

# *Appendix A*

## *Thermodynamic Property Tables*

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### ***General***

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Because of ammonia's widespread use as a refrigerant, comprehensive tables of thermodynamic properties are frequently needed by refrigeration engineers. Fortunately ammonia has been very thoroughly studied by thermodynamicists over the years and these properties have been established with a high level of confidence in their accuracy.

The various thermodynamic property tables correlate the following important properties of liquid and vapor:

- Pressure
- Temperature
- Specific Volume (Density)
- Enthalpy
- Entropy

The latest update of ammonia properties was conducted by R. Tillner-Roth, R. Harms-Watzenburg, and H. D. Baehr (1993) whose methods have subsequently been incorporated into the NIST (National Institute of Standards and Technology) software package REFPROP (Reference Fluid Thermodynamic and Transport Properties Database). REFPROP Version 7.0 (2002) was used to generate the thermodynamic property tables here in the IAR Ammonia Data Book. This data is generally now accepted as the highest authority when it comes to the thermodynamic properties of ammonia.

There has been, nonetheless, some confusion that has arisen about the various versions of published property data which has been generated from REFPROP and other sources such as Haar and Gallagher (1978). The main issue arises from the fact that enthalpy and entropy properties have no absolute values, only differences from some datum state assigned some arbitrary value.

The older property data published by ASHRAE used datum states such that the enthalpy and entropy of a saturated liquid were both 0.0 at  $-40^{\circ}\text{F}$ . Not by coincidence  $-40^{\circ}\text{F}$  coincides exactly with  $-40^{\circ}\text{C}$  on the temperature scale. The nice feature that resulted was that  $-40^{\circ}$  saturated liquid had zero entropy and enthalpy regardless of which temperature scale was being used. Many engineers used properties based on a  $-40^{\circ}$  datum for so long that they began to have a good feel for what the values of enthalpy and entropy were at commonly encountered conditions.

When the Haar and Gallagher data (1978) was released, ASHRAE chose not to simply update the old tables. Instead, they changed the datum conditions at which enthalpy and entropy were zero. As a result, many engineers chose to continue to use the old data with the familiar  $-40^{\circ}$  datum conditions. In these cases, the benefit of the more accurate property data was bypassed in favor of staying with the more familiar numbers.

Adding further complication to the matter, the International Institute of Refrigeration (IIR — not to be confused with IIAR) has published tables for ammonia that use  $-50^{\circ}\text{F}$  as the datum condition. Most of the European property tables are based on the work of Dvorak and Petrak (1975).

IIAR has opted to publish its own property tables which reflect the latest REFPROP (Version 7.0) data but which are adjusted for the more familiar datum conditions. The Inch-Pound (IP) tables are based on the familiar  $-40^{\circ}\text{F}$  zero datum state for enthalpy and entropy of the saturated liquid. This makes them similar to the older ASHRAE property tables but with the increased level of accuracy resulting from REFPROP.

The SI tables are based on datum conditions of saturated liquid with 200 kJ/kg (enthalpy) and 1.0 kJ/kg-K (entropy) at  $0^{\circ}\text{C}$ . This makes the SI tables for ammonia consistent with the halocarbon standard for SI tables.

The following property tables are included:

**Table A-1 — Saturation Properties of Ammonia — IP Units** using REFPROP (Version 7.0) with  $-40^{\circ}\text{F}$  zero datums for saturated liquid entropy and enthalpy. Inch-pound units.

**Table A-2 — Superheated Vapor Properties of Ammonia — IP Units** using REFPROP (Version 7.0) with  $-40^{\circ}\text{F}$  zero datums for saturated liquid entropy and enthalpy. Inch-pound units.

**Table A-3 — Ammonia Liquid and Vapor Properties — IP Units** at various isobars using equations and constants of REFPROP (Version 7.0) with  $-40^{\circ}\text{F}$  zero datums for saturated liquid entropy and enthalpy. Includes supercritical data. Inch-pound units.

**Table A-4 — Saturation Properties of Ammonia — SI Units** using REFPROP (Version 7.0) with  $0^{\circ}\text{C}$  datums of 200 kJ/kg enthalpy and 1.000 kJ/kg-K entropy. SI units.

**Table A-5 — Superheated Vapor Properties of Ammonia — SI Units** using REFPROP (Version 7.0) with  $0^{\circ}\text{C}$  datums of 200 kJ/kg enthalpy and 1.000 kJ/kg-K entropy. SI units.

The following diagrams are also included:

**Pressure-Enthalpy Diagram — IP Units**

**Pressure-Enthalpy Diagram — SI Units**

## Saturation Properties of Ammonia — IP Units

Saturation properties of ammonia using software REFPROP (NIST) where the equations and constants for ammonia originate from s-Watzenberg and Baehr (1993), Eine neue Fundamentalgleichung fure Ammoniak, DVK-Tagungsbericht, Vol. 20, pp167–181 (1993). The information is also accessible from Baehr and Tillner-Roth (1994), Thermodynamic Properties of Environmentally Acceptable Refrigerants; Equations of State and Tables for Ammonia, R22, R134a, R152a, and R123, Springer-Verlag, Berlin. Used in the REFPROP software version 7.0 (NIST 2002). The uncertainties of the equation of state are 0.2% in density, except in the critical region. The uncertainty in vapor pressure is 0.2%.

**Table A-1 Saturation Properties of Ammonia — IP Units**

Temperature (°F)	Pressure (psia)	Enthalpy (Btu/lb)		Entropy (Btu/lb-R)		Liq. Density (lbm/ft <sup>3</sup> )	Vapor Sp. Vol. (ft <sup>3</sup> /lbm)
		Liquid	Vapor	Liquid	Vapor		
-105	1.00	-67.036	570.018	-0.1733	1.6229	45.65	222.8251
-100	1.24	-61.994	572.260	-0.1592	.6042	45.47	182.1906
-95	1.52	-56.934	574.484	-0.1453	1.5862	45.28	149.9186
-90	1.86	-51.854	576.688	-0.1314	1.5689	45.09	124.1165
-85	2.27	-46.755	578.872	-0.1177	1.5521	44.90	103.3547
-80	2.74	-41.637	581.034	-0.1042	1.5359	44.71	86.5459
-78	2.95	-39.584	581.893	-0.0988	1.5295	44.63	80.7357
-76	3.18	-37.528	582.748	-0.0934	1.5233	44.55	75.3785
-74	3.41	-35.469	583.598	-0.0880	1.5171	44.47	70.4346
-72	3.67	-33.407	584.445	-0.0827	1.5110	44.39	65.8681
-70	3.94	-31.341	585.288	-0.0774	1.5050	44.31	61.6465
-68	4.22	-29.273	586.127	-0.0721	1.4991	44.23	57.7404
-66	4.53	-27.201	586.961	-0.0668	1.4933	44.15	54.1231
-64	4.85	-25.127	587.792	-0.0616	1.4875	44.07	50.7707
-62	5.19	-23.049	588.617	-0.0564	1.4818	43.99	47.6610
-60	5.54	-20.969	589.439	-0.0511	1.4761	43.91	44.7744
-59	5.73	-19.927	589.848	-0.0485	1.4733	43.87	43.4089
-58	5.92	-18.885	590.256	-0.0459	1.4706	43.83	42.0925
-57	6.12	-17.842	590.662	-0.0434	1.4678	43.79	40.8232
-56	6.32	-16.799	591.068	-0.0408	1.4651	43.75	39.5991
-55	6.53	-15.754	591.472	-0.0382	1.4624	43.71	38.4182
-54	6.75	-14.709	591.875	-0.0356	1.4597	43.67	37.2790
-53	6.96	-13.663	592.277	-0.0330	1.4570	43.63	36.1796
-52	7.19	-12.616	592.678	-0.0305	1.4543	43.58	35.1186
-51	7.42	-11.569	593.077	-0.0279	1.4516	43.54	34.0943
-50	7.66	-10.521	593.476	-0.0253	1.4490	43.50	33.1054
-49	7.90	-9.472	593.873	-0.0228	1.4464	43.46	32.1504
-48	8.15	-8.423	594.268	-0.0202	1.4438	43.42	31.2280
-47	8.41	-7.372	594.663	-0.0177	1.4412	43.38	30.3370
-46	8.67	-6.321	595.056	-0.0152	1.4386	43.34	29.4761
-45	8.94	-5.270	595.448	-0.0126	1.4360	43.29	28.6441
-44	9.22	-4.217	595.838	-0.0101	1.4335	43.25	27.8400
-43	9.50	-3.164	596.227	-0.0076	1.4310	43.21	27.0626
-42	9.79	-2.110	596.615	-0.0050	1.4285	43.17	26.3110
-41	10.09	-1.055	597.002	-0.0025	1.4260	43.13	25.5842

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**Table A-1 Saturation Properties of Ammonia — IP Units (continued)**

Temperature (°F)	Pressure (psia)	Enthalpy (Btu/lb)		Entropy (Btu/lb-R)		Liq. Density (lbm/ft <sup>3</sup> )	Vapor Sp. Vol. (ft <sup>3</sup> /lbm)
		Liquid	Vapor	Liquid	Vapor		
-40	10.40	0.000	597.387	0.0000	1.4235	43.09	24.8812
-39	10.71	1.056	597.771	0.0025	1.4210	43.04	24.2012
-38	11.03	2.113	598.153	0.0050	1.4185	43.00	23.5432
-37	11.36	3.170	598.534	0.0075	1.4161	42.96	22.9065
-36	11.70	4.228	598.914	0.0100	1.4137	42.92	22.2903
-35	12.04	5.287	599.292	0.0125	1.4113	42.87	21.6938
-34	12.39	6.347	599.669	0.0150	1.4089	42.83	21.1163
-33	12.76	7.407	600.045	0.0175	1.4065	42.79	20.5571
-32	13.12	8.468	600.419	0.0200	1.4041	42.75	20.0155
-31	13.50	9.530	600.791	0.0224	1.4017	42.70	19.4910
-30	13.89	10.592	601.162	0.0249	1.3994	42.66	18.9828
-29	14.29	11.655	601.532	0.0274	1.3970	42.62	18.4904
-28	14.69	12.719	601.900	0.0298	1.3947	42.58	18.0132
-27	15.11	13.783	602.266	0.0323	1.3924	42.53	17.5508
-26	15.53	14.848	602.631	0.0348	1.3901	42.49	17.1025
-25	15.96	15.914	602.995	0.0372	1.3878	42.45	16.6678
-24	16.41	16.980	603.357	0.0396	1.3856	42.40	16.2464
-23	16.86	18.048	603.717	0.0421	1.3833	42.36	15.8376
-22	17.32	19.115	604.076	0.0445	1.3811	42.32	15.4412
-21	17.80	20.184	604.433	0.0470	1.3788	42.27	15.0566
-20	18.28	21.253	604.789	0.0494	1.3766	42.23	14.6835
-19	18.77	22.323	605.143	0.0518	1.3744	42.19	14.3214
-18	19.28	23.394	605.496	0.0542	1.3722	42.14	13.9700
-17	19.79	24.465	605.847	0.0567	1.3700	42.10	13.6290
-16	20.32	25.537	606.196	0.0591	1.3678	42.05	13.2978
-15	20.86	26.609	606.544	0.0615	1.3657	42.01	12.9764
-14	21.41	27.683	606.890	0.0639	1.3635	41.97	12.6642
-13	21.97	28.757	607.234	0.0663	1.3614	41.92	12.3610
-12	22.54	29.831	607.577	0.0687	1.3592	41.88	12.0665
-11	23.13	30.906	607.918	0.0711	1.3571	41.83	11.7804
-10	23.72	31.982	608.257	0.0735	1.3550	41.79	11.5025
-9	24.33	33.059	608.595	0.0759	1.3529	41.75	11.2324
-8	24.95	34.136	608.930	0.0782	1.3508	41.70	10.9699
-7	25.59	35.214	609.264	0.0806	1.3488	41.66	10.7148
-6	26.24	36.293	609.597	0.0830	1.3467	41.61	10.4668
-5	26.90	37.372	609.928	0.0854	1.3446	41.57	10.2256
-4	27.57	38.452	610.256	0.0877	1.3426	41.52	9.9912
-3	28.26	39.533	610.583	0.0901	1.3405	41.48	9.7632
-2	28.96	40.614	610.909	0.0924	1.3385	41.43	9.5414
-1	29.67	41.697	611.232	0.0948	1.3365	41.39	9.3257
0	30.40	42.779	611.554	0.0971	1.3345	41.34	9.1159
1	31.14	43.863	611.874	0.0995	1.3325	41.30	8.9117
2	31.90	44.947	612.192	0.1018	1.3305	41.25	8.7130
3	32.67	46.032	612.508	0.1042	1.3285	41.21	8.5197
4	33.45	47.117	612.822	0.1065	1.3266	41.16	8.3315

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Table A-1 Saturation Properties of Ammonia — IP Units (continued)

Temperature (°F)	Pressure (psia)	Enthalpy (Btu/lb)		Entropy (Btu/lb-R)		Liq. Density (lbm/ft <sup>3</sup> )	Vapor Sp. Vol. (ft <sup>3</sup> /lbm)
		Liquid	Vapor	Liquid	Vapor		
5	34.25	48.203	613.135	0.1089	1.3246	41.12	8.1483
6	35.07	49.290	613.445	0.1112	1.3227	41.07	7.9699
7	35.90	50.378	613.754	0.1135	1.3207	41.03	7.7962
8	36.75	51.466	614.061	0.1158	1.3188	40.98	7.6271
9	37.61	52.555	614.366	0.1181	1.3169	40.94	7.4624
10	38.49	53.644	614.669	0.1205	1.3150	40.89	7.3020
11	39.38	54.734	614.970	0.1228	1.3131	40.84	7.1457
12	40.29	55.825	615.269	0.1251	1.3112	40.80	6.9935
13	41.22	56.917	615.566	0.1274	1.3093	40.75	6.8451
14	42.16	58.009	615.861	0.1297	1.3074	40.71	6.7006
15	43.13	59.103	616.154	0.1320	1.3055	40.66	6.5597
16	44.10	60.196	616.445	0.1343	1.3037	40.61	6.4224
17	45.10	61.291	616.734	0.1366	1.3018	40.57	6.2885
18	46.11	62.386	617.022	0.1388	1.3000	40.52	6.1580
19	47.15	63.482	617.307	0.1411	1.2981	40.48	6.0308
20	48.19	64.579	617.590	0.1434	1.2963	40.43	5.9067
21	49.26	65.676	617.871	0.1457	1.2945	40.38	5.7857
22	50.35	66.774	618.150	0.1479	1.2927	40.34	5.6677
23	51.45	67.873	618.427	0.1502	1.2909	40.29	5.5526
24	52.58	68.972	618.701	0.1525	1.2891	40.24	5.4403
25	53.72	70.072	618.974	0.1547	1.2873	40.20	5.3307
26	54.88	71.173	619.244	0.1570	1.2855	40.15	5.2238
27	56.06	72.275	619.513	0.1593	1.2837	40.10	5.1195
28	57.27	73.378	619.779	0.1615	1.2819	40.05	5.0176
29	58.49	74.481	620.043	0.1638	1.2802	40.01	4.9183
30	59.73	75.585	620.305	0.1660	1.2784	39.96	4.8213
31	60.99	76.689	620.565	0.1682	1.2767	39.91	4.7266
32	62.28	77.795	620.823	0.1705	1.2749	39.87	4.6341
33	63.58	78.901	621.078	0.1727	1.2732	39.82	4.5438
34	64.91	80.008	621.331	0.1749	1.2715	39.77	4.4556
35	66.26	81.116	621.582	0.1772	1.2698	39.72	4.3695
36	67.62	82.224	621.831	0.1794	1.2680	39.67	4.2854
37	69.02	83.334	622.078	0.1816	1.2663	39.63	4.2033
38	70.43	84.444	622.322	0.1838	1.2646	39.58	4.1230
39	71.86	85.555	622.564	0.1861	1.2629	39.53	4.0446
40	73.32	86.666	622.803	0.1883	1.2613	39.48	3.9680
41	74.80	87.779	623.041	0.1905	1.2596	39.43	3.8931
42	76.31	88.892	623.276	0.1927	1.2579	39.39	3.8199
43	77.84	90.006	623.509	0.1949	1.2562	39.34	3.7484
44	79.39	91.121	623.739	0.1971	1.2546	39.29	3.6785
45	80.96	92.237	623.967	0.1993	1.2529	39.24	3.6102
46	82.56	93.353	624.193	0.2015	1.2513	39.19	3.5434
47	84.19	94.471	624.416	0.2037	1.2496	39.14	3.4780
48	85.83	95.589	624.637	0.2059	1.2480	39.09	3.4142
49	87.51	96.708	624.855	0.2081	1.2463	39.04	3.3517

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**Table A-1 Saturation Properties of Ammonia — IP Units (continued)**

Temperature (°F)	Pressure (psia)	Enthalpy (Btu/lb)		Entropy (Btu/lb-R)		Liq. Density (lbm/ft <sup>3</sup> )	Vapor Sp. Vol. (ft <sup>3</sup> /lbm)
		Liquid	Vapor	Liquid	Vapor		
50	89.21	97.828	625.071	0.2102	1.2447	39.00	3.2906
51	90.93	98.949	625.285	0.2124	1.2431	38.95	3.2309
52	92.68	100.070	625.496	0.2146	1.2415	38.90	3.1724
53	94.45	101.190	625.705	0.2168	1.2399	38.85	3.1152
54	96.26	102.320	625.911	0.2189	1.2383	38.80	3.0593
55	98.08	103.440	626.115	0.2211	1.2367	38.75	3.0045
56	99.94	104.570	626.317	0.2233	1.2351	38.70	2.9510
57	101.82	105.690	626.515	0.2255	1.2335	38.65	2.8986
58	103.73	106.820	626.712	0.2276	1.2319	38.60	2.8473
59	105.66	107.950	626.905	0.2298	1.2303	38.55	2.7971
60	107.63	109.080	627.096	0.2319	1.2287	38.50	2.7479
61	109.62	110.210	627.285	0.2341	1.2272	38.45	2.6998
62	111.64	111.340	627.471	0.2362	1.2256	38.40	2.6527
63	113.69	112.470	627.654	0.2384	1.2241	38.35	2.6066
64	115.76	113.600	627.835	0.2405	1.2225	38.30	2.5614
65	117.87	114.730	628.013	0.2427	1.2210	38.25	2.5172
66	120.01	115.870	628.189	0.2448	1.2194	38.20	2.4739
67	122.17	117.000	628.362	0.2469	1.2179	38.14	2.4315
68	124.37	118.140	628.532	0.2491	1.2163	38.09	2.3899
69	126.59	119.280	628.699	0.2512	1.2148	38.04	2.3492
70	128.85	120.420	628.864	0.2533	1.2133	37.99	2.3094
71	131.13	121.560	629.026	0.2555	1.2118	37.94	2.2703
72	133.45	122.700	629.185	0.2576	1.2102	37.89	2.2320
73	135.80	123.840	629.342	0.2597	1.2087	37.84	2.1945
74	138.18	124.980	629.496	0.2618	1.2072	37.79	2.1578
75	140.59	126.130	629.647	0.2640	1.2057	37.73	2.1217
76	143.03	127.270	629.795	0.2661	1.2042	37.68	2.0864
77	145.51	128.420	629.940	0.2682	1.2027	37.63	2.0518
78	148.02	129.560	630.083	0.2703	1.2012	37.58	2.0179
79	150.56	130.710	630.222	0.2724	1.1997	37.53	1.9847
80	153.13	131.860	630.359	0.2745	1.1982	37.47	1.9521
81	155.74	133.010	630.493	0.2766	1.1967	37.42	1.9201
82	158.38	134.160	630.624	0.2787	1.1953	37.37	1.8888
83	161.06	135.320	630.752	0.2808	1.1938	37.31	1.8580
84	163.76	136.470	630.877	0.2829	1.1923	37.26	1.8279
85	166.51	137.620	630.999	0.2850	1.1909	37.21	1.7983
86	169.29	138.780	631.118	0.2871	1.1894	37.16	1.7693
87	172.10	139.940	631.234	0.2892	1.1879	37.10	1.7409
88	174.95	141.100	631.347	0.2913	1.1865	37.05	1.7130
89	177.84	142.260	631.457	0.2934	1.1850	37.00	1.6856
90	180.76	143.420	631.564	0.2955	1.1836	36.94	1.6588
91	183.71	144.580	631.668	0.2976	1.1821	36.89	1.6324
92	186.71	145.740	631.769	0.2997	1.1807	36.83	1.6066
93	189.74	146.910	631.866	0.3017	1.1792	36.78	1.5812
94	192.81	148.070	631.961	0.3038	1.1778	36.73	1.5563

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Table A-1 Saturation Properties of Ammonia — IP Units (continued)

Temperature (°F)	Pressure (psia)	Enthalpy (Btu/lb)		Entropy (Btu/lb-R)		Liq. Density (lbm/ft <sup>3</sup> )	Vapor Sp. Vol. (ft <sup>3</sup> /lbm)
		Liquid	Vapor	Liquid	Vapor		
95	195.91	149.240	632.052	0.3059	1.1763	36.67	1.5319
96	199.06	150.410	632.140	0.3080	1.1749	36.62	1.5079
97	202.24	151.580	632.225	0.3101	1.1735	36.56	1.4844
98	205.46	152.750	632.307	0.3121	1.1720	36.51	1.4612
99	208.71	153.920	632.385	0.3142	1.1706	36.45	1.4386
100	212.01	155.100	632.460	0.3163	1.1692	36.40	1.4163
101	215.35	156.270	632.532	0.3183	1.1678	36.34	1.3944
102	218.72	157.450	632.600	0.3204	1.1664	36.29	1.3729
103	222.14	158.630	632.665	0.3225	1.1649	36.23	1.3519
104	225.59	159.810	632.727	0.3245	1.1635	36.17	1.3311
105	229.09	160.990	632.785	0.3266	1.1621	36.12	1.3108
106	232.63	162.170	632.840	0.3287	1.1607	36.06	1.2908
107	236.21	163.360	632.891	0.3307	1.1593	36.01	1.2712
108	239.83	164.540	632.939	0.3328	1.1579	35.95	1.2519
109	243.49	165.730	632.984	0.3348	1.1565	35.89	1.2330
110	247.19	166.920	633.024	0.3369	1.1551	35.84	1.2144
111	250.93	168.110	633.062	0.3389	1.1537	35.78	1.1961
112	254.72	169.300	633.095	0.3410	1.1523	35.72	1.1782
113	258.55	170.490	633.125	0.3430	1.1509	35.66	1.1605
114	262.43	171.690	633.152	0.3451	1.1495	35.61	1.1432
115	266.34	172.890	633.175	0.3471	1.1481	35.55	1.1262
116	270.31	174.090	633.194	0.3492	1.1467	35.49	1.1094
117	274.31	175.290	633.209	0.3512	1.1453	35.43	1.0930
118	278.36	176.490	633.220	0.3533	1.1439	35.37	1.0768
119	282.46	177.690	633.228	0.3553	1.1425	35.32	1.0609
120	286.60	178.900	633.232	0.3574	1.1411	35.26	1.0452
121	290.78	180.100	633.232	0.3594	1.1398	35.20	1.0299
122	295.01	181.310	633.228	0.3615	1.1384	35.14	1.0148
123	299.29	182.520	633.220	0.3635	1.1370	35.08	0.9999
124	303.61	183.730	633.209	0.3655	1.1356	35.02	0.9853
125	307.98	184.950	633.193	0.3676	1.1342	34.96	0.9710
126	312.40	186.170	633.173	0.3696	1.1328	34.90	0.9568
127	316.86	187.380	633.149	0.3716	1.1315	34.84	0.9429
128	321.38	188.600	633.121	0.3737	1.1301	34.78	0.9293
129	325.94	189.830	633.089	0.3757	1.1287	34.72	0.9158
130	330.54	191.050	633.053	0.3778	1.1273	34.66	0.9026
131	335.20	192.280	633.012	0.3798	1.1260	34.60	0.8896
132	339.91	193.500	632.967	0.3818	1.1246	34.54	0.8768
133	344.66	194.730	632.918	0.3839	1.1232	34.48	0.8643
134	349.47	195.970	632.865	0.3859	1.1218	34.41	0.8519
135	354.32	197.200	632.807	0.3879	1.1204	34.35	0.8397
136	359.23	198.440	632.745	0.3900	1.1191	34.29	0.8277
137	364.18	199.670	632.678	0.3920	1.1177	34.23	0.8159
138	369.19	200.910	632.607	0.3940	1.1163	34.16	0.8043
139	374.25	202.160	632.531	0.3961	1.1149	34.10	0.7929

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**Table A-1 Saturation Properties of Ammonia — IP Units (continued)**

Temperature (°F)	Pressure (psia)	Enthalpy (Btu/lb)		Entropy (Btu/lb-R)		Liq. Density (lbm/ft <sup>3</sup> )	Vapor Sp. Vol. (ft <sup>3</sup> /lbm)
		Liquid	Vapor	Liquid	Vapor		
140	379.36	203.400	632.451	0.3981	1.1136	34.04	0.7817
141	384.52	204.650	632.366	0.4001	1.1122	33.98	0.7706
142	389.74	205.900	632.276	0.4021	1.1108	33.91	0.7597
143	395.00	207.150	632.182	0.4042	1.1094	33.85	0.7490
144	400.32	208.410	632.082	0.4062	1.1080	33.78	0.7384
145	405.70	209.660	631.978	0.4082	1.1067	33.72	0.7281
146	411.13	210.920	631.869	0.4103	1.1053	33.66	0.7178
147	416.61	212.180	631.755	0.4123	1.1039	33.59	0.7078
148	422.14	213.450	631.636	0.4143	1.1025	33.52	0.6978
149	427.73	214.710	631.512	0.4164	1.1011	33.46	0.6881
150	433.38	215.980	631.383	0.4184	1.0997	33.39	0.6785
151	439.08	217.260	631.249	0.4204	1.0984	33.33	0.6690
152	444.84	218.530	631.109	0.4225	1.0970	33.26	0.6597
153	450.65	219.810	630.965	0.4245	1.0956	33.19	0.6505
154	456.52	221.090	630.814	0.4265	1.0942	33.13	0.6414
155	462.45	222.370	630.659	0.4286	1.0928	33.06	0.6325
156	468.44	223.660	630.498	0.4306	1.0914	32.99	0.6238
157	474.48	224.940	630.331	0.4326	1.0900	32.93	0.6151
158	480.58	226.240	630.159	0.4347	1.0886	32.86	0.6066
159	486.74	227.530	629.981	0.4367	1.0872	32.79	0.5982
160	492.95	228.830	629.798	0.4388	1.0858	32.72	0.5899
162	505.57	231.430	629.413	0.4428	1.0830	32.58	0.5738
164	518.42	234.050	629.004	0.4469	1.0802	32.44	0.5580
166	531.52	236.680	628.571	0.4510	1.0774	32.30	0.5428
168	544.86	239.320	628.113	0.4551	1.0745	32.16	0.5280
170	558.45	241.970	627.629	0.4592	1.0717	32.01	0.5136
172	572.29	244.640	627.119	0.4633	1.0688	31.87	0.4996
174	586.39	247.330	626.581	0.4674	1.0659	31.72	0.4859
176	600.74	250.030	626.016	0.4715	1.0630	31.57	0.4727
178	615.36	252.740	625.421	0.4757	1.0601	31.42	0.4598
180	630.24	255.470	624.797	0.4798	1.0572	31.26	0.4473
182	645.39	258.220	624.142	0.4840	1.0542	31.11	0.4351
184	660.81	260.990	623.455	0.4881	1.0512	30.95	0.4232
186	676.51	263.770	622.736	0.4923	1.0482	30.79	0.4117
188	692.49	266.570	621.983	0.4965	1.0452	30.63	0.4004
190	708.74	269.390	621.195	0.5007	1.0422	30.47	0.3895
192	725.29	272.230	620.371	0.5049	1.0391	30.31	0.3788
194	742.12	275.090	619.510	0.5091	1.0360	30.14	0.3684
196	759.24	277.970	618.609	0.5133	1.0329	29.97	0.3582
198	776.66	280.880	617.669	0.5176	1.0297	29.80	0.3483

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Table A-1 Saturation Properties of Ammonia — IP Units (continued)

Temperature (°F)	Pressure (psia)	Enthalpy (Btu/lb)		Entropy (Btu/lb-R)		Liq. Density (lbm/ft <sup>3</sup> )	Vapor Sp. Vol. (ft <sup>3</sup> /lbm)
		Liquid	Vapor	Liquid	Vapor		
200	794.38	283.810	616.686	0.5219	1.0265	29.62	0.3387
205	840.03	291.240	614.035	0.5327	1.0183	29.17	0.3156
210	887.64	298.840	611.081	0.5436	1.0099	28.70	0.2938
215	937.28	306.640	607.788	0.5547	1.0011	28.21	0.2733
220	989.03	314.650	604.111	0.5661	0.9919	27.69	0.2538
225	1043.00	322.920	599.996	0.5776	0.9823	27.15	0.2354
230	1099.10	331.480	595.371	0.5895	0.9722	26.57	0.2178
235	1157.70	340.400	590.142	0.6018	0.9613	25.95	0.2010
240	1218.70	349.770	584.183	0.6146	0.9497	25.28	0.1849
245	1282.20	359.690	577.309	0.6281	0.9369	24.55	0.1693
250	1348.50	370.390	569.240	0.6425	0.9227	23.72	0.1540
255	1417.60	382.220	559.499	0.6583	0.9064	22.77	0.1388
260	1489.70	395.940	547.139	0.6766	0.8867	21.60	0.1233
265	1565.10	413.830	529.649	0.7005	0.8603	19.95	0.1061
270	1643.80	458.670	487.438	0.7610	0.8004	15.44	0.07807

## Superheated Vapor Properties of Ammonia — IP Units

Based on software REFPROP Version 7.0 (NIST 2002) where the equations and constants for ammonia originate from Tillner-Roth, R., Harms-Watzenburg, F., and Baehr, H.D., (1993), Eine neue Fundamentalgleichung fure Ammoniak, DVK-Tagungsbericht, Vol. 20, pp167-181 (1993). Enthalpy reference: 0 Btu/lb of saturated liquid at  $-40^{\circ}\text{F}$ . Entropy reference: 0 Btu/(lb-R) of saturated liquid at  $-40^{\circ}\text{F}$

**Table A-2 Superheated Vapor Properties of Ammonia — IP Units**

Saturation $t = -60\text{ F}$ , $p = 5.544\text{ psia}$				Saturation $t = -50\text{ F}$ , $p = 7.659\text{ psia}$			
Temp. $^{\circ}\text{F}$	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. $\text{ft}^3/\text{lb}$	Temp. $^{\circ}\text{F}$	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. $\text{ft}^3/\text{lb}$
-60	589.439	1.4761	44.7745	-50	593.476	1.4490	33.1055
-50	594.604	1.4889	45.9705	-40	598.718	1.4617	33.9807
-40	599.727	1.5013	47.1586	-30	603.911	1.4739	34.8491
-30	604.818	1.5133	48.3402	-20	609.065	1.4857	35.7118
-20	609.885	1.5249	49.5162	-10	614.190	1.4973	36.5697
-10	614.935	1.5363	50.6875	0	619.294	1.5085	37.4235
0	619.973	1.5473	51.8549	10	624.381	1.5194	38.2739
10	625.003	1.5582	53.0189	20	629.458	1.5301	39.1214
20	630.030	1.5688	54.1801	30	634.530	1.5406	39.9663
30	635.057	1.5791	55.3387	40	639.599	1.5508	40.8090
40	640.086	1.5893	56.4952	50	644.668	1.5609	41.6498
50	645.121	1.5993	57.6498	60	649.742	1.5708	42.4890
Saturation $t = -40\text{ F}$ , $p = 10.398\text{ psia}$				Saturation $t = -30\text{ F}$ , $p = 13.889\text{ psia}$			
Temp. $^{\circ}\text{F}$	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. $\text{ft}^3/\text{lb}$	Temp. $^{\circ}\text{F}$	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. $\text{ft}^3/\text{lb}$
-40	597.387	1.4235	24.8813	-30	601.162	1.3994	18.9838
-30	602.717	1.4360	25.5340	-20	606.590	1.4119	19.4794
-20	607.988	1.4482	26.1808	-10	611.950	1.4239	19.9697
-10	613.214	1.4599	26.8226	0	617.256	1.4356	20.4556
0	618.405	1.4713	27.4602	10	622.520	1.4469	20.9378
10	623.569	1.4824	28.0942	20	627.751	1.4580	21.4170
20	628.712	1.4933	28.7253	30	632.957	1.4687	21.8934
30	633.842	1.5039	29.3537	40	638.145	1.4792	22.3675
40	638.963	1.5142	29.9799	50	643.320	1.4894	22.8397
50	644.078	1.5243	30.6042	60	648.488	1.4995	23.3101
60	649.193	1.5343	31.2268	70	653.652	1.5093	23.7790
70	654.309	1.5440	31.8479	80	658.815	1.5190	24.2465

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Table A-2 Superheated Vapor Properties of Ammonia — IP Units (continued)

Saturation $t = -20$ F, $p = 18.278$ psia				Saturation $t = -10$ F, $p = 23.723$ psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
-20	604.789	1.3766	14.6840	-10	608.257	1.3550	11.5027
-10	610.326	1.3891	15.0664	0	613.915	1.3675	11.8025
0	615.784	1.4011	15.4443	10	619.482	1.3794	12.0982
10	621.179	1.4127	15.8182	20	624.975	1.3910	12.3904
20	626.524	1.4239	16.1889	30	630.409	1.4022	12.6797
30	631.830	1.4349	16.5568	40	635.797	1.4131	12.9665
40	637.105	1.4456	16.9223	50	641.149	1.4237	13.2511
50	642.358	1.4560	17.2858	60	646.473	1.4341	13.5339
60	647.594	1.4661	17.6474	70	651.775	1.4442	13.8151
70	652.819	1.4761	18.0076	80	657.063	1.4541	14.0949
80	658.037	1.4859	18.3663	90	662.340	1.4638	14.3735
90	663.252	1.4954	18.7239	100	667.611	1.4733	14.6510
Saturation $t = 0$ F, $p = 30.397$ psia				Saturation $t = 10$ F, $p = 38.487$ psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
0	611.554	1.3345	9.1160	10	614.669	1.3150	7.3021
10	617.346	1.3470	9.3545	20	620.607	1.3275	7.4944
20	623.032	1.3590	9.5893	30	626.424	1.3395	7.6834
30	628.633	1.3705	9.8209	40	632.143	1.3510	7.8695
40	634.166	1.3817	10.0499	50	637.783	1.3622	8.0532
50	639.644	1.3926	10.2766	60	643.360	1.3731	8.2349
60	645.079	1.4031	10.5015	70	648.886	1.3836	8.4148
70	650.480	1.4134	10.7246	80	654.372	1.3938	8.5932
80	655.855	1.4235	10.9463	90	659.826	1.4039	8.7703
90	661.211	1.4333	11.1668	100	665.256	1.4137	8.9462
100	666.553	1.4429	11.3861	110	670.668	1.4232	9.1211
110	671.886	1.4524	11.6044	120	676.067	1.4326	9.2952
Saturation $t = 20$ F, $p = 48.194$ psia				Saturation $t = 30$ F, $p = 59.730$ psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
20	617.590	1.2963	5.9067	30	620.305	1.2784	4.8213
30	623.689	1.3089	6.0638	40	626.580	1.2911	4.9512
40	629.649	1.3209	6.2179	50	632.695	1.3032	5.0783
50	635.496	1.3325	6.3693	60	638.682	1.3149	5.2030
60	641.253	1.3437	6.5185	70	644.566	1.3261	5.3257
70	646.937	1.3545	6.6659	80	650.366	1.3369	5.4466
80	652.562	1.3651	6.8117	90	656.098	1.3474	5.5661
90	658.139	1.3753	6.9561	100	661.774	1.3577	5.6843
100	663.679	1.3853	7.0993	110	667.406	1.3677	5.8015
110	669.190	1.3950	7.2414	120	673.003	1.3774	5.9176
120	674.677	1.4046	7.3826	130	678.573	1.3869	6.0329
130	680.148	1.4140	7.5230	140	684.121	1.3963	6.1474

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**Table A-2 Superheated Vapor Properties of Ammonia — IP Units (continued)**

Saturation $t = 40$ F, $p = 73.321$ psia				Saturation $t = 50$ F, $p = 89.204$ psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
40	622.804	1.2613	3.9680	50	625.072	1.2447	3.2907
50	629.268	1.2741	4.0767	60	631.744	1.2577	3.3826
60	635.553	1.2863	4.1827	70	638.211	1.2700	3.4720
70	641.692	1.2980	4.2866	80	644.514	1.2818	3.5593
80	647.713	1.3092	4.3885	90	650.683	1.2931	3.6450
90	653.638	1.3201	4.4889	100	656.743	1.3041	3.7292
100	659.484	1.3307	4.5879	110	662.714	1.3146	3.8121
110	665.268	1.3409	4.6858	120	668.612	1.3249	3.8939
120	670.999	1.3509	4.7826	130	674.450	1.3349	3.9748
130	676.689	1.3606	4.8786	140	680.240	1.3446	4.0548
140	682.347	1.3701	4.9737	150	685.991	1.3541	4.1341
150	687.978	1.3794	5.0681	160	691.711	1.3634	4.2128
Saturation $t = 60$ F, $p = 107.627$ psia				Saturation $t = 70$ F, $p = 128.846$ psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
60	627.096	1.2288	2.7479	70	628.864	1.2133	2.3094
70	633.994	1.2419	2.8264	80	636.007	1.2266	2.3771
80	640.660	1.2544	2.9026	90	642.888	1.2393	2.4427
90	647.140	1.2663	2.9769	100	649.558	1.2513	2.5064
100	653.468	1.2777	3.0495	110	656.058	1.2628	2.5686
110	659.673	1.2887	3.1208	120	662.419	1.2739	2.6295
120	665.777	1.2993	3.1909	130	668.666	1.2846	2.6893
130	671.798	1.3096	3.2600	140	674.818	1.2949	2.7482
140	677.751	1.3196	3.3282	150	680.893	1.3050	2.8062
150	683.648	1.3293	3.3956	160	686.905	1.3147	2.8635
160	689.499	1.3389	3.4624	170	692.864	1.3243	2.9202
170	695.315	1.3482	3.5285	180	698.780	1.3336	2.9763
Saturation $t = 80$ F, $p = 153.131$ psia				Saturation $t = 90$ F, $p = 180.757$ psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
80	630.359	1.1982	1.9521	90	631.564	1.1836	1.6588
90	637.769	1.2118	2.0111	100	639.265	1.1975	1.7107
100	644.882	1.2247	2.0680	110	646.630	1.2105	1.7605
110	651.758	1.2368	2.1232	120	653.729	1.2228	1.8087
120	658.443	1.2485	2.1769	130	660.612	1.2346	1.8555
130	664.971	1.2596	2.2295	140	667.320	1.2459	1.9012
140	671.371	1.2704	2.2809	150	673.884	1.2568	1.9459
150	677.664	1.2808	2.3315	160	680.328	1.2672	1.9897
160	683.870	1.2909	2.3813	170	686.673	1.2774	2.0328
170	690.003	1.3007	2.4304	180	692.936	1.2873	2.0753
180	696.077	1.3103	2.4790	190	699.131	1.2969	2.1171
190	702.101	1.3196	2.5270	200	705.270	1.3063	2.1585

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Table A-2 Superheated Vapor Properties of Ammonia — IP Units (continued)

Saturation $t = 100$ F, $p = 212.011$ psia				Saturation $t = 110$ F, $p = 247.189$ psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
100	632.460	1.1692	1.4163	110	633.024	1.1551	1.2144
110	640.479	1.1834	1.4623	120	641.394	1.1697	1.2556
120	648.119	1.1967	1.5063	130	649.333	1.1832	1.2948
130	655.458	1.2093	1.5488	140	656.932	1.1960	1.3325
140	662.556	1.2212	1.5899	150	664.260	1.2081	1.3689
150	669.456	1.2326	1.6299	160	671.368	1.2197	1.4042
160	676.195	1.2436	1.6690	170	678.295	1.2308	1.4387
170	682.800	1.2541	1.7073	180	685.072	1.2415	1.4723
180	689.294	1.2644	1.7449	190	691.724	1.2518	1.5053
190	695.696	1.2743	1.7818	200	698.273	1.2618	1.5377
200	702.020	1.2840	1.8182	210	704.735	1.2715	1.5696
210	708.280	1.2934	1.8542	220	711.125	1.2810	1.6011
Saturation $t = 120$ F, $p = 286.595$ psia				Saturation $t = 130$ F, $p = 330.544$ psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
120	633.232	1.1412	1.0453	130	633.053	1.1273	0.9026
130	641.988	1.1561	1.0824	140	642.239	1.1428	0.9364
140	650.254	1.1700	1.1176	150	650.865	1.1570	0.9683
150	658.137	1.1831	1.1513	160	659.056	1.1704	0.9986
160	665.715	1.1954	1.1838	170	666.904	1.1829	1.0278
170	673.045	1.2071	1.2152	180	674.475	1.1949	1.0560
180	680.173	1.2184	1.2458	190	681.819	1.2063	1.0833
190	687.134	1.2292	1.2756	200	688.977	1.2172	1.1099
200	693.956	1.2396	1.3048	210	695.979	1.2277	1.1358
210	700.662	1.2497	1.3334	220	702.852	1.2379	1.1613
220	707.270	1.2595	1.3615	230	709.616	1.2478	1.1863
230	713.797	1.2690	1.3892	240	716.288	1.2574	1.2108
Saturation $t = 140$ F, $p = 379.361$ psia				Saturation $t = 150$ F, $p = 433.381$ psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
140	632.451	1.1136	0.7817	150	631.383	1.0998	0.6785
150	642.119	1.1296	0.8126	160	641.598	1.1164	0.7071
160	651.143	1.1442	0.8417	170	651.065	1.1315	0.7338
170	659.673	1.1579	0.8693	180	659.966	1.1456	0.7591
180	667.814	1.1707	0.8957	190	668.428	1.1587	0.7831
190	675.644	1.1829	0.9210	200	676.539	1.1711	0.8061
200	683.221	1.1944	0.9456	210	684.367	1.1829	0.8284
210	690.590	1.2055	0.9695	220	691.962	1.1941	0.8499
220	697.785	1.2162	0.9928	230	699.364	1.2049	0.8709
230	704.836	1.2265	1.0155	240	706.605	1.2153	0.8913
240	711.765	1.2365	1.0378	250	713.710	1.2254	0.9114
250	718.592	1.2462	1.0597	260	720.700	1.2352	0.9310

(Continued on next page)

**Table A-2 Superheated Vapor Properties of Ammonia — IP Units (continued)**

Saturation t = 160 F, p = 494.950 psia				Saturation t = 170 F, p = 558.447 psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
160	629.799	1.0858	0.5899	170	627.629	1.0717	0.5136
170	640.638	1.1032	0.6167	180	639.194	1.0899	0.5388
180	650.602	1.1189	0.6414	190	649.721	1.1062	0.5619
190	659.916	1.1333	0.6647	200	659.494	1.1212	0.5834
200	668.728	1.1468	0.6867	210	668.693	1.1350	0.6037
210	677.145	1.1595	0.7077	220	677.443	1.1480	0.6231
220	685.244	1.1715	0.7280	230	685.835	1.1602	0.6416
230	693.082	1.1829	0.7476	240	693.936	1.1719	0.6595
240	700.705	1.1939	0.7666	250	701.796	1.1830	0.6768
250	708.149	1.2045	0.7851	260	709.457	1.1938	0.6937
260	715.441	1.2147	0.8032	270	716.949	1.2041	0.7101
270	722.606	1.2245	0.8209	280	724.299	1.2141	0.7261
Saturation t = 180 F, p = 630.241 psia				Saturation t = 190 F, p = 708.742 psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
180	624.797	1.0572	0.4473	190	621.195	1.0422	0.3895
190	637.216	1.0764	0.4713	200	634.640	1.0627	0.4126
200	648.388	1.0935	0.4930	210	646.557	1.0807	0.4332
210	658.675	1.1090	0.5131	220	657.426	1.0968	0.4521
220	668.301	1.1233	0.5320	230	667.528	1.1115	0.4697
230	677.417	1.1366	0.5499	240	677.046	1.1252	0.4864
240	686.128	1.1491	0.5670	250	686.105	1.1381	0.5022
250	694.512	1.1610	0.5834	260	694.796	1.1502	0.5173
260	702.628	1.1724	0.5993	270	703.185	1.1618	0.5320
270	710.520	1.1833	0.6147	280	711.326	1.1729	0.5461
280	718.225	1.1937	0.6296	290	719.259	1.1836	0.5598
290	725.772	1.2039	0.6443	300	727.016	1.1938	0.5732
Saturation t = 200 F, p = 794.385 psia				Saturation t = 210 F, p = 997.640 psia			
Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb	Temp. °F	Enthalpy Btu/lb	Entropy Btu/lb-R	Sp. Vol. ft <sup>3</sup> /lb
200	616.686	1.0265	0.3387	210	611.081	1.0099	0.2938
210	631.388	1.0486	0.3612	220	627.368	1.0340	0.3161
220	644.180	1.0676	0.3810	230	641.199	1.0542	0.3352
230	655.712	1.0844	0.3989	240	653.493	1.0719	0.3523
240	666.346	1.0997	0.4154	250	664.726	1.0879	0.3679
250	676.308	1.1139	0.4310	260	675.179	1.1025	0.3825
260	685.747	1.1271	0.4457	270	685.035	1.1161	0.3963
270	694.770	1.1395	0.4598	280	694.420	1.1289	0.4094
280	703.456	1.1514	0.4733	290	703.426	1.1410	0.4220
290	711.864	1.1627	0.4864	300	712.121	1.1525	0.4341
300	720.040	1.1735	0.4990	310	720.557	1.1635	0.4458
310	728.021	1.1839	0.5113	320	728.776	1.1741	0.4571

## Ammonia Liquid and Vapor Properties — IP Units

Based on software REFPROP Version 7.0 (NIST 2002) where the equations and constants for ammonia originate from Tillner-Roth, R., Harms-Watzenburg, F., and Baehr, H.D., (1993), Eine neue Fundamentalgleichung fure Ammoniak, DVK-Tagungsbericht, Vol. 20, pp167–181 (1993). Enthalpy reference: 0 Btu/lb of saturated liquid at  $-40^{\circ}\text{F}$ . Entropy reference: 0 Btu/(lb-R) of saturated liquid at  $-40^{\circ}\text{F}$ . (Note: temperatures greater than  $800^{\circ}\text{F}$  are extrapolated.)

**Table A-3 Ammonia Liquid and Vapor Properties — IP Units**

Pressure 28 in. Hg vac. (0.943 psia)				Pressure 27 in. Hg vac. (1.434 psia)				Pressure 26 in. Hg vac. (1.925 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-106.30	0.021882	-68.35	-0.1770	-100	0.0219938	-61.99	-0.1592	-100	0.0219938	-61.9923	-0.159224
				-96.4701	0.0220578	-58.42	-0.1493	-90	0.0221773	-51.8541	-0.131422
-106.30	235.08	569.43	1.6278	-96.4701	158.66	573.83	1.5915	-89.18	0.0221927	-51.0218	-0.129173
-100	239.37	572.537	1.6365	-90	161.57	577.04	1.6002	-89.18	120.41	577.05	1.5661
-90	246.16	577.4490	1.6500	-80	166.05	581.99	1.6134	-80	123.50	581.63	1.5783
-80	252.93	582.3460	1.6631	-70	170.53	586.92	1.6262	-70	126.85	586.60	1.5912
-70	259.69	587.2330	1.6758	-60	174.99	591.83	1.6387	-60	130.19	591.55	1.6038
-60	266.43	592.1130	1.6882	-50	179.44	596.74	1.6508	-50	133.52	596.49	1.6160
-50	273.17	596.9910	1.7002	-40	183.88	601.64	1.6626	-40	136.84	601.42	1.6279
-40	279.90	601.8700	1.7120	-30	188.32	606.55	1.6742	-30	140.16	606.34	1.6395
-30	286.63	606.7500	1.7235	-20	192.75	611.45	1.6855	-20	143.47	611.27	1.6508
-20	293.35	611.6360	1.7347	-10	197.18	616.36	1.6965	-10	146.78	616.19	1.6619
-10	300.07	616.5280	1.7457	0	201.60	621.27	1.7073	0	150.08	621.12	1.6727
0	306.78	621.4280	1.7565	10	206.03	626.20	1.7179	10	153.38	626.06	1.6833
10	313.49	626.3380	1.7671	20	210.44	631.13	1.7283	20	156.68	631.00	1.6937
20	320.19	631.259	1.7774	30	214.86	636.07	1.7385	30	159.98	635.95	1.7040
30	326.90	636.192	1.7876	40	219.27	641.03	1.7485	40	163.27	640.92	1.7140
40	333.60	641.138	1.7976	50	223.69	646.00	1.7584	50	166.56	645.89	1.7238
50	340.30	646.099	1.8074	60	228.10	650.98	1.7680	60	169.85	650.88	1.7335
60	347.00	651.0750	1.8171	70	232.51	655.98	1.7776	70	173.14	655.89	1.7431
70	353.70	656.0670	1.8266	80	236.91	660.99	1.7870	80	176.42	660.91	1.7525
80	360.39	661.0760	1.8360	90	241.32	666.02	1.7962	90	179.71	665.94	1.7617
90	367.09	666.1030	1.8452	100	245.73	671.07	1.8053	100	183.00	671.00	1.7708
100	373.78	671.1480	1.8543	110	250.13	676.14	1.8143	110	186.28	676.07	1.7798
110	380.47	676.2120	1.8633	120	254.53	681.23	1.8231	120	189.56	681.16	1.7887
120	387.17	681.2950	1.8721	130	258.94	686.34	1.8319	130	192.85	686.27	1.7974
130	393.86	686.3990	1.8808	140	263.34	691.46	1.8405	140	196.13	691.40	1.8060
140	400.55	691.5230	1.8895	150	267.74	696.61	1.8490	150	199.41	696.55	1.8146
150	407.24	696.6690	1.8980	160	272.14	701.78	1.8574	160	202.69	701.73	1.8230
160	413.93	701.8360	1.9064	170	276.55	706.97	1.8657	170	205.97	706.92	1.8313
170	420.62	707.0250	1.9147	180	280.95	712.19	1.8739	180	209.25	712.14	1.8395
180	427.31	712.237	1.9229	190	285.35	717.43	1.8821	190	212.53	717.38	1.8476
190	433.99	717.472	1.9310	200	289.75	722.69	1.8901	200	215.81	722.64	1.8557
200	440.68	722.73	1.9391	220	298.55	733.28	1.9059	220	222.37	733.24	1.8715
220	454.06	733.319	1.9549	240	307.34	743.97	1.9214	240	228.92	743.93	1.8870
240	467.43	744.005	1.9704	260	316.14	754.76	1.9366	260	235.48	754.72	1.9022
260	485.44	754.793	1.9867	280	324.94	765.65	1.9515	280	242.03	765.62	1.9172
280	494.18	765.682	2.0005	300	333.73	776.65	1.9662	300	248.59	776.62	1.9318
300	512.44	776.677	2.0163	320	342.53	787.75	1.9806	320	255.14	787.72	1.9463
320	520.92	787.779	2.0296	340	351.32	798.96	1.9948	340	261.69	798.94	1.9605
340	539.44	798.99	2.0449	360	360.12	810.29	2.0088	360	268.24	810.26	1.9744
360	547.66	810.311	2.0578	380	368.91	821.72	2.0226	380	274.80	821.70	1.9882
380	566.44	821.744	2.0727	400	377.70	833.27	2.0362	400	281.35	833.25	2.0018
400	574.40	833.29	2.0851	450	399.68	862.64	2.0694	450	297.72	862.62	2.0350
450	613.68	862.661	2.1195	500	421.66	892.75	2.1016	500	314.10	892.73	2.0672
500	641.24	892.764	2.1505	550	443.64	923.60	2.1330	550	330.47	923.58	2.0986
550	674.66	923.614	2.1819	600	465.62	955.21	2.1635	600	346.85	955.19	2.1291
600	708.07	955.22	2.2124	650	487.59	987.58	2.1934	650	363.22	987.57	2.1590
650	741.49	987.59	2.2423	700	509.57	1020.72	2.2226	700	379.59	1020.71	2.1882
700	774.91	1020.73	2.2715	750	531.55	1054.63	2.2512	750	395.96	1054.62	2.2168
750	808.32	1054.64	2.3001	800	553.52	1089.31	2.2793	800	412.33	1089.30	2.2449
800	841.74	1089.32	2.3282	850	575.50	1124.76	2.3069	850	428.70	1124.76	2.2725
850	875.15	1124.77	2.3558	900	597.47	1160.99	2.3340	900	445.07	1160.98	2.2997
900	908.57	1160.99	2.3829								

(Continued on next page)

**Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued**

Pressure 24 in. Hg vac. (2.908 psia)				Pressure 22 in. Hg vac. (3.890 psia)				Pressure 20 in. Hg vac. (4.872 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021994	-61.9895	-0.1592	-100	0.021994	-61.99	-0.1592	-100	0.021994	-61.9838	-0.159234
-90	0.02218	-51.8513	-0.1314	-90	0.022177	-51.85	-0.1314	-90	0.022177	-51.8458	-0.131432
-80	0.02237	-41.6363	-0.1042	-80	0.022368	-41.63	-0.1042	-80	0.022368	-41.6309	-0.104167
-78.39	0.02240	-39.9882	-0.0998	-70.34	0.022560	-31.70	-0.0783	-70	0.022567	-31.34	-0.0774
-78.39	81.842	581.72	1.5308	-70.34	62.348	585.14	1.5061	-63.84	0.022693	-24.9647	-0.0612
-70	83.726	585.96	1.5418	-70	62.406	585.32	1.5065	-63.84	50.519	587.86	1.4870
-60	85.960	590.99	1.5545	-60	64.094	590.41	1.5194	-60	51.042	589.84	1.4920
-50	88.184	595.98	1.5669	-50	65.772	595.47	1.5319	-50	52.394	594.96	1.5047
-40	90.402	600.96	1.5789	-40	67.443	600.51	1.5441	-40	53.738	600.04	1.5169
-30	92.613	605.93	1.5906	-30	69.107	605.52	1.5559	-30	55.077	605.10	1.5288
-20	94.818	610.89	1.6020	-20	70.766	610.52	1.5674	-20	56.409	610.14	1.5404
-10	97.019	615.85	1.6131	-10	72.420	615.51	1.5786	-10	57.737	615.17	1.5517
0	99.216	620.81	1.6240	0	74.070	620.50	1.5896	0	59.061	620.19	1.5628
10	101.41	625.77	1.6347	10	75.718	625.49	1.6003	10	60.382	625.20	1.5736
20	103.60	630.74	1.6452	20	77.362	630.47	1.6108	20	61.700	630.21	1.5841
30	105.79	635.71	1.6554	30	79.004	635.47	1.6211	30	63.015	635.22	1.5945
40	107.98	640.69	1.6655	40	80.643	640.47	1.6312	40	64.328	640.24	1.6046
50	110.16	645.68	1.6754	50	82.281	645.47	1.6411	50	65.639	645.27	1.6146
60	112.35	650.69	1.6851	60	83.917	650.49	1.6509	60	66.949	650.30	1.6243
70	114.53	655.70	1.6947	70	85.552	655.52	1.6605	70	68.257	655.34	1.6340
80	116.71	660.74	1.7041	80	87.185	660.57	1.6699	80	69.564	660.40	1.6434
90	118.89	665.78	1.7134	90	88.818	665.62	1.6792	90	70.870	665.46	1.6527
100	121.07	670.85	1.7225	100	90.449	670.70	1.6883	100	72.175	670.55	1.6619
110	123.24	675.93	1.7315	110	92.080	675.79	1.6974	110	73.479	675.64	1.6709
120	125.42	681.03	1.7404	120	93.709	680.89	1.7062	120	74.782	680.76	1.6798
130	127.60	686.15	1.7491	130	95.338	686.02	1.7150	130	76.085	685.89	1.6886
140	129.77	691.28	1.7578	140	96.967	691.16	1.7237	140	77.387	691.04	1.6973
150	131.95	696.44	1.7663	150	98.594	696.33	1.7322	150	78.688	696.21	1.7058
160	134.12	701.62	1.7747	160	100.22	701.51	1.7406	160	79.989	701.40	1.7142
170	136.29	706.82	1.7830	170	101.85	706.71	1.7490	170	81.289	706.61	1.7226
180	138.47	712.04	1.7913	180	103.48	711.94	1.7572	180	82.589	711.84	1.7308
190	140.64	717.28	1.7994	190	105.10	717.19	1.7653	190	83.888	717.09	1.7390
200	142.81	722.55	1.8074	200	106.73	722.46	1.7734	200	85.187	722.37	1.7470
220	147.16	733.15	1.8233	220	109.98	733.07	1.7892	220	87.785	732.99	1.7629
240	151.50	743.85	1.8388	240	113.23	743.78	1.8048	240	90.381	743.70	1.7784
260	155.84	754.65	1.8540	260	116.47	754.58	1.8200	260	92.976	754.51	1.7937
280	160.18	765.55	1.8689	280	119.72	765.49	1.8349	280	95.570	765.42	1.8086
300	164.52	776.55	1.8836	300	122.97	776.49	1.8496	300	98.164	776.43	1.8233
320	168.86	787.66	1.8981	320	126.21	787.61	1.8641	320	100.76	787.55	1.8377
340	173.20	798.88	1.9123	340	129.46	798.83	1.8783	340	103.35	798.78	1.8520
360	177.54	810.21	1.9263	360	132.70	810.16	1.8923	360	105.94	810.11	1.8660
380	181.88	821.65	1.9400	380	135.95	821.60	1.9061	380	108.53	821.55	1.8798
400	186.219	833.20	1.9536	400	139.19	833.16	1.9197	400	111.12	833.11	1.8934
450	197.063	862.58	1.9869	450	147.30	862.54	1.9529	450	117.60	862.51	1.9266
500	207.906	892.70	2.0191	500	155.41	892.66	1.9851	500	124.08	892.63	1.9588
550	218.747	923.55	2.0504	550	163.52	923.52	2.0165	550	130.55	923.49	1.9902
600	229.588	955.17	2.0810	600	171.62	955.14	2.0470	600	137.02	955.11	2.0207
650	240.427	987.54	2.1108	650	179.73	987.52	2.0769	650	143.49	987.49	2.0506
700	251.266	1020.68	2.1400	700	187.83	1020.66	2.1061	700	149.96	1020.64	2.0798
750	262.105	1054.60	2.1687	750	195.93	1054.58	2.1347	750	156.44	1054.56	2.1084
800	272.943	1089.28	2.1968	800	204.04	1089.26	2.1628	800	162.91	1089.25	2.1365
850	283.78	1124.74	2.2244	850	212.14	1124.72	2.1904	850	169.38	1124.71	2.1641
900	294.618	1160.96	2.2515	900	220.24	1160.95	2.2176	900	175.85	1160.93	2.1913

(Continued on next page)



Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued

Pressure 15 in. Hg vac. (7.328 psia)				Pressure 10 in. Hg vac. (9.784 psia)				Pressure 5 in. Hg vac. (12.240 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021993	-61.98	-0.1592	-100	0.021993	-61.97	-0.1593	-100	0.021993	-61.96	-0.1593
-90	0.022177	-51.84	-0.1314	-90	0.022177	-51.83	-0.1314	-90	0.022177	-51.83	-0.1315
-80	0.022368	-41.62	-0.1042	-80	0.022368	-41.62	-0.1042	-80	0.022368	-41.61	-0.1042
-70	0.022567	-31.33	-0.0774	-70	0.022566	-31.33	-0.0774	-70	0.022566	-31.32	-0.0774
-60	0.022773	-20.96	-0.0511	-60	0.022773	-20.96	-0.0512	-60	0.022773	-20.95	-0.0512
-51.40	0.022957	-11.99	-0.0289	-50	0.022987	-10.52	-0.0254	-50	0.022987	-10.51	-0.0254
				-42.04	0.023164	-2.15	-0.0051	-40	0.023210	0.00	0.0000
-51.40	34.501	592.92	1.4527					-34.43	0.023338	5.89	0.0139
-50	34.630	593.65	1.4545	-42.04	26.337	596.60	1.4285				
-40	35.542	598.88	1.4671	-40	26.479	597.69	1.4311				
-30	36.447	604.05	1.4793	-30	27.169	602.99	1.4436	-34.43	21.364	599.51	1.4099
-20	37.347	609.19	1.4911	-20	27.854	608.23	1.4557	-30	21.613	601.90	1.4155
-10	38.242	614.31	1.5026	-10	28.533	613.43	1.4674	-20	22.169	607.25	1.4278
0	39.133	619.40	1.5138	0	29.209	618.61	1.4788	-10	22.720	612.55	1.4397
10	40.021	624.48	1.5248	10	29.881	623.75	1.4898	0	23.267	617.80	1.4513
20	40.905	629.55	1.5354	20	30.550	628.88	1.5006	10	23.810	623.02	1.4625
30	41.787	634.61	1.5459	30	31.216	634.00	1.5112	20	24.350	628.21	1.4734
40	42.667	639.68	1.5561	40	31.881	639.11	1.5215	30	24.887	633.38	1.4841
50	43.545	644.74	1.5662	50	32.543	644.21	1.5316	40	25.422	638.53	1.4945
60	44.421	649.81	1.5760	60	33.203	649.32	1.5416	50	25.955	643.68	1.5047
70	45.296	654.88	1.5857	70	33.862	654.42	1.5513	60	26.487	648.82	1.5147
80	46.170	659.97	1.5952	80	34.520	659.54	1.5609	70	27.017	653.96	1.5245
90	47.042	665.06	1.6045	90	35.177	664.66	1.5703	80	27.546	659.11	1.5341
100	47.914	670.17	1.6137	100	35.833	669.79	1.5795	90	28.073	664.25	1.5436
110	48.784	675.29	1.6228	110	36.487	674.93	1.5886	100	28.599	669.41	1.5529
120	49.654	680.42	1.6318	120	37.141	680.09	1.5976	110	29.125	674.57	1.5620
130	50.523	685.57	1.6406	130	37.794	685.25	1.6064	120	29.650	679.75	1.5710
140	51.392	690.74	1.6492	140	38.447	690.44	1.6151	130	30.174	684.93	1.5799
150	52.259	695.92	1.6578	150	39.099	695.64	1.6237	140	30.697	690.13	1.5886
160	53.127	701.13	1.6663	160	39.750	700.85	1.6322	150	31.220	695.35	1.5973
170	53.993	706.35	1.6747	170	40.401	706.09	1.6406	160	31.742	700.58	1.6058
180	54.860	711.59	1.6829	180	41.052	711.35	1.6489	170	32.264	705.83	1.6142
190	55.726	716.86	1.6911	190	41.702	716.62	1.6571	180	32.785	711.10	1.6225
200	56.591	722.14	1.6991	200	42.352	721.92	1.6652	190	33.306	716.38	1.6307
220	58.322	732.78	1.7150	220	43.650	732.57	1.6811	200	33.826	721.69	1.6388
240	60.051	743.51	1.7306	240	44.948	743.32	1.6967	220	34.867	732.36	1.6547
260	61.779	754.33	1.7458	260	46.244	754.15	1.7119	240	35.905	743.12	1.6703
280	63.506	765.25	1.7608	280	47.540	765.09	1.7269	260	36.943	753.98	1.6856
300	65.233	776.28	1.7755	300	48.835	776.13	1.7416	280	37.981	764.92	1.7006
320	66.959	787.41	1.7900	320	50.129	787.26	1.7561	300	39.017	775.97	1.7154
340	68.684	798.64	1.8042	340	51.423	798.51	1.7704	320	40.053	787.12	1.7298
360	70.409	809.98	1.8182	360	52.716	809.86	1.7844	340	41.088	798.37	1.7441
380	72.134	821.44	1.8320	380	54.009	821.32	1.7982	360	42.123	809.73	1.7581
400	73.858	833.00	1.8456	400	55.301	832.89	1.8118	380	43.157	821.20	1.7720
450	78.167	862.41	1.8789	450	58.531	862.31	1.8451	400	44.191	832.78	1.7856
500	82.474	892.54	1.9111	500	61.759	892.46	1.8773	450	46.775	862.21	1.8189
550	86.781	923.42	1.9425	550	64.986	923.34	1.9087	500	49.357	892.37	1.8511
600	91.086	955.05	1.9731	600	68.212	954.98	1.9393	550	51.938	923.27	1.8825
650	95.390	987.43	2.0029	650	71.437	987.37	1.9691	600	54.517	954.91	1.9131
700	99.694	1020.59	2.0321	700	74.662	1020.53	1.9984	650	57.096	987.31	1.9430
750	104.00	1054.51	2.0608	750	77.886	1054.46	2.0270	700	59.675	1020.48	1.9722
800	108.30	1089.20	2.0889	800	81.109	1089.16	2.0551	750	62.253	1054.41	2.0008
850	112.60	1124.67	2.1165	850	84.332	1124.63	2.0827	800	64.830	1089.11	2.0290
900	116.91	1160.90	2.1436	900	87.555	1160.86	2.1099	850	67.407	1124.58	2.0566
								900	69.984	1160.82	2.0837

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**Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued**

Pressure 0 psig (14.696 psia)				Pressure 5 psig (19.696 psia)				Pressure 10 psig (24.696 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021993	-61.96	-0.1593	-100	0.021993	-61.94	-0.1593	-100	0.021992	-61.93	-0.1593
-90	0.022176	-51.82	-0.1315	-90	0.022176	-51.80	-0.1315	-90	0.022176	-51.79	-0.1315
-80	0.022367	-41.60	-0.1042	-80	0.022367	-41.59	-0.1042	-80	0.022367	-41.58	-0.1042
-70	0.022566	-31.31	-0.0774	-70	0.022566	-31.30	-0.0775	-70	0.022565	-31.28	-0.0775
-60	0.022772	-20.94	-0.0512	-60	0.022772	-20.93	-0.0512	-60	0.022772	-20.92	-0.0512
-50	0.022987	-10.50	-0.0254	-50	0.022986	-10.49	-0.0254	-50	0.022986	-10.48	-0.0254
-40	0.023210	0.01	0.0000	-40	0.023209	0.02	0.0000	-40	0.023209	0.04	-0.0001
-30	0.023441	10.59	0.0249	-30	0.023440	10.61	0.0249	-30	0.023440	10.62	0.0249
-27.99	0.023489	12.73	0.0299	-20	0.023680	21.26	0.0494	-20	0.023680	21.27	0.0494
				-17.19	0.023750	24.26	0.0562	-10	0.023929	31.98	0.0735
-27.99	18.007	601.90	1.3947					-8.41	0.023970	33.69	0.0773
-20	18.383	606.26	1.4047	-17.19	13.692	605.78	1.3704				
-10	18.849	611.65	1.4168	-10	13.949	609.79	1.3794	-8.41	11.077	608.79	1.3517
0	19.310	616.99	1.4286	0	14.302	615.30	1.3915	0	11.321	613.58	1.3622
10	19.767	622.28	1.4399	10	14.652	620.74	1.4032	10	11.606	619.17	1.3742
20	20.222	627.53	1.4510	20	14.998	626.12	1.4146	20	11.888	624.70	1.3859
30	20.673	632.75	1.4618	30	15.341	631.46	1.4256	30	12.167	630.15	1.3971
40	21.122	637.96	1.4723	40	15.682	636.77	1.4363	40	12.443	635.56	1.4081
50	21.570	643.14	1.4826	50	16.020	642.05	1.4468	50	12.717	640.93	1.4187
60	22.015	648.32	1.4927	60	16.357	647.30	1.4570	60	12.990	646.27	1.4291
70	22.459	653.50	1.5025	70	16.693	652.55	1.4670	70	13.261	651.59	1.4392
80	22.902	658.67	1.5122	80	17.027	657.78	1.4768	80	13.530	656.89	1.4491
90	23.343	663.85	1.5217	90	17.359	663.02	1.4864	90	13.798	662.18	1.4588
100	23.784	669.03	1.5310	100	17.691	668.25	1.4958	100	14.065	667.46	1.4684
110	24.223	674.21	1.5402	110	18.022	673.48	1.5051	110	14.331	672.74	1.4777
120	24.662	679.41	1.5493	120	18.352	678.71	1.5142	120	14.597	678.02	1.4869
130	25.100	684.61	1.5582	130	18.681	683.96	1.5232	130	14.861	683.30	1.4959
140	25.537	689.83	1.5669	140	19.010	689.21	1.5320	140	15.125	688.58	1.5048
150	25.974	695.06	1.5756	150	19.338	694.47	1.5407	150	15.388	693.88	1.5136
160	26.410	700.31	1.5841	160	19.665	699.75	1.5493	160	15.651	699.18	1.5222
170	26.846	705.57	1.5925	170	19.992	705.04	1.5577	170	15.913	704.50	1.5307
180	27.281	710.85	1.6009	180	20.318	710.34	1.5661	180	16.175	709.83	1.5391
190	27.716	716.15	1.6091	190	20.644	715.66	1.5744	190	16.436	715.17	1.5474
200	28.151	721.46	1.6172	200	20.970	721.00	1.5825	200	16.697	720.53	1.5556
220	29.019	732.15	1.6332	220	21.620	731.73	1.5985	220	17.218	731.30	1.5717
240	29.886	742.93	1.6488	240	22.269	742.54	1.6142	240	17.737	742.15	1.5874
260	30.752	753.80	1.6641	260	22.918	753.44	1.6296	260	18.256	753.07	1.6028
280	31.617	764.76	1.6791	280	23.565	764.42	1.6446	280	18.774	764.09	1.6179
300	32.481	775.82	1.6939	300	24.212	775.50	1.6594	300	19.291	775.19	1.6327
320	33.345	786.98	1.7084	320	24.858	786.68	1.6739	320	19.807	786.39	1.6473
340	34.208	798.24	1.7226	340	25.503	797.96	1.6882	340	20.323	797.69	1.6616
360	35.071	809.61	1.7367	360	26.148	809.35	1.7023	360	20.839	809.09	1.6757
380	35.933	821.08	1.7505	380	26.793	820.84	1.7161	380	21.354	820.60	1.6895
400	36.795	832.66	1.7641	400	27.437	832.44	1.7298	400	21.869	832.21	1.7032
450	38.948	862.12	1.7974	450	29.046	861.92	1.7631	450	23.154	861.72	1.7366
500	41.100	892.29	1.8297	500	30.654	892.11	1.7954	500	24.438	891.94	1.7689
550	43.251	923.19	1.8611	550	32.260	923.04	1.8268	550	25.720	922.88	1.8003
600	45.400	954.84	1.8917	600	33.866	954.71	1.8574	600	27.002	954.57	1.8309
650	47.549	987.25	1.9216	650	35.470	987.13	1.8873	650	28.282	987.01	1.8609
700	49.697	1020.42	1.9508	700	37.074	1020.31	1.9166	700	29.562	1020.20	1.8901
750	51.845	1054.36	1.9795	750	38.677	1054.26	1.9452	750	30.842	1054.16	1.9188
800	53.992	1089.07	2.0076	800	40.280	1088.98	1.9734	800	32.121	1088.89	1.9469
850	56.139	1124.54	2.0352	850	41.883	1124.46	2.0010	850	33.400	1124.38	1.9745
900	58.285	1160.79	2.0624	900	43.485	1160.71	2.0281	900	34.678	1160.64	2.0017

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Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued

Pressure 20 psig (34.696 psia)				Pressure 30 psig (44.696 psia)				Pressure 40 psig (54.696 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021992	-61.90	-0.1593	-100	0.021991	-61.87	-0.1594	-100	0.021990	-61.84	-0.1594
-90	0.022175	-51.76	-0.1315	-90	0.022174	-51.73	-0.1316	-90	0.022173	-51.71	-0.1316
-80	0.022366	-41.55	-0.1043	-80	0.022365	-41.52	-0.1043	-80	0.022364	-41.49	-0.1043
-70	0.022564	-31.26	-0.0775	-70	0.022563	-31.23	-0.0776	-70	0.022563	-31.20	-0.0776
-60	0.022771	-20.89	-0.0513	-60	0.022770	-20.86	-0.0513	-60	0.022769	-20.84	-0.0513
-50	0.022985	-10.45	-0.0255	-50	0.022984	-10.42	-0.0255	-50	0.022983	-10.40	-0.0255
-40	0.023208	0.06	-0.0001	-40	0.023206	0.09	-0.0001	-40	0.023205	0.11	-0.0002
-30	0.023439	10.64	0.0248	-30	0.023437	10.67	0.0248	-30	0.023436	10.69	0.0247
-20	0.023679	21.29	0.0493	-20	0.023677	21.32	0.0493	-20	0.023676	21.34	0.0492
-10	0.023928	32.01	0.0734	-10	0.023926	32.03	0.0734	-10	0.023925	32.05	0.0733
0	0.024187	42.79	0.0971	0	0.024185	42.81	0.0971	0	0.024184	42.83	0.0970
5.55	0.024335	48.80	0.1101	10	0.024455	53.66	0.1204	10	0.024453	53.68	0.1204
				16.60	0.024639	60.85	0.1356	20	0.024734	64.59	0.1434
5.55	8.050	613.30	1.3236	16.60	6.342	616.62	1.3026	25.84	0.024903	71.00	0.1566
10	8.145	615.94	1.3292	20	6.400	618.69	1.3069	30	5.299	621.80	1.2911
20	8.355	621.75	1.3414	30	6.567	624.69	1.3193	40	5.439	627.93	1.3035
30	8.561	627.47	1.3532	40	6.731	630.56	1.3311	50	5.575	633.93	1.3154
40	8.765	633.10	1.3646	50	6.892	636.33	1.3426	60	5.709	639.81	1.3268
50	8.966	638.66	1.3756	60	7.051	642.02	1.3536	70	5.841	645.61	1.3379
60	9.166	644.17	1.3863	70	7.209	647.64	1.3644	80	5.972	651.33	1.3486
70	9.363	649.64	1.3968	80	7.365	653.22	1.3748	90	6.101	656.99	1.3590
80	9.559	655.07	1.4069	90	7.519	658.75	1.3849	100	6.228	662.61	1.3691
90	9.754	660.48	1.4169	100	7.672	664.25	1.3949	110	6.355	668.19	1.3790
100	9.948	665.87	1.4266	110	7.825	669.73	1.4045	120	6.481	673.74	1.3886
110	10.141	671.24	1.4361	120	7.976	675.18	1.4140	130	6.606	679.26	1.3981
120	10.333	676.61	1.4454	130	8.127	680.62	1.4233	140	6.730	684.77	1.4073
130	10.524	681.97	1.4546	140	8.277	686.06	1.4325	150	6.854	690.27	1.4164
140	10.714	687.33	1.4636	150	8.426	691.48	1.4415	160	6.977	695.76	1.4254
150	10.904	692.69	1.4725	160	8.574	696.91	1.4503	170	7.099	701.25	1.4341
160	11.093	698.05	1.4812	170	8.722	702.34	1.4590	180	7.221	706.73	1.4428
170	11.282	703.42	1.4898	180	8.870	707.77	1.4675	190	7.342	712.22	1.4513
180	11.470	708.80	1.4983	190	9.017	713.21	1.4760	200	7.463	717.71	1.4597
190	11.658	714.19	1.5066	200	9.164	718.66	1.4843	220	7.705	728.72	1.4761
200	11.845	719.60	1.5149	220	9.457	729.59	1.5006	240	7.944	739.77	1.4922
220	12.219	730.45	1.5311	240	9.748	740.57	1.5165	260	8.183	750.88	1.5078
240	12.592	741.36	1.5469	260	10.039	751.61	1.5321	280	8.421	762.05	1.5231
260	12.963	752.35	1.5624	280	10.328	762.73	1.5473	300	8.659	773.30	1.5381
280	13.334	763.41	1.5776	300	10.617	773.93	1.5623	320	8.895	784.63	1.5528
300	13.704	774.56	1.5924	320	10.905	785.22	1.5769	340	9.132	796.04	1.5673
320	14.073	785.80	1.6070	340	11.193	796.59	1.5914	360	9.367	807.54	1.5815
340	14.442	797.14	1.6214	360	11.480	808.06	1.6055	380	9.602	819.14	1.5955
360	14.811	808.57	1.6355	380	11.767	819.63	1.6195	400	9.837	830.83	1.6092
380	15.179	820.11	1.6494	400	12.053	831.29	1.6332	450	10.423	860.53	1.6428
400	15.546	831.75	1.6631	450	12.768	860.92	1.6667	500	11.007	890.89	1.6753
450	16.464	861.32	1.6966	500	13.480	891.24	1.6991	550	11.589	921.96	1.7069
500	17.380	891.59	1.7289	550	14.192	922.27	1.7306	600	12.171	953.74	1.7376
550	18.295	922.57	1.7604	600	14.903	954.02	1.7613	650	12.752	986.27	1.7676
600	19.209	954.29	1.7911	650	15.612	986.51	1.7913	700	13.332	1019.54	1.7969
650	20.121	986.76	1.8210	700	16.322	1019.76	1.8206	750	13.912	1053.56	1.8256
700	21.034	1019.98	1.8503	750	17.030	1053.76	1.8493	800	14.491	1088.34	1.8538
750	21.946	1053.96	1.8790	800	17.738	1088.52	1.8775	850	15.070	1123.88	1.8815
800	22.857	1088.71	1.9071	850	18.446	1124.05	1.9051	900	15.649	1160.18	1.9087
850	23.768	1124.21	1.9348	900	19.154	1160.33	1.9323				
900	24.679	1160.49	1.9619								

(Continued on next page)

**Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued**

Pressure 60 psig (74.696 psia)				Pressure 80 psig (94.696 psia)				Pressure 100 psig (114.70 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021989	-61.78	-0.1595	-100	0.021987	-61.73	-0.1595	-100	0.021986	-61.67	-0.1596
-90	0.022172	-51.65	-0.1317	-90	0.022170	-51.59	-0.1317	-90	0.022169	-51.54	-0.1318
-80	0.022363	-41.44	-0.1044	-80	0.022361	-41.38	-0.1045	-80	0.022359	-41.33	-0.1046
-70	0.022561	-31.15	-0.0777	-70	0.022559	-31.09	-0.0777	-70	0.022557	-31.04	-0.0778
-60	0.022767	-20.78	-0.0514	-60	0.022765	-20.73	-0.0515	-60	0.022763	-20.68	-0.0516
-50	0.022981	-10.35	-0.0256	-50	0.022979	-10.29	-0.0257	-50	0.022977	-10.24	-0.0258
-40	0.023203	0.16	-0.0003	-40	0.023201	0.21	-0.0004	-40	0.023199	0.26	-0.0004
-30	0.023434	10.74	0.0246	-30	0.023432	10.79	0.0246	-30	0.023429	10.84	0.0245
-20	0.023674	21.39	0.0491	-20	0.023671	21.44	0.0490	-20	0.023669	21.48	0.0490
-10	0.023922	32.10	0.0732	-10	0.023920	32.15	0.0731	-10	0.023917	32.19	0.0730
0	0.024181	42.88	0.0969	0	0.024178	42.92	0.0968	0	0.024175	42.97	0.0967
10	0.024450	53.72	0.1203	10	0.024447	53.76	0.1202	10	0.024444	53.81	0.1201
20	0.024730	64.63	0.1433	20	0.024727	64.67	0.1431	20	0.024723	64.71	0.1430
30	0.025023	75.61	0.1659	30	0.025019	75.65	0.1658	30	0.025015	75.69	0.1657
40	0.025328	86.67	0.1883	40	0.025324	86.70	0.1881	40	0.025320	86.74	0.1880
40.93	0.025357	87.70	0.1903	50	0.025643	97.84	0.2102	50	0.025639	97.87	0.2101
				53.14	0.025746	101.35	0.2171	60	0.025973	109.09	0.2319
40.93	3.8984	623.02	1.2597					63.49	0.026094	113.02	0.2394
50	3.9956	628.91	1.2714	53.14	3.1076	625.73	1.2397				
60	4.1001	635.23	1.2836	60	3.1678	630.39	1.2487	63.49	2.5844	627.74	1.2233
70	4.2024	641.40	1.2954	70	3.2535	636.98	1.2612	70	2.6332	632.32	1.2320
80	4.3029	647.44	1.3067	80	3.3370	643.38	1.2732	80	2.7061	639.14	1.2447
90	4.4017	653.39	1.3176	90	3.4188	649.64	1.2847	90	2.7771	645.74	1.2569
100	4.4992	659.25	1.3282	100	3.4990	655.78	1.2958	100	2.8463	652.18	1.2685
110	4.5955	665.05	1.3384	110	3.5780	661.82	1.3065	110	2.9142	658.48	1.2796
120	4.6908	670.80	1.3484	120	3.6558	667.77	1.3168	120	2.9808	664.67	1.2904
130	4.7851	676.50	1.3582	130	3.7327	673.67	1.3269	130	3.0464	670.76	1.3008
140	4.8787	682.17	1.3677	140	3.8087	679.50	1.3367	140	3.1111	676.78	1.3110
150	4.9716	687.81	1.3771	150	3.8840	685.30	1.3463	150	3.1750	682.74	1.3208
160	5.0639	693.43	1.3862	160	3.9586	691.06	1.3557	160	3.2382	688.64	1.3304
170	5.1556	699.03	1.3952	170	4.0326	696.79	1.3649	170	3.3008	694.50	1.3398
180	5.2467	704.63	1.4040	180	4.1061	702.50	1.3738	180	3.3628	700.33	1.3490
190	5.3375	710.22	1.4127	190	4.1791	708.19	1.3827	190	3.4243	706.13	1.3580
200	5.4278	715.80	1.4212	200	4.2518	713.87	1.3914	200	3.4854	711.92	1.3668
220	5.6074	726.98	1.4379	220	4.3958	725.22	1.4083	220	3.6065	723.44	1.3840
240	5.7857	738.17	1.4541	240	4.5387	736.56	1.4247	240	3.7262	734.93	1.4007
260	5.9630	749.40	1.4699	260	4.6804	747.92	1.4408	260	3.8448	746.42	1.4169
280	6.1395	760.69	1.4854	280	4.8213	759.31	1.4564	280	3.9626	757.92	1.4326
300	6.3151	772.03	1.5005	300	4.9614	770.75	1.4716	300	4.0795	769.46	1.4480
320	6.4901	783.44	1.5154	320	5.1008	782.25	1.4866	320	4.1957	781.05	1.4631
340	6.6646	794.93	1.5299	340	5.2396	793.82	1.5012	340	4.3114	792.70	1.4778
360	6.8385	806.50	1.5442	360	5.3779	805.46	1.5156	360	4.4265	804.41	1.4923
380	7.0120	818.16	1.5583	380	5.5158	817.18	1.5297	380	4.5413	816.20	1.5065
400	7.1851	829.92	1.5721	400	5.6534	828.99	1.5436	400	4.6556	828.07	1.5205
450	7.6165	859.73	1.6058	450	5.9957	858.93	1.5775	450	4.9399	858.13	1.5545
500	8.0463	890.19	1.6384	500	6.3364	889.49	1.6102	500	5.2226	888.79	1.5873
550	8.4748	921.34	1.6700	550	6.6758	920.72	1.6419	550	5.5040	920.10	1.6191
600	8.9023	953.19	1.7008	600	7.0142	952.64	1.6728	600	5.7844	952.09	1.6500
650	9.3290	985.77	1.7309	650	7.3519	985.28	1.7028	650	6.0640	984.79	1.6801
700	9.7550	1019.09	1.7602	700	7.6888	1018.65	1.7323	700	6.3430	1018.20	1.7096
750	10.1806	1053.16	1.7890	750	8.0253	1052.76	1.7611	750	6.6214	1052.36	1.7384
800	10.6056	1087.98	1.8172	800	8.3612	1087.61	1.7893	800	6.8993	1087.25	1.7667
850	11.0303	1123.55	1.8449	850	8.6968	1123.22	1.8170	850	7.1769	1122.89	1.7944
900	11.4547	1159.88	1.8721	900	9.0321	1159.58	1.8442	900	7.4542	1159.28	1.8217

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Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued

Pressure 125 psig (139.70 psia)				Pressure 150 psig (164.70 psia)				Pressure 175 psig (189.70 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021984	-61.60	-0.1597	-100	0.021983	-61.52	-0.1598	-100	0.021981	-61.45	-0.1598
-90	0.022167	-51.46	-0.1319	-90	0.022165	-51.39	-0.1320	-90	0.022163	-51.32	-0.1321
-80	0.022357	-41.26	-0.1047	-80	0.022355	-41.19	-0.1047	-80	0.022353	-41.12	-0.1048
-70	0.022555	-30.97	-0.0779	-70	0.022553	-30.90	-0.0780	-70	0.022551	-30.84	-0.0781
-60	0.022761	-20.61	-0.0517	-60	0.022759	-20.55	-0.0518	-60	0.022756	-20.48	-0.0519
-50	0.022974	-10.18	-0.0259	-50	0.022972	-10.11	-0.0260	-50	0.022969	-10.05	-0.0261
-40	0.023196	0.33	-0.0005	-40	0.023194	0.39	-0.0006	-40	0.023191	0.46	-0.0008
-30	0.023426	10.90	0.0244	-30	0.023424	10.96	0.0243	-30	0.023421	11.03	0.0241
-20	0.023665	21.54	0.0488	-20	0.023662	21.60	0.0487	-20	0.023659	21.66	0.0486
-10	0.023914	32.25	0.0729	-10	0.023910	32.31	0.0728	-10	0.023907	32.37	0.0727
0	0.024172	43.02	0.0966	0	0.024168	43.08	0.0965	0	0.024164	43.14	0.0964
10	0.024440	53.86	0.1199	10	0.024436	53.91	0.1198	10	0.024432	53.97	0.1197
20	0.024719	64.77	0.1429	20	0.024715	64.82	0.1428	20	0.024711	64.87	0.1426
30	0.025010	75.74	0.1656	30	0.025006	75.79	0.1654	30	0.025001	75.84	0.1653
40	0.025315	86.79	0.1879	40	0.025310	86.83	0.1877	40	0.025304	86.88	0.1876
50	0.025633	97.91	0.2099	50	0.025628	97.95	0.2098	50	0.025622	98.00	0.2096
60	0.025967	109.12	0.2317	60	0.025961	109.16	0.2316	60	0.025955	109.20	0.2314
70	0.026319	120.43	0.2533	70	0.026312	120.47	0.2531	70	0.026306	120.50	0.2529
74.63	0.026488	125.71	0.2632	80	0.026683	131.87	0.2744	80	0.026675	131.90	0.2743
				84.34	0.026851	136.86	0.2837	90	0.027067	143.43	0.2954
74.63	2.1349	629.59	1.2063					92.99	0.027189	146.89	0.3017
80	2.1693	633.53	1.2136	84.34	1.8177	630.92	1.1918				
90	2.2315	640.64	1.2266	90	1.8495	635.22	1.1997	92.99	1.5815	631.87	1.1792
100	2.2919	647.50	1.2390	100	1.9041	642.57	1.2129	100	1.6168	637.37	1.1891
110	2.3506	654.16	1.2508	110	1.9567	649.64	1.2255	110	1.6654	644.91	1.2025
120	2.4079	660.66	1.2621	120	2.0079	656.50	1.2374	120	1.7122	652.16	1.2151
130	2.4642	667.03	1.2730	130	2.0578	663.17	1.2488	130	1.7576	659.16	1.2271
140	2.5194	673.29	1.2835	140	2.1065	669.69	1.2598	140	1.8018	665.98	1.2386
150	2.5737	679.46	1.2938	150	2.1544	676.10	1.2704	150	1.8450	672.63	1.2496
160	2.6274	685.56	1.3037	160	2.2014	682.40	1.2806	160	1.8872	679.16	1.2602
170	2.6803	691.59	1.3133	170	2.2478	688.62	1.2906	170	1.9288	685.58	1.2705
180	2.7327	697.58	1.3228	180	2.2935	694.77	1.3003	180	1.9697	691.90	1.2804
190	2.7846	703.52	1.3320	190	2.3387	700.87	1.3097	190	2.0100	698.16	1.2901
200	2.8360	709.43	1.3410	200	2.3833	706.91	1.3190	200	2.0497	704.35	1.2996
220	2.9375	721.18	1.3586	220	2.4714	718.90	1.3369	220	2.1280	716.58	1.3179
240	3.0378	732.87	1.3755	240	2.5581	730.79	1.3541	240	2.2047	728.68	1.3354
260	3.1368	744.53	1.3919	260	2.6436	742.62	1.3708	260	2.2803	740.69	1.3523
280	3.2350	756.18	1.4079	280	2.7282	754.42	1.3869	280	2.3548	752.64	1.3687
300	3.3323	767.85	1.4235	300	2.8119	766.22	1.4027	300	2.4285	764.57	1.3846
320	3.4289	779.55	1.4387	320	2.8949	778.03	1.4180	320	2.5015	776.50	1.4001
340	3.5250	791.29	1.4535	340	2.9773	789.88	1.4330	340	2.5739	788.46	1.4153
360	3.6205	803.10	1.4681	360	3.0591	801.77	1.4477	360	2.6457	800.44	1.4301
380	3.7156	814.96	1.4824	380	3.1406	813.72	1.4621	380	2.7170	812.48	1.4446
400	3.8103	826.91	1.4965	400	3.2216	825.74	1.4763	400	2.7880	824.57	1.4588
450	4.0455	857.12	1.5306	450	3.4226	856.11	1.5106	450	2.9639	855.10	1.4933
500	4.2791	887.91	1.5636	500	3.6220	887.02	1.5437	500	3.1380	886.14	1.5265
550	4.5113	919.32	1.5955	550	3.8200	918.54	1.5757	550	3.3109	917.76	1.5586
600	4.7426	951.40	1.6265	600	4.0171	950.71	1.6068	600	3.4827	950.01	1.5898
650	4.9731	984.17	1.6567	650	4.2133	983.55	1.6371	650	3.6538	982.93	1.6202
700	5.2029	1017.65	1.6862	700	4.4088	1017.09	1.6666	700	3.8241	1016.53	1.6498
750	5.4321	1051.85	1.7151	750	4.6039	1051.35	1.6956	750	3.9939	1050.85	1.6788
800	5.6609	1086.80	1.7434	800	4.7984	1086.34	1.7239	800	4.1633	1085.89	1.7071
850	5.8893	1122.48	1.7712	850	4.9926	1122.06	1.7517	850	4.3323	1121.65	1.7350
900	6.1174	1158.90	1.7985	900	5.1865	1158.53	1.7790	900	4.5009	1158.15	1.7623

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**Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued**

Pressure 200 psig (214.70 psia)				Pressure 225 psig (239.70 psia)				Pressure 250 psig (264.70 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021979	-61.38	-0.1599	-100	0.021977	-61.31	-0.1600	-100	0.021976	-61.24	-0.1601
-90	0.022162	-51.25	-0.1322	-90	0.022160	-51.18	-0.1322	-90	0.022158	-51.11	-0.1323
-80	0.022351	-41.05	-0.1049	-80	0.022349	-40.98	-0.1050	-80	0.022347	-40.91	-0.1051
-70	0.022549	-30.77	-0.0782	-70	0.022547	-30.70	-0.0783	-70	0.022544	-30.63	-0.0784
-60	0.022754	-20.41	-0.0520	-60	0.022752	-20.35	-0.0521	-60	0.022749	-20.28	-0.0521
-50	0.022967	-9.98	-0.0262	-50	0.022964	-9.92	-0.0263	-50	0.022962	-9.85	-0.0264
-40	0.023188	0.52	-0.0009	-40	0.023185	0.58	-0.0010	-40	0.023183	0.65	-0.0011
-30	0.023418	11.09	0.0240	-30	0.023415	11.15	0.0239	-30	0.023412	11.21	0.0238
-20	0.023656	21.72	0.0485	-20	0.023653	21.78	0.0484	-20	0.023650	21.84	0.0483
-10	0.023904	32.43	0.0726	-10	0.023900	32.48	0.0725	-10	0.023897	32.54	0.0723
0	0.024161	43.19	0.0962	0	0.024157	43.25	0.0961	0	0.024153	43.30	0.0960
10	0.024428	54.02	0.1196	10	0.024424	54.08	0.1194	10	0.024420	54.13	0.1193
20	0.024706	64.92	0.1425	20	0.024702	64.97	0.1424	20	0.024698	65.02	0.1423
30	0.024996	75.88	0.1651	30	0.024992	75.93	0.1650	30	0.024987	75.98	0.1649
40	0.025299	86.92	0.1875	40	0.025294	86.97	0.1873	40	0.025289	87.01	0.1872
50	0.025617	98.04	0.2095	50	0.025611	98.08	0.2093	50	0.025605	98.12	0.2092
60	0.025949	109.24	0.2312	60	0.025943	109.28	0.2311	60	0.025937	109.32	0.2309
70	0.026299	120.53	0.2528	70	0.026292	120.57	0.2526	70	0.026286	120.60	0.2524
80	0.026668	131.93	0.2741	80	0.026661	131.96	0.2739	80	0.026653	131.99	0.2737
90	0.027059	143.45	0.2952	90	0.027051	143.47	0.2950	90	0.027042	143.49	0.2949
100	0.027475	155.10	0.3162	100	0.027466	155.12	0.3160	100	0.027456	155.13	0.3158
100.81	0.027510	156.05	0.3179	107.97	0.027816	164.50	0.3327	110	0.027899	166.93	0.3367
100.81	1.3986	632.52	1.1681	107.97	1.2526	632.94	1.1579	114.58	0.028112	172.39	0.3463
110	1.4406	639.93	1.1812	110	1.2613	634.67	1.1610	114.58	1.1333	633.17	1.1487
120	1.4844	647.62	1.1946	120	1.3030	642.87	1.1753	120	1.1548	637.86	1.1568
130	1.5265	655.00	1.2072	130	1.3428	650.67	1.1886	130	1.1929	646.14	1.1710
140	1.5673	662.14	1.2192	140	1.3811	658.15	1.2012	140	1.2293	654.02	1.1842
150	1.6070	669.07	1.2306	150	1.4181	665.39	1.2131	150	1.2644	661.58	1.1967
160	1.6457	675.83	1.2417	160	1.4542	672.41	1.2246	160	1.2983	668.89	1.2086
170	1.6837	682.46	1.2523	170	1.4893	679.27	1.2356	170	1.3313	675.99	1.2200
180	1.7209	688.98	1.2625	180	1.5237	685.98	1.2461	180	1.3634	682.92	1.2309
190	1.7575	695.40	1.2725	190	1.5574	692.58	1.2564	190	1.3949	689.70	1.2414
200	1.7936	701.74	1.2822	200	1.5906	699.08	1.2663	200	1.4257	696.37	1.2516
220	1.8643	714.23	1.3008	220	1.6554	711.85	1.2854	220	1.4859	709.42	1.2711
240	1.9335	726.55	1.3187	240	1.7187	724.38	1.3035	240	1.5443	722.20	1.2896
260	2.0014	738.74	1.3359	260	1.7806	736.76	1.3210	260	1.6015	734.77	1.3074
280	2.0683	750.85	1.3525	280	1.8415	749.04	1.3378	280	1.6575	747.21	1.3244
300	2.1344	762.92	1.3686	300	1.9015	761.25	1.3541	300	1.7126	759.56	1.3409
320	2.1997	774.97	1.3842	320	1.9608	773.42	1.3699	320	1.7669	771.86	1.3569
340	2.2643	787.03	1.3995	340	2.0194	785.59	1.3853	340	1.8206	784.14	1.3724
360	2.3285	799.11	1.4144	360	2.0774	797.76	1.4004	360	1.8737	796.41	1.3876
380	2.3921	811.23	1.4290	380	2.1350	809.97	1.4151	380	1.9263	808.70	1.4024
400	2.4554	823.39	1.4433	400	2.1921	822.21	1.4295	400	1.9785	821.02	1.4169
450	2.6119	854.08	1.4780	450	2.3334	853.06	1.4644	450	2.1075	852.04	1.4520
500	2.7668	885.25	1.5114	500	2.4730	884.36	1.4979	500	2.2347	883.47	1.4856
550	2.9204	916.98	1.5436	550	2.6113	916.20	1.5302	550	2.3606	915.41	1.5180
600	3.0729	949.32	1.5749	600	2.7485	948.62	1.5615	600	2.4854	947.93	1.5495
650	3.2246	982.31	1.6053	650	2.8849	981.69	1.5920	650	2.6094	981.07	1.5800
700	3.3756	1015.98	1.6350	700	3.0206	1015.42	1.6218	700	2.7327	1014.86	1.6098
750	3.5261	1050.35	1.6640	750	3.1558	1049.84	1.6508	750	2.8554	1049.34	1.6389
800	3.6761	1085.43	1.6924	800	3.2905	1084.97	1.6793	800	2.9777	1084.52	1.6674
850	3.8257	1121.24	1.7203	850	3.4248	1120.82	1.7072	850	3.0997	1120.41	1.6953
900	3.9750	1157.77	1.7477	900	3.5588	1157.39	1.7346	900	3.2213	1157.02	1.7228

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Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued

Pressure 300 psig (314.70 psia)				Pressure 350 psig (364.70 psia)				Pressure 400 psig (414.70 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021972	-61.09	-0.1603	-100	0.021969	-60.95	-0.1604	-100	0.021965	-60.80	-0.1606
-90	0.022154	-50.97	-0.1325	-90	0.022150	-50.83	-0.1327	-90	0.022147	-50.69	-0.1328
-80	0.022343	-40.77	-0.1053	-80	0.022339	-40.63	-0.1055	-80	0.022335	-40.49	-0.1056
-70	0.022540	-30.50	-0.0786	-70	0.022536	-30.36	-0.0788	-70	0.022532	-30.22	-0.0789
-60	0.022745	-20.15	-0.0523	-60	0.022740	-20.01	-0.0525	-60	0.022735	-19.88	-0.0527
-50	0.022957	-9.72	-0.0266	-50	0.022952	-9.59	-0.0268	-50	0.022947	-9.46	-0.0270
-40	0.023177	0.77	-0.0013	-40	0.023172	0.90	-0.0015	-40	0.023167	1.03	-0.0017
-30	0.023406	11.34	0.0236	-30	0.023400	11.46	0.0234	-30	0.023395	11.58	0.0232
-20	0.023644	21.96	0.0481	-20	0.023637	22.09	0.0478	-20	0.023631	22.21	0.0476
-10	0.023890	32.66	0.0721	-10	0.023883	32.78	0.0719	-10	0.023877	32.89	0.0716
0	0.024146	43.42	0.0958	0	0.024139	43.53	0.0955	0	0.024132	43.64	0.0953
10	0.024412	54.24	0.1191	10	0.024405	54.35	0.1188	10	0.024397	54.45	0.1186
20	0.024689	65.12	0.1420	20	0.024681	65.23	0.1417	20	0.024672	65.33	0.1415
30	0.024978	76.08	0.1646	30	0.024969	76.18	0.1643	30	0.024960	76.27	0.1640
40	0.025279	87.10	0.1869	40	0.025269	87.20	0.1866	40	0.025259	87.29	0.1863
50	0.025594	98.21	0.2089	50	0.025584	98.29	0.2086	50	0.025573	98.38	0.2083
60	0.025925	109.39	0.2306	60	0.025913	109.47	0.2303	60	0.025901	109.55	0.2300
70	0.026272	120.67	0.2521	70	0.026259	120.74	0.2518	70	0.026246	120.81	0.2515
80	0.026639	132.05	0.2734	80	0.026624	132.11	0.2730	80	0.026609	132.17	0.2727
90	0.027026	143.54	0.2945	90	0.027010	143.59	0.2941	90	0.026994	143.64	0.2938
100	0.027438	155.17	0.3155	100	0.027420	155.20	0.3151	100	0.027402	155.24	0.3147
110	0.027878	166.94	0.3363	110	0.027857	166.96	0.3359	110	0.027837	166.98	0.3355
120	0.028350	178.90	0.3571	120	0.028327	178.90	0.3567	120	0.028304	178.90	0.3562
126.52	0.028679	186.80	0.3707	130	0.028835	191.03	0.3774	130	0.028808	191.01	0.3769
				137.10	0.029222	199.80	0.3922	140	0.029357	203.37	0.3977
126.52	0.94962	633.16	1.1321					146.65	0.029751	211.75	0.4116
130	0.96201	636.38	1.1376	137.10	0.81471	632.67	1.1175				
140	0.99617	645.21	1.1525	140	0.82413	635.50	1.1223	146.65	0.71123	631.80	1.1044
150	1.0286	653.55	1.1662	150	0.85526	644.83	1.1377	150	0.72132	635.24	1.1101
160	1.0596	661.50	1.1792	160	0.88462	653.58	1.1520	160	0.75000	645.01	1.1259
170	1.0895	669.16	1.1914	170	0.91259	661.89	1.1653	170	0.77691	654.12	1.1405
180	1.1184	676.56	1.2031	180	0.93942	669.85	1.1778	180	0.80244	662.74	1.1541
190	1.1465	683.76	1.2143	190	0.96531	677.53	1.1897	190	0.82686	670.97	1.1669
200	1.1739	690.79	1.2250	200	0.99041	684.98	1.2011	200	0.85036	678.89	1.1790
220	1.2271	704.46	1.2454	220	1.0387	699.33	1.2225	220	0.89518	694.00	1.2016
240	1.2784	717.73	1.2647	240	1.0849	713.14	1.2425	240	0.93773	708.41	1.2224
260	1.3282	730.72	1.2830	260	1.1296	726.57	1.2615	260	0.97857	722.32	1.2420
280	1.3769	743.50	1.3005	280	1.1730	739.73	1.2795	280	1.0181	735.87	1.2606
300	1.4246	756.15	1.3174	300	1.2154	752.69	1.2968	300	1.0565	749.16	1.2784
320	1.4715	768.71	1.3337	320	1.2569	765.52	1.3135	320	1.0940	762.27	1.2954
340	1.5177	781.21	1.3495	340	1.2978	778.25	1.3296	340	1.1308	775.25	1.3118
360	1.5634	793.69	1.3649	360	1.3380	790.93	1.3453	360	1.1669	788.15	1.3278
380	1.6085	806.16	1.3800	380	1.3777	803.58	1.3605	380	1.2025	800.98	1.3432
400	1.6532	818.64	1.3947	400	1.4170	816.23	1.3754	400	1.2376	813.80	1.3583
450	1.7633	849.99	1.4301	450	1.5135	847.92	1.4112	450	1.3238	845.84	1.3945
500	1.8716	881.68	1.4640	500	1.6081	879.88	1.4454	500	1.4081	878.08	1.4290
550	1.9786	913.84	1.4967	550	1.7014	912.26	1.4783	550	1.4911	910.67	1.4621
600	2.0846	946.53	1.5283	600	1.7937	945.13	1.5101	600	1.5729	943.73	1.4941
650	2.1897	979.82	1.5590	650	1.8850	978.57	1.5409	650	1.6539	977.32	1.5251
700	2.2941	1013.74	1.5889	700	1.9757	1012.62	1.5709	700	1.7342	1011.50	1.5552
750	2.3979	1048.33	1.6181	750	2.0659	1047.32	1.6002	750	1.8139	1046.32	1.5846
800	2.5013	1083.61	1.6467	800	2.1556	1082.69	1.6289	800	1.8932	1081.78	1.6133
850	2.6043	1119.58	1.6747	850	2.2448	1118.75	1.6569	850	1.9720	1117.92	1.6414
900	2.7070	1156.26	1.7021	900	2.3338	1155.51	1.6845	900	2.0506	1154.76	1.6690

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Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued

Pressure 450 psig (464.70 psia)				Pressure 500 psig (514.70 psia)				Pressure 550 psig (564.70 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021962	-60.66	-0.1608	-100	0.021959	-60.52	-0.1609	-100	0.021955	-60.37	-0.1611
-90	0.022143	-50.54	-0.1330	-90	0.022139	-50.40	-0.1332	-90	0.022136	-50.26	-0.1334
-80	0.022331	-40.35	-0.1058	-80	0.022327	-40.21	-0.1060	-80	0.022323	-40.07	-0.1062
-70	0.022527	-30.09	-0.0791	-70	0.022523	-29.95	-0.0793	-70	0.022519	-29.81	-0.0795
-60	0.022731	-19.74	-0.0529	-60	0.022726	-19.61	-0.0531	-60	0.022722	-19.48	-0.0533
-50	0.022942	-9.33	-0.0272	-50	0.022937	-9.20	-0.0274	-50	0.022932	-9.07	-0.0276
-40	0.023161	1.16	-0.0019	-40	0.023156	1.28	-0.0021	-40	0.023151	1.41	-0.0023
-30	0.023389	11.71	0.0230	-30	0.023383	11.83	0.0227	-30	0.023378	11.96	0.0225
-20	0.023625	22.33	0.0474	-20	0.023619	22.45	0.0472	-20	0.023613	22.57	0.0469
-10	0.023870	33.01	0.0714	-10	0.023864	33.13	0.0712	-10	0.023857	33.24	0.0709
0	0.024125	43.75	0.0950	0	0.024117	43.87	0.0948	0	0.024110	43.98	0.0946
10	0.024389	54.56	0.1183	10	0.024381	54.67	0.1181	10	0.024374	54.78	0.1178
20	0.024664	65.43	0.1412	20	0.024656	65.54	0.1409	20	0.024647	65.64	0.1407
30	0.024951	76.37	0.1638	30	0.024941	76.47	0.1635	30	0.024932	76.57	0.1632
40	0.025249	87.38	0.1860	40	0.025240	87.47	0.1857	40	0.025230	87.57	0.1855
50	0.025562	98.46	0.2080	50	0.025551	98.55	0.2077	50	0.025540	98.64	0.2074
60	0.025889	109.63	0.2297	60	0.025877	109.70	0.2294	60	0.025866	109.78	0.2291
70	0.026233	120.88	0.2511	70	0.026220	120.95	0.2508	70	0.026207	121.02	0.2505
80	0.026595	132.23	0.2724	80	0.026581	132.29	0.2720	80	0.026566	132.35	0.2717
90	0.026978	143.69	0.2934	90	0.026962	143.73	0.2930	90	0.026946	143.79	0.2927
100	0.027384	155.27	0.3143	100	0.027366	155.31	0.3139	100	0.027348	155.35	0.3135
110	0.027817	167.00	0.3351	110	0.027797	167.02	0.3346	110	0.027777	167.05	0.3342
120	0.028281	178.90	0.3558	120	0.028258	178.90	0.3553	120	0.028236	178.91	0.3549
130	0.028782	190.99	0.3764	130	0.028756	190.98	0.3760	130	0.028730	190.96	0.3755
140	0.029326	203.32	0.3972	140	0.029296	203.28	0.3967	140	0.029266	203.24	0.3961
150	0.029924	215.94	0.4180	150	0.029888	215.86	0.4175	150	0.029853	215.79	0.4169
155.38	0.030271	222.86	0.4293	160	0.030545	228.78	0.4385	160	0.030503	228.66	0.4378
155.38	0.62921	630.60	1.0923	163.43	0.030788	233.29	0.4457	170	0.031233	241.95	0.4591
160	0.64225	635.59	1.1004	163.43	0.56251	629.12	1.0810	170.91	0.031304	243.18	0.4611
170	0.66885	645.72	1.1166	170	0.58000	636.53	1.0928	170.91	0.50714	627.40	1.0704
180	0.69372	655.15	1.1314	180	0.60478	646.96	1.1093	180	0.53006	638.03	1.0871
190	0.71723	664.03	1.1452	190	0.62786	656.64	1.1243	190	0.55319	648.69	1.1037
200	0.73966	672.50	1.1582	200	0.64965	665.74	1.1382	200	0.57470	658.57	1.1187
220	0.78201	688.47	1.1820	220	0.69029	682.71	1.1635	220	0.61425	676.67	1.1458
240	0.82183	703.53	1.2039	240	0.72806	698.49	1.1864	240	0.65053	693.27	1.1699
260	0.85977	717.96	1.2242	260	0.76377	713.48	1.2075	260	0.68450	708.87	1.1918
280	0.89625	731.93	1.2433	280	0.79790	727.90	1.2273	280	0.71677	723.78	1.2123
300	0.93158	745.57	1.2615	300	0.83080	741.91	1.2460	300	0.74772	738.19	1.2315
320	0.96597	758.98	1.2790	320	0.86271	755.63	1.2638	320	0.77763	752.23	1.2497
340	0.99958	772.21	1.2957	340	0.89381	769.13	1.2809	340	0.80668	766.01	1.2672
360	1.03254	785.33	1.3119	360	0.92422	782.47	1.2974	360	0.83502	779.59	1.2840
380	1.06494	798.36	1.3276	380	0.95406	795.71	1.3134	380	0.86276	793.03	1.3002
400	1.09687	811.35	1.3429	400	0.98340	808.87	1.3289	400	0.89000	806.38	1.3159
450	1.17497	843.74	1.3795	450	1.05502	841.64	1.3659	450	0.95629	839.51	1.3533
500	1.25117	876.26	1.4143	500	1.12470	874.44	1.4010	500	1.02061	872.60	1.3888
550	1.32596	909.08	1.4477	550	1.19293	907.48	1.4346	550	1.08346	905.88	1.4226
600	1.39964	942.32	1.4798	600	1.26005	940.91	1.4669	600	1.14518	939.50	1.4551
650	1.47246	976.07	1.5109	650	1.32630	974.81	1.4981	650	1.20603	973.56	1.4865
700	1.54459	1010.38	1.5412	700	1.39185	1009.26	1.5285	700	1.26617	1008.13	1.5169
750	1.61615	1045.30	1.5707	750	1.45683	1044.29	1.5581	750	1.32574	1043.28	1.5466
800	1.68725	1080.87	1.5995	800	1.52135	1079.96	1.5870	800	1.38483	1079.04	1.5756
850	1.75795	1117.10	1.6277	850	1.58547	1116.27	1.6152	850	1.44353	1115.44	1.6039
900	1.82832	1154.00	1.6553	900	1.64925	1153.25	1.6429	900	1.50190	1152.5	1.6317

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Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued

Pressure 600 psig (614.70 psia)				Pressure 700 psig (714.70 psia)				Pressure 800 psig (814.70 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021952	-60.23	-0.1612	-100	0.021945	-59.94	-0.1616	-100	0.021938	-59.65	-0.1619
-90	0.022132	-50.12	-0.1335	-90	0.022125	-49.83	-0.1339	-90	0.022117	-49.55	-0.1342
-80	0.022319	-39.94	-0.1063	-80	0.022312	-39.66	-0.1067	-80	0.022304	-39.38	-0.1071
-70	0.022514	-29.68	-0.0797	-70	0.022506	-29.40	-0.0800	-70	0.022498	-29.13	-0.0804
-60	0.022717	-19.34	-0.0535	-60	0.022708	-19.07	-0.0539	-60	0.022699	-18.81	-0.0543
-50	0.022927	-8.94	-0.0278	-50	0.022918	-8.67	-0.0282	-50	0.022908	-8.41	-0.0286
-40	0.023146	1.54	-0.0025	-40	0.023135	1.79	-0.0029	-40	0.023125	2.05	-0.0033
-30	0.023372	12.08	0.0223	-30	0.023361	12.33	0.0219	-30	0.023349	12.58	0.0215
-20	0.023607	22.69	0.0467	-20	0.023595	22.93	0.0463	-20	0.023583	23.18	0.0458
-10	0.023850	33.36	0.0707	-10	0.023837	33.60	0.0703	-10	0.023824	33.83	0.0698
0	0.024103	44.09	0.0943	0	0.024089	44.32	0.0938	0	0.024075	44.55	0.0934
10	0.024366	54.89	0.1176	10	0.024351	55.11	0.1171	10	0.024336	55.33	0.1166
20	0.024639	65.75	0.1404	20	0.024623	65.96	0.1399	20	0.024606	66.17	0.1394
30	0.024923	76.67	0.1630	30	0.024906	76.87	0.1624	30	0.024888	77.07	0.1619
40	0.025220	87.66	0.1852	40	0.025200	87.85	0.1846	40	0.025181	88.04	0.1841
50	0.025530	98.72	0.2071	50	0.025508	98.90	0.2065	50	0.025487	99.07	0.2059
60	0.025854	109.86	0.2288	60	0.025831	110.02	0.2281	60	0.025807	110.18	0.2275
70	0.026194	121.09	0.2501	70	0.026168	121.23	0.2495	70	0.026143	121.38	0.2489
80	0.026552	132.41	0.2713	80	0.026524	132.53	0.2706	80	0.026496	132.66	0.2700
90	0.026930	143.84	0.2923	90	0.026899	143.94	0.2916	90	0.026868	144.05	0.2909
100	0.027331	155.38	0.3131	100	0.027296	155.46	0.3124	100	0.027261	155.55	0.3116
110	0.027757	167.07	0.3338	110	0.027718	167.12	0.3330	110	0.027679	167.18	0.3322
120	0.028213	178.92	0.3544	120	0.028169	178.93	0.3536	120	0.028126	178.96	0.3527
130	0.028704	190.95	0.3750	130	0.028654	190.93	0.3741	130	0.028604	190.91	0.3731
140	0.029237	203.20	0.3956	140	0.029179	203.13	0.3946	140	0.029122	203.07	0.3936
150	0.029819	215.72	0.4163	150	0.029751	215.59	0.4152	150	0.029685	215.46	0.4141
160	0.030462	228.55	0.4372	160	0.030382	228.35	0.4360	160	0.030304	228.15	0.4347
170	0.031183	241.79	0.4584	170	0.031086	241.49	0.4570	170	0.030992	241.20	0.4556
177.91	0.031823	252.62	0.4755	180	0.031884	255.10	0.4784	180	0.031768	254.70	0.4769
				190	0.032810	269.35	0.5005	190	0.032663	268.77	0.4987
177.91	0.46038	625.45	1.0602	190.72	0.032883	270.42	0.5022	200	0.033722	283.65	0.5214
180	0.46567	628.13	1.0644					202.25	0.033991	287.14	0.5267
190	0.48937	640.07	1.0830	190.72	0.38556	620.90	1.0411				
200	0.51099	650.89	1.0995	200	0.40704	633.51	1.0603	202.25	0.32811	615.53	1.0228
220	0.55001	670.34	1.1285	220	0.44669	656.56	1.0948	220	0.36591	640.77	1.0605
240	0.58523	687.86	1.1540	240	0.48091	676.33	1.1234	240	0.40061	663.67	1.0937
260	0.61787	704.13	1.1769	260	0.51183	694.18	1.1486	260	0.43081	683.51	1.1217
280	0.64866	719.56	1.1980	280	0.54049	710.79	1.1714	280	0.45820	701.53	1.1464
300	0.67803	734.38	1.2178	300	0.56750	726.54	1.1924	300	0.48363	718.35	1.1688
320	0.70628	748.77	1.2365	320	0.59326	741.68	1.2120	320	0.50764	734.32	1.1896
340	0.73364	762.84	1.2543	340	0.61802	756.36	1.2306	340	0.53053	749.69	1.2090
360	0.76026	776.67	1.2714	360	0.64198	770.72	1.2484	360	0.55254	764.61	1.2275
380	0.78627	790.32	1.2879	380	0.66527	784.82	1.2654	380	0.57383	779.20	1.2451
400	0.81175	803.86	1.3038	400	0.68800	798.75	1.2818	400	0.59453	793.55	1.2619
450	0.87360	837.38	1.3417	450	0.74289	833.06	1.3206	450	0.64422	828.69	1.3017
500	0.93344	870.76	1.3774	500	0.79568	867.05	1.3569	500	0.69172	863.31	1.3387
550	0.99179	904.27	1.4115	550	0.84693	901.04	1.3915	550	0.73764	897.78	1.3738
600	1.04900	938.08	1.4441	600	0.89702	935.23	1.4245	600	0.78236	932.37	1.4072
650	1.10533	972.30	1.4757	650	0.94620	969.77	1.4564	650	0.82615	967.23	1.4393
700	1.16094	1007.01	1.5063	700	0.99466	1004.75	1.4872	700	0.86922	1002.49	1.4704
750	1.21597	1042.27	1.5361	750	1.04253	1040.24	1.5172	750	0.91169	1038.21	1.5006
800	1.27053	1078.13	1.5651	800	1.08993	1076.30	1.5464	800	0.95368	1074.47	1.5299
850	1.32470	1114.61	1.5935	850	1.13693	1112.95	1.5749	850	0.99527	1111.30	1.5586
900	1.37853	1151.74	1.6213	900	1.18359	1150.24	1.6028	900	1.03652	1148.73	1.5867

(Continued on next page)

**Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued**

Pressure 900 psig (914.70 psia)				Pressure 1000 psig (1014.7 psia)				Pressure 1100 psig (1114.7 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021931	-59.36	-0.1622	-100	0.021925	-59.07	-0.1625	-100	0.021918	-58.78	-0.1629
-90	0.022110	-49.27	-0.1345	-90	0.022103	-48.98	-0.1349	-90	0.022095	-48.70	-0.1352
-80	0.022296	-39.10	-0.1074	-80	0.022288	-38.82	-0.1078	-80	0.022280	-38.54	-0.1081
-70	0.022489	-28.85	-0.0808	-70	0.022481	-28.58	-0.0811	-70	0.022472	-28.31	-0.0815
-60	0.022690	-18.54	-0.0546	-60	0.022681	-18.27	-0.0550	-60	0.022672	-18.00	-0.0554
-50	0.022898	-8.15	-0.0290	-50	0.022888	-7.89	-0.0294	-50	0.022879	-7.62	-0.0297
-40	0.023114	2.31	-0.0037	-40	0.023104	2.57	-0.0041	-40	0.023093	2.82	-0.0046
-30	0.023338	12.83	0.0210	-30	0.023327	13.08	0.0206	-30	0.023316	13.33	0.0202
-20	0.023570	23.42	0.0454	-20	0.023558	23.66	0.0450	-20	0.023547	23.91	0.0445
-10	0.023811	34.07	0.0693	-10	0.023798	34.31	0.0689	-10	0.023786	34.54	0.0684
0	0.024061	44.78	0.0929	0	0.024047	45.01	0.0924	0	0.024033	45.24	0.0920
10	0.024320	55.55	0.1161	10	0.024305	55.77	0.1156	10	0.024291	55.99	0.1151
20	0.024590	66.38	0.1389	20	0.024574	66.59	0.1384	20	0.024558	66.80	0.1379
30	0.024870	77.27	0.1614	30	0.024852	77.47	0.1608	30	0.024835	77.67	0.1603
40	0.025162	88.22	0.1835	40	0.025143	88.42	0.1830	40	0.025124	88.61	0.1824
50	0.025466	99.25	0.2054	50	0.025446	99.43	0.2048	50	0.025425	99.61	0.2042
60	0.025785	110.35	0.2269	60	0.025762	110.51	0.2263	60	0.025740	110.68	0.2257
70	0.026118	121.53	0.2482	70	0.026093	121.68	0.2476	70	0.026069	121.83	0.2470
80	0.026468	132.79	0.2693	80	0.026441	132.92	0.2686	80	0.026414	133.06	0.2680
90	0.026837	144.16	0.2902	90	0.026807	144.27	0.2895	90	0.026777	144.38	0.2888
100	0.027227	155.63	0.3109	100	0.027194	155.72	0.3101	100	0.027161	155.82	0.3094
110	0.027642	167.24	0.3314	110	0.027604	167.30	0.3306	110	0.027567	167.37	0.3298
120	0.028083	178.98	0.3519	120	0.028041	179.02	0.3510	120	0.028000	179.05	0.3502
130	0.028556	190.90	0.3722	130	0.028508	190.90	0.3713	130	0.028462	190.90	0.3704
140	0.029066	203.01	0.3926	140	0.029012	202.96	0.3916	140	0.028958	202.92	0.3907
150	0.029620	215.35	0.4130	150	0.029557	215.25	0.4119	150	0.029496	215.16	0.4109
160	0.030228	227.98	0.4335	160	0.030154	227.81	0.4324	160	0.030082	227.66	0.4312
170	0.030901	240.93	0.4543	170	0.030813	240.69	0.4530	170	0.030728	240.45	0.4517
180	0.031657	254.32	0.4754	180	0.031551	253.96	0.4739	180	0.031448	253.63	0.4725
190	0.032523	268.24	0.4970	190	0.032390	267.74	0.4953	190	0.032263	267.27	0.4936
200	0.033538	282.88	0.5193	200	0.033366	282.17	0.5173	200	0.033203	281.52	0.5154
212.75	0.035170	303.11	0.5497	220	0.036023	314.27	0.5652	220	0.035706	312.87	0.5622
				222.41	0.036450	318.60	0.5716	231.35	0.037869	333.85	0.5928
212.75	0.28236	609.31	1.0051								
220	0.29890	621.82	1.0236	222.41	0.24481	602.19	0.9874	231.35	0.21319	594.02	0.9693
240	0.33597	649.47	1.0637	240	0.28166	633.07	1.0321	240	0.23359	613.08	0.9967
260	0.36640	671.95	1.0954	260	0.31346	659.25	1.0690	260	0.26853	645.02	1.0418
280	0.39320	691.70	1.1225	280	0.34027	681.17	1.0991	280	0.29604	669.81	1.0758
300	0.41763	709.75	1.1466	300	0.36416	700.71	1.1251	300	0.31979	691.14	1.1042
320	0.44040	726.68	1.1686	320	0.38610	718.72	1.1486	320	0.34122	710.41	1.1293
340	0.46193	742.80	1.1890	340	0.40662	735.69	1.1700	340	0.36102	728.33	1.1520
360	0.48248	758.35	1.2082	360	0.42607	751.91	1.1901	360	0.37963	745.29	1.1729
380	0.50226	773.46	1.2264	380	0.44468	767.58	1.2090	380	0.39732	761.57	1.1925
400	0.52140	788.24	1.2438	400	0.46260	782.84	1.2269	400	0.41427	777.33	1.2111
450	0.56708	824.26	1.2845	450	0.50511	819.77	1.2687	450	0.45423	815.23	1.2540
500	0.61048	859.53	1.3223	500	0.54523	855.71	1.3072	500	0.49169	851.86	1.2932
550	0.65224	894.51	1.3578	550	0.58367	891.21	1.3432	550	0.52741	887.89	1.3298
600	0.69277	929.50	1.3916	600	0.62086	926.61	1.3774	600	0.56185	923.71	1.3644
650	0.73237	964.69	1.4241	650	0.65708	962.14	1.4102	650	0.59532	959.58	1.3975
700	0.77122	1000.22	1.4554	700	0.69256	997.95	1.4418	700	0.62803	995.68	1.4293
750	0.80948	1036.18	1.4857	750	0.72743	1034.15	1.4723	750	0.66012	1032.11	1.4600
800	0.84725	1072.64	1.5153	800	0.76181	1070.81	1.5020	800	0.69172	1068.98	1.4899
850	0.88461	1109.64	1.5441	850	0.79578	1107.99	1.5310	850	0.72291	1106.33	1.5190
900	0.92164	1147.23	1.5722	900	0.82941	1145.73	1.5592	900	0.75375	1144.23	1.5474

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Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued

Pressure 1200 psig (1214.7 psia)				Pressure 1400 psig (1414.7 psia)				Pressure 1600 psig (1614.7 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021911	-58.49	-0.1632	-100	0.021898	-57.91	-0.1638	-100	0.021884	-57.33	-0.1645
-90	0.022088	-48.41	-0.1356	-90	0.022074	-47.84	-0.1362	-90	0.022059	-47.27	-0.1369
-80	0.022272	-38.26	-0.1085	-80	0.022257	-37.70	-0.1091	-80	0.022242	-37.13	-0.1098
-70	0.022464	-28.03	-0.0819	-70	0.022447	-27.48	-0.0826	-70	0.022431	-26.93	-0.0833
-60	0.022663	-17.73	-0.0558	-60	0.022645	-17.19	-0.0565	-60	0.022627	-16.65	-0.0573
-50	0.022869	-7.36	-0.0301	-50	0.022850	-6.83	-0.0309	-50	0.022831	-6.30	-0.0317
-40	0.023083	3.08	-0.0050	-40	0.023063	3.60	-0.0058	-40	0.023042	4.12	-0.0066
-30	0.023305	13.59	0.0198	-30	0.023283	14.09	0.0189	-30	0.023263	14.60	0.0181
-20	0.023535	24.15	0.0441	-20	0.023511	24.65	0.0432	-20	0.023488	25.14	0.0424
-10	0.023773	34.78	0.0680	-10	0.023747	35.26	0.0671	-10	0.023722	35.74	0.0662
0	0.024020	45.47	0.0915	0	0.023992	45.93	0.0906	0	0.023965	46.40	0.0897
10	0.024276	56.21	0.1146	10	0.024246	56.66	0.1137	10	0.024217	57.11	0.1127
20	0.024542	67.02	0.1374	20	0.024510	67.44	0.1364	20	0.024479	67.88	0.1354
30	0.024818	77.88	0.1598	30	0.024783	78.29	0.1588	30	0.024750	78.70	0.1577
40	0.025105	88.80	0.1819	40	0.025068	89.19	0.1808	40	0.025031	89.58	0.1797
50	0.025405	99.79	0.2036	50	0.025364	100.16	0.2025	50	0.025325	100.53	0.2014
60	0.025717	110.85	0.2251	60	0.025673	111.19	0.2240	60	0.025630	111.53	0.2228
70	0.026044	121.98	0.2464	70	0.025996	122.29	0.2451	70	0.025949	122.61	0.2439
80	0.026387	133.20	0.2673	80	0.026335	133.47	0.2660	80	0.026283	133.76	0.2648
90	0.026748	144.50	0.2881	90	0.026690	144.74	0.2867	90	0.026633	145.00	0.2854
100	0.027128	155.91	0.3087	100	0.027064	156.11	0.3072	100	0.027002	156.32	0.3058
110	0.027531	167.44	0.3291	110	0.027460	167.59	0.3276	110	0.027390	167.75	0.3261
120	0.027959	179.10	0.3494	120	0.027879	179.19	0.3477	120	0.027802	179.30	0.3462
130	0.028416	190.90	0.3696	130	0.028326	190.93	0.3678	130	0.028239	190.98	0.3661
140	0.028906	202.89	0.3897	140	0.028804	202.84	0.3879	140	0.028706	202.82	0.3860
150	0.029436	215.08	0.4099	150	0.029319	214.94	0.4079	150	0.029208	214.83	0.4059
160	0.030013	227.51	0.4301	160	0.029878	227.26	0.4279	160	0.029750	227.05	0.4258
170	0.030646	240.24	0.4505	170	0.030488	239.85	0.4481	170	0.030339	239.51	0.4457
180	0.031349	253.32	0.4711	180	0.031161	252.75	0.4684	180	0.030985	252.26	0.4658
190	0.032141	266.83	0.4920	190	0.031913	266.04	0.4890	190	0.031702	265.35	0.4861
200	0.033050	280.91	0.5135	200	0.032766	279.82	0.5100	200	0.032507	278.87	0.5068
220	0.035421	311.62	0.5594	220	0.034923	309.48	0.5543	220	0.034496	307.68	0.5498
239.68	0.039486	349.15	0.6138	240	0.038303	344.39	0.6049	240	0.037401	340.47	0.5973
				254.80	0.043834	381.71	0.6576	260	0.043239	384.55	0.6594
239.68	0.18589	584.59	0.9504					268.17	0.055167	432.18	0.7251
240	0.18684	585.59	0.9519	254.80	0.13945	559.94	0.9071				
260	0.22909	628.61	1.0126	260	0.15685	581.91	0.9378	268.17	0.09221	511.34	0.8338
280	0.25818	657.40	1.0521	280	0.19522	627.96	1.0010	280	0.14053	586.31	0.9363
300	0.28222	680.96	1.0835	300	0.22137	658.26	1.0414	300	0.17296	631.06	0.9960
320	0.30340	701.71	1.1105	320	0.24287	682.90	1.0734	320	0.19602	661.73	1.0359
340	0.32272	720.69	1.1345	340	0.26177	704.50	1.1008	340	0.21516	686.87	1.0678
360	0.34069	738.47	1.1565	360	0.27895	724.21	1.1251	360	0.23204	708.98	1.0951
380	0.35766	755.40	1.1769	380	0.29491	742.62	1.1473	380	0.24741	729.17	1.1194
400	0.37383	771.71	1.1961	400	0.30994	760.12	1.1679	400	0.26169	748.05	1.1416
450	0.41170	810.62	1.2401	450	0.34462	801.23	1.2144	450	0.29411	791.60	1.1909
500	0.44696	847.98	1.2801	500	0.37646	840.11	1.2560	500	0.32344	832.11	1.2343
550	0.48042	884.55	1.3172	550	0.40640	877.81	1.2944	550	0.35074	871.01	1.2738
600	0.51258	920.80	1.3523	600	0.43496	914.95	1.3302	600	0.37662	909.05	1.3106
650	0.54374	957.02	1.3857	650	0.46250	951.87	1.3643	650	0.40144	946.71	1.3453
700	0.57413	993.40	1.4177	700	0.48925	988.84	1.3969	700	0.42545	984.27	1.3784
750	0.60391	1030.07	1.4487	750	0.51537	1026.00	1.4283	750	0.44883	1021.93	1.4102
800	0.63318	1067.15	1.4787	800	0.54099	1063.49	1.4586	800	0.47168	1059.83	1.4409
850	0.66205	1104.68	1.5079	850	0.56618	1101.38	1.4881	850	0.49412	1098.09	1.4707
900	0.69057	1142.73	1.5364	900	0.59103	1139.74	1.5169	900	0.51621	1136.77	1.4996

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**Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued**

Pressure 2000 psig (2014.7 psia)				Pressure 2500 psig (2514.7 psia)				Pressure 3000 psig (3014.7 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021858	-56.16	-0.1657	-100	0.021825	-54.70	-0.1673	-100	0.021793	-53.23	-0.1688
-90	0.022031	-46.12	-0.1382	-90	0.021996	-44.68	-0.1398	-90	0.021961	-43.24	-0.1414
-80	0.022211	-36.01	-0.1112	-80	0.022173	-34.59	-0.1129	-80	0.022136	-33.17	-0.1146
-70	0.022398	-25.82	-0.0847	-70	0.022358	-24.43	-0.0865	-70	0.022318	-23.04	-0.0882
-60	0.022592	-15.56	-0.0587	-60	0.022549	-14.20	-0.0605	-60	0.022507	-12.83	-0.0623
-50	0.022794	-5.24	-0.0332	-50	0.022748	-3.90	-0.0351	-50	0.022702	-2.55	-0.0369
-40	0.023002	5.16	-0.0081	-40	0.022953	6.47	-0.0101	-40	0.022905	7.78	-0.0120
-30	0.023218	15.61	0.0165	-30	0.023165	16.89	0.0145	-30	0.023114	18.18	0.0125
-20	0.023442	26.13	0.0407	-20	0.023385	27.38	0.0386	-20	0.023330	28.64	0.0365
-10	0.023673	36.70	0.0645	-10	0.023612	37.92	0.0623	-10	0.023553	39.15	0.0602
0	0.023912	47.33	0.0878	0	0.023848	48.52	0.0856	0	0.023784	49.71	0.0834
10	0.024160	58.02	0.1108	10	0.024091	59.16	0.1085	10	0.024023	60.33	0.1062
20	0.024417	68.75	0.1334	20	0.024342	69.86	0.1310	20	0.024270	70.98	0.1287
30	0.024683	79.54	0.1557	30	0.024603	80.60	0.1532	30	0.024525	81.69	0.1508
40	0.024960	90.38	0.1776	40	0.024873	91.40	0.1750	40	0.024789	92.44	0.1725
50	0.025247	101.28	0.1992	50	0.025153	102.25	0.1965	50	0.025062	103.24	0.1939
60	0.025546	112.24	0.2205	60	0.025444	113.15	0.2177	60	0.025346	114.09	0.2150
70	0.025857	123.26	0.2415	70	0.025747	124.11	0.2386	70	0.025641	125.00	0.2358
80	0.026183	134.36	0.2623	80	0.026063	135.14	0.2592	80	0.025948	135.96	0.2563
90	0.026523	145.52	0.2828	90	0.026392	146.23	0.2796	90	0.026267	146.98	0.2765
100	0.026881	156.78	0.3031	100	0.026737	157.39	0.2997	100	0.026600	158.07	0.2965
110	0.027257	168.12	0.3231	110	0.027099	168.64	0.3196	110	0.026949	169.23	0.3163
120	0.027654	179.57	0.3431	120	0.027479	179.98	0.3394	120	0.027315	180.47	0.3358
130	0.028074	191.14	0.3629	130	0.027880	191.42	0.3590	130	0.027699	191.80	0.3552
140	0.028520	202.84	0.3825	140	0.028304	202.98	0.3784	140	0.028103	203.23	0.3744
150	0.028997	214.70	0.4022	150	0.028755	214.67	0.3977	150	0.028531	214.77	0.3935
160	0.029509	226.73	0.4217	160	0.029235	226.51	0.4170	160	0.028985	226.44	0.4125
170	0.030062	238.97	0.4413	170	0.029750	238.51	0.4362	170	0.029468	238.25	0.4314
180	0.030663	251.45	0.4610	180	0.030304	250.71	0.4554	180	0.029984	250.22	0.4503
190	0.031321	264.21	0.4808	190	0.030905	263.14	0.4747	190	0.030539	262.37	0.4691
200	0.032049	277.31	0.5008	200	0.031560	275.82	0.4941	200	0.031137	274.74	0.4880
220	0.033787	304.82	0.5419	220	0.033079	302.17	0.5334	220	0.032499	300.22	0.5261
240	0.036119	334.95	0.5855	240	0.034998	330.30	0.5742	240	0.034153	327.01	0.5649
260	0.039674	370.03	0.6349	260	0.037580	361.17	0.6177	260	0.036242	355.63	0.6052
280	0.047539	420.06	0.7034	280	0.041470	396.96	0.6667	280	0.039035	386.96	0.6482
300	0.091524	543.45	0.8679	300	0.048868	443.97	0.7294	300	0.043105	422.71	0.6958
320	0.12575	608.13	0.9521	320	0.066662	513.76	0.8200	320	0.049790	466.04	0.7521
340	0.14760	645.89	0.9999	340	0.090750	579.97	0.9039	340	0.061011	518.27	0.8182
360	0.16503	675.12	1.0360	360	0.11001	625.01	0.9596	360	0.075677	570.57	0.8829
380	0.18007	700.04	1.0661	380	0.12549	659.00	1.0006	380	0.090098	614.23	0.9355
400	0.19357	722.36	1.0924	400	0.13874	687.29	1.0339	400	0.10285	649.68	0.9772
450	0.22316	771.64	1.1481	450	0.16640	745.49	1.0997	450	0.12903	718.41	1.0551
500	0.24907	815.76	1.1953	500	0.18967	794.78	1.1525	500	0.15046	773.46	1.1140
550	0.27273	857.21	1.2374	550	0.21042	839.72	1.1982	550	0.16920	822.13	1.1635
600	0.29485	897.18	1.2761	600	0.22952	882.24	1.2393	600	0.18623	867.31	1.2072
650	0.31585	936.34	1.3122	650	0.24745	923.37	1.2772	650	0.20206	910.47	1.2470
700	0.33602	975.12	1.3464	700	0.26450	963.72	1.3128	700	0.21701	952.43	1.2840
750	0.35552	1013.79	1.3790	750	0.28089	1003.69	1.3465	750	0.23128	993.70	1.3188
800	0.37450	1052.55	1.4104	800	0.29674	1043.53	1.3788	800	0.24502	1034.63	1.3520
850	0.39306	1091.54	1.4408	850	0.31216	1083.44	1.4099	850	0.25832	1075.46	1.3837
900	0.41126	1130.85	1.4702	900	0.32723	1123.54	1.4399	900	0.27128	1116.35	1.4144

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Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued

Pressure 4000 psig (4014.7 psia)				Pressure 6000 psig (6014.7 psia)				Pressure 8000 psig (8014.7 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-100	0.021730	-50.29	-0.1718	-100	0.021607	-44.35	-0.1776	-100	0.021491	-38.35	-0.1831
-90	0.021893	-40.34	-0.1446	-90	0.021763	-34.48	-0.1506	-90	0.021639	-28.57	-0.1563
-80	0.022064	-30.32	-0.1178	-80	0.021925	-24.55	-0.1241	-80	0.021793	-18.72	-0.1300
-70	0.022241	-20.23	-0.0916	-70	0.022093	-14.55	-0.0981	-70	0.021953	-8.80	-0.1043
-60	0.022424	-10.07	-0.0658	-60	0.022267	-4.48	-0.0726	-60	0.022118	1.18	-0.0790
-50	0.022614	0.15	-0.0406	-50	0.022446	5.65	-0.0475	-50	0.022289	11.23	-0.0541
-40	0.022811	10.44	-0.0158	-40	0.022632	15.84	-0.0230	-40	0.022466	21.33	-0.0298
-30	0.023013	20.79	0.0086	-30	0.022824	26.09	0.0012	-30	0.022647	31.50	-0.0058
-20	0.023223	31.19	0.0325	-20	0.023021	36.39	0.0249	-20	0.022834	41.71	0.0177
-10	0.023439	41.64	0.0560	-10	0.023225	46.74	0.0482	-10	0.023027	51.97	0.0407
0	0.023662	52.14	0.0791	0	0.023434	57.13	0.0710	0	0.023224	62.26	0.0634
10	0.023892	62.69	0.1018	10	0.023650	67.56	0.0935	10	0.023427	72.60	0.0856
20	0.024130	73.28	0.1241	20	0.023871	78.03	0.1155	20	0.023635	82.96	0.1075
30	0.024375	83.91	0.1461	30	0.024099	88.54	0.1372	30	0.023849	93.36	0.1289
40	0.024628	94.58	0.1677	40	0.024334	99.07	0.1585	40	0.024068	103.79	0.1500
50	0.024890	105.30	0.1889	50	0.024575	109.64	0.1794	50	0.024293	114.23	0.1707
60	0.025161	116.06	0.2098	60	0.024824	120.24	0.2000	60	0.024523	124.71	0.1910
70	0.025441	126.86	0.2304	70	0.025080	130.87	0.2203	70	0.024760	135.20	0.2111
80	0.025731	137.70	0.2507	80	0.025344	141.54	0.2402	80	0.025003	145.72	0.2307
90	0.026033	148.60	0.2707	90	0.025616	152.23	0.2599	90	0.025253	156.26	0.2501
100	0.026346	159.55	0.2904	100	0.025898	162.96	0.2792	100	0.025510	166.83	0.2691
110	0.026672	170.56	0.3099	110	0.026189	173.73	0.2983	110	0.025774	177.42	0.2879
120	0.027012	181.63	0.3292	120	0.026490	184.54	0.3171	120	0.026046	188.03	0.3063
130	0.027368	192.77	0.3482	130	0.026802	195.39	0.3357	130	0.026326	198.67	0.3245
140	0.027740	203.98	0.3671	140	0.027125	206.29	0.3540	140	0.026615	209.34	0.3425
150	0.028130	215.28	0.3858	150	0.027461	217.23	0.3721	150	0.026913	220.04	0.3602
160	0.028540	226.67	0.4043	160	0.027810	228.23	0.3900	160	0.027221	230.77	0.3776
170	0.028973	238.17	0.4227	170	0.028174	239.30	0.4077	170	0.027539	241.54	0.3949
180	0.029431	249.78	0.4410	180	0.028554	250.42	0.4252	180	0.027867	252.35	0.4119
190	0.029916	261.52	0.4592	190	0.028950	261.62	0.4426	190	0.028208	263.20	0.4287
200	0.030433	273.41	0.4774	200	0.029365	272.90	0.4598	200	0.028561	274.10	0.4454
220	0.031576	297.67	0.5136	220	0.030257	295.70	0.4939	220	0.029307	296.04	0.4782
240	0.032902	322.74	0.5499	240	0.031244	318.90	0.5275	240	0.030113	318.20	0.5103
260	0.034470	348.82	0.5867	260	0.032345	342.56	0.5609	260	0.030987	340.61	0.5419
280	0.036365	376.19	0.6242	280	0.033581	366.73	0.5940	280	0.031938	363.30	0.5730
300	0.038719	405.23	0.6629	300	0.034981	391.50	0.6270	300	0.032977	386.29	0.6036
320	0.041738	436.44	0.7035	320	0.036575	416.93	0.6601	320	0.034114	409.60	0.6339
340	0.045722	470.35	0.7464	340	0.038402	443.07	0.6932	340	0.035361	433.24	0.6639
360	0.051004	507.06	0.7918	360	0.040505	469.96	0.7264	360	0.036731	457.23	0.6935
380	0.057667	545.37	0.8379	380	0.042924	497.58	0.7597	380	0.038234	481.54	0.7228
400	0.065343	583.09	0.8823	400	0.045690	525.81	0.7929	400	0.039881	506.15	0.7518
450	0.085320	665.59	0.9757	450	0.054077	597.31	0.8737	450	0.044665	568.62	0.8224
500	0.10324	731.53	1.0463	500	0.063867	666.05	0.9473	500	0.050338	631.21	0.8894
550	0.11897	787.62	1.1033	550	0.073998	729.23	1.0115	550	0.056639	692.24	0.9514
600	0.13312	838.12	1.1522	600	0.083827	786.93	1.0673	600	0.063236	750.67	1.0079
650	0.14613	885.31	1.1957	650	0.093149	840.37	1.1166	650	0.069867	806.27	1.0591
700	0.15830	930.44	1.2355	700	0.10196	890.77	1.1610	700	0.076381	859.33	1.1059
750	0.16982	974.29	1.2725	750	0.11032	939.05	1.2018	750	0.082707	910.33	1.1490
800	0.18083	1017.36	1.3074	800	0.11830	985.88	1.2397	800	0.088827	959.73	1.1890
850	0.19143	1059.99	1.3406	850	0.12595	1031.74	1.2755	850	0.094744	1007.95	1.2265
900	0.20169	1102.44	1.3724	900	0.13332	1076.97	1.3093	900	0.100472	1055.33	1.2621

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**Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued**

Pressure 10000 psig (10015 psia)				Pressure 15000 psig (15015 psia)				Pressure 20000 psig (20015 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-90	0.021520	-22.59	-0.1618	-90	0.021246	-7.47	-0.1744	-80	0.021118	17.28	-0.1607
-80	0.021667	-12.83	-0.1357	-80	0.021378	2.11	-0.1489	-70	0.021242	26.76	-0.1361
-70	0.021820	-2.99	-0.1101	-70	0.021515	11.76	-0.1238	-60	0.021371	36.31	-0.1119
-60	0.021978	6.91	-0.0851	-60	0.021657	21.48	-0.0991	-50	0.021505	45.94	-0.0881
-50	0.022141	16.88	-0.0604	-50	0.021803	31.27	-0.0749	-40	0.021642	55.64	-0.0647
-40	0.022309	26.91	-0.0362	-40	0.021954	41.12	-0.0512	-30	0.021782	65.40	-0.0417
-30	0.022482	36.99	-0.0125	-30	0.022109	51.03	-0.0278	-20	0.021927	75.22	-0.0191
-20	0.022660	47.12	0.0108	-20	0.022268	60.99	-0.0049	-10	0.022074	85.08	0.0031
-10	0.022842	57.30	0.0337	-10	0.022431	71.00	0.0176	0	0.022224	94.98	0.0249
0	0.023030	67.51	0.0562	0	0.022597	81.04	0.0397	10	0.022378	104.92	0.0463
10	0.023222	77.76	0.0782	10	0.022767	91.11	0.0613	20	0.022534	114.89	0.0672
20	0.023418	88.04	0.0999	20	0.022941	101.22	0.0826	30	0.022693	124.88	0.0879
30	0.023619	98.35	0.1211	30	0.023118	111.34	0.1035	40	0.022854	134.88	0.1081
40	0.023825	108.68	0.1420	40	0.023298	121.48	0.1240	50	0.023018	144.90	0.1279
50	0.024036	119.03	0.1625	50	0.023482	131.64	0.1441	60	0.023185	154.93	0.1474
60	0.024252	129.39	0.1827	60	0.023669	141.81	0.1639	70	0.023354	164.97	0.1666
70	0.024473	139.78	0.2025	70	0.023860	151.99	0.1833	80	0.023526	175.01	0.1853
80	0.024699	150.18	0.2219	80	0.024054	162.18	0.2024	90	0.023700	185.05	0.2038
90	0.024931	160.60	0.2411	90	0.024252	172.37	0.2211	100	0.023877	195.09	0.2219
100	0.025168	171.03	0.2599	100	0.024454	182.57	0.2395	110	0.024057	205.13	0.2396
110	0.025411	181.48	0.2784	110	0.024659	192.77	0.2575	120	0.024238	215.16	0.2571
120	0.025660	191.94	0.2966	120	0.024868	202.97	0.2753	130	0.024423	225.19	0.2743
130	0.025916	202.42	0.3145	130	0.025081	213.18	0.2927	140	0.024610	235.22	0.2911
140	0.026178	212.92	0.3322	140	0.025297	223.38	0.3099	150	0.024800	245.24	0.3077
150	0.026448	223.43	0.3495	150	0.025518	233.59	0.3268	160	0.024993	255.26	0.3240
160	0.026724	233.97	0.3667	160	0.025743	243.81	0.3434	170	0.025188	265.27	0.3400
170	0.027009	244.53	0.3836	170	0.025973	254.02	0.3598	180	0.025386	275.28	0.3558
180	0.027301	255.11	0.4003	180	0.026207	264.24	0.3759	190	0.025587	285.28	0.3713
190	0.027602	265.71	0.4167	190	0.026445	274.46	0.3917	200	0.025791	295.28	0.3866
200	0.027913	276.35	0.4330	200	0.026689	284.69	0.4073	220	0.026208	315.26	0.4164
220	0.028561	297.70	0.4648	220	0.027191	305.17	0.4379	240	0.026638	335.23	0.4454
240	0.029252	319.19	0.4960	240	0.027713	325.67	0.4676	260	0.027081	355.20	0.4735
260	0.029988	340.83	0.5265	260	0.028258	346.21	0.4966	280	0.027538	375.16	0.5009
280	0.030775	362.62	0.5564	280	0.028827	366.80	0.5248	300	0.028008	395.12	0.5275
300	0.031617	384.59	0.5857	300	0.029421	387.43	0.5523	320	0.028494	415.09	0.5535
320	0.032521	406.75	0.6145	320	0.030041	408.12	0.5792	340	0.028994	435.08	0.5788
340	0.033490	429.09	0.6428	340	0.030689	428.87	0.6055	360	0.029511	455.08	0.6035
360	0.034529	451.63	0.6706	360	0.031365	449.67	0.6312	380	0.030043	475.10	0.6276
380	0.035644	474.35	0.6980	380	0.032072	470.54	0.6563	400	0.030591	495.13	0.6512
400	0.036839	497.23	0.7249	400	0.032808	491.46	0.6810	450	0.032034	545.32	0.7079
450	0.040191	555.05	0.7903	450	0.034788	543.99	0.7404	500	0.033580	595.64	0.7618
500	0.044064	613.25	0.8526	500	0.036965	596.76	0.7968	550	0.035227	646.05	0.8130
550	0.048390	671.08	0.9113	550	0.039331	649.60	0.8505	600	0.036968	696.52	0.8618
600	0.053039	727.83	0.9662	600	0.041868	702.35	0.9015	650	0.038792	746.97	0.9083
650	0.057870	783.05	1.0171	650	0.044545	754.80	0.9499	700	0.040689	797.37	0.9527
700	0.062764	836.62	1.0643	700	0.047329	806.83	0.9957	750	0.042644	847.66	0.9952
750	0.067638	888.66	1.1083	750	0.050185	858.35	1.0392	800	0.044644	897.81	1.0358
800	0.072443	939.36	1.1493	800	0.053083	909.33	1.0805	850	0.046675	947.82	1.0747
850	0.077152	988.99	1.1880	850	0.055998	959.79	1.1198	900	0.048726	997.69	1.1121
900	0.081754	1037.78	1.2245	900	0.058911	1009.81	1.1573				

(Continued on next page)

Table A-3 Ammonia Liquid and Vapor Properties — IP Units continued

Pressure 30000 psig (30015 psia)				Pressure 50000 psig (50015 psia)				Pressure 70000 psig (70015 psia)			
Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R	Temp. °F	Volume ft <sup>3</sup> /lb	Enthalpy Btu/lb	Entropy Btu/lb-R
-70	0.020772	57.23	-0.1577								
-60	0.020882	66.49	-0.1342								
-50	0.020995	75.84	-0.1111	-50	0.020210	136.81	-0.1483				
-40	0.021111	85.27	-0.0883	-40	0.020300	145.81	-0.1266				
-30	0.021231	94.78	-0.0659	-30	0.020392	154.92	-0.1052	-30	0.019769	215.85	-0.1363
-20	0.021353	104.36	-0.0439	-20	0.020487	164.12	-0.0840	-20	0.019846	224.74	-0.1159
-10	0.021478	114.00	-0.0222	-10	0.020583	173.42	-0.0631	-10	0.019924	233.76	-0.0956
0	0.021605	123.69	-0.0009	0	0.020681	182.78	-0.0425	0	0.020004	242.87	-0.0755
10	0.021734	133.41	0.0200	10	0.020781	192.22	-0.0222	10	0.020086	252.08	-0.0557
20	0.021865	143.18	0.0406	20	0.020882	201.70	-0.0022	20	0.020168	261.36	-0.0362
30	0.021999	152.97	0.0608	30	0.020985	211.23	0.0175	30	0.020252	270.70	-0.0169
40	0.022134	162.78	0.0806	40	0.021088	220.80	0.0368	40	0.020336	280.09	0.0021
50	0.022270	172.61	0.1001	50	0.021192	230.39	0.0558	50	0.020422	289.53	0.0208
60	0.022409	182.44	0.1192	60	0.021298	240.01	0.0745	60	0.020507	299.01	0.0392
70	0.022549	192.29	0.1380	70	0.021404	249.64	0.0928	70	0.020594	308.51	0.0573
80	0.022690	202.14	0.1564	80	0.021511	259.28	0.1109	80	0.020681	318.03	0.0751
90	0.022833	211.99	0.1745	90	0.021619	268.93	0.1286	90	0.020769	327.57	0.0926
100	0.022977	221.83	0.1922	100	0.021727	278.58	0.1460	100	0.020857	337.11	0.1098
110	0.023123	231.67	0.2096	110	0.021836	288.23	0.1631	110	0.020945	346.67	0.1268
120	0.023270	241.51	0.2268	120	0.021946	297.87	0.1799	120	0.021034	356.22	0.1434
130	0.023419	251.33	0.2436	130	0.022056	307.51	0.1964	130	0.021123	365.77	0.1597
140	0.023568	261.15	0.2601	140	0.022167	317.14	0.2125	140	0.021212	375.32	0.1758
150	0.023720	270.95	0.2763	150	0.022278	326.76	0.2284	150	0.021301	384.86	0.1915
160	0.023872	280.75	0.2922	160	0.022389	336.36	0.2441	160	0.021391	394.39	0.2071
170	0.024026	290.53	0.3079	170	0.022502	345.96	0.2594	170	0.021481	403.91	0.2223
180	0.024182	300.30	0.3233	180	0.022614	355.54	0.2745	180	0.021571	413.42	0.2373
190	0.024338	310.06	0.3384	190	0.022727	365.10	0.2894	190	0.021662	422.91	0.2520
200	0.024496	319.81	0.3533	200	0.022841	374.65	0.3039	200	0.021752	432.39	0.2665
220	0.024817	339.27	0.3824	220	0.023069	393.70	0.3324	220	0.021934	451.31	0.2947
240	0.025143	358.68	0.4105	240	0.023299	412.69	0.3599	240	0.022116	470.16	0.3221
260	0.025475	378.06	0.4378	260	0.023531	431.63	0.3866	260	0.022299	488.95	0.3486
280	0.025814	397.39	0.4643	280	0.023765	450.50	0.4125	280	0.022482	507.68	0.3742
300	0.026158	416.70	0.4901	300	0.024000	469.33	0.4376	300	0.022666	526.36	0.3991
320	0.026508	435.97	0.5151	320	0.024238	488.10	0.4620	320	0.022851	544.97	0.4233
340	0.026865	455.23	0.5395	340	0.024477	506.83	0.4857	340	0.023036	563.54	0.4468
360	0.027229	474.46	0.5633	360	0.024718	525.52	0.5088	360	0.023222	582.06	0.4697
380	0.027599	493.68	0.5864	380	0.024961	544.18	0.5313	380	0.023408	600.53	0.4920
400	0.027976	512.89	0.6090	400	0.025206	562.81	0.5532	400	0.023595	618.98	0.5137
450	0.028946	560.91	0.6633	450	0.025826	609.30	0.6058	450	0.024066	664.96	0.5657
500	0.029959	608.95	0.7147	500	0.026459	655.73	0.6555	500	0.024541	710.84	0.6148
550	0.031014	657.06	0.7636	550	0.027105	702.17	0.7026	550	0.025022	756.69	0.6614
600	0.032107	705.27	0.8102	600	0.027762	748.68	0.7476	600	0.025507	802.59	0.7057
650	0.033238	753.59	0.8548	650	0.028432	795.33	0.7906	650	0.025998	848.60	0.7481
700	0.034403	802.04	0.8975	700	0.029114	842.16	0.8319	700	0.026493	894.78	0.7889
750	0.035598	850.63	0.9385	750	0.029806	889.20	0.8716	750	0.026994	941.17	0.8280
800	0.036820	899.35	0.9780	800	0.030509	936.49	0.9099	800	0.027500	987.83	0.8658
850	0.038063	948.21	1.0160	850	0.031221	984.05	0.9469	850	0.028010	1034.77	0.9024
900	0.039325	997.23	1.0527	900	0.031941	1031.91	0.9828	900	0.028525	1082.05	0.9378



## Saturation Properties of Ammonia — SI Units

Table A-4 Saturation Properties of Ammonia — SI Units

Temperature (°C)	Pressure (kPa)	Enthalpy (kJ/kg)		Entropy (kJ/kg-K)		Liq. Density (kg/m <sup>3</sup> )	Vapor Sp. Vol. (L/kg)
		Liquid	Vapor	Liquid	Vapor		
-77	6.42	-140.392	1342.470	-0.4575	7.1023	732.21	14856.938
-76	6.94	-136.183	1344.355	-0.4361	7.0736	731.16	13797.202
-75	7.51	-131.969	1346.235	-0.4148	7.0452	730.10	12824.122
-74	8.11	-127.749	1348.110	-0.3936	7.0172	729.03	11929.795
-73	8.75	-123.523	1349.979	-0.3724	6.9896	727.96	11107.107
-72	9.43	-119.292	1351.843	-0.3513	6.9623	726.88	10349.649
-71	10.16	-115.055	1353.702	-0.3303	6.9354	725.80	9651.641
-70	10.94	-110.812	1355.554	-0.3094	6.9088	724.72	9007.864
-69	11.77	-106.563	1357.401	-0.2885	6.8825	723.63	8413.603
-68	12.65	-102.309	1359.242	-0.2677	6.8566	722.53	7864.593
-67	13.58	-98.048	1361.076	-0.2470	6.8309	721.43	7356.972
-66	14.57	-93.782	1362.905	-0.2264	6.8056	720.33	6887.240
-65	15.62	-89.510	1364.726	-0.2058	6.7807	719.22	6452.225
-64	16.74	-85.232	1366.542	-0.1853	6.7560	718.11	6049.044
-63	17.92	-80.948	1368.350	-0.1649	6.7316	716.99	5675.080
-62	19.17	-76.659	1370.152	-0.1446	6.7075	715.87	5327.952
-61	20.49	-72.363	1371.947	-0.1243	6.6837	714.75	5005.493
-60	21.89	-68.062	1373.734	-0.1040	6.6602	713.62	4705.729
-59	23.37	-63.754	1375.515	-0.0839	6.6369	712.48	4426.859
-58	24.93	-59.441	1377.288	-0.0638	6.6140	711.35	4167.243
-57	26.58	-55.122	1379.053	-0.0438	6.5913	710.20	3925.380
-56	28.32	-50.797	1380.811	-0.0238	6.5689	709.06	3699.900
-55	30.14	-46.467	1382.560	-0.0040	6.5467	707.90	3489.548
-54	32.07	-42.130	1384.302	0.0159	6.5248	706.75	3293.178
-53	34.10	-37.788	1386.036	0.0356	6.5031	705.59	3109.737
-52	36.24	-33.440	1387.761	0.0553	6.4817	704.43	2938.263
-51	38.48	-29.087	1389.478	0.0749	6.4606	703.26	2777.871
-50	40.84	-24.727	1391.186	0.0945	6.4396	702.09	2627.750
-49	43.31	-20.363	1392.886	0.1140	6.4189	700.91	2487.152
-48	45.91	-15.992	1394.577	0.1334	6.3985	699.73	2355.393
-47	48.64	-11.616	1396.258	0.1528	6.3782	698.55	2231.842
-46	51.49	-7.234	1397.930	0.1721	6.3582	697.36	2115.918
-45	54.49	-2.847	1399.594	0.1914	6.3384	696.17	2007.084
-44	57.63	1.545	1401.247	0.2106	6.3188	694.97	1904.849
-43	60.91	5.943	1402.891	0.2297	6.2994	693.77	1808.755
-42	64.34	10.347	1404.525	0.2488	6.2803	692.57	1718.384
-41	67.94	14.756	1406.149	0.2678	6.2613	691.36	1633.346
-40	71.69	19.170	1407.763	0.2867	6.2425	690.15	1553.282
-39	75.61	23.590	1409.367	0.3056	6.2240	688.94	1477.861
-38	79.71	28.015	1410.960	0.3245	6.2056	687.72	1406.775
-37	83.99	32.445	1412.542	0.3432	6.1874	686.49	1339.739
-36	88.45	36.880	1414.114	0.3619	6.1694	685.27	1276.489
-35	93.10	41.321	1415.675	0.3806	6.1516	684.04	1216.781
-34	97.95	45.767	1417.225	0.3992	6.1339	682.80	1160.388
-33	103.00	50.218	1418.764	0.4177	6.1165	681.57	1107.098

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Table A-4 Saturation Properties of Ammonia — SI Units (continued)

Temperature (°C)	Pressure (kPa)	Enthalpy (kJ/kg)		Entropy (kJ/kg-K)		Liq. Density (kg/m <sup>3</sup> )	Vapor Sp. Vol. (L/kg)
		Liquid	Vapor	Liquid	Vapor		
-32	108.26	54.675	1420.291	0.4362	6.0992	680.33	1056.717
-31	113.73	59.136	1421.807	0.4547	6.0820	679.08	1009.061
-30	119.43	63.603	1423.311	0.4730	6.0651	677.83	963.963
-29	125.35	68.075	1424.804	0.4914	6.0483	676.58	921.263
-28	131.51	72.551	1426.284	0.5096	6.0317	675.32	880.816
-27	137.92	77.033	1427.752	0.5278	6.0152	674.06	842.486
-26	144.57	81.521	1429.208	0.5460	5.9989	672.80	806.144
-25	151.47	86.013	1430.652	0.5641	5.9827	671.53	771.672
-24	158.64	90.510	1432.082	0.5821	5.9667	670.26	738.959
-23	166.08	95.013	1433.501	0.6001	5.9508	668.98	707.901
-22	173.79	99.520	1434.906	0.6180	5.9351	667.71	678.403
-21	181.79	104.033	1436.298	0.6359	5.9195	666.42	650.374
-20	190.08	108.550	1437.677	0.6538	5.9041	665.14	623.730
-19	198.67	113.073	1439.042	0.6715	5.8888	663.85	598.390
-18	207.56	117.601	1440.394	0.6893	5.8736	662.55	574.283
-17	216.77	122.134	1441.733	0.7069	5.8586	661.25	551.338
-16	226.31	126.672	1443.057	0.7246	5.8437	659.95	529.490
-15	236.17	131.216	1444.368	0.7421	5.8289	658.65	508.679
-14	246.37	135.764	1445.664	0.7597	5.8143	657.34	488.849
-13	256.91	140.318	1446.946	0.7771	5.7997	656.02	469.944
-12	267.82	144.876	1448.214	0.7946	5.7853	654.70	451.916
-11	279.08	149.441	1449.466	0.8119	5.7710	653.38	434.717
-10	290.71	154.010	1450.705	0.8293	5.7569	652.06	418.303
-9	302.73	158.584	1451.928	0.8466	5.7428	650.73	402.632
-8	315.13	163.164	1453.136	0.8638	5.7289	649.39	387.666
-7	327.93	167.750	1454.329	0.8810	5.7150	648.06	373.367
-6	341.14	172.340	1455.506	0.8981	5.7013	646.71	359.701
-5	354.76	176.936	1456.668	0.9152	5.6877	645.37	346.635
-4	368.80	181.538	1457.814	0.9323	5.6741	644.02	334.139
-3	383.27	186.145	1458.944	0.9493	5.6607	642.66	322.184
-2	398.19	190.758	1460.058	0.9662	5.6474	641.30	310.742
-1	413.56	195.376	1461.156	0.9831	5.6342	639.94	299.788
0	429.38	200.000	1462.238	1.0000	5.6210	638.57	289.297
1	445.68	204.630	1463.303	1.0168	5.6080	637.20	279.247
2	462.46	209.265	1464.351	1.0336	5.5951	635.82	269.616
3	479.72	213.907	1465.382	1.0503	5.5822	634.44	260.384
4	497.48	218.554	1466.396	1.0670	5.5695	633.06	251.531
5	515.75	223.207	1467.393	1.0837	5.5568	631.66	243.039
6	534.53	227.867	1468.373	1.1003	5.5442	630.27	234.891
7	553.85	232.532	1469.335	1.1169	5.5317	628.87	227.071
8	573.70	237.204	1470.279	1.1334	5.5192	627.46	219.563
9	594.09	241.882	1471.206	1.1499	5.5069	626.05	212.352
10	615.05	246.566	1472.114	1.1664	5.4946	624.64	205.426
11	636.57	251.257	1473.004	1.1828	5.4824	623.22	198.770
12	658.66	255.954	1473.875	1.1992	5.4703	621.79	192.372

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**Table A-4 Saturation Properties of Ammonia — SI Units (continued)**

Temperature (°C)	Pressure (kPa)	Enthalpy (kJ/kg)		Entropy (kJ/kg-K)		Liq. Density (kg/m <sup>3</sup> )	Vapor Sp. Vol. (L/kg)
		Liquid	Vapor	Liquid	Vapor		
13	681.35	260.659	1474.728	1.2155	5.4583	620.36	186.221
14	704.63	265.369	1475.562	1.2318	5.4463	618.93	180.305
15	728.52	270.087	1476.376	1.2481	5.4344	617.49	174.614
16	753.03	274.812	1477.172	1.2643	5.4226	616.04	169.138
17	778.17	279.544	1477.948	1.2805	5.4108	614.59	163.867
18	803.95	284.283	1478.704	1.2967	5.3991	613.13	158.793
19	830.38	289.029	1479.441	1.3128	5.3874	611.67	153.906
20	857.48	293.783	1480.157	1.3289	5.3759	610.20	149.198
21	885.24	298.544	1480.853	1.3449	5.3643	608.72	144.662
22	913.69	303.313	1481.529	1.3610	5.3529	607.24	140.290
23	942.83	308.089	1482.184	1.3770	5.3415	605.76	136.076
24	972.68	312.874	1482.818	1.3929	5.3301	604.26	132.012
25	1003.24	317.667	1483.431	1.4089	5.3188	602.76	128.092
26	1034.53	322.468	1484.022	1.4248	5.3076	601.26	124.311
27	1066.56	327.277	1484.592	1.4406	5.2964	599.75	120.662
28	1099.34	332.095	1485.140	1.4565	5.2853	598.23	117.140
29	1132.88	336.921	1485.665	1.4723	5.2742	596.70	113.740
30	1167.20	341.757	1486.169	1.4881	5.2631	595.17	110.457
31	1202.30	346.601	1486.649	1.5038	5.2521	593.63	107.285
32	1238.19	351.455	1487.107	1.5196	5.2412	592.08	104.221
33	1274.89	356.318	1487.541	1.5353	5.2303	590.53	101.261
34	1312.42	361.190	1487.952	1.5509	5.2194	588.97	98.399
35	1350.77	366.073	1488.340	1.5666	5.2086	587.40	95.632
36	1389.97	370.965	1488.703	1.5822	5.1978	585.82	92.957
37	1430.02	375.867	1489.041	1.5979	5.1870	584.24	90.370
38	1470.94	380.780	1489.355	1.6134	5.1763	582.65	87.867
39	1512.73	385.703	1489.645	1.6290	5.1656	581.05	85.445
40	1555.42	390.637	1489.908	1.6446	5.1549	579.44	83.101
41	1599.01	395.581	1490.146	1.6601	5.1443	577.82	80.832
42	1643.52	400.538	1490.358	1.6756	5.1337	576.20	78.635
43	1688.96	405.505	1490.544	1.6911	5.1231	574.56	76.507
44	1735.33	410.484	1490.703	1.7065	5.1126	572.92	74.446
45	1782.66	415.475	1490.835	1.7220	5.1020	571.27	72.450
46	1830.95	420.479	1490.939	1.7374	5.0915	569.61	70.515
47	1880.23	425.494	1491.016	1.7528	5.0810	567.94	68.640
48	1930.49	430.523	1491.064	1.7683	5.0706	566.25	66.822
49	1981.75	435.564	1491.083	1.7836	5.0601	564.56	65.060
50	2034.03	440.619	1491.074	1.7990	5.0497	562.86	63.350
51	2087.34	445.687	1491.034	1.8144	5.0393	561.15	61.692
52	2141.69	450.770	1490.965	1.8297	5.0289	559.43	60.084
53	2197.10	455.866	1490.865	1.8451	5.0185	557.70	58.523
54	2253.58	460.977	1490.734	1.8604	5.0081	555.95	57.008
55	2311.13	466.103	1490.572	1.8758	4.9977	554.20	55.537
56	2369.78	471.244	1490.377	1.8911	4.9873	552.43	54.110
57	2429.54	476.401	1490.150	1.9064	4.9770	550.65	52.723

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Table A-4 Saturation Properties of Ammonia — SI Units (continued)

Temperature (°C)	Pressure (kPa)	Enthalpy (kJ/kg)		Entropy (kJ/kg-K)		Liq. Density (kg/m <sup>3</sup> )	Vapor Sp. Vol. (L/kg)
		Liquid	Vapor	Liquid	Vapor		
58	2490.42	481.573	1489.889	1.9217	4.9666	548.86	51.377
59	2552.44	486.762	1489.595	1.9370	4.9562	547.06	50.068
60	2615.60	491.968	1489.267	1.9523	4.9458	545.24	48.797
61	2679.93	497.191	1488.903	1.9676	4.9355	543.41	47.562
62	2745.43	502.431	1488.504	1.9829	4.9251	541.57	46.361
63	2812.12	507.690	1488.068	1.9982	4.9147	539.72	45.194
64	2880.01	512.967	1487.596	2.0135	4.9043	537.85	44.059
65	2949.13	518.262	1487.085	2.0288	4.8939	535.96	42.955
66	3019.48	523.577	1486.536	2.0441	4.8834	534.06	41.881
67	3091.07	528.912	1485.948	2.0594	4.8730	532.15	40.837
68	3163.92	534.268	1485.320	2.0747	4.8625	530.22	39.820
69	3238.05	539.644	1484.651	2.0901	4.8520	528.27	38.831
70	3313.47	545.042	1483.940	2.1054	4.8415	526.31	37.868
71	3390.20	550.462	1483.186	2.1208	4.8310	524.33	36.931
72	3468.24	555.905	1482.389	2.1361	4.8204	522.33	36.018
73	3547.63	561.371	1481.547	2.1515	4.8098	520.32	35.129
74	3628.36	566.860	1480.659	2.1669	4.7992	518.28	34.263
75	3710.45	572.375	1479.724	2.1823	4.7885	516.23	33.419
76	3793.93	577.915	1478.742	2.1977	4.7778	514.16	32.596
77	3878.81	583.481	1477.710	2.2131	4.7670	512.07	31.795
78	3965.09	589.073	1476.628	2.2286	4.7562	509.96	31.014
80	4141.97	600.342	1474.309	2.2596	4.7344	505.67	29.509
82	4324.69	611.729	1471.771	2.2908	4.7124	501.29	28.078
84	4513.39	623.240	1469.005	2.3220	4.6901	496.82	26.715
86	4708.20	634.883	1465.995	2.3534	4.6675	492.24	25.417
88	4909.26	646.669	1462.727	2.3850	4.6446	487.56	24.179
90	5116.72	658.605	1459.186	2.4168	4.6213	482.75	22.997
92	5330.72	670.705	1455.351	2.4488	4.5976	477.82	21.868
94	5551.41	682.980	1451.204	2.4810	4.5734	472.76	20.790
96	5778.96	695.443	1446.719	2.5136	4.5487	467.55	19.757
98	6013.52	708.111	1441.872	2.5464	4.5234	462.18	18.768
100	6255.27	721.003	1436.632	2.5797	4.4975	456.63	17.820
102	6504.38	734.138	1430.963	2.6133	4.4708	450.90	16.910
104	6761.04	747.541	1424.825	2.6474	4.4432	444.95	16.035
106	7025.45	761.241	1418.171	2.6821	4.4147	438.78	15.192
108	7297.81	775.275	1410.944	2.7173	4.3851	432.34	14.380
110	7578.34	789.683	1403.076	2.7533	4.3542	425.61	13.596
112	7867.28	804.520	1394.482	2.7902	4.3219	418.54	12.837
114	8164.87	819.855	1385.058	2.8280	4.2879	411.08	12.100
116	8471.40	835.777	1374.670	2.8671	4.2519	403.15	11.383
118	8787.16	852.409	1363.141	2.9077	4.2134	394.67	10.682
120	9112.49	869.923	1350.230	2.9502	4.1719	385.49	9.993
122	9447.75	888.578	1335.588	2.9953	4.1266	375.40	9.311
124	9793.37	908.788	1318.682	3.0440	4.0761	364.08	8.628
126	10149.84	931.287	1298.614	3.0980	4.0183	350.95	7.933
128	10517.73	957.605	1273.634	3.1611	3.9489	334.79	7.202
130	10897.68	992.018	1239.317	3.2437	3.8571	312.29	6.379

## Superheated Vapor Properties of Ammonia — SI Units

Table A-5 Superheated Vapor Properties of Ammonia — SI Units

Saturation $t = -50$ C, $p = 40.84$ kPa				Saturation $t = -45$ C, $p = 54.49$ kPa			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
-50	1391.186	6.4396	2627.7756	-45	1399.594	6.3384	2007.1027
-45	1402.027	6.4877	2690.8291	-40	1410.584	6.3860	2054.8351
-40	1412.785	6.5343	2753.4876	-35	1421.477	6.4323	2102.2216
-35	1423.476	6.5797	2815.8111	-30	1432.293	6.4772	2149.3139
-30	1434.116	6.6239	2877.849	-25	1443.047	6.5210	2196.1549
-25	1444.717	6.6671	2939.6421	-20	1453.754	6.5637	2242.7801
-20	1455.289	6.7092	3001.2246	-15	1464.426	6.6055	2289.2191
-15	1465.841	6.7505	3062.6249	-10	1475.071	6.6463	2335.4967
-10	1476.380	6.7909	3123.8671	-5	1485.699	6.6863	2381.6337
-5	1486.913	6.8306	3184.9713	0	1496.316	6.7255	2427.6479
0	1497.446	6.8695	3245.9546	5	1506.929	6.7641	2473.5542
5	1507.984	6.9077	3306.8316	10	1517.544	6.8019	2519.3653
Saturation $t = -40$ C, $p = 71.69$ kPa				Saturation $t = -35$ C, $p = 93.10$ kPa			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
-40	1407.763	6.2425	1553.3015	-35	1415.675	6.1516	1216.7791
-35	1418.919	6.2899	1589.9925	-30	1427.016	6.1987	1245.3904
-30	1429.964	6.3358	1626.3779	-25	1438.228	6.2443	1273.7301
-25	1440.918	6.3804	1662.5033	-20	1449.336	6.2887	1301.8381
-20	1451.800	6.4238	1698.406	-15	1460.359	6.3318	1329.7477
-15	1462.626	6.4661	1734.1172	-10	1471.316	6.3738	1357.4862
-10	1473.408	6.5075	1769.6628	-5	1482.220	6.4149	1385.0766
-5	1484.157	6.5480	1805.0646	0	1493.083	6.4550	1412.5380
0	1494.882	6.5876	1840.3408	5	1503.916	6.4943	1439.8868
5	1505.592	6.6264	1875.5071	10	1514.728	6.5328	1467.1366
10	1516.294	6.6646	1910.5765	15	1525.527	6.5706	1494.2991
15	1526.994	6.7020	1945.5604	20	1536.319	6.6078	1521.3844
Saturation $t = -30$ C, $p = 119.43$ kPa				Saturation $t = -25$ C, $p = 151.47$ kPa			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
-30	1423.311	6.0651	963.9667	-25	1430.652	5.9827	771.6731
-25	1434.856	6.1121	986.5824	-20	1442.420	6.0297	789.7789
-20	1446.253	6.1576	1008.9544	-15	1454.019	6.0751	807.6648
-15	1457.529	6.2017	1031.1188	-10	1465.481	6.1190	825.3633
-10	1468.708	6.2446	1053.1050	-5	1476.829	6.1617	842.9009
-5	1479.808	6.2863	1074.9375	0	1488.086	6.2033	860.2996
0	1490.845	6.3271	1096.6368	5	1499.270	6.2439	877.5778
5	1501.834	6.3670	1118.2199	10	1510.395	6.2836	894.7508
10	1512.785	6.4060	1139.7013	15	1521.474	6.3223	911.8316
15	1523.708	6.4443	1161.0933	20	1532.519	6.3603	928.8312
20	1534.613	6.4818	1182.4062	25	1543.538	6.3976	945.7589
25	1545.506	6.5186	1203.6491	30	1554.541	6.4342	962.6227

(Continued on next page)

Table A-5 Superheated Vapor Properties of Ammonia — SI Units (continued)

Saturation $t = -20$ C, $p = 190.08$ kPa				Saturation $t = -15$ C, $p = 236.17$ kPa			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
-20	1437.677	5.9041	623.7291	-15	1444.368	5.8289	508.6798
-15	1449.690	5.9511	638.4000	-10	1456.647	5.8760	520.7037
-10	1461.510	5.9965	652.8712	-5	1468.708	5.9214	532.5449
-5	1473.173	6.0404	667.1721	0	1480.590	5.9653	544.2305
0	1484.707	6.0830	681.3269	5	1492.324	6.0079	555.7827
5	1496.135	6.1244	695.3555	10	1503.937	6.0493	567.2196
10	1507.477	6.1649	709.2745	15	1515.452	6.0896	578.5563
15	1518.750	6.2043	723.0977	20	1526.885	6.1289	589.8055
20	1529.969	6.2429	736.8370	25	1538.255	6.1674	600.9777
25	1541.145	6.2807	750.5021	30	1549.573	6.2051	612.0821
30	1552.289	6.3178	764.1016	35	1560.851	6.2420	623.1262
35	1563.410	6.3542	777.6427	40	1572.099	6.2782	634.1167
Saturation $t = -10$ C, $p = 290.71$ kPa				Saturation $t = -5$ C, $p = 354.76$ kPa			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
-10	1450.705	5.7569	418.3027	-5	1456.668	5.6877	346.6356
-5	1463.273	5.8042	428.2639	0	1469.550	5.7353	354.9727
0	1475.595	5.8497	438.0570	5	1482.154	5.7810	363.1542
5	1487.714	5.8937	447.7072	10	1494.528	5.8251	371.2036
10	1499.665	5.9363	457.2347	15	1506.714	5.8677	379.1398
15	1511.478	5.9776	466.6564	20	1518.743	5.9091	386.9783
20	1523.178	6.0179	475.9861	25	1530.642	5.9494	394.7319
25	1534.785	6.0571	485.2353	30	1542.435	5.9886	402.4112
30	1546.317	6.0955	494.4138	35	1554.141	6.0269	410.0251
35	1557.788	6.1330	503.5299	40	1565.776	6.0644	417.5814
40	1569.210	6.1698	512.5904	45	1577.353	6.1010	425.0864
45	1580.596	6.2059	521.6016	50	1588.886	6.1370	432.5456
Saturation $t = 0$ C, $p = 429.39$ kPa				Saturation $t = 5$ C, $p = 515.75$ kPa			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
0	1462.240	5.6211	289.3115	5	1467.393	5.5568	243.0391
5	1475.461	5.6690	296.3574	10	1480.980	5.6052	249.0486
10	1488.368	5.7150	303.2586	15	1494.216	5.6515	254.9226
15	1501.018	5.7593	310.0370	20	1507.162	5.6961	260.6818
20	1513.455	5.8021	316.7103	25	1519.869	5.7391	266.3430
25	1525.715	5.8436	323.2930	30	1532.378	5.7807	271.9198
30	1537.829	5.8839	329.7969	35	1544.721	5.8210	277.4232
35	1549.822	5.9231	336.2320	40	1556.927	5.8603	282.8625
40	1561.714	5.9614	342.6065	45	1569.019	5.8986	288.2453
45	1573.524	5.9988	348.9275	50	1581.016	5.9361	293.5783
50	1585.267	6.0354	355.2008	55	1592.936	5.9727	298.8669
55	1596.957	6.0713	361.4317	60	1604.793	6.0085	304.1160

(Continued on next page)

**Table A-5 Superheated Vapor Properties of Ammonia — SI Units (continued)**

Saturation $t = 10\text{ C}$ , $p = 615.05\text{ kPa}$				Saturation $t = 15\text{ C}$ , $p = 728.52\text{ kPa}$			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
10	1472.114	5.4946	205.4257	15	1476.376	5.4344	174.6143
15	1486.095	5.5436	210.5966	20	1490.783	5.4840	179.1011
20	1499.683	5.5903	215.6398	25	1504.750	5.5312	183.4670
25	1512.947	5.6352	220.5754	30	1518.355	5.5765	187.7312
30	1525.944	5.6784	225.4190	35	1531.661	5.6200	191.9089
35	1538.718	5.7202	230.1835	40	1544.719	5.6620	196.0121
40	1551.306	5.7607	234.8794	45	1557.569	5.7027	200.0507
45	1563.740	5.8001	239.5154	50	1570.245	5.7423	204.0331
50	1576.045	5.8385	244.0985	55	1582.776	5.7808	207.9659
55	1588.242	5.8760	248.6350	60	1595.186	5.8183	211.8549
60	1600.350	5.9126	253.1301	65	1607.494	5.8550	215.7051
65	1612.385	5.9485	257.5881	70	1619.719	5.8909	219.5204
Saturation $t = 20\text{ C}$ , $p = 857.48\text{ kPa}$				Saturation $t = 25\text{ C}$ , $p = 1003.24\text{ kPa}$			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
20	1480.157	5.3759	149.1978	25	1483.431	5.3188	128.0924
25	1495.023	5.4262	153.1223	30	1498.792	5.3699	131.5518
30	1509.397	5.4740	156.9318	35	1513.603	5.4184	134.9010
35	1523.367	5.5197	160.6447	40	1527.965	5.4646	138.1580
40	1537.004	5.5636	164.2756	45	1541.956	5.5090	141.3370
45	1550.365	5.6059	167.8362	50	1555.639	5.5516	144.4492
50	1563.493	5.6468	171.3359	55	1569.065	5.5929	147.5035
55	1576.428	5.6866	174.7824	60	1582.275	5.6328	150.5076
60	1589.200	5.7252	178.1823	65	1595.303	5.6716	153.4675
65	1601.836	5.7628	181.5408	70	1608.178	5.7094	156.3883
70	1614.357	5.7996	184.8628	75	1620.924	5.7463	159.2745
75	1626.781	5.8355	188.1519	80	1633.561	5.7823	162.1297
Saturation $t = 30\text{ C}$ , $p = 1167.20\text{ kPa}$				Saturation $t = 35\text{ C}$ , $p = 1350.77\text{ kPa}$			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
30	1486.169	5.2631	110.4567	35	1488.340	5.2086	95.6325
35	1502.065	5.3151	113.5289	40	1504.816	5.2616	98.3806
40	1517.347	5.3643	116.4949	45	1520.605	5.3116	101.0256
45	1532.128	5.4112	119.3724	50	1535.837	5.3591	103.5853
50	1546.498	5.4560	122.1752	55	1550.612	5.4045	106.0731
55	1560.526	5.4991	124.9143	60	1565.007	5.4480	108.4998
60	1574.268	5.5406	127.5983	65	1579.086	5.4900	110.8739
65	1587.770	5.5809	130.2344	70	1592.898	5.5305	113.2021
70	1601.070	5.6199	132.8286	75	1606.486	5.5698	115.4904
75	1614.198	5.6579	135.3857	80	1619.884	5.6081	117.7433
80	1627.182	5.6949	137.9099	85	1633.120	5.6453	119.9649
85	1640.045	5.7311	140.4048	90	1646.221	5.6816	122.1585

*(Continued on next page)*

Table A-5 Superheated Vapor Properties of Ammonia — SI Units (continued)

Saturation $t = 40\text{ C}$ , $p = 1555.42\text{ kPa}$				Saturation $t = 45\text{ C}$ , $p = 1782.66\text{ kPa}$			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
40	1489.908	5.1549	83.1008	45	1490.835	5.1020	72.4498
45	1507.015	5.2091	85.5764	50	1508.629	5.1575	74.6954
50	1523.352	5.2601	87.9514	55	1525.560	5.2095	76.8420
55	1539.069	5.3083	90.2434	60	1541.798	5.2586	78.9076
60	1554.277	5.3543	92.4660	65	1557.472	5.3053	80.9055
65	1569.065	5.3984	94.6296	70	1572.679	5.3500	82.8464
70	1583.502	5.4408	96.7426	75	1587.498	5.3929	84.7383
75	1597.644	5.4817	98.8117	80	1601.991	5.4342	86.5880
80	1611.538	5.5213	100.8424	85	1616.209	5.4742	88.4008
85	1625.220	5.5598	102.8394	90	1630.194	5.5129	90.1811
90	1638.724	5.5972	104.8064	95	1643.980	5.5507	91.9327
95	1652.076	5.6338	106.7467	100	1657.597	5.5874	93.6587
Saturation $t = 50\text{ C}$ , $p = 2034.03\text{ kPa}$				Saturation $t = 55\text{ C}$ , $p = 2311.13\text{ kPa}$			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
50	1491.074	5.0497	63.3503	55	1490.572	4.9977	55.5375
55	1509.621	5.1067	65.4013	60	1509.950	5.0563	57.4236
60	1527.198	5.1598	67.3541	65	1528.231	5.1108	59.2114
65	1544.000	5.2099	69.2271	70	1545.644	5.1619	60.9203
70	1560.173	5.2574	71.0340	75	1562.356	5.2103	62.5640
75	1575.830	5.3027	72.7853	80	1578.494	5.2563	64.1533
80	1591.056	5.3461	74.4892	85	1594.156	5.3003	65.6962
85	1605.923	5.3879	76.1521	90	1609.420	5.3427	67.1994
90	1620.485	5.4283	77.7793	95	1624.348	5.3835	68.6679
95	1634.790	5.4674	79.3753	100	1638.992	5.4230	70.1063
100	1648.875	5.5054	80.9436	105	1653.394	5.4613	71.5178
105	1662.772	5.5424	82.4873	110	1667.588	5.4986	72.9056
Saturation $t = 60\text{ C}$ , $p = 2615.60\text{ kPa}$				Saturation $t = 65\text{ C}$ , $p = 2949.13\text{ kPa}$			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
60	1489.267	4.9458	48.7972	65	1487.085	4.8939	42.9551
65	1509.568	5.0063	50.5436	70	1508.419	4.9565	44.5835
70	1528.622	5.0623	52.1909	75	1528.326	5.0141	46.1110
75	1546.699	5.1146	53.7593	80	1547.129	5.0677	47.5589
80	1563.992	5.1639	55.2631	85	1565.053	5.1181	48.9424
85	1580.648	5.2107	56.7132	90	1582.266	5.1659	50.2727
90	1596.776	5.2555	58.1180	95	1598.894	5.2113	51.5583
95	1612.464	5.2984	59.4839	100	1615.036	5.2549	52.8057
100	1627.782	5.3397	60.8161	105	1630.768	5.2968	54.0202
105	1642.786	5.3796	62.1189	110	1646.154	5.3372	55.2060
110	1657.522	5.4183	63.3957	115	1661.245	5.3763	56.3665
115	1672.030	5.4560	64.6496	120	1676.084	5.4143	57.5047

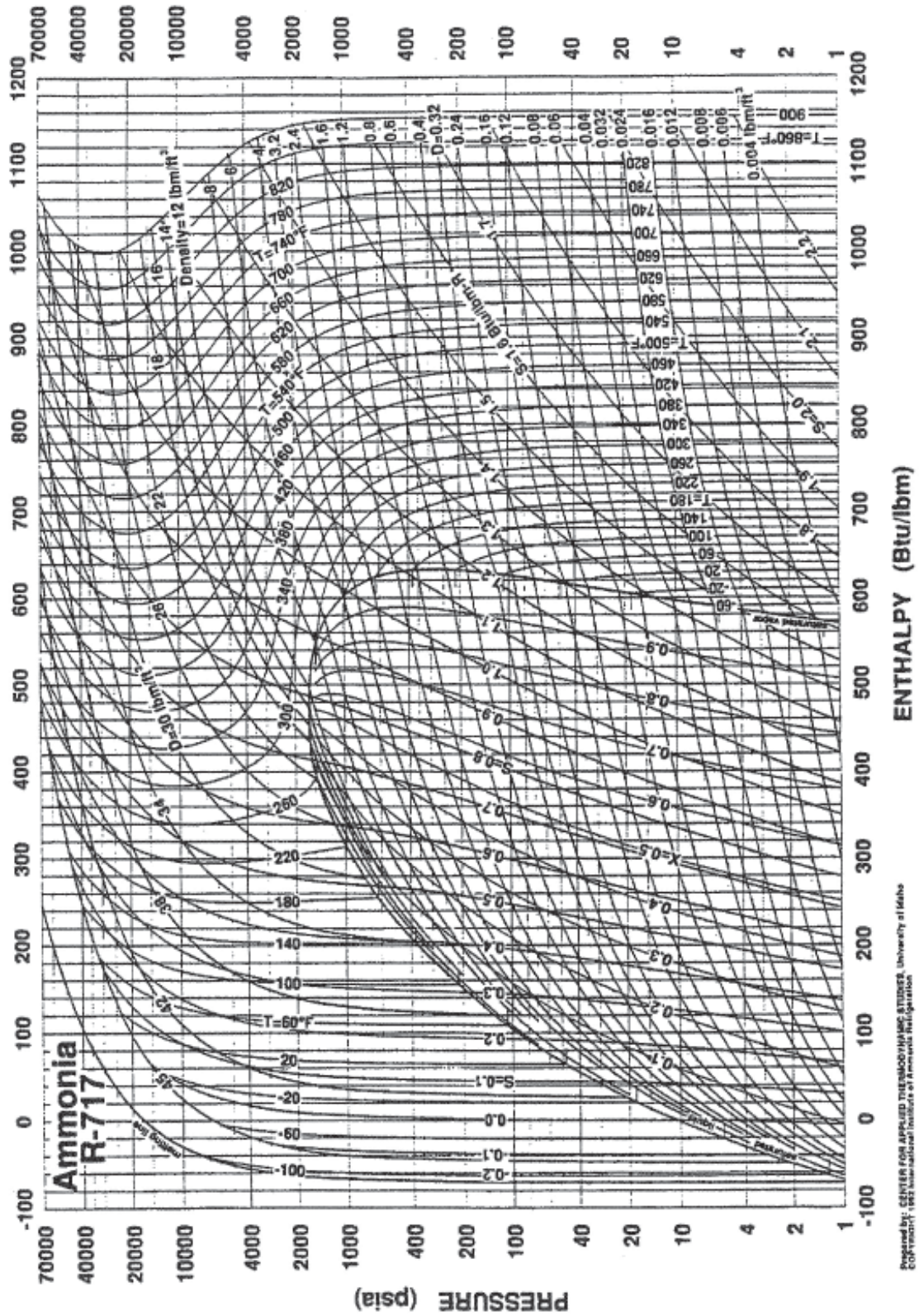
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**Table A-5 Superheated Vapor Properties of Ammonia — SI Units (continued)**

Saturation $t = 70\text{ C}$ , $p = 3313.47\text{ kPa}$				Saturation $t = 75\text{ C}$ , $p = 3710.45\text{ kPa}$			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
70	1483.940	4.8415	37.8682	75	1479.724	4.7885	33.4187
75	1506.439	4.9066	39.3976	80	1503.553	4.8564	34.8662
80	1527.294	4.9661	40.8230	85	1525.470	4.9181	36.2049
85	1546.893	5.0212	42.1675	90	1545.949	4.9749	37.4608
90	1565.504	5.0728	43.4473	95	1565.310	5.0278	38.6511
95	1583.320	5.1215	44.6741	100	1583.779	5.0777	39.7881
100	1600.486	5.1679	45.8565	105	1601.524	5.1249	40.8809
105	1617.112	5.2121	47.0013	110	1618.670	5.1699	41.9365
110	1633.286	5.2546	48.1137	115	1635.317	5.2131	42.9601
115	1649.079	5.2956	49.1980	120	1651.542	5.2546	43.9560
120	1664.546	5.3352	50.2577	125	1667.409	5.2947	44.9278
125	1679.736	5.3736	51.2955	130	1682.970	5.3336	45.8783
Saturation $t = 80\text{ C}$ , $p = 4141.97\text{ kPa}$				Saturation $t = 85\text{ C}$ , $p = 4610.02\text{ kPa}$			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
80	1474.309	4.7344	29.5092	85	1467.531	4.6789	26.0581
85	1499.674	4.8057	30.8901	90	1494.698	4.7542	27.3871
90	1522.789	4.8698	32.1559	95	1519.177	4.8212	28.5923
95	1544.245	4.9285	33.3358	100	1541.726	4.8820	29.7073
100	1564.430	4.9830	34.4487	105	1562.820	4.9382	30.7534
105	1583.611	5.0340	35.5079	110	1582.777	4.9906	31.7448
110	1601.981	5.0823	36.5227	115	1601.826	5.0400	32.6914
115	1619.686	5.1282	37.5003	120	1620.133	5.0868	33.6009
120	1636.838	5.1721	38.4463	125	1637.826	5.1316	34.4789
125	1653.524	5.2143	39.3651	130	1655.004	5.1744	35.3299
130	1669.816	5.2550	40.2600	135	1671.748	5.2157	36.1573
135	1685.770	5.2943	41.1340	140	1688.120	5.2556	36.9642
Saturation $t = 90\text{ C}$ , $p = 5116.72\text{ kPa}$				Saturation $t = 95\text{ C}$ , $p = 5664.32\text{ kPa}$			
Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg	Temp. °C	Enthalpy kJ/kg	Entropy kJ/(kg-K)	Sp. Vol. L/kg
90	1459.186	4.6213	22.9970	95	1449.005	4.5612	20.2677
95	1488.499	4.7015	24.2883	100	1480.927	4.6473	21.5361
100	1514.550	4.7718	25.4441	105	1508.810	4.7215	22.6530
105	1538.330	4.8351	26.5043	110	1533.986	4.7877	23.6670
110	1560.431	4.8932	27.4927	115	1557.210	4.8479	24.6058
115	1581.240	4.9471	28.4250	120	1578.956	4.9036	25.4867
120	1601.026	4.9978	29.3120	125	1599.544	4.9556	26.3214
125	1619.982	5.0457	30.1616	130	1619.204	5.0047	27.1182
130	1638.257	5.0913	30.9798	135	1638.103	5.0513	27.8835
135	1655.961	5.1350	31.7710	140	1656.371	5.0958	28.6220
140	1673.185	5.1769	32.5390	145	1674.108	5.1384	29.3373
145	1690.001	5.2174	33.2866	150	1691.394	5.1795	30.0325

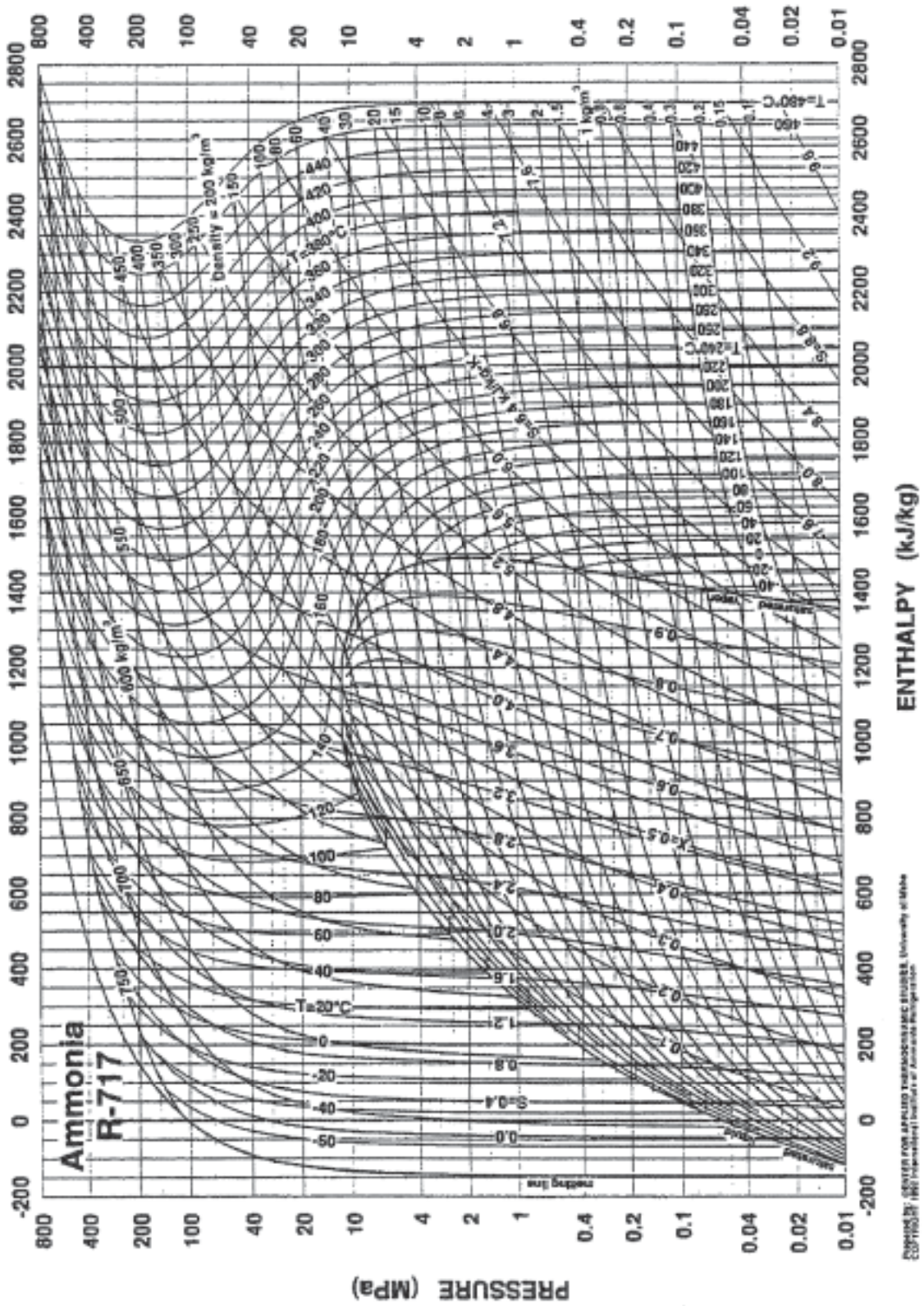


*Pressure-Enthalpy Diagram — IP Units*





**Pressure-Enthalpy Diagram — SI Units**



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 EOP-1100 (2011) (International Institute of Ammonia Refrigeration)