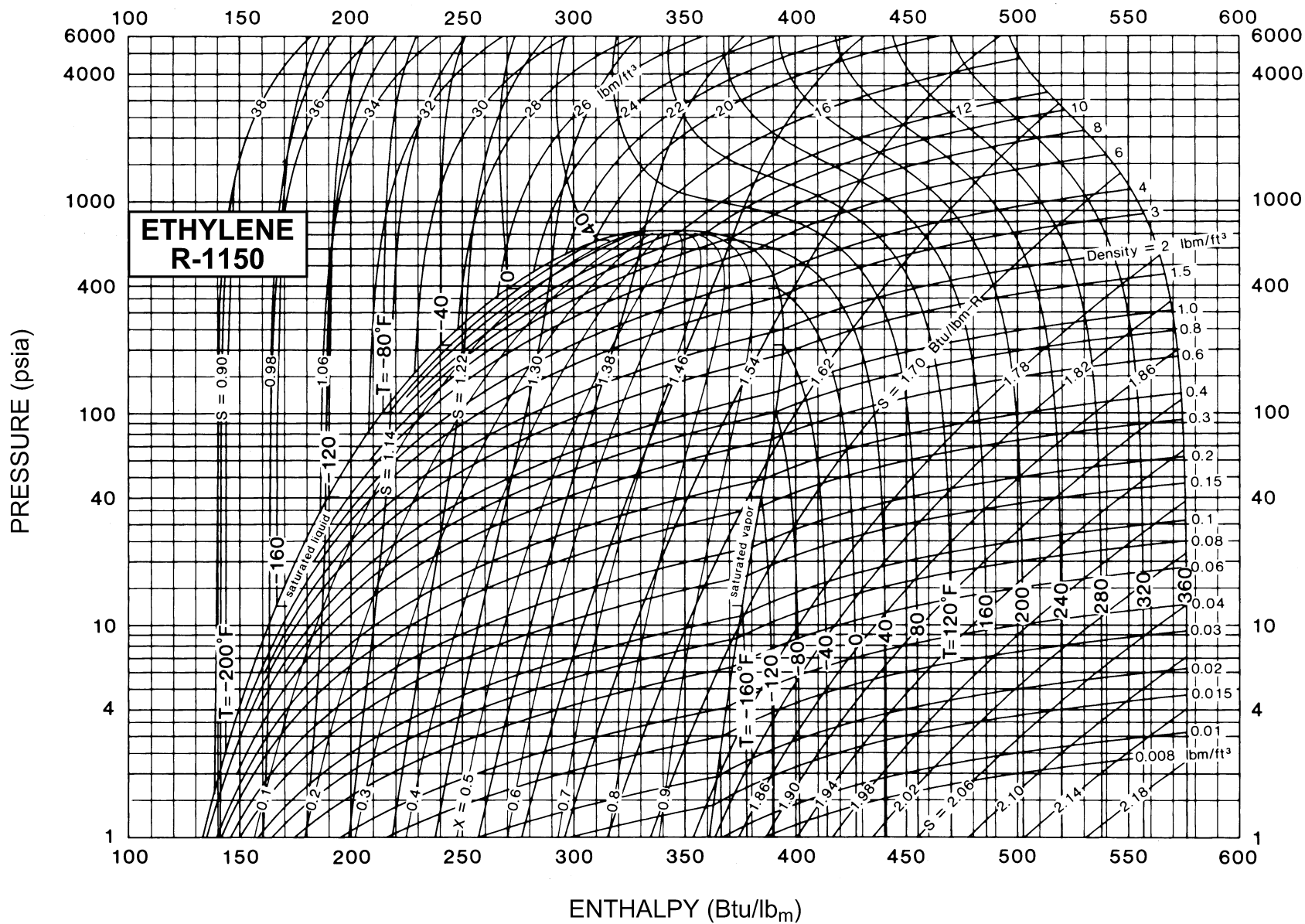


Fig. 20 Pressure-Enthalpy Diagram for Refrigerant 1150 (Ethylene)

Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 1150 (Ethylene) Properties of Saturated Liquid and Saturated Vapor

Table with 21 columns: Temp., Pressure, Density (Liquid/Vapor), Volume (Liquid/Vapor), Enthalpy (Liquid/Vapor), Entropy (Liquid/Vapor), Specific Heat (Liquid/Vapor), Vel. of Sound (Liquid/Vapor), Viscosity (Liquid/Vapor), Thermal Cond. (Liquid/Vapor), and Surface Tension. Rows range from -272.50a to 48.56c.

*Temperatures are on the ITS-90 scale

a = triple point

b = normal boiling point

c = critical point

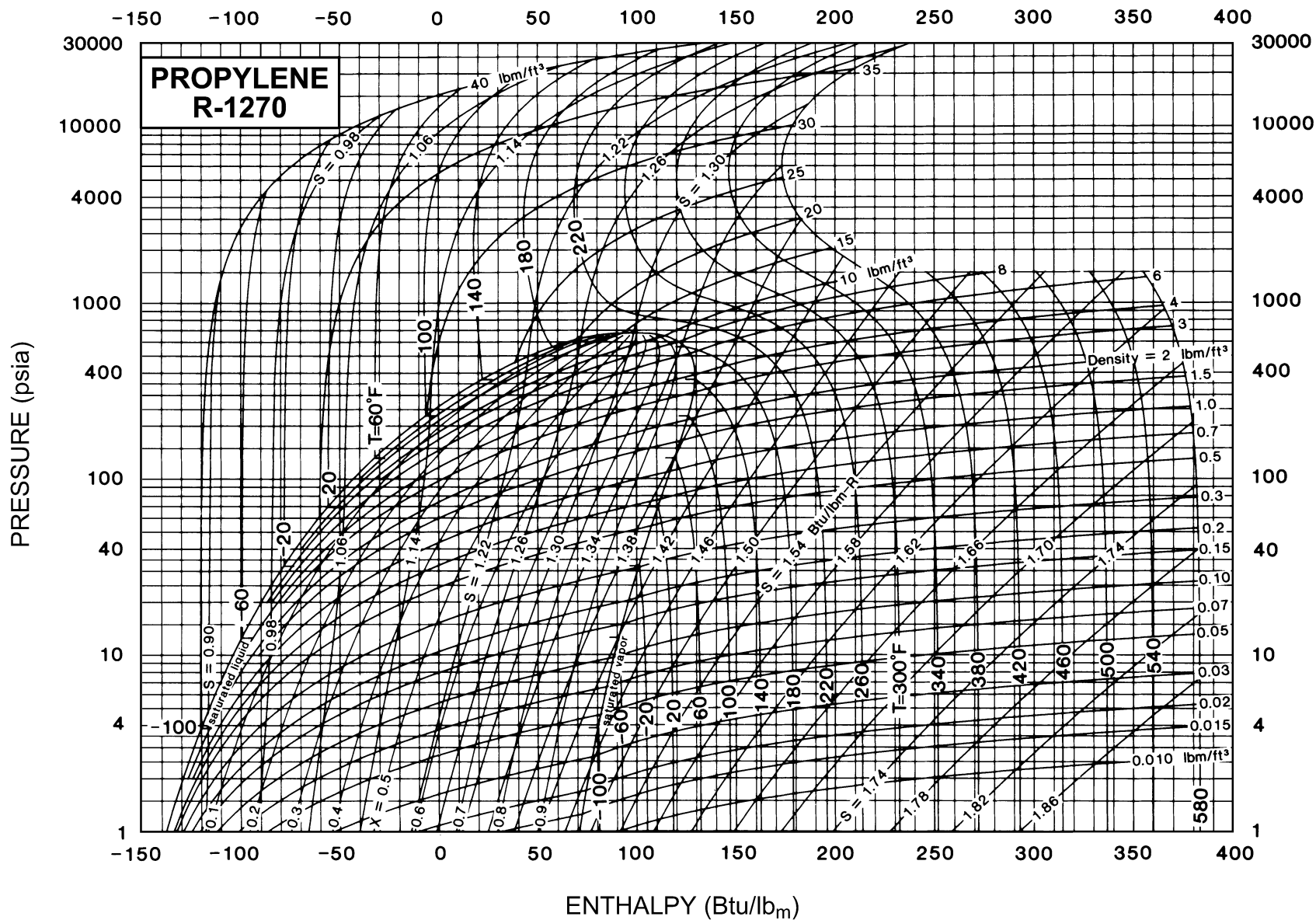


Fig. 21 Pressure-Enthalpy Diagram for Refrigerant 1270 (Propylene)

Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 1270 (Propylene) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °F	Pres- sure, psia	Density, lb/ft³		Volume, ft³/lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°F		Specific Heat c_p , Btu/lb·°F			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°F		Surface Tension, Temp., dyne/cm °F
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	
-200.00	0.030	43.93	2190.7	-79.208	143.636	-0.23626	0.62201	0.4646	0.2489	1.2345	5497.	615.2	3.072	0.0099	0.1174	0.00346	29.86	-200.00	
-190.00	0.059	43.54	1162.7	-74.538	146.132	-0.21861	0.59976	0.4693	0.2522	1.2310	5375.	625.9	2.666	0.0103	0.1146	0.00363	28.92	-190.00	
-180.00	0.110	43.14	650.36	-69.823	148.654	-0.20144	0.57983	0.4735	0.2555	1.2277	5258.	636.4	2.325	0.0107	0.1118	0.00381	27.99	-180.00	
-170.00	0.194	42.75	381.16	-65.070	151.201	-0.18474	0.56193	0.4771	0.2590	1.2245	5144.	646.5	2.037	0.0110	0.1092	0.00399	27.06	-170.00	
-160.00	0.327	42.35	232.88	-60.280	153.772	-0.16849	0.54586	0.4805	0.2626	1.2215	5031.	656.3	1.793	0.0114	0.1065	0.00418	26.13	-160.00	
-150.00	0.533	41.96	147.70	-55.459	156.364	-0.15266	0.53142	0.4837	0.2664	1.2188	4919.	665.8	1.585	0.0118	0.1040	0.00437	25.22	-150.00	
-145.00	0.671	41.76	119.13	-53.036	157.666	-0.14490	0.52474	0.4852	0.2683	1.2175	4864.	670.4	1.493	0.0120	0.1027	0.00447	24.76	-145.00	
-140.00	0.838	41.56	96.853	-50.605	158.973	-0.13724	0.51841	0.4868	0.2703	1.2163	4808.	675.0	1.407	0.0122	0.1014	0.00457	24.31	-140.00	
-135.00	1.039	41.36	79.334	-48.166	160.284	-0.12967	0.51241	0.4884	0.2724	1.2151	4753.	679.4	1.328	0.0124	0.1002	0.00467	23.86	-135.00	
-130.00	1.277	41.16	65.449	-45.719	161.597	-0.12220	0.50671	0.4900	0.2745	1.2141	4697.	683.7	1.255	0.0126	0.0989	0.00477	23.41	-130.00	
-125.00	1.560	40.96	54.359	-43.264	162.914	-0.11481	0.50130	0.4916	0.2767	1.2131	4642.	687.9	1.186	0.0128	0.0977	0.00487	22.96	-125.00	
-120.00	1.892	40.76	45.439	-40.801	164.232	-0.10751	0.49616	0.4933	0.2789	1.2122	4586.	692.1	1.123	0.0130	0.0965	0.00497	22.51	-120.00	
-115.00	2.280	40.56	38.214	-38.330	165.553	-0.10029	0.49128	0.4950	0.2812	1.2114	4530.	696.1	1.064	0.0132	0.0953	0.00507	22.07	-115.00	
-110.00	2.730	40.36	32.324	-35.849	166.875	-0.09315	0.48665	0.4967	0.2836	1.2107	4474.	700.0	1.010	0.0134	0.0941	0.00518	21.63	-110.00	
-105.00	3.252	40.16	27.492	-33.359	168.198	-0.08608	0.48224	0.4985	0.2860	1.2101	4418.	703.8	0.959	0.0136	0.0929	0.00529	21.19	-105.00	
-100.00	3.851	39.95	23.504	-30.860	169.522	-0.07909	0.47806	0.5004	0.2886	1.2096	4362.	707.4	0.911	0.0138	0.0918	0.00539	20.75	-100.00	
-95.00	4.536	39.75	20.196	-28.351	170.844	-0.07217	0.47409	0.5023	0.2911	1.2093	4306.	711.0	0.867	0.0140	0.0906	0.00550	20.31	-95.00	
-90.00	5.316	39.54	17.435	-25.832	172.167	-0.06532	0.47031	0.5043	0.2938	1.2090	4249.	714.4	0.825	0.0142	0.0895	0.00561	19.87	-90.00	
-85.00	6.201	39.34	15.119	-23.302	173.488	-0.05854	0.46672	0.5064	0.2966	1.2089	4192.	717.6	0.786	0.0144	0.0883	0.00572	19.44	-85.00	
-80.00	7.199	39.13	13.167	-20.762	174.807	-0.05181	0.46331	0.5085	0.2994	1.2089	4136.	720.8	0.750	0.0146	0.0872	0.00584	19.01	-80.00	
-75.00	8.321	38.92	11.513	-18.211	176.123	-0.04515	0.46007	0.5107	0.3023	1.2091	4078.	723.8	0.716	0.0148	0.0861	0.00595	18.58	-75.00	
-70.00	9.578	38.71	10.107	-15.648	177.437	-0.03855	0.45698	0.5130	0.3053	1.2094	4021.	726.6	0.684	0.0150	0.0850	0.00607	18.15	-70.00	
-65.00	10.980	38.50	8.9046	-13.072	178.747	-0.03200	0.45405	0.5154	0.3084	1.2099	3964.	729.3	0.654	0.0152	0.0839	0.00619	17.73	-65.00	
-60.00	12.538	38.29	7.8733	-10.485	180.052	-0.02550	0.45125	0.5179	0.3116	1.2105	3906.	731.9	0.626	0.0154	0.0828	0.00631	17.31	-60.00	
-55.00	14.265	38.07	6.9847	-7.884	181.353	-0.01906	0.44860	0.5204	0.3150	1.2113	3848.	734.3	0.600	0.0157	0.0817	0.00643	16.88	-55.00	
-53.84b	14.690	38.02	6.7968	-7.280	181.654	-0.01757	0.44800	0.5210	0.3157	1.2115	3835.	734.8	0.594	0.0157	0.0814	0.00646	16.79	-53.84	
-50.00	16.172	37.86	6.2161	-5.270	182.649	-0.01266	0.44607	0.5231	0.3184	1.2123	3791.	736.5	0.575	0.0159	0.0806	0.00656	16.47	-50.00	
-45.00	18.272	37.64	5.5490	-2.642	183.938	-0.00631	0.44366	0.5258	0.3219	1.2134	3732.	738.5	0.552	0.0161	0.0795	0.00668	16.05	-45.00	
-40.00	20.577	37.42	4.9679	0.000	185.221	0.00000	0.44136	0.5287	0.3255	1.2148	3674.	740.4	0.530	0.0163	0.0785	0.00681	15.63	-40.00	
-35.00	23.101	37.20	4.4599	2.657	186.496	0.00627	0.43918	0.5316	0.3292	1.2163	3616.	742.2	0.509	0.0165	0.0774	0.00695	15.22	-35.00	
-30.00	25.856	36.97	4.0144	5.330	187.764	0.01249	0.43709	0.5347	0.3331	1.2181	3557.	743.7	0.489	0.0167	0.0764	0.00708	14.81	-30.00	
-25.00	28.857	36.75	3.6224	8.019	189.023	0.01868	0.43510	0.5379	0.3371	1.2201	3498.	745.0	0.471	0.0170	0.0754	0.00722	14.41	-25.00	
-20.00	32.117	36.52	3.2765	10.725	190.272	0.02483	0.43321	0.5411	0.3412	1.2223	3440.	746.2	0.453	0.0172	0.0744	0.00736	14.00	-20.00	
-15.00	35.651	36.29	2.9705	13.447	191.512	0.03095	0.43140	0.5445	0.3454	1.2248	3381.	747.2	0.437	0.0174	0.0733	0.00751	13.60	-15.00	
-10.00	39.472	36.06	2.6989	16.187	192.741	0.03703	0.42967	0.5481	0.3498	1.2275	3322.	747.9	0.421	0.0177	0.0723	0.00766	13.20	-10.00	
-5.00	43.596	35.83	2.4571	18.946	193.959	0.04308	0.42801	0.5517	0.3544	1.2306	3262.	748.5	0.406	0.0179	0.0713	0.00781	12.80	-5.00	
0.00	48.036	35.59	2.2414	21.723	195.164	0.04911	0.42643	0.5555	0.3591	1.2339	3203.	748.9	0.392	0.0181	0.0704	0.00797	12.40	0.00	
5.00	52.808	35.35	2.0486	24.520	196.356	0.05511	0.42491	0.5594	0.3640	1.2375	3144.	749.0	0.378	0.0184	0.0694	0.00813	12.01	5.00	
10.00	57.928	35.11	1.8756	27.337	197.535	0.06108	0.42346	0.5635	0.3690	1.2415	3084.	749.0	0.365	0.0186	0.0684	0.00830	11.62	10.00	
15.00	63.411	34.86	1.7201	30.175	198.698	0.06703	0.42206	0.5677	0.3743	1.2459	3024.	748.7	0.353	0.0189	0.0674	0.00847	11.23	15.00	
20.00	69.271	34.61	1.5801	33.034	199.847	0.07295	0.42072	0.5721	0.3797	1.2506	2965.	748.1	0.341	0.0191	0.0665	0.00864	10.85	20.00	
25.00	75.525	34.36	1.4537	35.916	200.978	0.07886	0.41943	0.5766	0.3854	1.2558	2905.	747.4	0.330	0.0194	0.0655	0.00882	10.47	25.00	
30.00	82.190	34.10	1.3393	38.821	202.092	0.08475	0.41818	0.5814	0.3913	1.2614	2845.	746.4	0.319	0.0196	0.0646	0.00900	10.09	30.00	
35.00	89.280	33.84	1.2356	41.749	203.187	0.09062	0.41698	0.5863	0.3975	1.2675	2785.	745.2	0.309	0.0199	0.0636	0.00919	9.71	35.00	
40.00	96.812	33.58	1.1414	44.702	204.263	0.09648	0.41581	0.5915	0.4039	1.2742	2725.	743.7	0.299	0.0202	0.0627	0.00939	9.34	40.00	
45.00	104.80	33.31	1.0556	47.681	205.317	0.10232	0.41467	0.5968	0.4107	1.2815	2665.	741.9	0.290	0.0204	0.0618	0.00959	8.97	45.00	
50.00	113.27	33.04	0.9774	50.687	206.349	0.10815	0.41357	0.6025	0.4177	1.2894	2605.	739.9	0.280	0.0207	0.0608	0.00980	8.60	50.00	
55.00	122.23	32.77	0.9060	53.720	207.357	0.11398	0.41249	0.6083	0.4251	1.2980	2544.	737.6	0.272	0.0210	0.0599	0.01001	8.24	55.00	
60.00	131.69	32.49	0.8406	56.782	208.340	0.11979	0.41144	0.6145	0.4330	1.3074	2484.	735.0	0.263	0.0213	0.0590	0.01023	7.88	60.00	
65.00	141.69	32.20	0.7806	59.874	209.296	0.12561	0.41040	0.6210	0.4412	1.3177	2423.	732.2	0.255	0.0216	0.0581	0.01046	7.52	65.00	
70.00	152.22	31.91	0.7255	62.996	210.223	0.13141	0.40937	0.6279	0.4499	1.3289	2362.	729.0	0.247	0.0219	0.0572	0.01069	7.17	70.00	
75.00	163.32	31.61	0.6749	66.151	211.119	0.13722	0.40835	0.6352	0.4591	1.3413	2301.	725.6	0.239	0.0222	0.0563	0.01094	6.82	75.00	
80.00	175.00	31.31	0.6282	69.340	211.983	0.14303	0.40734	0.6429	0.4690	1.3548	2240.	721.8	0.232	0.0225	0.0554	0.01119	6.47	80.00	
85.00	187.27	31.00	0.5851	72.564	212.810	0.14884	0.40632	0.6510	0.4795	1.3698	2179.	717.7	0.225	0.0229	0.0545	0.01146	6.13	85.00	
90.00	200.16	30.68	0.5452	75.826	213.600	0.15466	0.40530	0.6598	0.4907	1.3863	2118.	713.3	0.218	0.0232	0.0536	0.01173	5.79	90.00	
95.00	213.69	30.36	0.5083	79.128	214.348	0.16049	0.40427	0.6691	0.5029	1.4045	2056.	708.5	0.211	0.0236	0.0527	0.01202	5.45	95.00	
100.00	227.87	30.03	0.4741	82.471	215.053	0.16634	0.403												

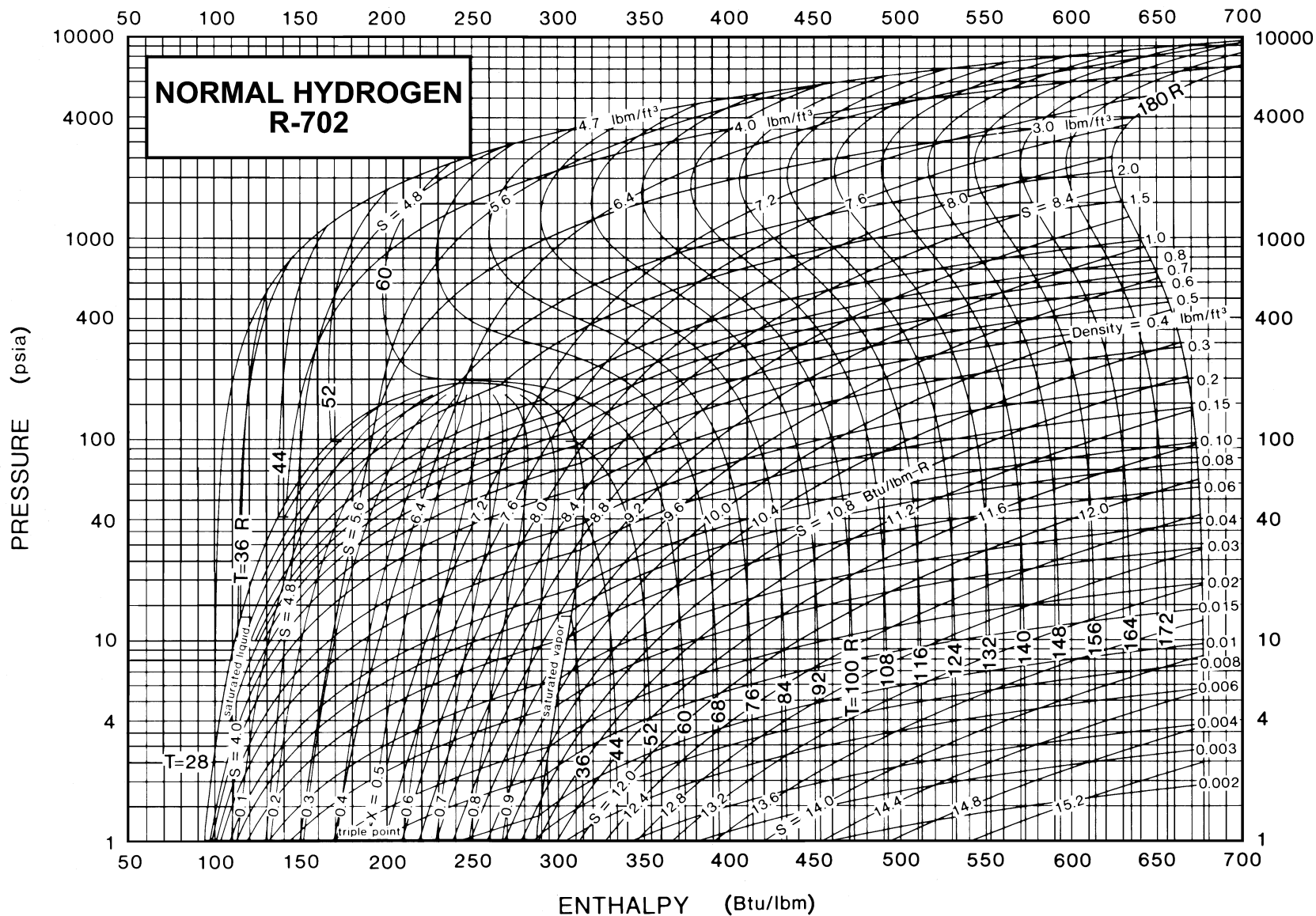


Fig. 22 Pressure-Enthalpy Diagram for Refrigerant 702 (Normal Hydrogen)

Refrigerant 702 (Normal Hydrogen) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °R	Pres- sure, psia	Density, lb/ft ³		Volume, ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°R		Specific Heat c_p , Btu/lb·°R			Velocity of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°R		Surface Tension, dyne/cm	Temp.,* °R
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
25.11a	1.125	4.801	116.73	93.84	287.11	3.3656	11.0477	1.858	2.605	1.669	4467.	998.9	0.0617	0.00160	0.0440	0.00599	3.181	25.11		
26.00	1.464	4.776	92.561	95.60	289.08	3.4270	10.8701	1.751	2.590	1.688	4405.	1018.5	0.0577	0.00170	0.0463	0.00635	3.081	26.00		
28.00	2.513	4.715	57.548	99.07	293.31	3.5540	10.5077	1.716	2.611	1.711	4240.	1054.2	0.0503	0.00189	0.0506	0.00706	2.859	28.00		
30.00	4.060	4.651	37.736	102.54	297.29	3.6755	10.1889	1.807	2.658	1.732	4072.	1084.8	0.0446	0.00206	0.0539	0.00771	2.640	30.00		
31.00	5.062	4.618	31.072	104.38	299.18	3.7357	10.0431	1.872	2.686	1.744	3992.	1098.9	0.0422	0.00215	0.0553	0.00803	2.532	31.00		
32.00	6.239	4.584	25.834	106.31	301.00	3.7960	9.9051	1.944	2.717	1.758	3917.	1112.3	0.0400	0.00223	0.0564	0.00835	2.424	32.00		
33.00	7.611	4.549	21.668	108.34	302.74	3.8565	9.7740	2.020	2.752	1.773	3845.	1125.0	0.0380	0.00231	0.0574	0.00867	2.318	33.00		
34.00	9.195	4.513	18.319	110.47	304.39	3.9173	9.6491	2.100	2.790	1.791	3776.	1137.0	0.0361	0.00239	0.0583	0.00899	2.212	34.00		
35.00	11.013	4.477	15.600	112.68	305.96	3.9785	9.5297	2.182	2.832	1.811	3709.	1148.3	0.0345	0.00247	0.0590	0.00932	2.107	35.00		
36.00	13.082	4.439	13.372	114.98	307.42	4.0401	9.4152	2.267	2.879	1.833	3644.	1159.0	0.0329	0.00256	0.0595	0.00966	2.003	36.00		
36.70b	14.696	4.412	12.045	116.66	308.39	4.0836	9.3376	2.328	2.915	1.851	3598.	1166.1	0.0319	0.00261	0.0598	0.00990	1.931	36.70		
37.00	15.425	4.400	11.531	117.38	308.79	4.1023	9.3051	2.355	2.931	1.858	3579.	1169.0	0.0315	0.00264	0.0600	0.01000	1.900	37.00		
38.00	18.061	4.359	9.976	119.86	310.04	4.1650	9.1989	2.445	2.989	1.887	3514.	1178.2	0.0301	0.00272	0.0603	0.01036	1.798	38.00		
39.00	21.010	4.317	8.7112	122.43	311.18	4.2284	9.0961	2.540	3.054	1.919	3448.	1186.8	0.0289	0.00281	0.0605	0.01073	1.698	39.00		
40.00	24.295	4.273	7.6245	125.10	312.19	4.2924	8.9963	2.640	3.127	1.955	3380.	1194.8	0.0277	0.00289	0.0606	0.01111	1.598	40.00		
41.00	27.935	4.227	6.7006	127.87	313.06	4.3573	8.8991	2.746	3.209	1.995	3311.	1202.0	0.0266	0.00298	0.0607	0.01150	1.499	41.00		
42.00	31.952	4.179	5.9104	130.75	313.80	4.4229	8.8041	2.860	3.302	2.042	3239.	1208.7	0.0255	0.00307	0.0606	0.01191	1.402	42.00		
43.00	36.367	4.129	5.2308	133.75	314.38	4.4894	8.7109	2.982	3.408	2.094	3166.	1214.7	0.0245	0.00316	0.0605	0.01233	1.306	43.00		
44.00	41.202	4.077	4.6430	136.88	314.80	4.5567	8.6192	3.116	3.528	2.154	3089.	1220.0	0.0236	0.00326	0.0603	0.01278	1.211	44.00		
45.00	46.477	4.022	4.1320	140.14	315.04	4.6250	8.5285	3.262	3.666	2.224	3011.	1224.7	0.0227	0.00335	0.0600	0.01324	1.117	45.00		
46.00	52.214	3.965	3.6857	143.56	315.10	4.6944	8.4386	3.425	3.827	2.304	2929.	1228.8	0.0218	0.00345	0.0596	0.01373	1.025	46.00		
47.00	58.434	3.905	3.2939	147.13	314.94	4.7649	8.3490	3.609	4.014	2.398	2845.	1232.3	0.0209	0.00356	0.0591	0.01425	0.935	47.00		
48.00	65.158	3.842	2.9484	150.87	314.56	4.8368	8.2592	3.817	4.235	2.509	2757.	1235.2	0.0201	0.00367	0.0586	0.01480	0.846	48.00		
49.00	72.407	3.776	2.6423	154.81	313.92	4.9103	8.1690	4.059	4.499	2.642	2666.	1237.4	0.0193	0.00378	0.0580	0.01540	0.758	49.00		
50.00	80.202	3.705	2.3698	158.95	313.01	4.9858	8.0776	4.344	4.820	2.803	2572.	1239.1	0.0185	0.00390	0.0573	0.01603	0.673	50.00		
52.00	97.512	3.547	1.9068	167.99	310.19	5.1449	7.8888	5.123	5.718	3.252	2367.	1240.8	0.0170	0.00417	0.0556	0.01750	0.508	52.00		
54.00	117.25	3.356	1.5282	178.43	305.67	5.3220	7.6857	6.484	7.246	4.013	2133.	1240.5	0.0154	0.00451	0.0535	0.01933	0.352	54.00		
56.00	139.59	3.102	1.2092	191.38	298.64	5.5351	7.4556	9.791	10.325	5.537	1851.	1238.9	0.0138	0.00500	0.0507	0.02187	0.208	56.00		
58.00	164.68	2.702	0.9281	210.22	287.39	5.8358	7.1718	–	–	–	–	–	–	–	–	–	0.082	58.00		
59.74c	190.75	1.880	0.5320	248.30	248.30	6.4441	6.4441	∞	∞	∞	0.	0.0	–	–	∞	∞	0.000	59.74		

*Temperatures are on the IPTS-68 scale a = triple point b = normal boiling point c = critical point

Refrigerant 702 (Normal Hydrogen) Properties of Gas at 14.696 psia (one standard atmosphere)

Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	c_p , Btu/lb·°F	c_p/c_v	Vel. Sound, ft/s	Viscos- ity, lb/ft·h	Thermal Cond., Btu/h·ft·°F	Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	c_p , Btu/lb·°F	c_p/c_v	Vel. Sound, ft/s	Viscos- ity, lb/ft·h	Thermal Cond., Btu/h·ft·°F
-423.0a	0.08302	308.39	9.3376	2.915	1.851	1166.1	0.0026	0.0099	0.0	0.00600	1545.27	16.3039	3.367	1.414	4006.9	0.0194	0.0944
-420.0	0.07529	316.85	9.5592	2.792	1.812	1226.5	0.0028	0.0106	10.0	0.00587	1578.98	16.3765	3.376	1.413	4048.1	0.0197	0.0961
-410.0	0.05801	343.71	10.1639	2.617	1.748	1401.0	0.0035	0.0132	20.0	0.00575	1612.78	16.4477	3.384	1.411	4088.9	0.0200	0.0978
-400.0	0.04750	369.53	10.6376	2.555	1.720	1549.3	0.0042	0.0156	30.0	0.00563	1646.66	16.5176	3.391	1.410	4129.4	0.0203	0.0994
-390.0	0.04032	394.93	11.0312	2.527	1.704	1681.7	0.0048	0.0179	40.0	0.00552	1680.61	16.5862	3.398	1.409	4169.5	0.0205	0.1010
-380.0	0.03507	420.11	11.3690	2.512	1.694	1802.7	0.0054	0.0201	50.0	0.00541	1714.62	16.6536	3.405	1.408	4209.4	0.0208	0.1026
-370.0	0.03105	445.19	11.6655	2.505	1.686	1914.8	0.0060	0.0221	60.0	0.00531	1748.69	16.7198	3.410	1.407	4248.9	0.0211	0.1042
-360.0	0.02787	470.22	11.9302	2.503	1.679	2019.3	0.0065	0.0241	70.0	0.00521	1782.83	16.7849	3.416	1.406	4288.2	0.0214	0.1057
-340.0	0.02314	520.39	12.3889	2.518	1.663	2208.2	0.0075	0.0281	80.0	0.00511	1817.01	16.8488	3.421	1.405	4327.1	0.0216	0.1073
-320.0	0.01980	571.09	12.7806	2.556	1.641	2373.7	0.0084	0.0318	90.0	0.00502	1851.24	16.9117	3.425	1.404	4365.8	0.0219	0.1088
-300.0	0.01730	622.76	13.1262	2.613	1.615	2520.1	0.0093	0.0355	100.0	0.00493	1885.51	16.9735	3.429	1.404	4404.2	0.0222	0.1104
-280.0	0.01537	675.70	13.4385	2.683	1.588	2651.9	0.0101	0.0394	120.0	0.00476	1954.17	17.0940	3.437	1.402	4480.2	0.0227	0.1134
-260.0	0.01382	730.11	13.7256	2.759	1.561	2773.0	0.0109	0.0437	140.0	0.00460	2022.97	17.2107	3.443	1.401	4555.2	0.0233	0.1166
-240.0	0.01256	786.05	13.9925	2.835	1.537	2886.5	0.0117	0.0479	160.0	0.00445	2091.87	17.3237	3.447	1.401	4629.1	0.0238	0.1199
-220.0	0.01151	843.50	14.2428	2.910	1.515	2994.3	0.0124	0.0521	180.0	0.00431	2160.85	17.4333	3.451	1.400	4702.1	0.0243	0.1231
-200.0	0.01063	902.40	14.4788	2.979	1.497	3098.0	0.0131	0.0562	200.0	0.00418	2229.91	17.5396	3.454	1.399	4774.1	0.0248	0.1261
-180.0	0.00986	962.63	14.7022	3.043	1.481	3198.3	0.0138	0.0604	220.0	0.00406	2299.02	17.6428	3.457	1.399	4845.2	0.0253	0.1292
-160.0	0.00921	1024.07	14.9143	3.100	1.468	3295.9	0.0145	0.0645	240.0	0.00394	2368.17	17.7431	3.459	1.399	4915.3	0.0258	0.1322
-140.0	0.00863	1086.59	15.1163	3.151	1.457	3391.1	0.0151	0.0686	260.0	0.00383	2437.36	17.8406	3.460	1.398	4984.6	0.0263	0.1352
-120.0	0.00812	1150.06	15.3089	3.196	1.447	3484.2	0.0158	0.0726	280.0	0.00373	2506.57	17.9354	3.461	1.398	5053.0	–	–
-100.0	0.00767	1214.38	15.4929	3.235	1.439	3575.5	0.0164	0.0765	300.0	0.00363	2575.80	18.0278	3.462	1.398	5120.4	–	–
-80.0	0.00727	1279.43	15.6689	3.269	1.432	3664.9	0.0170	0.0802	320.0	0.00354	2645.06	18.1178	3.463	1.398	5187.1	–	–
-60.0	0.00690	1345.13	15.8375	3.299	1.427	3752.7	0.0176	0.0839	340.0	0.00345	2714.33	18.2055	3.464	1.398	5252.8	–	–
-40.0	0.00657	1411.38	15.9992	3.325	1.422	3838.9	0.0182	0.0875	360.0	0.00337	2783.62	18.2911	3.465	1.398	5317.8	–	–
-20.0	0.00627	1478.11	16.1546	3.348	1.418	3923.7	0.0188	0.0910	380.0	0.00329	2852.93	18.3746	3.466	1.397	5381.9	–	–
									400.0	0.00321	2922.25	18.4562	3.467	1.397	5445.2	–	–

a = saturated vapor at normal boiling point

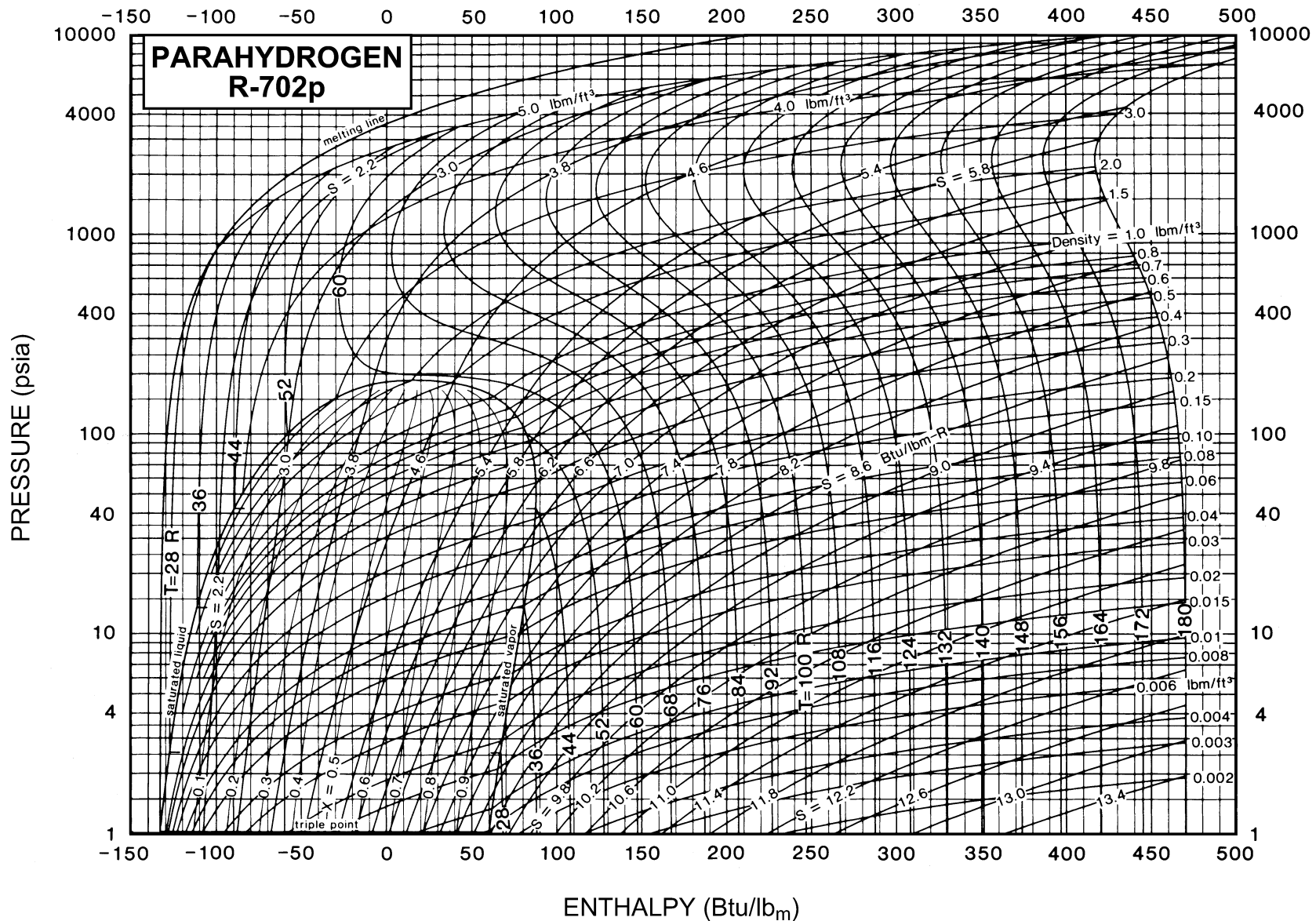


Fig. 23 Pressure-Enthalpy Diagram for Refrigerant 702p (Parahydrogen)

Refrigerant 702p (Parahydrogen) Properties of Saturated Liquid and Saturated Vapor

Table with 18 columns: Temp., Pressure, Density (Liquid/Vapor), Volume (Liquid/Vapor), Enthalpy (Liquid/Vapor), Entropy (Liquid/Vapor), Specific Heat (Liquid/Vapor), Velocity of Sound (Liquid/Vapor), Viscosity (Liquid/Vapor), Thermal Cond. (Liquid/Vapor), Surface Tension, Temp.*. Rows range from 24.84a to 59.29c.

*Temperatures are on the IPTS-68 scale a = triple point b = normal boiling point c = critical point

Refrigerant 702p (Parahydrogen) Properties of Gas at 14.696 psia (one standard atmosphere)

Table with 18 columns: Temp., Density, Enthalpy, Entropy, Cp, Vel. Sound, Viscosity, Thermal Cond., Temp., Density, Enthalpy, Entropy, Cp, Vel. Sound, Viscosity, Thermal Cond. Rows range from -423.2a to 250.0.

a = saturated vapor at normal boiling point

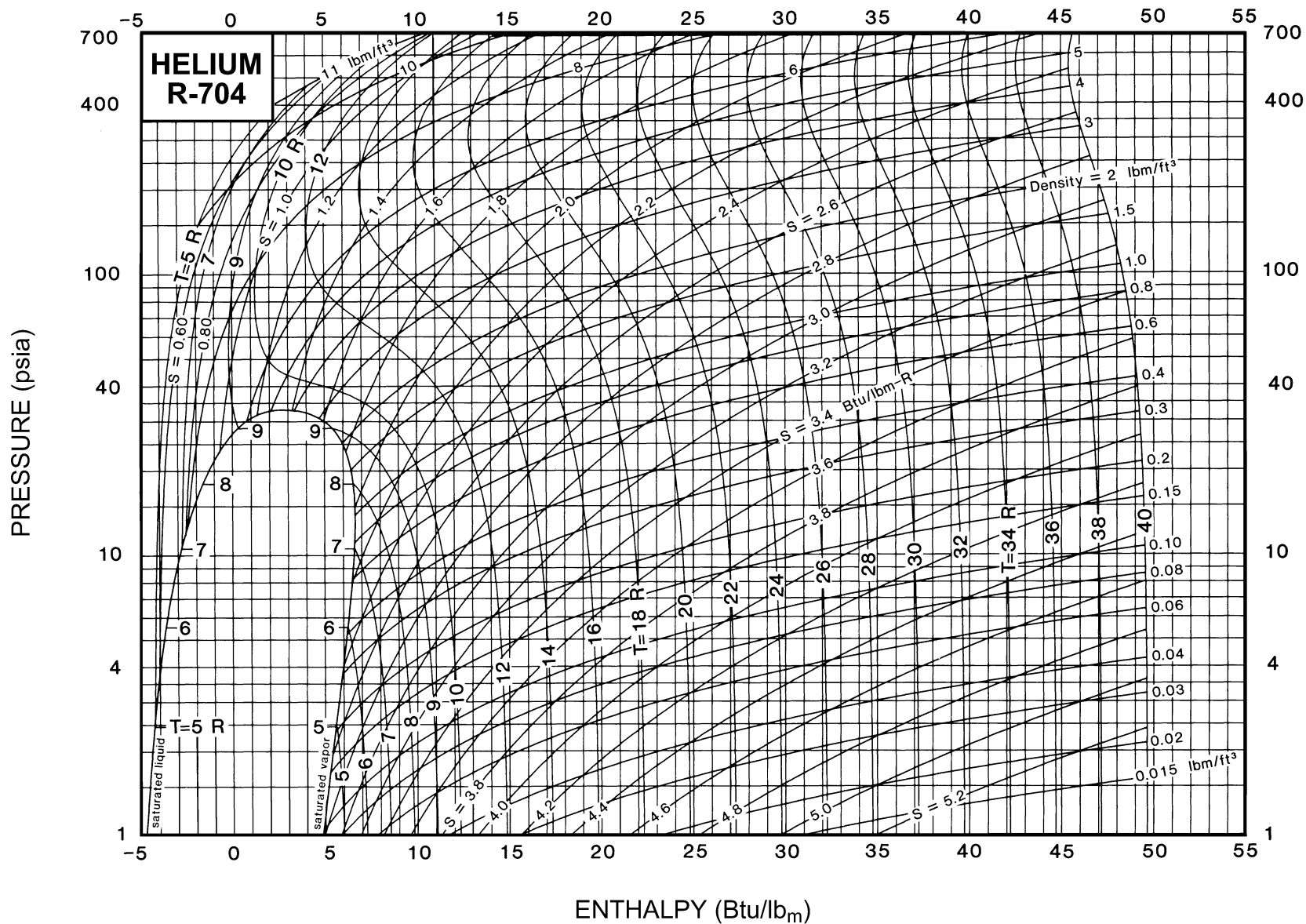


Fig. 24 Pressure-Enthalpy Diagram for Refrigerant 704 (Helium)

Note: The reference states for enthalpy and entropy differ from those in the table.

Refrigerant 704 (Helium) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °R	Pres- sure, psia	Density, Volume,		Enthalpy,		Entropy,		Specific Heat c_p ,			Velocity of		Viscosity,		Thermal Cond.,		Surface Tension, dyne/cm	Temp.,* °R
		lb/ft ³ Liquid	ft ³ /lb Vapor	Btu/lb Liquid	Btu/lb Vapor	Btu/lb·°R Liquid	Btu/lb·°R Vapor	Liquid	Vapor	Vapor	c_p/c_v	Liquid	Vapor	lb _m /ft-h Liquid	lb _m /ft-h Vapor	Btu/h-ft·°R Liquid		
3.92a	0.704	9.130	13.9837	1.005	10.998	0.33557	2.88589	1.5100	1.4485	1.747	711.	273.0	—	—	—	—	0.388	3.92
4.00	0.789	9.122	12.7008	1.121	11.076	0.36428	2.85306	1.2809	1.4556	1.752	710.	275.2	—	—	—	—	0.382	4.00
4.20	1.021	9.099	10.1926	1.340	11.263	0.41671	2.77927	0.9051	1.4720	1.768	708.	280.3	—	—	—	—	0.366	4.20
4.40	1.296	9.068	8.3274	1.504	11.445	0.45355	2.71288	0.7039	1.4879	1.786	708.	285.1	—	—	—	—	0.350	4.40
4.60	1.617	9.030	6.9024	1.640	11.621	0.48225	2.65223	0.6064	1.5037	1.805	710.	289.7	—	—	—	—	0.334	4.60
4.80	1.988	8.987	5.7905	1.763	11.792	0.50693	2.59623	0.5700	1.5199	1.827	711.	294.0	—	—	—	—	0.319	4.80
5.00	2.413	8.938	4.9078	1.884	11.955	0.52983	2.54407	0.5694	1.5371	1.851	711.	298.0	—	—	—	—	0.303	5.00
5.20	2.896	8.883	4.1970	2.008	12.111	0.55216	2.49514	0.5893	1.5554	1.879	708.	301.7	—	—	—	—	0.287	5.20
5.40	3.442	8.824	3.6172	2.138	12.260	0.57454	2.44894	0.6209	1.5755	1.910	703.	305.2	—	—	—	—	0.272	5.40
5.60	4.053	8.760	3.1392	2.276	12.400	0.59727	2.40509	0.6590	1.5978	1.944	696.	308.5	—	—	—	—	0.256	5.60
5.80	4.734	8.690	2.7410	2.423	12.531	0.62047	2.36323	0.7009	1.6229	1.984	688.	311.5	—	—	—	—	0.241	5.80
6.00	5.488	8.616	2.4063	2.579	12.652	0.64419	2.32304	0.7453	1.6513	2.029	679.	314.3	—	—	—	—	0.226	6.00
6.20	6.319	8.536	2.1226	2.744	12.763	0.66842	2.28427	0.7918	1.6839	2.080	669.	316.8	—	—	—	—	0.211	6.20
6.40	7.230	8.451	1.8803	2.920	12.862	0.69316	2.24664	0.8407	1.7217	2.139	659.	319.2	0.00844	0.00238	0.0103	0.00416	0.196	6.40
6.60	8.224	8.360	1.6717	3.106	12.950	0.71841	2.20990	0.8927	1.7657	2.207	647.	321.3	0.00832	0.00248	0.0104	0.00432	0.181	6.60
6.80	9.306	8.262	1.4910	3.303	13.025	0.74419	2.17383	0.9489	1.8177	2.286	635.	323.2	0.00819	0.00258	0.0105	0.00448	0.166	6.80
7.00	10.480	8.158	1.3333	3.511	13.085	0.77053	2.13816	1.0109	1.8798	2.379	623.	324.9	0.00807	0.00268	0.0106	0.00466	0.152	7.00
7.20	11.748	8.047	1.1948	3.732	13.129	0.79748	2.10264	1.0810	1.9547	2.491	609.	326.3	0.00793	0.00279	0.0107	0.00483	0.138	7.20
7.40	13.114	7.927	1.0724	3.965	13.155	0.82515	2.06700	1.1621	2.0466	2.626	595.	327.6	0.00780	0.00290	0.0107	0.00502	0.123	7.40
7.60	14.584	7.797	0.9634	4.214	13.161	0.85365	2.03091	1.2586	2.1613	2.792	580.	328.7	0.00766	0.00301	0.0108	0.00522	0.109	7.60
7.61b	14.696	7.787	0.9559	4.233	13.160	0.85578	2.02824	1.2664	2.1708	2.806	579.	328.8	0.00765	0.00302	0.0108	0.00524	0.108	7.61
7.80	16.161	7.656	0.8657	4.479	13.143	0.88319	1.99398	1.3768	2.3077	3.003	564.	329.6	0.00752	0.00313	0.0108	0.00544	0.095	7.80
8.00	17.850	7.501	0.7774	4.764	13.098	0.91401	1.95573	1.5272	2.5001	3.278	547.	330.3	0.00737	0.00326	0.0108	0.00568	0.082	8.00
8.20	19.657	7.329	0.6969	5.072	13.018	0.94651	1.91551	1.7271	2.7626	3.650	529.	330.8	0.00721	0.00340	0.0109	0.00596	0.068	8.20
8.40	21.587	7.135	0.6226	5.410	12.895	0.98128	1.87237	2.0092	3.1400	4.181	509.	331.2	0.00704	0.00354	0.0109	0.00629	0.055	8.40
8.60	23.650	6.911	0.5529	5.788	12.716	1.01927	1.82486	2.4415	3.7248	5.003	487.	331.6	0.00686	0.00371	0.0110	0.00670	0.042	8.60
8.80	25.854	6.641	0.4861	6.222	12.453	1.06226	1.77037	3.1940	4.7457	6.434	463.	332.2	0.00664	0.00389	0.0110	0.00724	0.030	8.80
9.00	28.215	6.294	0.4192	6.751	12.055	1.11412	1.70345	4.8375	6.9536	9.531	436.	333.4	0.00638	0.00411	0.0112	0.00801	0.018	9.00
9.20	30.755	5.771	0.3451	7.493	11.364	1.18708	1.60775	11.0204	14.9798	20.845	404.	336.9	0.00603	0.00440	0.0115	0.00932	0.007	9.20
9.35c	32.990	4.348	0.2300	9.339	9.339	1.37760	1.37760	∞	∞	∞	0.	0.0	—	—	∞	∞	0.000	9.35

*Temperatures are on the EPT-76 scale

a = lower lambda point

b = normal boiling point

c = critical point

Refrigerant 704 (Helium) Properties of Gas at 14.696 psia (one standard atmosphere)

Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	c_p , Btu/lb·°F	c_p/c_v	Vel. Sound, ft/s	Viscos- ity, lb/ft-h	Thermal Cond., Btu/h-ft·°F	Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	c_p , Btu/lb·°F	c_p/c_v	Vel. Sound, ft/s	Viscos- ity, lb/ft-h	Thermal Cond., Btu/h-ft·°F
-452.1a	1.04613	13.16	2.0282	2.1708	2.806	328.8	0.0030	0.00523	0.0	0.01192	577.15	7.3479	1.2412	1.667	3086.5	0.0432	0.08064
-450.0	0.66840	16.73	2.4459	1.5277	2.037	415.4	0.0035	0.00624	20.0	0.01142	601.97	7.4007	1.2412	1.667	3152.8	0.0445	0.08304
-440.0	0.28462	30.24	3.4138	1.2880	1.729	636.4	0.0058	0.01035	40.0	0.01096	626.79	7.4514	1.2412	1.667	3217.8	0.0457	0.08542
-430.0	0.18546	42.96	3.9370	1.2616	1.691	786.5	0.0076	0.01343	60.0	0.01054	651.62	7.5001	1.2412	1.667	3281.5	0.0470	0.08776
-420.0	0.13809	55.52	4.3020	1.2525	1.679	910.2	0.0092	0.01608	80.0	0.01015	676.44	7.5470	1.2411	1.667	3344.0	0.0482	0.09008
-400.0	0.09163	80.49	4.8118	1.2459	1.671	1115.8	0.0119	0.02074	100.0	0.00979	701.26	7.5922	1.2411	1.667	3405.3	0.0494	0.09238
-380.0	0.06862	105.39	5.1716	1.2437	1.669	1288.4	0.0143	0.02493	120.0	0.00945	726.09	7.6357	1.2411	1.667	3465.6	0.0506	0.09465
-360.0	0.05486	130.25	5.4500	1.2427	1.668	1440.3	0.0164	0.02882	140.0	0.00914	750.91	7.6778	1.2411	1.667	3524.8	0.0518	0.09690
-340.0	0.04571	155.10	5.6772	1.2421	1.667	1577.5	0.0183	0.03248	160.0	0.00884	775.73	7.7186	1.2411	1.667	3583.1	0.0530	0.09912
-320.0	0.03917	179.94	5.8691	1.2418	1.667	1703.7	0.0202	0.03596	180.0	0.00857	800.55	7.7580	1.2411	1.667	3640.4	0.0542	0.10133
-300.0	0.03427	204.77	6.0353	1.2416	1.667	1821.2	0.0219	0.03931	200.0	0.00831	825.38	7.7962	1.2411	1.667	3696.8	0.0553	0.10351
-280.0	0.03046	229.60	6.1818	1.2415	1.667	1931.5	0.0236	0.04254	240.0	0.00783	875.02	7.8693	1.2411	1.667	3807.1	0.0576	0.10783
-260.0	0.02741	254.43	6.3129	1.2414	1.667	2035.8	0.0248	0.04566	280.0	0.00741	924.67	7.9383	1.2411	1.667	3914.4	0.0599	0.11207
-240.0	0.02492	279.26	6.4314	1.2413	1.667	2135.1	0.0264	0.04870	320.0	0.00703	974.32	8.0036	1.2411	1.667	4018.8	0.0621	0.11624
-220.0	0.02285	304.08	6.5395	1.2413	1.667	2229.9	0.0280	0.05166	360.0	0.00669	1023.96	8.0657	1.2411	1.667	4120.5	0.0643	0.12036
-200.0	0.02109	328.91	6.6390	1.2413	1.666	2320.9	0.0295	0.05454	400.0	0.00637	1073.61	8.1249	1.2411	1.667	4219.8	0.0665	0.12441
-180.0	0.01958	353.73	6.7311	1.2412	1.666	2408.4	0.0310	0.05737	440.0	0.00609	1123.25	8.1813	1.2411	1.667	4316.8	0.0686	0.12841
-160.0	0.01827	378.56	6.8168	1.2412	1.666	2492.9	0.0324	0.06013	480.0	0.00583	1172.90	8.2353	1.2411	1.667	4411.6	0.0707	0.13236
-140.0	0.01713	403.38	6.8970	1.2412	1.666	2574.6	0.0338	0.06284	520.0	0.00559	1222.55	8.2871	1.2411	1.667	4504.5	0.0728	0.13626
-120.0	0.01613	428.21	6.9724	1.2412	1.666	2653.7	0.0352	0.06551	560.0	0.00537	1272.19	8.3367	1.2411	1.667	4595.5	0.0749	0.14011
-100.0	0.01523	453.03	7.0434	1.2412	1.666	2730.6	0.0366	0.06813	600.0	0.00517	1321.84	8.3845	1.2411	1.667	4684.7	0.0769	0.14392
-80.0	0.01443	477.85	7.1105	1.2412	1.667	2805.4	0.0380	0.07070	640.0	0.00498	1371.48	8.4305	1.2412	1.667	4772.3	0.0789	0.14768
-60.0	0.01371	502.68	7.1743	1.2412	1.667	2878.2	0.0393	0.07324	680.0	0.00481	1421.13	8.4748	1.2412	1.667	4858.3	0.0809	0.15141
-40.0	0.01305	527.50	7.2349	1.2412	1.667	2949.3	0.0406	0.07574	720.0	0.00465	1470.78	8.5176	1.2412	1.667	4942.8	0.0829	0.15509
-20.0	0.01246	552.32	7.2927	1.2412	1.667	3018.7	0.0419	0.07821	760.0	0.00449	1520.42	8.5590	1.2412	1.667	5025.8	0.0849	0.15874
									800.0	0.00435	1570.07	8.5991	1.2412	1.667	5107.6	0.0868	0.16236

a = saturated vapor at normal boiling point

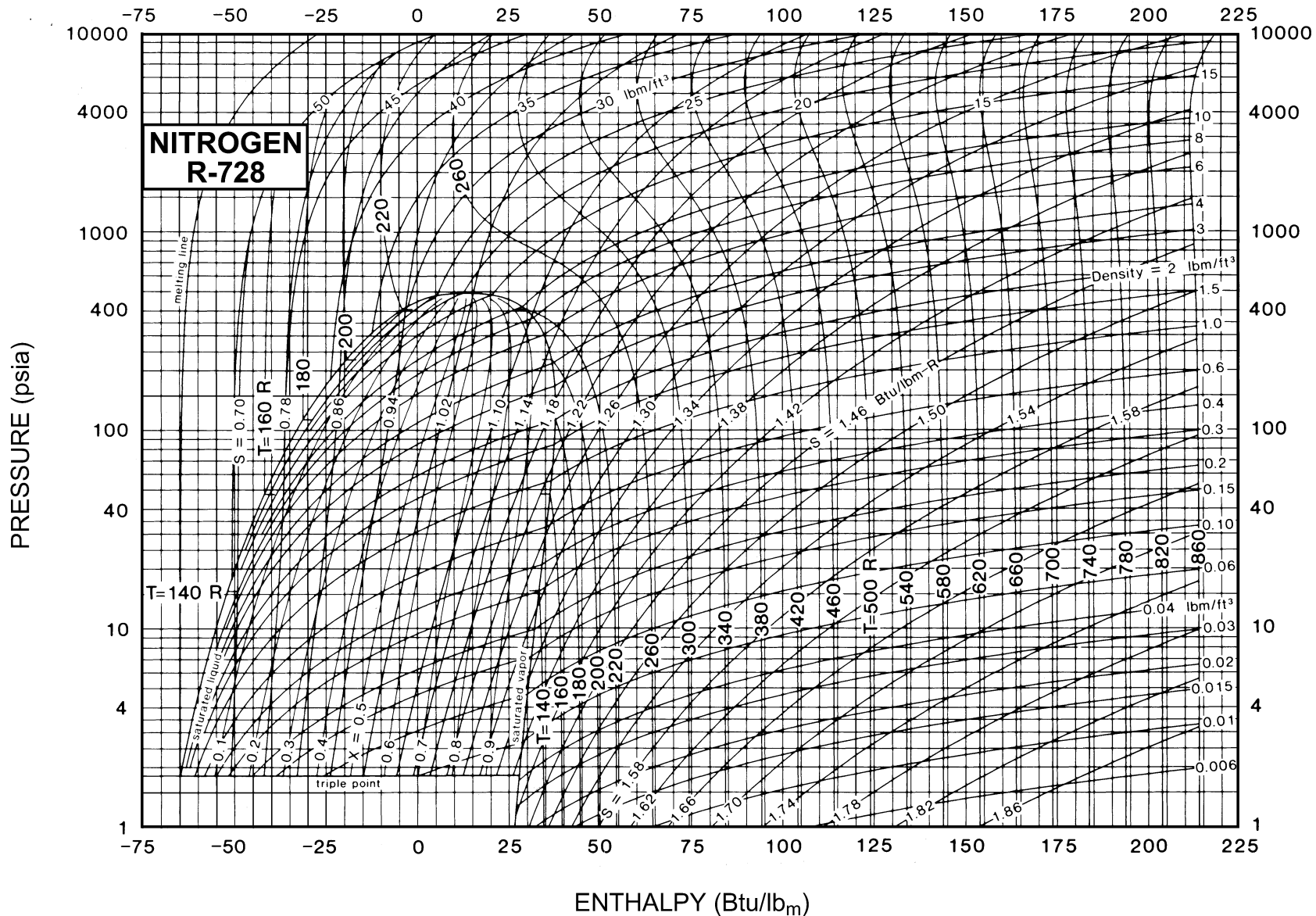


Fig. 25 Pressure-Enthalpy Diagram for Refrigerant 728 (Nitrogen)

Refrigerant 728 (Nitrogen) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °R	Pres- sure, psia	Density, lb/ft ³ Liquid	Volume, ft ³ /lb Vapor	Enthalpy, Btu/lb		Entropy, Btu/lb·°R		Specific Heat <i>c_p</i> , Btu/lb·°R		<i>c_p</i> / <i>c_v</i>	Velocity of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°R		Surface Tension, dyne/cm	Temp.,* °R
				Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
113.67a	1.82	54.29	23.738	-64.91	27.76	0.57825	1.39348	0.4826	0.2838	1.390	3352.	523.2	0.6916	0.0101	0.1009	0.00311	12.24	113.67
115.00	2.08	54.09	20.970	-64.26	28.06	0.58387	1.38665	0.4821	0.2857	1.390	3318.	525.7	0.6639	0.0102	0.1000	0.00315	12.06	115.00
120.00	3.34	53.34	13.542	-61.85	29.16	0.60435	1.36278	0.4811	0.2929	1.394	3197.	535.0	0.5749	0.0107	0.0963	0.00333	11.39	120.00
125.00	5.15	52.58	9.0919	-59.44	30.22	0.62397	1.34131	0.4815	0.3002	1.400	3084.	543.7	0.5044	0.0111	0.0928	0.00350	10.72	125.00
130.00	7.66	51.81	6.3130	-57.03	31.25	0.64286	1.32189	0.4830	0.3075	1.408	2976.	551.7	0.4472	0.0116	0.0893	0.00369	10.06	130.00
135.00	11.04	51.03	4.5130	-54.60	32.22	0.66109	1.30423	0.4854	0.3146	1.419	2873.	559.2	0.3999	0.0121	0.0859	0.00388	9.42	135.00
139.23b	14.696	50.36	3.4662	-52.53	33.01	0.67606	1.29047	0.4881	0.3205	1.430	2787.	565.0	0.3659	0.0125	0.0831	0.00404	8.88	139.23
140.00	15.45	50.23	3.3089	-52.16	33.15	0.67875	1.28806	0.4887	0.3215	1.432	2772.	566.0	0.3602	0.0126	0.0826	0.00407	8.78	140.00
145.00	21.11	49.42	2.4801	-49.69	34.01	0.69590	1.27315	0.4928	0.3285	1.449	2673.	572.1	0.3262	0.0131	0.0793	0.00428	8.15	145.00
150.00	28.20	48.58	1.8949	-47.20	34.81	0.71259	1.25931	0.4977	0.3355	1.470	2575.	577.5	0.2968	0.0137	0.0761	0.00449	7.53	150.00
155.00	36.93	47.73	1.4722	-44.69	35.53	0.72888	1.24637	0.5035	0.3430	1.495	2478.	582.1	0.2710	0.0142	0.0729	0.00472	6.92	155.00
160.00	47.53	46.85	1.1605	-42.13	36.16	0.74482	1.23417	0.5104	0.3513	1.526	2380.	585.9	0.2482	0.0148	0.0698	0.00496	6.32	160.00
165.00	60.20	45.94	0.9264	-39.54	36.71	0.76044	1.22256	0.5186	0.3610	1.563	2281.	588.9	0.2277	0.0153	0.0667	0.00521	5.74	165.00
170.00	75.19	44.99	0.7476	-36.91	37.14	0.77580	1.21141	0.5284	0.3726	1.608	2180.	591.1	0.2093	0.0159	0.0636	0.00548	5.16	170.00
175.00	92.71	44.02	0.6089	-34.22	37.46	0.79095	1.20059	0.5404	0.3870	1.663	2078.	592.3	0.1925	0.0166	0.0605	0.00577	4.60	175.00
180.00	113.01	42.99	0.4997	-31.48	37.65	0.80595	1.18999	0.5553	0.4051	1.731	1972.	592.6	0.1770	0.0172	0.0575	0.00609	4.05	180.00
185.00	136.32	41.92	0.4127	-28.65	37.69	0.82086	1.17946	0.5741	0.4284	1.817	1862.	592.0	0.1627	0.0179	0.0545	0.00644	3.52	185.00
190.00	162.89	40.78	0.3424	-25.74	37.55	0.83577	1.16887	0.5984	0.4591	1.927	1748.	590.3	0.1493	0.0187	0.0515	0.00683	3.00	190.00
195.00	192.99	39.56	0.2850	-22.71	37.21	0.85077	1.15805	0.6309	0.5007	2.074	1627.	587.5	0.1366	0.0195	0.0484	0.00727	2.50	195.00
200.00	226.88	38.23	0.2374	-19.54	36.62	0.86603	1.14680	0.6762	0.5590	2.275	1499.	583.5	0.1245	0.0204	0.0453	0.00778	2.02	200.00
205.00	264.86	36.76	0.1975	-16.16	35.71	0.88175	1.13481	0.7430	0.6455	2.570	1361.	578.2	0.1127	0.0215	0.0421	0.00841	1.56	205.00
210.00	307.25	35.07	0.1634	-12.52	34.39	0.89828	1.12165	0.8496	0.7847	3.035	1212.	571.5	0.1009	0.0228	0.0388	0.00925	1.13	210.00
215.00	354.43	33.06	0.1336	-8.45	32.47	0.91622	1.10651	1.0416	1.0417	3.877	1049.	563.0	0.0889	0.0244	0.0354	0.01052	0.73	215.00
220.00	406.84	30.49	0.1065	-3.66	29.52	0.93683	1.08763	1.4809	1.6619	5.856	867.	552.1	0.0761	0.0266	0.0326	0.01310	0.38	220.00
225.00	465.28	26.51	0.0784	2.91	23.94	0.96462	1.05807	3.8790	5.1786	16.586	654.	535.3	0.0606	0.0309	0.0358	0.02362	0.08	225.00
227.15c	492.81	19.55	0.0512	12.83	12.83	1.00750	1.00750	∞	∞	∞	0.	0.0	-	-	∞	∞	0.00	227.15

*Temperatures are on the IPTS-68 scale a = triple point b = normal boiling point c = critical point

Refrigerant 728 (Nitrogen) Properties of Gas at 14.696 psia (one standard atmosphere)

Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	<i>c_p</i> , Btu/lb·°F	<i>c_p</i> / <i>c_v</i>	Vel. Sound, ft/s	Viscos- ity, lb/ft·h	Thermal Cond., Btu/h·ft·°F	Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	<i>c_p</i> , Btu/lb·°F	<i>c_p</i> / <i>c_v</i>	Vel. Sound, ft/s	Viscos- ity, lb/ft·h	Thermal Cond., Btu/h·ft·°F
-320.4a	0.2885	33.01	1.2905	0.3205	1.430	565.0	0.0125	0.00404	200.0	0.0581	163.68	1.6841	0.2493	1.399	1280.2	0.0497	0.01745
-300.0	0.2471	38.64	1.3283	0.2595	1.436	619.8	0.0144	0.00470	220.0	0.0564	168.66	1.6916	0.2494	1.399	1299.4	0.0508	0.01786
-275.0	0.2116	45.05	1.3656	0.2546	1.425	670.7	0.0167	0.00550	240.0	0.0548	173.65	1.6988	0.2496	1.399	1318.2	0.0519	0.01826
-250.0	0.1853	51.39	1.3978	0.2527	1.418	717.1	0.0189	0.00631	260.0	0.0533	178.65	1.7059	0.2497	1.398	1336.7	0.0530	0.01866
-225.0	0.1650	57.69	1.4262	0.2516	1.413	760.2	0.0211	0.00711	280.0	0.0518	183.64	1.7127	0.2499	1.398	1354.9	0.0540	0.01906
-200.0	0.1487	63.97	1.4516	0.2508	1.410	800.8	0.0232	0.00783	300.0	0.0505	188.65	1.7194	0.2502	1.397	1372.8	0.0551	0.01945
-180.0	0.1379	68.98	1.4702	0.2504	1.408	831.7	0.0248	0.00841	320.0	0.0492	193.65	1.7259	0.2504	1.396	1390.5	0.0561	0.01985
-160.0	0.1286	73.99	1.4875	0.2500	1.407	861.4	0.0264	0.00898	340.0	0.0480	198.66	1.7322	0.2507	1.396	1407.9	0.0571	0.02024
-140.0	0.1204	78.99	1.5036	0.2498	1.406	890.1	0.0279	0.00954	360.0	0.0468	203.68	1.7384	0.2510	1.395	1425.0	0.0581	0.02062
-120.0	0.1132	83.98	1.5188	0.2496	1.405	917.9	0.0294	0.01008	380.0	0.0457	208.70	1.7445	0.2514	1.394	1441.9	0.0591	0.02101
-100.0	0.1069	88.97	1.5331	0.2494	1.404	944.8	0.0309	0.01061	400.0	0.0446	213.73	1.7504	0.2517	1.393	1458.6	0.0601	0.02140
-80.0	0.1012	93.96	1.5466	0.2493	1.404	970.9	0.0323	0.01113	420.0	0.0436	218.77	1.7562	0.2521	1.392	1475.0	0.0611	0.02178
-60.0	0.0961	98.94	1.5594	0.2492	1.403	996.3	0.0337	0.01163	440.0	0.0426	223.82	1.7619	0.2525	1.391	1491.2	0.0620	0.02216
-40.0	0.0915	103.92	1.5715	0.2491	1.403	1021.1	0.0351	0.01213	460.0	0.0417	228.87	1.7674	0.2529	1.391	1507.2	0.0630	0.02254
-20.0	0.0873	108.90	1.5831	0.2490	1.403	1045.2	0.0364	0.01261	480.0	0.0408	233.93	1.7729	0.2534	1.390	1522.9	0.0639	0.02292
0.0	0.0835	113.88	1.5942	0.2490	1.402	1068.8	0.0378	0.01309	500.0	0.0400	239.01	1.7782	0.2538	1.389	1538.5	0.0648	0.02330
10.0	0.0817	116.37	1.5996	0.2489	1.402	1080.4	0.0384	0.01332	520.0	0.0391	244.09	1.7834	0.2543	1.387	1553.9	0.0658	0.02368
20.0	0.0800	118.86	1.6048	0.2489	1.402	1091.9	0.0390	0.01355	540.0	0.0384	249.18	1.7886	0.2548	1.386	1569.0	0.0667	0.02406
30.0	0.0784	121.35	1.6099	0.2489	1.402	1103.3	0.0397	0.01378	560.0	0.0376	254.28	1.7936	0.2553	1.385	1584.0	0.0676	0.02444
40.0	0.0768	123.84	1.6150	0.2489	1.402	1114.5	0.0403	0.01401	580.0	0.0369	259.39	1.7986	0.2559	1.384	1598.8	0.0685	0.02482
50.0	0.0753	126.33	1.6199	0.2489	1.402	1125.6	0.0409	0.01424	600.0	0.0362	264.51	1.8035	0.2564	1.383	1613.5	0.0693	0.02519
60.0	0.0738	128.82	1.6247	0.2489	1.402	1136.6	0.0416	0.01446	620.0	0.0355	269.65	1.8083	0.2570	1.382	1627.9	0.0702	0.02557
70.0	0.0724	131.31	1.6295	0.2489	1.401	1147.5	0.0422	0.01469	640.0	0.0349	274.79	1.8130	0.2575	1.381	1642.2	0.0711	0.02594
80.0	0.0711	133.80	1.6341	0.2489	1.401	1158.3	0.0428	0.01491	660.0	0.0342	279.95	1.8176	0.2581	1.379	1656.3	0.0720	0.02632
90.0	0.0698	136.28	1.6387	0.2489	1.401	1169.0	0.0434	0.01513	680.0	0.0336	285.12	1.8222	0.2587	1.378	1670.3	0.0728	0.02670
100.0	0.0686	138.77	1.6432	0.2489	1.401	1179.6	0.0440	0.01534	700.0	0.0331	290.30	1.8267	0.2593	1.377	1684.2	0.0737	0.02707
120.0	0.0662	143.75	1.6519	0.2489	1.401	1200.4	0.0452	0.01578	720.0	0.0325	295.49	1.8312	0.2599	1.376	1697.9	0.0745	0.02745
140.0	0.0640	148.73	1.6604	0.2490	1.400	1220.9	0.0463	0.01620	740.0	0.0320	300.69	1.8355	0.2606	1.374	1711.4	0.0754	0.02782
160.0	0.0619	153.71	1.6685	0.2491	1.400	1241.0	0.0475	0.01662	760.0	0.0314	305.91	1.8399	0.2612	1.373	1724.8	0.0762	0.02820
180.0	0.0600	158.69	1.6765	0.2492	1.400	1260.8	0.0486	0.01704	780.0	0.030							

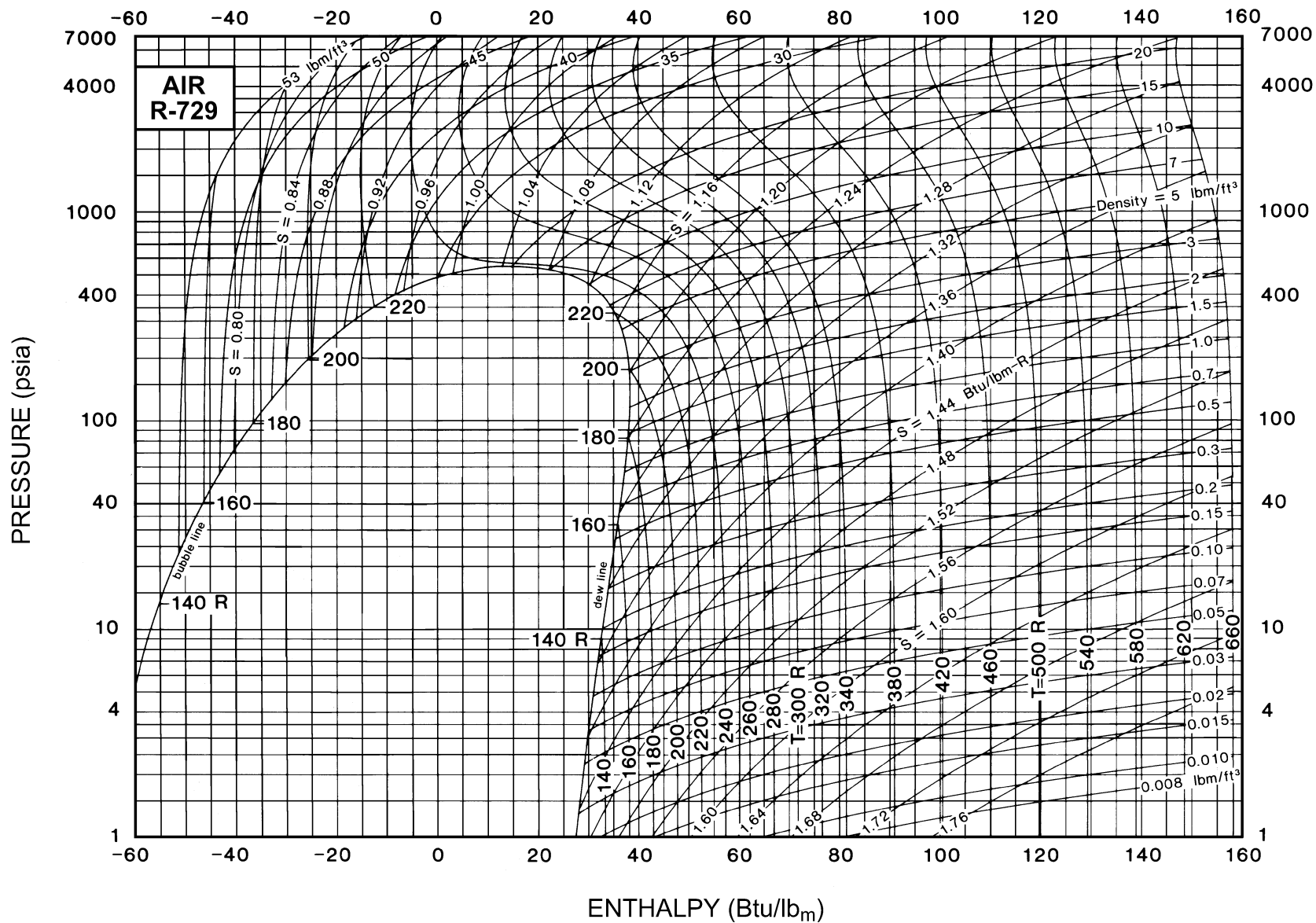


Fig. 26 Pressure-Enthalpy Diagram for Refrigerant 729 (Air)

Refrigerant 729 (Air) Properties of Liquid on the Bubble Line and Vapor on the Dew Line

Pressure, psia	Temp., °R		Density, lb/ft ³	Volume, ft ³ /lb	Enthalpy, Btu/lb		Entropy, Btu/lb·°R		Specific Heat <i>c_p</i> , Btu/lb·°R			Vel. of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°R		Surface Tension, dyne/cm
	Bubble	Dew			Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	
0.91a	107.55	115.19	59.79	46.8083	-70.04	27.29	0.58484	1.46086	0.4591	0.2447	1.406	3322.	524.	1.0650	0.0106	0.1009	0.00325	14.12
1.00	108.49	116.03	59.65	42.7531	-69.61	27.48	0.58883	1.45585	0.4588	0.2450	1.406	3312.	526.	1.0248	0.0107	0.1003	0.00328	14.00
2.00	115.58	122.47	58.62	22.4796	-66.36	28.92	0.61781	1.42069	0.4573	0.2475	1.410	3225.	539.	0.7885	0.0114	0.0961	0.00350	13.04
4.00	123.53	129.89	57.44	11.8472	-62.72	30.51	0.64820	1.38636	0.4573	0.2511	1.417	3115.	553.	0.6173	0.0121	0.0914	0.00375	11.98
6.00	128.66	134.75	56.66	8.1498	-60.37	31.51	0.66682	1.36662	0.4581	0.2539	1.423	3039.	562.	0.5382	0.0126	0.0885	0.00393	11.31
8.00	132.56	138.46	56.07	6.2499	-58.57	32.24	0.68050	1.35274	0.4591	0.2563	1.429	2979.	568.	0.4892	0.0129	0.0863	0.00406	10.80
10.00	135.75	141.49	55.58	5.0865	-57.10	32.83	0.69142	1.34203	0.4602	0.2585	1.435	2928.	572.	0.4546	0.0133	0.0845	0.00417	10.39
12.00	138.47	144.09	55.15	4.2980	-55.84	33.31	0.70054	1.33332	0.4613	0.2605	1.440	2885.	576.	0.4283	0.0135	0.0830	0.00427	10.04
14.696b	141.63	147.10	54.65	3.5634	-54.38	33.86	0.71094	1.32367	0.4627	0.2630	1.448	2833.	580.	0.4009	0.0138	0.0812	0.00439	9.64
20.00	146.73	151.96	53.84	2.6779	-52.00	34.69	0.72728	1.30905	0.4657	0.2675	1.461	2749.	586.	0.3624	0.0144	0.0784	0.00458	9.00
40.00	159.68	164.35	51.68	1.4015	-45.87	36.53	0.76687	1.27616	0.4765	0.2819	1.511	2524.	599.	0.2875	0.0157	0.0715	0.00510	7.42
60.00	168.40	172.73	50.13	0.9542	-41.64	37.50	0.79222	1.25669	0.4875	0.2952	1.561	2364.	605.	0.2492	0.0167	0.0669	0.00549	6.39
80.00	175.19	179.27	48.87	0.7234	-38.27	38.08	0.81141	1.24256	0.4988	0.3085	1.612	2235.	608.	0.2239	0.0175	0.0633	0.00582	5.61
100.00	180.84	184.71	47.77	0.5815	-35.40	38.43	0.82710	1.23128	0.5107	0.3222	1.666	2124.	609.	0.2051	0.0182	0.0604	0.00612	4.98
150.00	192.04	195.53	45.40	0.3865	-29.49	38.66	0.85774	1.20957	0.5440	0.3609	1.819	1893.	609.	0.1724	0.0197	0.0544	0.00680	3.77
200.00	200.80	203.97	43.34	0.2851	-24.59	38.32	0.88164	1.19252	0.5846	0.4089	2.009	1701.	606.	0.1497	0.0210	0.0497	0.00745	2.88
250.00	208.12	210.98	41.41	0.2222	-20.23	37.56	0.90188	1.17767	0.6368	0.4719	2.258	1530.	601.	0.1322	0.0223	0.0457	0.00815	2.18
300.00	214.47	217.03	39.51	0.1787	-16.17	36.45	0.91999	1.16383	0.7075	0.5593	2.602	1372.	596.	0.1175	0.0236	0.0420	0.00895	1.60
350.00	220.11	222.38	37.57	0.1464	-12.26	34.96	0.93692	1.15024	0.8101	0.6893	3.109	1223.	590.	0.1046	0.0250	0.0387	0.00998	1.12
400.00	225.21	227.19	35.51	0.1210	-8.33	33.03	0.95342	1.13618	0.9738	0.9040	3.934	1079.	584.	0.0927	0.0266	0.0357	0.01149	0.72
450.00	229.89	231.56	33.18	0.0998	-4.19	30.48	0.97040	1.12061	1.2881	1.3302	5.534	936.	578.	0.0813	0.0287	0.0335	0.01417	0.39
500.00	234.23	235.51	30.19	0.0802	0.65	26.68	0.99001	1.10078	2.2460	2.6522	10.317	773.	571.	0.0694	0.0315	0.0336	0.02069	0.12
548.97c	238.71	238.71	18.89	0.0529	16.38	16.38	1.05489	1.05489	-	-	-	-	-	-	-	-	-	0.00

*Temperatures are on the IPTS-68 scale a = triple point b = bubble and dew points at 14.696 psia c = critical point

Refrigerant 729 (Air) Properties of Gas at 14.696 psia (one standard atmosphere)

Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	<i>c_p</i> , Btu/lb·°F	<i>c_p/c_v</i>	Vel. Sound, ft/s	Viscosity, lb/ft·h	Thermal Cond., Btu/ft·h·°F	Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	<i>c_p</i> , Btu/lb·°F	<i>c_p/c_v</i>	Vel. Sound, ft/s	Viscosity, lb/ft·h	Thermal Cond., Btu/ft·h·°F
-312.6a	0.2806	33.86	1.3237	0.2630	1.448	580.3	0.0138	0.00439	300.0	0.0522	182.15	1.7231	0.2430	1.394	1348.9	0.0574	0.01978
-300.0	0.2561	37.11	1.3449	0.2547	1.438	608.6	0.0150	0.00480	320.0	0.0508	187.01	1.7294	0.2433	1.394	1366.2	0.0584	0.02019
-280.0	0.2255	42.13	1.3745	0.2483	1.428	649.6	0.0169	0.00545	340.0	0.0496	191.88	1.7356	0.2437	1.393	1383.1	0.0595	0.02059
-260.0	0.2017	47.06	1.4005	0.2454	1.422	687.3	0.0188	0.00611	360.0	0.0484	196.76	1.7416	0.2442	1.392	1399.8	0.0605	0.02099
-240.0	0.1827	51.95	1.4239	0.2437	1.417	722.5	0.0206	0.00677	380.0	0.0472	201.65	1.7475	0.2446	1.391	1416.3	0.0616	0.02140
-220.0	0.1670	56.81	1.4451	0.2427	1.414	755.9	0.0224	0.00764	400.0	0.0461	206.54	1.7533	0.2451	1.389	1432.5	0.0626	0.02180
-200.0	0.1538	61.66	1.4645	0.2420	1.412	787.7	0.0241	0.00799	420.0	0.0451	211.45	1.7589	0.2455	1.388	1448.5	0.0636	0.02220
-180.0	0.1426	66.50	1.4824	0.2415	1.410	818.2	0.0258	0.00856	440.0	0.0441	216.36	1.7644	0.2460	1.387	1464.3	0.0646	0.02260
-160.0	0.1329	71.32	1.4991	0.2412	1.409	847.5	0.0275	0.00913	460.0	0.0431	221.29	1.7698	0.2465	1.386	1479.9	0.0656	0.02299
-140.0	0.1245	76.14	1.5147	0.2409	1.408	875.7	0.0291	0.00968	480.0	0.0422	226.22	1.7752	0.2471	1.385	1495.3	0.0666	0.02339
-120.0	0.1171	80.96	1.5293	0.2407	1.407	903.0	0.0307	0.01023	500.0	0.0413	231.17	1.7804	0.2476	1.384	1510.5	0.0675	0.02378
-100.0	0.1105	85.77	1.5431	0.2405	1.406	929.5	0.0322	0.01076	520.0	0.0405	236.13	1.7855	0.2482	1.382	1525.5	0.0685	0.02418
-80.0	0.1047	90.58	1.5561	0.2404	1.405	955.2	0.0337	0.01128	540.0	0.0397	241.10	1.7905	0.2487	1.381	1540.2	0.0694	0.02457
-60.0	0.0994	95.39	1.5684	0.2403	1.405	980.2	0.0351	0.01179	560.0	0.0389	246.08	1.7954	0.2493	1.380	1554.9	0.0704	0.02496
-40.0	0.0946	100.19	1.5801	0.2403	1.404	1004.6	0.0366	0.01229	580.0	0.0381	251.07	1.8003	0.2499	1.379	1569.3	0.0713	0.02536
-20.0	0.0903	105.00	1.5913	0.2402	1.404	1028.3	0.0380	0.01278	600.0	0.0374	256.08	1.8051	0.2505	1.377	1583.6	0.0722	0.02575
0.0	0.0863	109.81	1.6020	0.2402	1.403	1051.5	0.0393	0.01326	620.0	0.0367	261.09	1.8097	0.2511	1.376	1597.8	0.0732	0.02614
20.0	0.0827	114.61	1.6122	0.2402	1.403	1074.2	0.0407	0.01372	640.0	0.0360	266.12	1.8144	0.2517	1.375	1611.8	0.0741	0.02653
40.0	0.0794	119.42	1.6221	0.2403	1.403	1096.3	0.0420	0.01419	660.0	0.0354	271.16	1.8189	0.2524	1.374	1625.6	0.0750	0.02692
60.0	0.0763	124.22	1.6315	0.2403	1.402	1118.0	0.0433	0.01465	680.0	0.0348	276.22	1.8234	0.2530	1.372	1639.3	0.0759	0.02731
80.0	0.0735	129.03	1.6406	0.2404	1.402	1139.3	0.0446	0.01510	700.0	0.0342	281.28	1.8278	0.2536	1.371	1652.8	0.0768	0.02770
100.0	0.0709	133.84	1.6493	0.2405	1.401	1160.1	0.0458	0.01554	720.0	0.0336	286.36	1.8321	0.2543	1.370	1666.2	0.0776	0.02808
120.0	0.0684	138.65	1.6578	0.2407	1.401	1180.6	0.0470	0.01599	740.0	0.0330	291.45	1.8364	0.2549	1.368	1679.5	0.0785	0.02847
140.0	0.0661	143.47	1.6659	0.2408	1.400	1200.6	0.0483	0.01642	760.0	0.0325	296.56	1.8406	0.2555	1.367	1692.7	0.0794	0.02885
160.0	0.0640	148.28	1.6738	0.2410	1.400	1220.3	0.0495	0.01685	780.0	0.0320	301.68	1.8448	0.2562	1.366	1705.7	0.0802	0.02924
180.0	0.0620	153.11	1.6815	0.2412	1.399	1239.6	0.0506	0.01728	800.0	0.0315	306.81	1.8489	0.2568	1.365	1718.6	0.0811	0.02962
200.0	0.0601	157.93	1.6889	0.2414	1.398	1258.6	0.0518	0.01771	820.0	0.0310	311.95	1.8529	0.2574	1.363	1731.4	0.0820	0.03001
220.0	0.0583	162.76	1.6961	0.2417	1.398	1277.3	0.0529	0.01813	840.0	0.0305	317.10	1.8569	0.2581	1.362	1744.1	0.0828	0.03039
240.0	0.0567	167.60	1.														

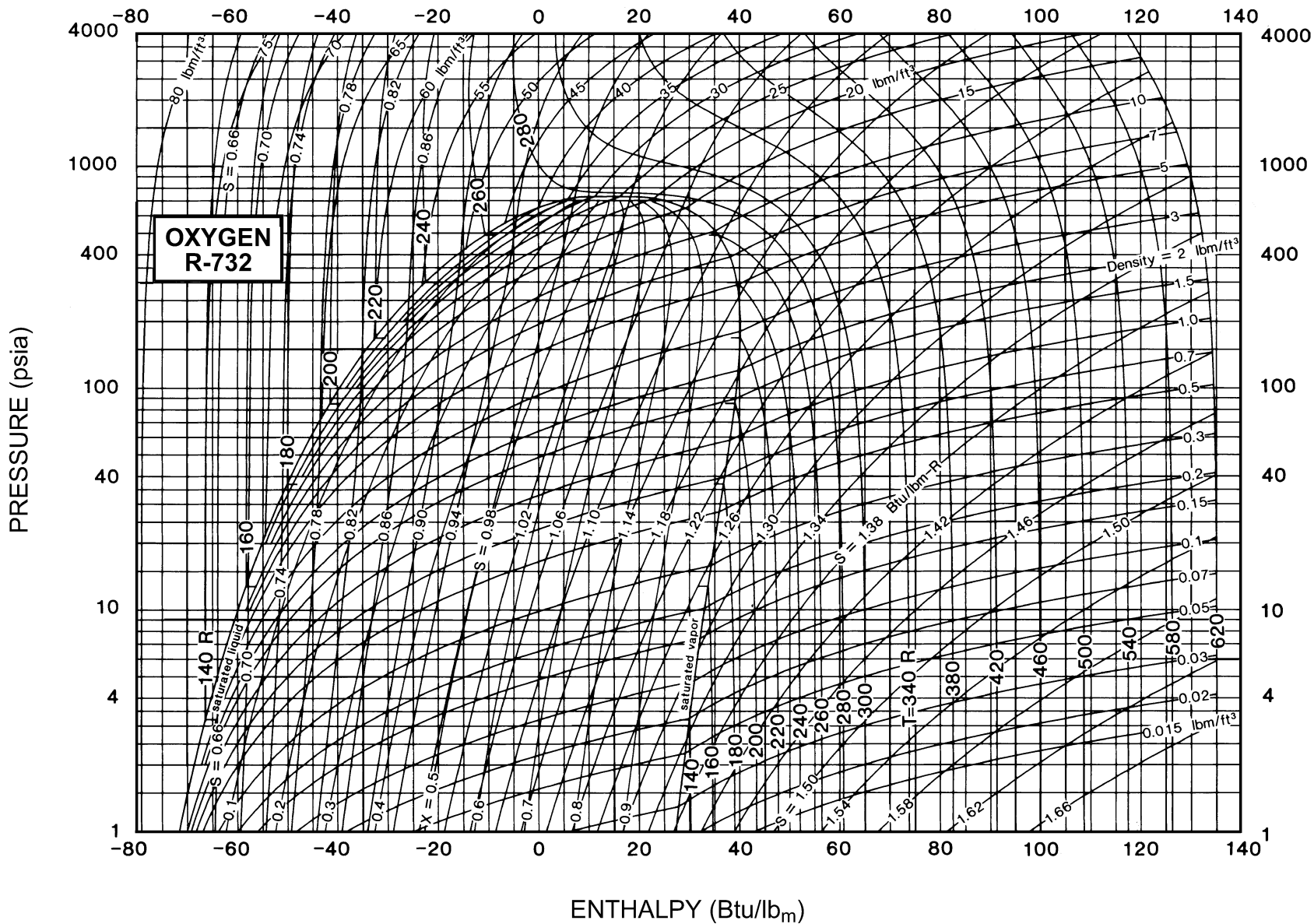


Fig. 27 Pressure-Enthalpy Diagram for Refrigerant 732 (Oxygen)

Refrigerant 732 (Oxygen) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °R	Pres- sure, psia	Density, lb/ft ³		Enthalpy, Btu/lb		Entropy, Btu/lb·°R		Specific Heat <i>c_p</i> Btu/lb·°R			Velocity of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°R		Surface Tension, dyne/cm	Temp.,* °R
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	<i>c_p/c_v</i>	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
97.85a	0.02	81.54	1546.5	-83.30	21.13	0.49922	1.56638	0.3999	0.2213	1.395	3686.	460.4	2.3755	0.0097	0.1173	0.00291	22.68	97.85
100.00	0.03	81.23	1092.6	-82.44	21.59	0.50790	1.54816	0.3993	0.2223	1.394	3704.	465.2	2.1422	0.0099	0.1164	0.00297	22.35	100.00
110.00	0.14	79.73	265.18	-78.44	23.74	0.54599	1.47490	0.4002	0.2276	1.389	3685.	486.6	1.4145	0.0109	0.1119	0.00326	20.82	110.00
120.00	0.48	78.17	83.783	-74.43	25.87	0.58085	1.41673	0.4010	0.2322	1.386	3578.	506.8	1.0216	0.0119	0.1074	0.00356	19.31	120.00
130.00	1.34	76.58	32.306	-70.42	27.98	0.61295	1.36988	0.4011	0.2341	1.388	3443.	526.3	0.7868	0.0129	0.1028	0.00386	17.82	130.00
140.00	3.20	74.97	14.5114	-66.40	30.04	0.64267	1.33157	0.4015	0.2335	1.397	3298.	545.1	0.6339	0.0139	0.0982	0.00417	16.36	140.00
150.00	6.73	73.33	7.3371	-62.38	32.02	0.67039	1.29969	0.4028	0.2320	1.411	3151.	562.8	0.5270	0.0149	0.0937	0.00449	14.92	150.00
155.00	9.39	72.49	5.4088	-60.36	32.96	0.68360	1.28566	0.4039	0.2316	1.421	3077.	571.0	0.4848	0.0154	0.0914	0.00465	14.20	155.00
160.00	12.80	71.64	4.0699	-58.33	33.87	0.69643	1.27267	0.4054	0.2317	1.431	3002.	578.8	0.4480	0.0160	0.0891	0.00482	13.50	160.00
162.34b	14.696	71.24	3.5859	-57.38	34.28	0.70230	1.26692	0.4062	0.2320	1.437	2967.	582.2	0.4324	0.0162	0.0881	0.00490	13.17	162.34
165.00	17.11	70.78	3.1187	-56.29	34.74	0.70890	1.26060	0.4072	0.2325	1.444	2927.	586.0	0.4156	0.0165	0.0869	0.00499	12.80	165.00
170.00	22.45	69.90	2.4290	-54.24	35.56	0.72105	1.24932	0.4094	0.2342	1.457	2851.	592.6	0.3868	0.0170	0.0846	0.00517	12.11	170.00
175.00	28.97	69.01	1.9195	-52.18	36.34	0.73291	1.23873	0.4121	0.2369	1.473	2775.	598.5	0.3609	0.0176	0.0823	0.00535	11.43	175.00
180.00	36.84	68.10	1.5366	-50.10	37.06	0.74451	1.22875	0.4153	0.2405	1.491	2697.	603.9	0.3376	0.0181	0.0801	0.00554	10.75	180.00
185.00	46.21	67.17	1.2444	-48.00	37.73	0.75587	1.21928	0.4190	0.2453	1.510	2619.	608.5	0.3163	0.0187	0.0778	0.00573	10.09	185.00
190.00	57.25	66.22	1.0182	-45.88	38.34	0.76701	1.21026	0.4234	0.2512	1.533	2540.	612.4	0.2968	0.0193	0.0755	0.00593	9.43	190.00
195.00	70.13	65.24	0.8409	-43.74	38.88	0.77796	1.20163	0.4284	0.2583	1.559	2460.	615.7	0.2787	0.0198	0.0732	0.00615	8.77	195.00
200.00	85.02	64.24	0.7002	-41.56	39.35	0.78874	1.19333	0.4343	0.2668	1.589	2378.	618.2	0.2620	0.0204	0.0709	0.00637	8.13	200.00
205.00	102.10	63.20	0.5873	-39.36	39.75	0.79938	1.18529	0.4411	0.2768	1.623	2294.	620.0	0.2464	0.0210	0.0686	0.00661	7.50	205.00
210.00	121.55	62.13	0.4958	-37.12	40.07	0.80990	1.17746	0.4491	0.2884	1.663	2209.	621.1	0.2318	0.0216	0.0663	0.00686	6.87	210.00
215.00	143.55	61.02	0.4208	-34.84	40.30	0.82033	1.16980	0.4585	0.3020	1.711	2122.	621.4	0.2180	0.0223	0.0640	0.00714	6.26	215.00
220.00	168.28	59.87	0.3590	-32.51	40.43	0.83069	1.16224	0.4696	0.3181	1.767	2033.	621.1	0.2049	0.0229	0.0616	0.00743	5.66	220.00
225.00	195.93	58.66	0.3074	-30.12	40.46	0.84101	1.15474	0.4830	0.3372	1.835	1942.	619.9	0.1924	0.0236	0.0593	0.00776	5.07	225.00
230.00	226.69	57.40	0.2641	-27.68	40.38	0.85134	1.14722	0.4991	0.3603	1.919	1848.	618.1	0.1805	0.0243	0.0569	0.00813	4.49	230.00
235.00	260.77	56.07	0.2274	-25.16	40.15	0.86170	1.13962	0.5190	0.3886	2.023	1750.	615.4	0.1690	0.0251	0.0545	0.00855	3.93	235.00
240.00	298.37	54.65	0.1961	-22.55	39.78	0.87216	1.13185	0.5442	0.4244	2.155	1649.	611.9	0.1578	0.0259	0.0521	0.00903	3.38	240.00
245.00	339.72	53.13	0.1692	-19.83	39.22	0.88279	1.12381	0.5768	0.4710	2.328	1544.	607.5	0.1470	0.0268	0.0496	0.00962	2.84	245.00
250.00	385.04	51.47	0.1457	-16.97	38.45	0.89367	1.11535	0.6208	0.5342	2.563	1434.	602.2	0.1363	0.0278	0.0471	0.01034	2.33	250.00
260.00	488.67	47.59	0.1068	-10.68	35.97	0.91683	1.09626	0.7794	0.7669	3.421	1192.	588.2	0.1148	0.0303	0.0423	0.01257	1.36	260.00
270.00	611.86	42.17	0.0745	-2.87	31.22	0.94436	1.07061	1.3059	1.5835	6.314	898.	567.0	0.0914	0.0342	0.0383	0.01751	0.51	270.00
278.25c	731.42	27.23	0.0367	13.95	13.95	1.00320	1.00320	∞	∞	∞	0.	0.0	—	—	∞	∞	0.00	278.25

*Temperatures are on the IPTS-68 scale a = triple point b = normal boiling point c = critical point

Refrigerant 732 (Oxygen) Properties of Gas at 14.696 psia (one standard atmosphere)

Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	<i>c_p</i> Btu/lb·°F	<i>c_p/c_v</i>	Vel. Sound, ft/s	Viscos- ity, lb/ft·h	Thermal Cond., Btu/h·ft·°F	Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	<i>c_p</i> Btu/lb·°F	<i>c_p/c_v</i>	Vel. Sound, ft/s	Viscos- ity, lb/ft·h	Thermal Cond., Btu/h·ft·°F
-297.3a	0.2789	34.28	1.2669	0.2320	1.437	582.2	0.0162	0.00490	200.0	0.0664	143.80	1.5762	0.2230	1.388	1192.5	0.0586	0.01784
-280.0	0.2499	38.20	1.2898	0.2236	1.433	617.3	0.0180	0.00542	220.0	0.0645	148.27	1.5828	0.2236	1.386	1209.7	0.0599	0.01829
-260.0	0.2234	42.66	1.3134	0.2226	1.424	652.8	0.0200	0.00603	240.0	0.0626	152.75	1.5893	0.2243	1.384	1226.7	0.0613	0.01874
-240.0	0.2022	47.10	1.3346	0.2217	1.418	686.2	0.0221	0.00664	260.0	0.0609	157.24	1.5957	0.2251	1.382	1243.3	0.0626	0.01920
-220.0	0.1848	51.53	1.3539	0.2208	1.414	718.0	0.0241	0.00724	280.0	0.0592	161.75	1.6018	0.2258	1.381	1259.7	0.0639	0.01964
-200.0	0.1702	55.94	1.3716	0.2201	1.411	748.3	0.0261	0.00783	300.0	0.0577	166.28	1.6079	0.2266	1.379	1275.8	0.0652	0.02009
-180.0	0.1577	60.33	1.3879	0.2196	1.409	777.3	0.0280	0.00843	320.0	0.0562	170.81	1.6138	0.2274	1.377	1291.6	0.0665	0.02054
-160.0	0.1470	64.72	1.4030	0.2192	1.407	805.2	0.0300	0.00899	340.0	0.0548	175.37	1.6196	0.2282	1.375	1307.2	0.0677	0.02099
-140.0	0.1377	69.10	1.4172	0.2189	1.406	832.1	0.0318	0.00954	360.0	0.0535	179.94	1.6252	0.2290	1.373	1322.6	0.0690	0.02143
-120.0	0.1295	73.48	1.4304	0.2187	1.405	858.1	0.0337	0.01009	380.0	0.0522	184.53	1.6307	0.2298	1.371	1337.7	0.0702	0.02188
-100.0	0.1222	77.85	1.4430	0.2186	1.404	883.2	0.0355	0.01062	400.0	0.0510	189.13	1.6361	0.2307	1.369	1352.6	0.0714	0.02232
-80.0	0.1157	82.23	1.4548	0.2185	1.404	907.7	0.0372	0.01115	420.0	0.0498	193.75	1.6415	0.2315	1.367	1367.3	0.0726	0.02276
-60.0	0.1099	86.60	1.4660	0.2185	1.403	931.4	0.0389	0.01167	440.0	0.0487	198.39	1.6467	0.2323	1.366	1381.9	0.0738	0.02320
-40.0	0.1046	90.97	1.4767	0.2185	1.402	954.5	0.0406	0.01217	460.0	0.0476	203.05	1.6518	0.2332	1.364	1396.2	0.0750	0.02364
-20.0	0.0998	95.34	1.4869	0.2186	1.401	977.0	0.0423	0.01267	480.0	0.0466	207.72	1.6568	0.2340	1.362	1410.4	0.0761	0.02407
0.0	0.0955	99.71	1.4966	0.2188	1.401	998.9	0.0439	0.01316	500.0	0.0457	212.41	1.6618	0.2349	1.360	1424.4	0.0773	0.02451
20.0	0.0915	104.09	1.5059	0.2190	1.400	1020.3	0.0455	0.01365	520.0	0.0447	217.12	1.6666	0.2357	1.358	1438.3	0.0784	0.02494
40.0	0.0878	108.47	1.5149	0.2192	1.399	1041.1	0.0470	0.01413	540.0	0.0438	221.84	1.6714	0.2365	1.357	1452.0	0.0795	0.02537
60.0	0.0844	112.86	1.5235	0.2195	1.398	1061.5	0.0485	0.01460	560.0	0.0430	226.58	1.6761	0.2374	1.355	1465.5	0.0807	0.02580
80.0	0.0812	117.25	1.5318	0.2199	1.396	1081.4	0.0500	0.01507	580.0	0.0421	231.33	1.6807	0.2382	1.353	1478.9	0.0818	0.02622
100.0	0.0783	121.65	1.5398	0.2203	1.395	1100.9	0.0515	0.01553	600.0	0.0413	236.10	1.6852	0.2390	1.352	1492.2	0.0829	0.02665
120.0	0.0756	126.06	1.5475	0.2207	1.394	1120.0	0.0530	0.01600	650.0	0.0395	248.10	1.6963	0.2409	1.348	1524.8	0.0856	0.02770
140.0	0.0731	130.48	1.5550	0.2212	1.392	1138.7	0.0544	0.01646	700.0	0.0378	260.20	1.7070	0.2428	1.344	1556.6	0.0882	0.02873
160.0	0.0707	134.91	1.5623	0.2218	1.391	1157.0	0.0558	0.01692	750.0	0.0362	272.38	1.7172	0.2447	1.340	1587.7	0.0908	0.02975
180.0	0.0685	139.35	1.5693	0.2223	1.389	1174.9	0.0572	0.01738	800.								

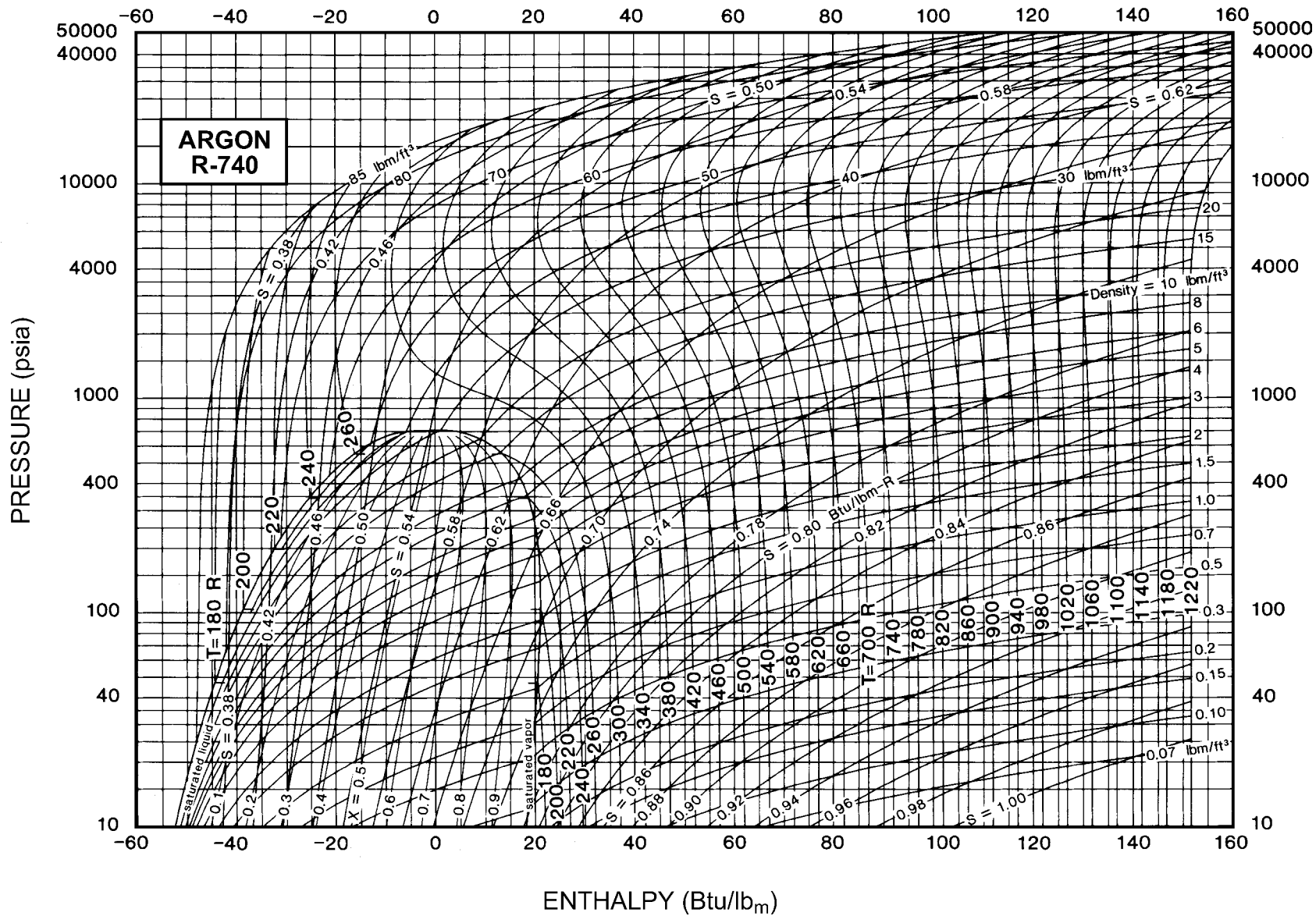


Fig. 28 Pressure-Enthalpy Diagram for Refrigerant 740 (Argon)

Refrigerant 740 (Argon) Properties of Saturated Liquid and Saturated Vapor

Temp.,* °R	Pres- sure, psia	Density, lb/ft ³		Volume, ft ³ /lb		Enthalpy, Btu/lb		Entropy, Btu/lb·°R		Specific Heat <i>c_p</i> , Btu/lb·°R			Velocity of Sound, ft/s		Viscosity, lb _m /ft·h		Thermal Cond., Btu/h·ft·°R		Surface Tension, dyne/cm	Temp.,* °R
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor		
150.85a	10.00	88.47	3.9491	-52.08	18.32	0.31822	0.78492	0.2549	—	—	—	2799.	685.0	0.6840	0.0162	0.0784	0.00304	13.42	150.85	
155.00	12.95	87.61	3.1154	-51.01	18.64	0.32515	0.77453	0.2568	—	—	—	2749.	644.0	0.6382	0.0166	0.0764	0.00313	12.83	155.00	
157.13b	14.696	87.17	2.7731	-50.46	18.80	0.32865	0.76944	0.2577	—	—	—	2723.	630.8	0.6166	0.0169	0.0754	0.00318	12.53	157.13	
160.00	17.34	86.56	2.3822	-49.72	19.00	0.33332	0.76282	0.2592	—	—	—	2688.	618.0	0.5889	0.0172	0.0740	0.00325	12.13	160.00	
165.00	22.78	85.49	1.8525	-48.41	19.34	0.34130	0.75192	0.2619	—	—	—	2626.	604.2	0.5449	0.0178	0.0716	0.00337	11.44	165.00	
170.00	29.43	84.38	1.4624	-47.08	19.66	0.34913	0.74173	0.2649	—	—	—	2563.	596.8	0.5053	0.0184	0.0693	0.00350	10.75	170.00	
175.00	37.45	83.25	1.1701	-45.74	19.95	0.35681	0.73217	0.2683	0.1379	1.866	2500.	593.1	0.4696	0.0190	0.0670	0.00364	10.08	175.00		
180.00	46.99	82.09	0.9474	-44.38	20.21	0.36436	0.72316	0.2721	0.1474	1.854	2436.	591.6	0.4371	0.0196	0.0647	0.00378	9.41	180.00		
185.00	58.23	80.90	0.7753	-43.00	20.43	0.37179	0.71463	0.2763	0.1563	1.859	2370.	591.4	0.4074	0.0203	0.0624	0.00392	8.76	185.00		
190.00	71.32	79.68	0.6405	-41.59	20.61	0.37913	0.70650	0.2810	0.1647	1.875	2304.	592.1	0.3802	0.0210	0.0601	0.00408	8.11	190.00		
195.00	86.44	78.42	0.5335	-40.16	20.74	0.38638	0.69870	0.2864	0.1731	1.904	2235.	593.2	0.3551	0.0217	0.0579	0.00425	7.48	195.00		
200.00	103.76	77.12	0.4477	-38.70	20.82	0.39356	0.69119	0.2924	0.1818	1.944	2165.	594.5	0.3319	0.0224	0.0557	0.00442	6.86	200.00		
205.00	123.47	75.77	0.3782	-37.21	20.85	0.40069	0.68389	0.2992	0.1912	1.995	2093.	595.8	0.3103	0.0231	0.0535	0.00462	6.25	205.00		
210.00	145.72	74.38	0.3212	-35.68	20.80	0.40778	0.67676	0.3072	0.2016	2.060	2018.	597.0	0.2901	0.0239	0.0514	0.00482	5.65	210.00		
215.00	170.72	72.93	0.2742	-34.12	20.69	0.41485	0.66975	0.3166	0.2136	2.140	1941.	598.0	0.2711	0.0247	0.0492	0.00504	5.07	215.00		
220.00	198.64	71.41	0.2349	-32.51	20.48	0.42193	0.66279	0.3278	0.2279	2.239	1860.	598.6	0.2532	0.0256	0.0471	0.00529	4.50	220.00		
225.00	229.66	69.82	0.2019	-30.84	20.19	0.42905	0.65583	0.3415	0.2453	2.363	1775.	598.9	0.2362	0.0266	0.0450	0.00556	3.95	225.00		
230.00	264.00	68.13	0.1739	-29.11	19.78	0.43624	0.64881	0.3586	0.2671	2.519	1686.	598.6	0.2200	0.0276	0.0428	0.00587	3.41	230.00		
235.00	301.85	66.34	0.1499	-27.31	19.25	0.44355	0.64165	0.3805	0.2952	2.721	1591.	597.8	0.2043	0.0287	0.0407	0.00623	2.89	235.00		
240.00	343.44	64.40	0.1292	-25.41	18.56	0.45104	0.63424	0.4097	0.3328	2.989	1490.	596.4	0.1892	0.0300	0.0385	0.00665	2.39	240.00		
245.00	388.99	62.27	0.1111	-23.39	17.68	0.45881	0.62646	0.4505	0.3853	3.360	1380.	594.2	0.1742	0.0314	0.0363	0.00717	1.91	245.00		
250.00	438.76	59.88	0.0952	-21.21	16.56	0.46701	0.61811	0.5110	0.4636	3.904	1260.	591.2	0.1593	0.0331	0.0341	0.00785	1.46	250.00		
255.00	493.05	57.12	0.0809	-18.81	15.12	0.47586	0.60889	0.6095	0.5914	4.778	1129.	587.3	0.1440	0.0352	0.0319	0.00882	1.03	255.00		
260.00	552.18	53.78	0.0678	-16.05	13.19	0.48581	0.59826	0.7963	0.8335	6.393	984.	582.1	0.1278	0.0379	0.0299	0.01043	0.64	260.00		
265.00	616.56	49.38	0.0553	-12.65	10.43	0.49785	0.58497	1.2601	1.4494	10.381	824.	574.9	0.1099	0.0418	0.0293	0.01386	0.30	265.00		
271.19c	704.88	33.14	0.0302	-1.53	-1.53	0.53776	0.53776	∞	∞	∞	0.	0.0	—	—	∞	∞	0.00	271.19		

*Temperatures are on the IPTS-68 scale a = triple point b = normal boiling point c = critical point

Refrigerant 740 (Argon) Properties of Gas at 14.696 psia (one standard atmosphere)

Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	<i>c_p</i> , Btu/lb·°F	<i>c_p/c_v</i>	Vel. Sound, ft/s	Viscos- ity, lb/ft·h	Thermal Cond., Btu/h·ft·°F	Temp., °F	Density, lb/ft ³	Enthalpy, Btu/lb	Entropy, Btu/lb·°F	<i>c_p</i> , Btu/lb·°F	<i>c_p/c_v</i>	Vel. Sound, ft/s	Viscos- ity, lb/ft·h	Thermal Cond., Btu/h·ft·°F
-302.5a	0.3606	18.80	0.7694	—	—	630.8	0.0169	0.00318	200.0	0.0829	81.98	0.9507	0.1245	1.668	1170.2	0.0650	0.01214
-300.0	0.3545	19.06	0.7711	—	—	597.4	0.0171	0.00323	220.0	0.0805	84.47	0.9544	0.1245	1.668	1187.8	0.0666	0.01243
-275.0	0.3028	22.35	0.7902	0.1335	1.689	609.4	0.0199	0.00373	240.0	0.0782	86.96	0.9580	0.1245	1.668	1205.2	0.0681	0.01271
-250.0	0.2648	25.62	0.8068	0.1291	1.689	654.0	0.0226	0.00425	260.0	0.0760	89.45	0.9616	0.1245	1.668	1222.3	0.0696	0.01299
-225.0	0.2356	28.82	0.8213	0.1273	1.686	694.2	0.0254	0.00478	280.0	0.0740	91.94	0.9650	0.1245	1.668	1239.2	0.0711	0.01327
-200.0	0.2124	31.99	0.8341	0.1264	1.682	731.6	0.0281	0.00534	300.0	0.0720	94.43	0.9683	0.1245	1.668	1255.8	0.0726	0.01354
-180.0	0.1969	34.52	0.8435	0.1260	1.680	759.9	0.0303	0.00578	320.0	0.0702	96.92	0.9715	0.1245	1.668	1272.2	0.0740	0.01382
-160.0	0.1835	37.03	0.8521	0.1257	1.678	787.0	0.0324	0.00609	340.0	0.0684	99.41	0.9747	0.1245	1.668	1288.4	0.0755	0.01408
-140.0	0.1719	39.54	0.8603	0.1255	1.676	813.2	0.0345	0.00647	360.0	0.0667	101.90	0.9778	0.1245	1.668	1304.5	0.0769	0.01435
-120.0	0.1616	42.05	0.8679	0.1253	1.675	838.6	0.0366	0.00684	380.0	0.0651	104.39	0.9808	0.1245	1.668	1320.3	0.0783	0.01461
-100.0	0.1525	44.56	0.8750	0.1252	1.674	863.1	0.0386	0.00721	400.0	0.0636	106.88	0.9837	0.1245	1.668	1335.9	0.0797	0.01487
-80.0	0.1444	47.06	0.8818	0.1251	1.673	887.0	0.0406	0.00759	420.0	0.0622	109.37	0.9865	0.1244	1.668	1351.3	0.0811	0.01513
-60.0	0.1372	49.56	0.8882	0.1250	1.672	910.2	0.0426	0.00795	440.0	0.0608	111.86	0.9893	0.1244	1.667	1366.6	0.0824	0.01538
-40.0	0.1306	52.06	0.8943	0.1249	1.672	932.8	0.0445	0.00831	460.0	0.0595	114.34	0.9921	0.1244	1.667	1381.7	0.0838	0.01563
-20.0	0.1246	54.56	0.9001	0.1248	1.671	954.9	0.0464	0.00866	480.0	0.0582	116.83	0.9948	0.1244	1.667	1396.7	0.0851	0.01588
0.0	0.1192	57.05	0.9057	0.1248	1.671	976.5	0.0482	0.00900	500.0	0.0570	119.32	0.9974	0.1244	1.667	1411.5	0.0864	0.01613
10.0	0.1166	58.30	0.9084	0.1248	1.671	987.1	0.0491	0.00917	520.0	0.0558	121.81	0.9999	0.1244	1.667	1426.1	0.0878	0.01637
20.0	0.1142	59.55	0.9110	0.1248	1.670	997.5	0.0500	0.00934	540.0	0.0547	124.30	1.0025	0.1244	1.667	1440.6	0.0891	0.01662
30.0	0.1118	60.79	0.9136	0.1247	1.670	1007.9	0.0509	0.00950	560.0	0.0536	126.79	1.0049	0.1244	1.667	1454.9	0.0903	0.01685
40.0	0.1096	62.04	0.9161	0.1247	1.670	1018.2	0.0518	0.00967	580.0	0.0526	129.28	1.0073	0.1244	1.667	1469.1	0.0916	0.01709
50.0	0.1074	63.29	0.9186	0.1247	1.670	1028.4	0.0527	0.00983	600.0	0.0516	131.76	1.0097	0.1244	1.667	1483.2	0.0929	0.01733
60.0	0.1053	64.54	0.9210	0.1247	1.670	1038.4	0.0535	0.00999	620.0	0.0507	134.25	1.0120	0.1244	1.667	1497.1	0.0941	0.01756
70.0	0.1034	65.78	0.9234	0.1247	1.670	1048.4	0.0544	0.01016	640.0	0.0497	136.74	1.0143	0.1244	1.667	1510.9	0.0954	0.01779
80.0	0.1014	67.03	0.9257	0.1247	1.669	1058.3	0.0553	0.01031	660.0	0.0488	139.23	1.0166	0.1244	1.667	1524.5	0.0966	0.01802
90.0	0.0996	68.28	0.9280	0.1246	1.669	1068.0	0.0561	0.01047	680.0	0.0480	141.72	1.0188	0.1244	1.667	1538.1	0.0978	0.01825
100.0	0.0978	69.52	0.9302	0.1246	1.669	1077.7	0.0569	0.01063	700.0	0.0472	144.21	1.0209	0.1244	1.667	1551.5	0.0990	0.01847
120.0	0.0944	72.01	0.9346	0.1246	1.669	1096.8	0.0586	0.01094	720.0	0.0464	146.69	1.0231	0.1244	1.667	1564.8	0.1002	0.01870
140.0	0.0913	74.51	0.9388	0.1246	1.669	1115.6	0.0602	0.01125	740.0	0.0456	149.18	1.0252	0.1244	1.667	1578.0	0.1014	0.01892
160.0	0.0883	77.00	0.9429	0.1246	1.669	1134.1	0.0619	0.01155	760.0	0.0448	151.67	1.0272	0.1244	1.667	1591.2	0.1026	0.01914
180.0	0.0855	79.49	0.9469	0.1246	1.668	1152.3	0.0635	0.01184	780.0	0.0441	154.16	1.0292	0.1244	1.667	1604.1		

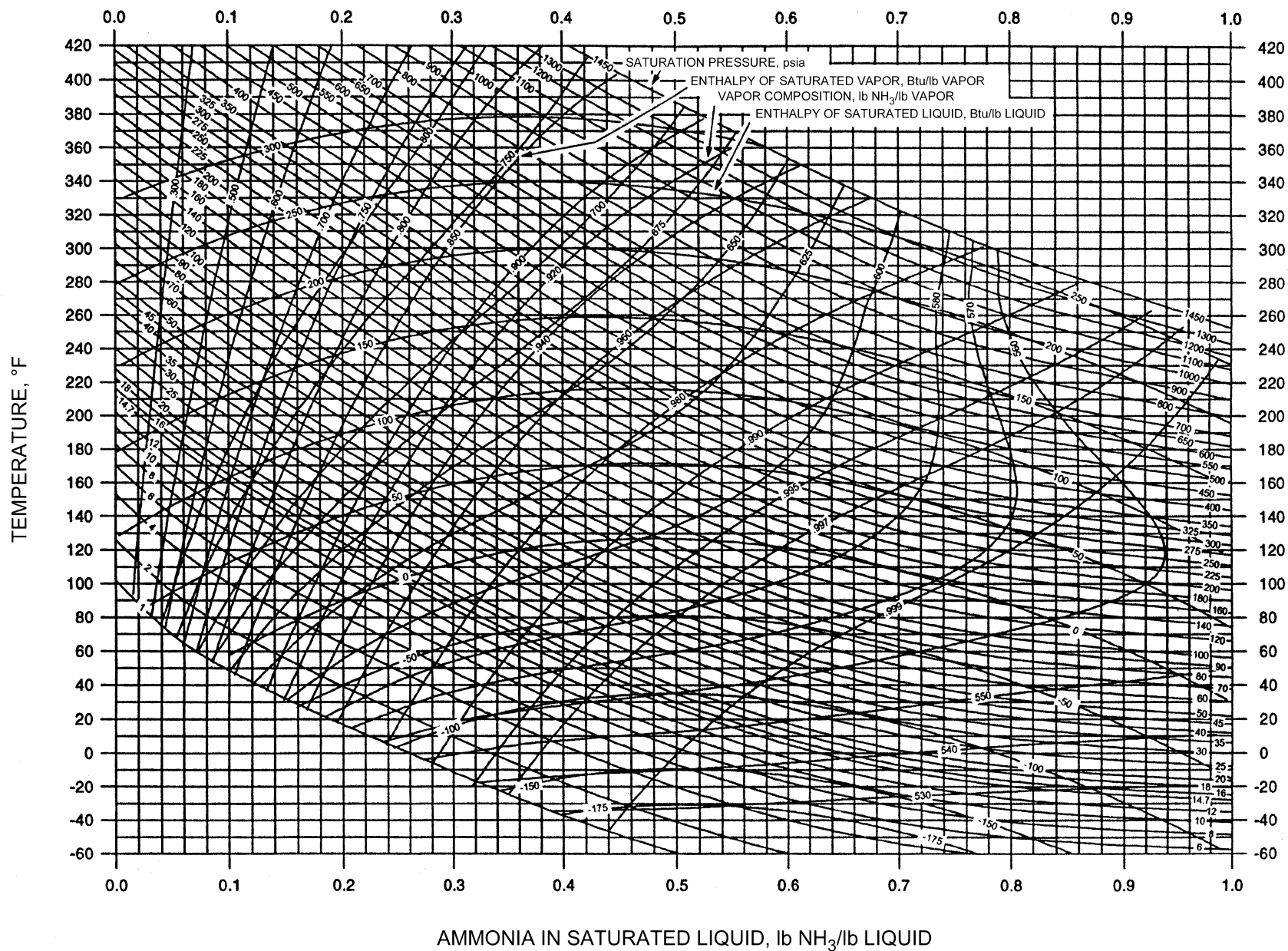


Fig. 29 Enthalpy Diagram for Ammonia-Water Solutions

Prepared by Kwang Kim and Keith Herold, Center for Environmental Energy Engineering, University of Maryland at College Park

Specific Volume of Saturated Ammonia-Water Solutions, ft³/lb

Temp., °F	Concentration, Ammonia (Mass Basis)										Temp., °F	
	0	10	20	30	40	50	60	70	80	90		100
20	0.0160	0.0165	0.0170	0.0176	0.0182	0.0190	0.0197	0.0207	0.0217	0.0230	0.0245	20
40	0.0160	0.0165	0.0171	0.0177	0.0184	0.0191	0.0200	0.0209	0.0221	0.0236	0.0253	40
60	0.0160	0.0166	0.0172	0.0178	0.0186	0.0193	0.0202	0.0212	0.0225	0.0241	0.0260	60
80	0.0161	0.0167	0.0173	0.0180	0.0188	0.0196	0.0205	0.0216	0.0230	0.0247	0.0267	80
100	0.0161	0.0168	0.0174	0.0182	0.0190	0.0198	0.0208	0.0220	0.0235	0.0254	0.0275	100
120	0.0162	0.0169	0.0176	0.0184	0.0192	0.0201	0.0211	0.0224	0.0241	0.0261	0.0284	120
140	0.0163	0.0170	0.0177	0.0185	0.0194	0.0203	0.0215	0.0229	0.0247	0.0268	0.0294	140
160	0.0164	0.0172	0.0179	0.0187	0.0196	0.0206	0.0219	0.0235	0.0254	0.0277	0.0306	160
180	0.0165	0.0173	0.0181	0.0190	0.0199	0.0210	0.0223	0.0241	0.0262	0.0286	0.0320	180
200	0.0166	0.0175	0.0183	0.0192	0.0202	0.0213	0.0228	0.0247	0.0270	0.0298	0.0338	200
220	0.0168	0.0176	0.0185	0.0194	0.0205	0.0217	0.0234	0.0255	0.0279	0.0312	0.0361	220

Prepared under Research Project No. 271-RP, sponsored by TC 8.3.
Data reference: B.H. Jennings, Ammonia water properties (paper presented at ASHRAE meeting, January 1965).

Refrigerant Temperature ($t' = \text{°F}$) and Enthalpy ($h = \text{Btu/lb}$) of Lithium Bromide Solutions

Temp., ($t = \text{°F}$)		Percent LiBr										
		0	10	20	30	40	45	50	55	60	65	70
80	t'	80.0	78.2	75.6	70.5	60.9	53.5	42.1	28.6	13.8	-0.2#	-11.6#
	h	48.0	39.2	31.8	25.6	21.6	21.2	23.0	28.7	38.9	52.7#	67.1#
100	t'	100.0	98.1	95.3	89.9	79.6	71.8	60.0	46.1	30.9	16.2#	3.8#
	h	68.0	56.6	47.0	38.7	33.2	32.1	33.2	38.2	47.8	61.1#	75.1#
120	t'	120.0	117.9	114.9	109.2	98.3	90.1	77.9	63.6	48.1	32.7	19.1#
	h	87.9	73.6	61.7	51.7	44.7	43.0	43.6	48.0	56.9	69.4	83.0#
140	t'	140.0	137.8	134.6	128.5	117.1	108.5	95.8	81.2	65.2	49.1	34.4#
	h	107.9	91.0	77.0	65.1	56.5	54.1	54.1	57.9	66.1	78.0	91.1#
160	t'	160.0	157.7	154.3	147.9	135.8	126.8	113.8	98.7	82.3	65.6	49.7#
	h	127.9	108.2	92.0	78.2	68.1	65.1	64.7	67.9	75.4	86.6	99.2#
180	t'	180.0	177.5	173.9	167.2	154.5	145.1	131.7	116.2	99.5	82.0	65.1#
	h	147.9	125.4	107.9	91.9	80.4	76.6	75.3	77.7	84.6	95.1	107.2#
200	t'	200.0	197.4	193.6	186.5	173.3	163.5	149.6	133.7	116.6	98.5	80.4#
	h	168.0	143.4	123.3	105.3	92.1	87.4	85.9	87.8	94.1	104.0	115.6#
220	t'	220.0	217.2	213.3	205.8	192.0	181.8	167.5	151.3	133.7	114.9	95.7
	h	188.1	160.7	138.2	119.0	104.1	99.0	96.5	97.8	103.3	112.5	123.6
240	t'	240.0*	237.1*	232.9	225.2	210.7	200.2	185.4	168.8	150.9	131.4	111.0
	h	208.3*	178.4*	154.0	132.6	116.0	110.3	107.1	107.7	112.5	121.1	131.6
260	t'	260.0*	256.9*	252.6*	244.5*	229.4	218.5	203.3	186.3	168.0	147.9	126.4
	h	228.6*	195.7*	169.1*	146.2*	128.1	121.6	117.6	117.6	121.6	129.5	139.5
280	t'	280.0*	276.8*	272.3*	263.8*	248.2*	236.8*	221.2	203.9	185.1	164.3	141.7
	h	249.1*	213.8*	185.1*	159.7*	140.0*	132.8*	128.1	127.5	130.6	137.9	147.6
300	t'	300.0*	296.7*	291.9*	283.1*	266.9*	255.2*	239.2*	221.4	202.3	180.8	157.0
	h	269.6*	231.6*	200.7*	173.5*	152.1*	144.1*	138.9*	137.3	139.8	146.5	155.5
320	t'	320.0*	316.5*	311.6*	302.5*	285.6*	273.5*	257.1*	238.9*	219.4	197.2	172.4
	h	290.3*	249.7*	216.3*	187.2*	164.2*	155.3*	149.5*	147.1*	148.8	154.9	163.4
340	t'	340.0*	336.4*	331.3*	321.8*	304.4*	291.9*	275.0*	256.4*	236.5*	213.7	187.7
	h	311.1*	267.9*	232.1*	201.0*	176.1*	166.6*	160.1*	157.0*	158.0*	163.5	171.0
360	t'	360.0*	356.2*	350.9*	341.1*	323.1*	310.2*	292.9*	274.0*	253.7*	230.1	203.0
	h	332.2*	286.1*	248.0*	214.9*	188.2*	178.0*	170.6*	166.8*	167.0*	171.9	178.3

*Extensions of data above 235°F are well above the original data and should be used with care.
#Supersaturated solution.

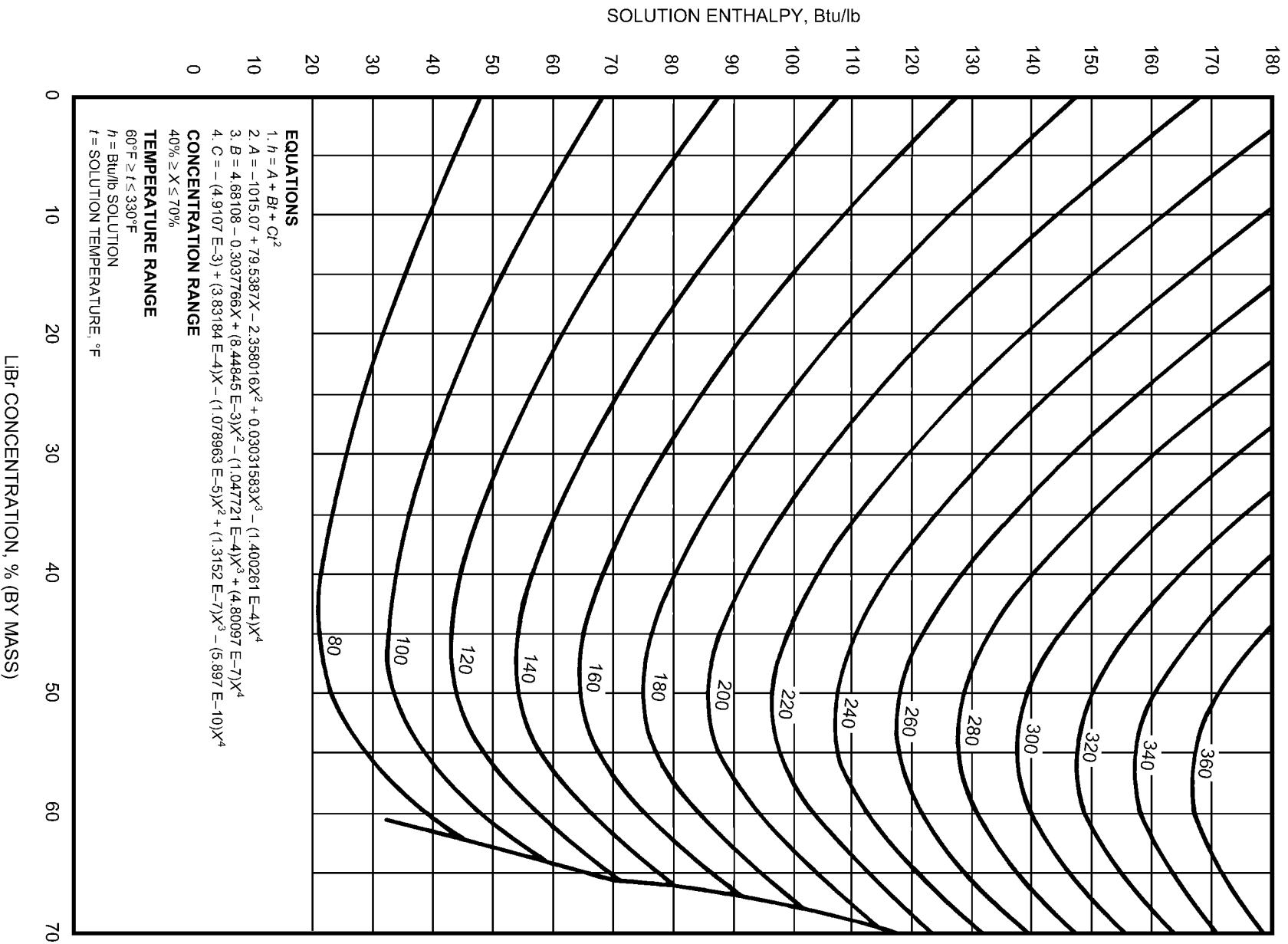


Fig. 30 Enthalpy-Concentration Diagram for Water-Lithium Bromide Solutions

EQUATIONS

1. $t = At' + B$
2. $t' = (t - B)/A$
3. $A = -2.00755 + 0.16976X - (3.133362 E-3)X^2 + (1.97668 E-5)X^3$
4. $B = 321.128 - 19.322X + 0.374382X^2 - (2.0637 E-3)X^3$
5. $\log_{10}P = C + D/(t' + 459.72)^2 + E/(t' + 459.72)^2$
6. $t' = \frac{-2E}{D + [D^2 - 4E(C - \log_{10}P)]^{0.5}} - 459.72$

Temperature Range (Refrigerant) $0 < t' \leq 230^\circ\text{F}$
 Temperature Range (Solution) $40 < t \leq 350^\circ\text{F}$
 Concentration Range $45\% < X \leq 70\%$

$C = 6.21147$
 $D = -2886.373$
 $E = -337269.46$
 t' = Refrigerant Temperature, °F
 t = Solution Temperature, °F
 X = Percent LiBr
 P = psia

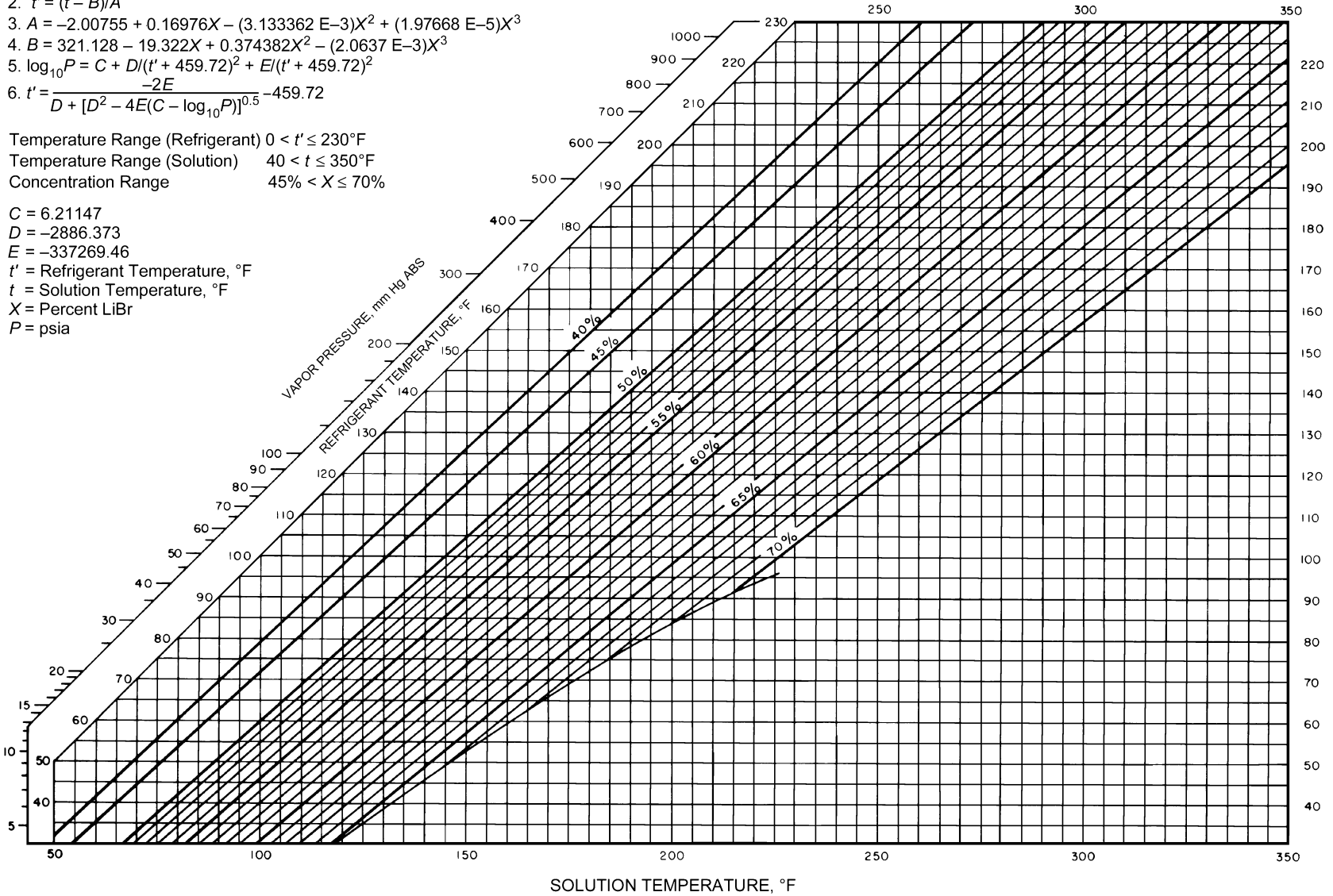


Fig. 31 Equilibrium Chart for Aqueous Lithium Bromide Solutions
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