Designation: D3984 – 13

Standard Specification for Ethane Thermophysical Property Tables[1]

This standard is issued under the fixed designation D3984; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 The thermophysical property tables for ethane are for use in the calculation of the pressure-volume-temperature (PVT), thermodynamic, and transport properties of ethane for process design and operations. Tables are provided for gaseous and liquid ethane at temperatures between 92 and 600 K at pressures to 20 MPa. Two tables provide properties at the conditions of liquid-vapor equilibrium (saturation properties). A third table provides properties at selected *T*, *p* points for the equilibrium phase at those conditions. The tables were developed by the National Institute of Standards and Technology from a Standard Reference Database product REFPROP, version 9.0.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

2. Applicability

2.1 These tables apply directly only to pure gaseous ethane. However, it is expected that they may find substantial use in mathematical models and tables for the thermophysical properties of mixtures containing ethane.

3. Tables

3.1 These tables were produced by equations from a computer package, "NIST Standard Reference Database 23; Reference Fluid Thermodynamic and Transport Properties Database (REFPROP): Version 9.0." A wide selection of units (SI units, engineering units, chemical units) and additional properties are available with this program.[2]

3.2 These thermophysical property tables are:

3.2.1 *Thermophysical Properties of Ethane Liquid at Vapor-Liquid Equilibrium,* in SI units. See Table 1.

3.2.2 *Thermophysical Properties of Ethane Vapor at Vapor-Liquid Equilibrium,* in SI units. See Table 2.

3.2.3 *Thermophysical Properties of Ethane Along Isobars,* in SI units. See Table 3.

3.3 The symbols are:

T, temperature (K)
ρ, molar density ($mol \cdot l^{-1}$)
H, molar enthalpy ($J \cdot mol^{-1}$)
S, molar entropy ($J \cdot K^{-1} \cdot mol^{-1}$)
C_v, constant volume molar heat capacity ($J \cdot K^{-1} \cdot mol^{-1}$)
C_p, constant pressure molar heat capacity ($J \cdot K^{-1} \cdot mol^{-1}$)
c, speed of sound ($m \cdot s^{-1}$)
η, viscosity (μPa·s)
λ, thermal conductivity ($mW \cdot m^{-1} \cdot K^{-1}$)

3.4 The tabulated thermophysical properties are:

ρ, molar density ($mol \cdot l^{-1}$)
H, molar enthalpy ($J \cdot mol^{-1}$)
S, molar entropy ($J \cdot K^{-1} \cdot mol^{-1}$)
C_v, constant volume molar heat capacity ($J \cdot K^{-1} \cdot mol^{-1}$)
C_p, constant pressure molar heat capacity ($J \cdot K^{-1} \cdot mol^{-1}$)
c, speed of sound ($m \cdot s^{-1}$)
η, viscosity (μPa·s)
λ, thermal conductivity ($mW \cdot m^{-1} \cdot K^{-1}$)

4. Additional Information

4.1 Reference state properties are required to calculate certain of the thermodynamic properties (enthalpy, entropy, etc.) from an equation of state formulation. The reference state properties used to generate the tables in this specification are: enthalpy, *H*, and entropy, *S*, at the Normal Boiling Point; 184.57K and 0.10133MPa (H = 14716 J/mol and S = 79.731 J/(mol K)). The molar mass of ethane is 30.069 g/mol.

5. Keywords

5.1 ethane gas tables; natural gas; thermodynamic properties of ethane; transport properties of ethane

[1] This specification is under the jurisdiction of ASTM Committee D03 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.08 on Thermophysical Properties.

Current edition approved May 1, 2013. Published May 2013. Originally approved in 1982. Last previous edition approved in 2008 as D3984 – 08. DOI: 10.1520/D3984-13.

[2] Available from Standard Reference Data, National Institute of Standards and Technology (NIST), 100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899.

TABLE 1 Thermophysical Properties of Ethane Liquid at Vapor-Liquid Equilibrium

T K	p MPa	ρ $mol \cdot l^{-1}$	H $J \cdot mol^{-1}$	S $J \cdot mol^{-1} \cdot K^{-1}$	C_v $J \cdot mol^{-1} \cdot K^{-1}$	C_p $J \cdot mol^{-1} \cdot K^{-1}$	c $m \cdot s^{-1}$	η μPa·s	λ $mW \cdot m^{-1} \cdot K^{-1}$
90.4	1.1518E-06	1.5324E-06	11295	148.09	26.811	35.126	180.97	3.0436	2.9100
92	1.7410E-06	2.2760E-06	11351	145.27	26.905	35.220	182.48	3.0888	3.0000
94	2.8559E-06	3.6541E-06	11421	141.92	27.024	35.339	184.36	3.1453	3.1131
96	4.5809E-06	5.7391E-06	11492	138.73	27.143	35.458	186.22	3.2020	3.2268
98	7.1951E-06	8.8304E-06	11563	135.71	27.263	35.578	188.05	3.2588	3.3412
100	1.1081E-05	1.3327E-05	11634	132.84	27.384	35.699	189.86	3.3157	3.4563
102	1.6752E-05	1.9754E-05	11706	130.11	27.505	35.821	191.65	3.3729	3.5723
104	2.4891E-05	2.8787E-05	11778	127.52	27.627	35.944	193.42	3.4302	3.6890
106	3.6383E-05	4.1284E-05	11850	125.05	27.749	36.067	195.17	3.4877	3.8067
108	5.2368E-05	5.8323E-05	11922	122.69	27.873	36.192	196.90	3.5454	3.9252
110	7.4287E-05	8.1234E-05	11994	120.45	27.997	36.318	198.61	3.6034	4.0447
112	1.0394E-04	1.1164E-04	12067	118.31	28.124	36.447	200.30	3.6615	4.1651
114	1.4357E-04	1.5150E-04	12139	116.27	28.252	36.578	201.98	3.7199	4.2865
116	1.9587E-04	2.0314E-04	12212	114.32	28.382	36.713	203.63	3.7784	4.4089
118	2.6414E-04	2.6932E-04	12286	112.46	28.515	36.850	205.27	3.8372	4.5323
120	3.5230E-04	3.5326E-04	12359	110.69	28.651	36.992	206.89	3.8961	4.6568
122	4.6500E-04	4.5866E-04	12432	108.99	28.791	37.139	208.49	3.9553	4.7823
124	6.0768E-04	5.8981E-04	12506	107.36	28.933	37.290	210.07	4.0146	4.9090
126	7.8667E-04	7.5154E-04	12580	105.81	29.079	37.446	211.63	4.0742	5.0368
128	1.0093E-03	9.4934E-04	12654	104.32	29.229	37.606	213.17	4.1339	5.1658
130	1.2839E-03	1.1893E-03	12728	102.89	29.380	37.770	214.69	4.1937	5.2959
132	1.6200E-03	1.4783E-03	12802	101.53	29.534	37.937	216.19	4.2538	5.4273
134	2.0283E-03	1.8238E-03	12876	100.22	29.689	38.107	217.68	4.3140	5.5600
136	2.5209E-03	2.2340E-03	12950	98.966	29.845	38.279	219.14	4.3744	5.6940
138	3.1110E-03	2.7181E-03	13025	97.764	30.000	38.451	220.58	4.4349	5.8294
140	3.8136E-03	3.2857E-03	13099	96.610	30.154	38.623	222.01	4.4956	5.9661
142	4.6448E-03	3.9473E-03	13173	95.504	30.306	38.793	223.42	4.5564	6.1043
144	5.6226E-03	4.7144E-03	13248	94.442	30.454	38.961	224.80	4.6174	6.2440
146	6.7664E-03	5.5990E-03	13322	93.422	30.599	39.127	226.17	4.6785	6.3852
148	8.0973E-03	6.6141E-03	13397	92.442	30.739	39.289	227.51	4.7398	6.5280
150	9.6380E-03	7.7732E-03	13471	91.501	30.876	39.449	228.84	4.8011	6.6725
152	1.1413E-02	9.0909E-03	13545	90.596	31.008	39.607	230.14	4.8626	6.8187
154	1.3448E-02	1.0582E-02	13619	89.726	31.137	39.763	231.42	4.9243	6.9666
156	1.5772E-02	1.2264E-02	13693	88.889	31.264	39.919	232.68	4.9860	7.1164
158	1.8414E-02	1.4151E-02	13767	88.083	31.389	40.076	233.91	5.0479	7.2680
160	2.1405E-02	1.6263E-02	13841	87.308	31.513	40.235	235.12	5.1100	7.4216
162	2.4779E-02	1.8617E-02	13914	86.561	31.637	40.399	236.30	5.1722	7.5772
164	2.8570E-02	2.1232E-02	13988	85.841	31.765	40.569	237.45	5.2345	7.7349
166	3.2814E-02	2.4127E-02	14060	85.146	31.895	40.748	238.57	5.2969	7.8947
168	3.7551E-02	2.7324E-02	14133	84.477	32.031	40.937	239.67	5.3595	8.0567
170	4.2819E-02	3.0843E-02	14205	83.831	32.173	41.138	240.73	5.4223	8.2209
172	4.8660E-02	3.4706E-02	14277	83.207	32.322	41.353	241.76	5.4852	8.3876
174	5.5118E-02	3.8935E-02	14348	82.604	32.480	41.583	242.76	5.5483	8.5566
176	6.2235E-02	4.3553E-02	14419	82.021	32.648	41.829	243.72	5.6116	8.7282
178	7.0060E-02	4.8584E-02	14489	81.458	32.826	42.093	244.65	5.6751	8.9023
180	7.8638E-02	5.4053E-02	14559	80.912	33.015	42.375	245.54	5.7388	9.0790
182	8.8019E-02	5.9985E-02	14628	80.385	33.214	42.676	246.39	5.8027	9.2585
184	9.8253E-02	6.6405E-02	14697	79.874	33.425	42.996	247.20	5.8669	9.4408
186	0.10939	7.3340E-02	14764	79.379	33.646	43.335	247.98	5.9313	9.6259
188	0.12149	8.0817E-02	14832	78.899	33.878	43.693	248.71	5.9959	9.8141
190	0.13459	8.8865E-02	14898	78.433	34.120	44.070	249.41	6.0609	10.005
192	0.14876	9.7512E-02	14964	77.982	34.371	44.465	250.06	6.1262	10.200
194	0.16405	0.10679	15030	77.543	34.631	44.878	250.67	6.1918	10.397
196	0.18052	0.11672	15094	77.118	34.900	45.309	251.24	6.2577	10.598
198	0.19823	0.12735	15158	76.704	35.175	45.756	251.77	6.3241	10.803
200	0.21723	0.13870	15221	76.302	35.457	46.220	252.26	6.3908	11.011
202	0.23759	0.15080	15283	75.911	35.745	46.699	252.70	6.4580	11.223
204	0.25936	0.16370	15344	75.530	36.037	47.195	253.10	6.5257	11.438
206	0.28261	0.17742	15404	75.160	36.334	47.705	253.45	6.5938	11.658
208	0.30740	0.19200	15464	74.799	36.634	48.230	253.76	6.6626	11.881
210	0.33380	0.20749	15523	74.447	36.937	48.771	254.02	6.7319	12.109
212	0.36185	0.22392	15580	74.103	37.243	49.327	254.24	6.8018	12.341
214	0.39164	0.24133	15637	73.768	37.551	49.899	254.41	6.8724	12.578
216	0.42323	0.25976	15693	73.440	37.861	50.488	254.54	6.9438	12.820
218	0.45667	0.27927	15747	73.119	38.173	51.094	254.62	7.0159	13.066
220	0.49205	0.29989	15801	72.806	38.486	51.718	254.65	7.0889	13.318
222	0.52941	0.32168	15853	72.498	38.800	52.363	254.63	7.1627	13.575
224	0.56884	0.34468	15904	72.197	39.116	53.029	254.56	7.2376	13.837
226	0.61040	0.36896	15954	71.901	39.434	53.718	254.44	7.3134	14.106
228	0.65416	0.39457	16003	71.610	39.755	54.433	254.27	7.3905	14.381
230	0.70018	0.42157	16050	71.324	40.077	55.176	254.05	7.4687	14.662
232	0.74854	0.45003	16096	71.042	40.402	55.949	253.78	7.5482	14.950
234	0.79931	0.48000	16140	70.764	40.731	56.756	253.45	7.6291	15.245
236	0.85256	0.51158	16183	70.489	41.063	57.601	253.07	7.7115	15.548

TABLE 1 *Continued*

T K	p MPa	ρ mol·l^{-1}	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
238	0.90836	0.54482	16225	70.218	41.400	58.487	252.64	7.7956	15.859
240	0.96679	0.57983	16264	69.948	41.742	59.419	252.14	7.8814	16.179
242	1.0279	0.61668	16302	69.681	42.089	60.401	251.59	7.9691	16.507
244	1.0918	0.65547	16338	69.416	42.443	61.439	250.98	8.0589	16.846
246	1.1585	0.69630	16372	69.151	42.803	62.539	250.31	8.1509	17.196
248	1.2282	0.73929	16404	68.888	43.171	63.709	249.58	8.2454	17.557
250	1.3008	0.78456	16434	68.624	43.548	64.956	248.79	8.3424	17.930
252	1.3766	0.83224	16461	68.360	43.934	66.288	247.93	8.4424	18.316
254	1.4555	0.88247	16486	68.096	44.330	67.717	247.00	8.5454	18.718
256	1.5376	0.93543	16509	67.829	44.737	69.255	246.01	8.6519	19.135
258	1.6230	0.99127	16528	67.561	45.155	70.914	244.95	8.7621	19.569
260	1.7118	1.0502	16545	67.290	45.586	72.712	243.81	8.8764	20.023
262	1.8041	1.1124	16559	67.015	46.030	74.668	242.61	8.9952	20.498
264	1.9000	1.1782	16569	66.737	46.488	76.805	241.33	9.1189	20.997
266	1.9996	1.2478	16576	66.453	46.963	79.154	239.97	9.2482	21.522
268	2.1029	1.3215	16579	66.163	47.457	81.749	238.54	9.3835	22.078
270	2.2100	1.3998	16578	65.865	47.971	84.634	237.02	9.5257	22.667
272	2.3210	1.4829	16572	65.560	48.511	87.865	235.42	9.6755	23.294
274	2.4361	1.5713	16562	65.245	49.078	91.508	233.73	9.8339	23.966
276	2.5554	1.6657	16546	64.918	49.677	95.649	231.95	10.002	24.690
278	2.6789	1.7666	16524	64.579	50.312	100.40	230.07	10.181	25.473
280	2.8067	1.8748	16495	64.224	50.986	105.91	228.10	10.373	26.327
282	2.9391	1.9913	16459	63.852	51.705	112.36	226.01	10.580	27.265
284	3.0760	2.1172	16414	63.458	52.475	120.03	223.82	10.804	28.306
286	3.2177	2.2540	16360	63.040	53.303	129.31	221.51	11.048	29.472
288	3.3643	2.4034	16294	62.592	54.200	140.75	219.07	11.318	30.795
290	3.5159	2.5679	16215	62.107	55.181	155.23	216.50	11.617	32.319
292	3.6728	2.7507	16120	61.577	56.268	174.14	213.78	11.954	34.109
294	3.8351	2.9566	16005	60.990	57.494	199.90	210.88	12.340	36.266
296	4.0031	3.1925	15864	60.326	58.915	237.10	207.77	12.791	38.954
298	4.1770	3.4695	15687	59.556	60.627	295.46	204.37	13.335	42.475
300	4.3573	3.8079	15458	58.625	62.820	399.89	200.51	14.023	47.465
302	4.5442	4.2525	15141	57.416	65.958	637.90	195.74	14.970	55.660
304	4.7387	4.9503	14617	55.547	71.737	1657.3	188.14	16.567	75.456
305	4.8392	5.6788	14058	53.648	78.860	7440.9	178.83	18.400	122.14

TABLE 2 Thermophysical Properties of Ethane Vapor at Liquid-Vapor Equilibrium

T	p	ρ	H	S	C_v	C_p	c	η	λ
K	MPa	$mol \cdot l^{-1}$	$J \cdot mol^{-1}$	$J \cdot mol^{-1} \cdot K^{-1}$	$J \cdot mol^{-1} \cdot K^{-1}$	$J \cdot mol^{-1} \cdot K^{-1}$	$m \cdot s^{-1}$	μPa·s	$mW \cdot m^{-1} \cdot K^{-1}$
90.4	1.1518E-06	21.667	-6588.5	-49.729	48.255	69.928	2008.5	1279.0	255.59
92	1.7410E-06	21.608	-6476.9	-48.505	47.848	69.604	1996.7	1192.7	254.34
94	2.8559E-06	21.535	-6338.0	-47.012	47.394	69.271	1982.1	1097.2	252.75
96	4.5809E-06	21.462	-6199.7	-45.557	46.994	69.006	1967.5	1013.2	251.14
98	7.1951E-06	21.389	-6061.9	-44.136	46.639	68.798	1952.9	939.07	249.50
100	1.1081E-05	21.316	-5924.5	-42.748	46.324	68.639	1938.4	873.22	247.83
102	1.6752E-05	21.243	-5787.4	-41.390	46.043	68.521	1924.0	814.50	246.14
104	2.4891E-05	21.170	-5650.4	-40.060	45.791	68.438	1909.5	761.91	244.42
106	3.6383E-05	21.097	-5513.6	-38.757	45.564	68.385	1895.1	714.64	242.68
108	5.2368E-05	21.024	-5376.9	-37.479	45.358	68.357	1880.8	671.99	240.91
110	7.4287E-05	20.951	-5240.1	-36.225	45.172	68.351	1866.4	633.38	239.12
112	1.0394E-04	20.878	-5103.4	-34.993	45.003	68.363	1852.0	598.30	237.32
114	1.4357E-04	20.805	-4966.7	-33.783	44.848	68.390	1837.6	566.34	235.49
116	1.9587E-04	20.731	-4829.9	-32.593	44.706	68.431	1823.2	537.14	233.64
118	2.6414E-04	20.658	-4692.9	-31.423	44.574	68.482	1808.8	510.37	231.78
120	3.5230E-04	20.584	-4555.9	-30.271	44.453	68.544	1794.4	485.78	229.91
122	4.6500E-04	20.511	-4418.8	-29.138	44.341	68.614	1780.0	463.13	228.02
124	6.0768E-04	20.437	-4281.5	-28.022	44.236	68.691	1765.5	442.21	226.12
126	7.8667E-04	20.363	-4144.0	-26.922	44.138	68.775	1751.0	422.84	224.20
128	1.0093E-03	20.289	-4006.3	-25.838	44.047	68.864	1736.5	404.87	222.28
130	1.2839E-03	20.214	-3868.5	-24.770	43.962	68.959	1722.0	388.17	220.35
132	1.6200E-03	20.140	-3730.5	-23.716	43.882	69.058	1707.5	372.61	218.40
134	2.0283E-03	20.065	-3592.2	-22.677	43.806	69.162	1692.9	358.08	216.45
136	2.5209E-03	19.991	-3453.8	-21.652	43.736	69.271	1678.3	344.48	214.50
138	3.1110E-03	19.916	-3315.1	-20.640	43.669	69.383	1663.7	331.75	212.54
140	3.8136E-03	19.840	-3176.2	-19.640	43.607	69.499	1649.1	319.79	210.57
142	4.6448E-03	19.765	-3037.1	-18.654	43.548	69.619	1634.4	308.54	208.60
144	5.6226E-03	19.689	-2897.7	-17.679	43.494	69.743	1619.7	297.94	206.63
146	6.7664E-03	19.613	-2758.0	-16.717	43.443	69.871	1605.0	287.94	204.66
148	8.0973E-03	19.537	-2618.1	-15.765	43.395	70.003	1590.3	278.50	202.68
150	9.6380E-03	19.461	-2477.9	-14.825	43.351	70.139	1575.5	269.55	200.71
152	1.1413E-02	19.384	-2337.4	-13.895	43.311	70.279	1560.7	261.07	198.73
154	1.3448E-02	19.307	-2196.6	-12.976	43.273	70.424	1545.9	253.03	196.75
156	1.5772E-02	19.230	-2055.5	-12.066	43.240	70.574	1531.1	245.38	194.78
158	1.8414E-02	19.152	-1914.2	-11.167	43.209	70.728	1516.2	238.10	192.81
160	2.1405E-02	19.074	-1772.4	-10.276	43.183	70.888	1501.3	231.16	190.84
162	2.4779E-02	18.996	-1630.4	-9.3949	43.159	71.052	1486.3	224.54	188.87
164	2.8570E-02	18.918	-1488.0	-8.5225	43.139	71.222	1471.4	218.22	186.90
166	3.2814E-02	18.839	-1345.2	-7.6586	43.123	71.398	1456.4	212.17	184.94
168	3.7551E-02	18.759	-1202.1	-6.8030	43.110	71.580	1441.4	206.38	182.98
170	4.2819E-02	18.680	-1058.5	-5.9553	43.100	71.768	1426.3	200.83	181.03
172	4.8660E-02	18.600	-914.61	-5.1155	43.094	71.963	1411.2	195.50	179.08
174	5.5118E-02	18.519	-770.26	-4.2831	43.092	72.164	1396.1	190.39	177.14
176	6.2235E-02	18.438	-625.49	-3.4581	43.094	72.372	1380.9	185.47	175.20
178	7.0060E-02	18.357	-480.27	-2.6400	43.099	72.588	1365.7	180.74	173.27
180	7.8638E-02	18.275	-334.59	-1.8288	43.108	72.812	1350.5	176.18	171.34
182	8.8019E-02	18.193	-188.44	-1.0241	43.120	73.043	1335.2	171.79	169.42
184	9.8253E-02	18.110	-41.785	-0.22582	43.137	73.283	1319.9	167.55	167.51
186	0.10939	18.026	105.38	0.56634	43.157	73.532	1304.5	163.46	165.60
188	0.12149	17.942	253.08	1.3526	43.181	73.789	1289.2	159.50	163.70
190	0.13459	17.858	401.33	2.1331	43.210	74.056	1273.7	155.68	161.84
192	0.14876	17.773	550.14	2.9081	43.242	74.333	1258.3	151.97	159.97
194	0.16405	17.687	699.55	3.6778	43.278	74.620	1242.8	148.39	158.11
196	0.18052	17.601	849.57	4.4423	43.318	74.918	1227.2	144.91	156.25
198	0.19823	17.514	1000.2	5.2019	43.363	75.227	1211.7	141.54	154.40
200	0.21723	17.426	1151.5	5.9569	43.411	75.548	1196.0	138.27	152.56
202	0.23759	17.337	1303.5	6.7072	43.464	75.881	1180.4	135.09	150.72
204	0.25936	17.248	1456.2	7.4532	43.520	76.226	1164.7	132.00	148.90
206	0.28261	17.158	1609.7	8.1951	43.582	76.585	1148.9	129.00	147.08
208	0.30740	17.068	1763.8	8.9329	43.647	76.958	1133.1	126.08	145.27
210	0.33380	16.976	1918.8	9.6670	43.717	77.345	1117.3	123.23	143.47
212	0.36185	16.884	2074.6	10.397	43.791	77.748	1101.4	120.46	141.68
214	0.39164	16.790	2231.2	11.124	43.869	78.167	1085.4	117.76	139.89
216	0.42323	16.696	2388.7	11.848	43.952	78.603	1069.5	115.13	138.12
218	0.45667	16.601	2547.1	12.569	44.039	79.057	1053.4	112.56	136.35
220	0.49205	16.504	2706.4	13.287	44.131	79.529	1037.3	110.05	134.60
222	0.52941	16.407	2866.7	14.002	44.228	80.022	1021.2	107.60	132.85
224	0.56884	16.309	3028.0	14.714	44.329	80.537	1005.0	105.21	131.11
226	0.61040	16.209	3190.4	15.424	44.435	81.074	988.76	102.87	129.38
228	0.65416	16.108	3353.8	16.133	44.545	81.635	972.46	100.58	127.66
230	0.70018	16.006	3518.4	16.839	44.661	82.221	956.09	98.339	125.95
232	0.74854	15.903	3684.2	17.543	44.781	82.836	939.66	96.146	124.24
234	0.79931	15.798	3851.1	18.246	44.907	83.480	923.17	93.997	122.55
236	0.85256	15.692	4019.3	18.947	45.037	84.155	906.60	91.890	120.86

TABLE 2 *Continued*

T K	p MPa	ρ mol·l^{-1}	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
238	0.90836	15.584	4188.9	19.648	45.173	84.865	889.97	89.825	119.18
240	0.96679	15.475	4359.8	20.347	45.314	85.612	873.25	87.799	117.51
242	1.0279	15.364	4532.2	21.046	45.461	86.398	856.45	85.809	115.85
244	1.0918	15.251	4706.1	21.744	45.614	87.229	839.57	83.855	114.20
246	1.1585	15.136	4881.5	22.442	45.772	88.107	822.59	81.936	112.56
248	1.2282	15.019	5058.6	23.141	45.937	89.037	805.51	80.048	110.92
250	1.3008	14.901	5237.4	23.839	46.109	90.024	788.33	78.190	109.29
252	1.3766	14.779	5418.0	24.538	46.287	91.075	771.03	76.362	107.66
254	1.4555	14.656	5600.5	25.239	46.472	92.195	753.60	74.561	106.05
256	1.5376	14.530	5785.0	25.940	46.665	93.393	736.05	72.785	104.44
258	1.6230	14.401	5971.7	26.643	46.866	94.677	718.36	71.034	102.83
260	1.7118	14.270	6160.6	27.349	47.076	96.059	700.52	69.305	101.24
262	1.8041	14.135	6351.8	28.057	47.294	97.550	682.53	67.596	99.642
264	1.9000	13.997	6545.6	28.768	47.523	99.166	664.38	65.907	98.054
266	1.9996	13.855	6742.1	29.482	47.761	100.93	646.06	64.235	96.469
268	2.1029	13.709	6941.4	30.201	48.010	102.85	627.58	62.579	94.887
270	2.2100	13.559	7143.8	30.924	48.269	104.96	608.92	60.936	93.309
272	2.3210	13.405	7349.6	31.653	48.539	107.30	590.08	59.304	91.732
274	2.4361	13.245	7559.0	32.388	48.820	109.90	571.04	57.681	90.157
276	2.5554	13.079	7772.4	33.131	49.113	112.82	551.77	56.065	88.583
278	2.6789	12.907	7990.0	33.882	49.419	116.12	532.23	54.452	87.008
280	2.8067	12.728	8212.4	34.644	49.743	119.89	512.38	52.839	85.434
282	2.9391	12.541	8440.2	35.417	50.090	124.26	492.15	51.222	83.858
284	3.0760	12.345	8673.9	36.204	50.469	129.38	471.46	49.596	82.282
286	3.2177	12.138	8914.4	37.007	50.890	135.48	450.22	47.956	80.706
288	3.3643	11.918	9162.8	37.830	51.369	142.91	428.34	46.295	79.135
290	3.5159	11.684	9420.4	38.677	51.927	152.19	405.70	44.603	77.574
292	3.6728	11.431	9689.1	39.554	52.590	164.16	382.18	42.868	76.037
294	3.8351	11.155	9971.6	40.469	53.394	180.25	357.64	41.072	74.553
296	4.0031	10.849	10272	41.435	54.396	203.18	331.84	39.190	73.178
298	4.1770	10.502	10597	42.473	55.695	238.66	304.47	37.181	72.045
300	4.3573	10.094	10957	43.620	57.488	301.37	274.91	34.970	71.489
302	4.5442	9.5785	11379	44.958	60.283	443.32	241.95	32.398	72.472
304	4.7387	8.8094	11945	46.758	66.070	1064.0	202.16	28.942	79.529
305	4.8392	8.0469	12448	48.370	74.262	4934.1	175.12	25.900	106.34

TABLE 3 Themophysical Properties of Ethane Along Isobars

T K	ρ mol·l^{-1}	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
Pressure = 1.0 MPa								
92	21.609	-6473	-48.513	47.851	69.603	1997.1	1193.8	254.38
100	21.317	-5920.6	-42.756	46.328	68.636	1938.8	873.92	247.88
110	20.952	-5236.3	-36.233	45.176	68.347	1866.8	633.84	239.17
120	20.586	-4552.1	-30.280	44.457	68.539	1794.9	486.12	229.96
130	20.216	-3864.8	-24.779	43.966	68.953	1722.5	388.43	220.40
140	19.842	-3172.6	-19.650	43.611	69.492	1649.6	319.99	210.63
150	19.463	-2474.6	-14.834	43.355	70.131	1576.1	269.72	200.77
160	19.076	-1769.7	-10.285	43.186	70.879	1501.8	231.29	190.89
170	18.681	-1056.6	-5.9619	43.103	71.760	1426.7	200.92	181.08
180	18.276	-333.90	-1.8314	43.109	72.808	1350.6	176.21	171.36
184.33	18.096	-17.904	-9.6671E-02	43.140	73.323	1317.4	166.87	167.20
184.33	6.7496E-02	14708	79.792	33.460	43.050	247.33	5.8773	9.4707
190	6.5270E-02	14953	81.102	33.858	43.314	251.25	6.0553	9.9122
200	6.1716E-02	15388	83.336	34.553	43.810	257.90	6.3683	10.723
210	5.8558E-02	15829	85.487	35.286	44.388	264.25	6.6803	11.574
220	5.5728E-02	16276	87.567	36.089	45.071	270.34	6.9911	12.468
230	5.3174E-02	16731	89.587	36.962	45.851	276.18	7.3003	13.405
240	5.0854E-02	17194	91.557	37.898	46.713	281.81	7.6078	14.386
250	4.8735E-02	17665	93.482	38.889	47.644	287.25	7.9133	15.412
260	4.6792E-02	18147	95.370	39.929	48.634	292.53	8.2168	16.482
270	4.5003E-02	18638	97.225	41.012	49.676	297.65	8.5182	17.598
280	4.3349E-02	19140	99.051	42.134	50.763	302.63	8.8172	18.760
290	4.1815E-02	19654	100.85	43.290	51.888	307.49	9.1138	19.966
300	4.0388E-02	20178	102.63	44.475	53.048	312.23	9.4081	21.218
310	3.9057E-02	20715	104.39	45.686	54.236	316.88	9.6998	22.513
320	3.7813E-02	21263	106.13	46.919	55.449	321.43	9.9891	23.851
330	3.6646E-02	21824	107.86	48.169	56.682	325.89	10.276	25.232
340	3.5551E-02	22397	109.57	49.434	57.931	330.28	10.560	26.654
350	3.4519E-02	22982	111.26	50.710	59.193	334.59	10.842	28.115
360	3.3547E-02	23581	112.95	51.993	60.465	338.84	11.121	29.615
370	3.2629E-02	24192	114.62	53.282	61.742	343.02	11.398	31.151
380	3.1760E-02	24816	116.29	54.573	63.023	347.15	11.672	32.723
390	3.0937E-02	25452	117.94	55.864	64.305	351.22	11.944	34.328
400	3.0155E-02	26102	119.58	57.153	65.586	355.24	12.213	35.965
410	2.9413E-02	26764	121.22	58.438	66.864	359.21	12.480	37.632
420	2.8706E-02	27439	122.85	59.718	68.137	363.13	12.744	39.329
430	2.8033E-02	28127	124.46	60.991	69.404	367.01	13.006	41.053
440	2.7391E-02	28827	126.07	62.255	70.663	370.85	13.266	42.802
450	2.6778E-02	29540	127.68	63.511	71.912	374.65	13.523	44.577
460	2.6192E-02	30265	129.27	64.756	73.153	378.40	13.779	46.374
470	2.5631E-02	31003	130.86	65.990	74.382	382.13	14.032	48.193
480	2.5094E-02	31753	132.44	67.212	75.600	385.81	14.282	50.033
490	2.4579E-02	32515	134.01	68.422	76.807	389.47	14.531	51.892
500	2.4084E-02	33289	135.57	69.620	78.001	393.08	14.778	53.769
510	2.3610E-02	34075	137.13	70.804	79.182	396.67	15.022	55.663
520	2.3154E-02	34872	138.68	71.976	80.351	400.22	15.264	57.574
530	2.2715E-02	35682	140.22	73.135	81.506	403.75	15.505	59.500
540	2.2292E-02	36503	141.75	74.280	82.649	407.24	15.743	61.440
550	2.1885E-02	37335	143.28	75.411	83.778	410.71	15.980	63.394
560	2.1493E-02	38178	144.80	76.530	84.894	414.15	16.214	65.360
570	2.1115E-02	39033	146.31	77.635	85.997	417.56	16.447	67.339
580	2.0749E-02	39898	147.82	78.726	87.086	420.94	16.678	69.328
590	2.0397E-02	40774	149.31	79.805	88.163	424.30	16.907	71.328
600	2.0056E-02	41661	150.80	80.870	89.227	427.63	17.135	73.338
Pressure = 1.0 MPa								
92	21.620	-6437.8	-48.584	47.886	69.587	2000.7	1203.5	254.77
100	21.329	-5885.6	-42.828	46.362	68.612	1942.4	880.24	248.30
110	20.965	-5201.6	-36.308	45.210	68.315	1870.5	638.01	239.64
120	20.600	-4517.8	-30.358	44.491	68.498	1798.9	489.15	230.47
130	20.232	-3830.9	-24.860	44.000	68.903	1727.0	390.80	220.95
140	19.860	-3139.3	-19.735	43.646	69.430	1654.5	321.96	211.21
150	19.482	-2442.0	-14.925	43.391	70.054	1581.4	271.41	201.39
160	19.098	-1737.9	-10.381	43.223	70.783	1507.7	232.81	191.55
170	18.706	-1025.9	-6.0646	43.140	71.640	1433.2	202.31	181.78
180	18.303	-304.56	-1.9418	43.146	72.657	1357.9	177.52	172.11
190	17.888	427.90	2.0181	43.245	73.871	1281.5	156.88	162.59
200	17.457	1173.7	5.8431	43.441	75.331	1204.0	139.33	153.30
210	17.007	1935.5	9.5599	43.739	77.101	1124.9	124.13	144.15
220	16.532	2717.0	13.195	44.145	79.278	1044.0	110.74	135.16
230	16.026	3523.0	16.777	44.665	82.014	960.67	98.760	126.31
240	15.477	4360.1	20.339	45.314	85.578	873.85	87.848	117.56
241.1	15.414	4454.3	20.731	45.394	86.038	864.04	86.702	116.60
241.1	0.59982	16285	69.802	41.932	59.951	251.85	7.9293	16.358

TABLE 3 *Continued*

T K	ρ mol·l^{-1}	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
250	0.56362	16807	71.926	41.694	57.595	260.39	8.1910	17.042
260	0.52980	17376	74.161	42.098	56.525	268.91	8.4855	17.916
270	0.50106	17939	76.286	42.760	56.158	276.67	8.7793	18.877
280	0.47613	18501	78.328	43.567	56.201	283.85	9.0719	19.913
290	0.45416	19064	80.305	44.483	56.527	290.57	9.3628	21.014
300	0.43455	19632	82.230	45.482	57.061	296.92	9.6518	22.177
310	0.41689	20206	84.112	46.547	57.751	302.96	9.9387	23.396
320	0.40085	20788	85.958	47.665	58.560	308.73	10.223	24.668
330	0.38619	21378	87.773	48.823	59.460	314.29	10.506	25.991
340	0.37271	21977	89.563	50.013	60.431	319.64	10.786	27.362
350	0.36027	22586	91.329	51.227	61.457	324.83	11.064	28.777
360	0.34872	23206	93.075	52.458	62.526	329.86	11.339	30.236
370	0.33797	23837	94.804	53.703	63.629	334.76	11.612	31.736
380	0.32793	24479	96.515	54.956	64.758	339.54	11.883	33.274
390	0.31853	25132	98.212	56.215	65.906	344.20	12.151	34.849
400	0.30970	25797	99.896	57.476	67.069	348.76	12.417	36.459
410	0.30138	26474	101.57	58.736	68.241	353.23	12.681	38.101
420	0.29353	27162	103.22	59.994	69.419	357.62	12.942	39.775
430	0.28611	27862	104.87	61.247	70.601	361.92	13.201	41.478
440	0.27908	28574	106.51	62.494	71.783	366.15	13.458	43.208
450	0.27241	29298	108.13	63.733	72.963	370.32	13.713	44.964
460	0.26607	30033	109.75	64.964	74.140	374.41	13.965	46.745
470	0.26004	30781	111.36	66.185	75.311	378.45	14.215	48.548
480	0.25428	31540	112.96	67.396	76.477	382.43	14.463	50.374
490	0.24879	32310	114.55	68.595	77.634	386.36	14.710	52.219
500	0.24355	33092	116.13	69.783	78.784	390.24	14.954	54.084
510	0.23853	33886	117.70	70.959	79.924	394.06	15.196	55.967
520	0.23372	34691	119.26	72.122	81.055	397.85	15.436	57.867
530	0.22911	35507	120.81	73.273	82.175	401.58	15.674	59.782
540	0.22468	36334	122.36	74.411	83.285	405.28	15.910	61.713
550	0.22043	37172	123.90	75.537	84.383	408.93	16.144	63.657
560	0.21635	38022	125.43	76.649	85.471	412.54	16.377	65.615
570	0.21241	38882	126.95	77.748	86.547	416.12	16.607	67.585
580	0.20863	39753	128.47	78.835	87.612	419.66	16.836	69.567
590	0.20497	40634	129.97	79.908	88.666	423.16	17.064	71.559
600	0.20145	41526	131.47	80.969	89.708	426.64	17.289	73.562
				Pressure = 2.0 MPa				
92	21.632	-6398.7	-48.661	47.925	69.570	2004.6	1214.4	255.20
100	21.342	-5846.7	-42.907	46.401	68.586	1946.3	887.34	248.77
110	20.980	-5163.0	-36.390	45.247	68.279	1874.7	642.68	240.15
120	20.616	-4479.6	-30.444	44.528	68.453	1803.4	492.54	231.03
130	20.249	-3793.2	-24.950	44.038	68.847	1731.9	393.45	221.55
140	19.879	-3102.2	-19.830	43.685	69.362	1659.9	324.14	211.85
150	19.504	-2405.7	-15.024	43.431	69.970	1587.3	273.30	202.07
160	19.122	-1702.5	-10.487	43.264	70.679	1514.2	234.49	192.28
170	18.732	-991.66	-6.1774	43.181	71.511	1440.4	203.85	182.55
180	18.333	-271.77	-2.0629	43.187	72.495	1365.8	178.97	172.93
190	17.922	458.85	1.8871	43.285	73.665	1290.4	158.27	163.46
200	17.497	1202.3	5.7001	43.480	75.065	1213.9	140.68	154.24
210	17.053	1961.1	9.4021	43.774	76.753	1136.1	125.47	145.16
220	16.586	2738.6	13.018	44.173	78.810	1056.8	112.09	136.26
230	16.091	3538.9	16.576	44.683	81.360	975.52	100.15	127.52
240	15.558	4368.1	20.104	45.312	84.618	891.42	89.310	118.91
250	14.972	5235.0	23.642	46.083	88.983	803.18	79.296	110.36
260	14.309	6154.2	27.247	47.044	95.325	708.23	69.819	101.75
266.01	13.854	6742.9	29.485	47.762	100.930	645.98	64.228	96.462
266.01	1.2481	16576	66.451	46.965	79.164	239.97	9.2487	21.525
270	1.1982	16883	67.595	46.388	74.708	245.72	9.3319	21.589
280	1.0993	17596	70.190	46.097	68.777	257.97	9.5623	22.080
290	1.0233	18268	72.548	46.433	65.936	268.34	9.8099	22.835
300	0.96149	18919	74.756	47.037	64.458	277.51	10.066	23.750
310	0.90949	19560	76.856	47.812	63.757	285.81	10.328	24.782
320	0.86469	20196	78.876	48.710	63.557	293.45	10.591	25.907
330	0.82542	20832	80.834	49.701	63.701	300.57	10.856	27.111
340	0.79052	21471	82.741	50.762	64.089	307.28	11.121	28.382
350	0.75918	22114	84.606	51.875	64.655	313.63	11.386	29.714
360	0.73078	22764	86.437	53.026	65.354	319.68	11.650	31.101
370	0.70488	23422	88.238	54.206	66.153	325.49	11.912	32.539
380	0.68109	24088	90.014	55.407	67.029	331.07	12.174	34.022
390	0.65915	24763	91.767	56.621	67.964	336.46	12.434	35.549
400	0.63881	25447	93.500	57.845	68.944	341.67	12.692	37.116
410	0.61988	26142	95.215	59.073	69.958	346.73	12.948	38.720
420	0.60220	26846	96.913	60.304	71.000	351.66	13.203	40.359
430	0.58563	27562	98.596	61.533	72.061	356.46	13.455	42.030

TABLE 3 *Continued*

T K	ρ mol·l^{-1}	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
440	0.57007	28288	100.27	62.759	73.137	361.14	13.706	43.732
450	0.55542	29024	101.92	63.980	74.222	365.72	13.956	45.462
460	0.54158	29772	103.56	65.194	75.315	370.21	14.203	47.219
470	0.52850	30531	105.20	66.400	76.410	374.60	14.448	49.001
480	0.51609	31300	106.82	67.597	77.507	378.91	14.692	50.806
490	0.50431	32081	108.43	68.785	78.602	383.14	14.933	52.633
500	0.49310	32872	110.02	69.962	79.695	387.31	15.173	54.480
510	0.48243	33675	111.61	71.127	80.784	391.40	15.411	56.347
520	0.47224	34488	113.19	72.282	81.867	395.43	15.647	58.231
530	0.46251	35312	114.76	73.424	82.944	399.40	15.882	60.133
540	0.45321	36147	116.32	74.555	84.013	403.31	16.114	62.050
550	0.44430	36992	117.87	75.673	85.075	407.17	16.345	63.982
560	0.43575	37848	119.42	76.778	86.128	410.97	16.575	65.928
570	0.42755	38715	120.95	77.872	87.173	414.73	16.802	67.887
580	0.41967	39592	122.47	78.953	88.208	418.44	17.028	69.859
590	0.41210	40479	123.99	80.021	89.234	422.10	17.252	71.841
600	0.40481	41376	125.50	81.077	90.250	425.73	17.475	73.835
				Pressure = 3.0 MPa				
92	21.644	-6359.6	-48.739	47.965	69.554	2008.4	1225.5	255.63
100	21.355	-5807.8	-42.987	46.439	68.560	1950.1	894.53	249.24
110	20.994	-5124.4	-36.473	45.284	68.244	1878.8	647.40	240.67
120	20.632	-4441.4	-30.530	44.564	68.409	1807.9	495.95	231.58
130	20.267	-3755.5	-25.040	44.075	68.793	1736.8	396.11	222.14
140	19.898	-3065.1	-19.924	43.723	69.295	1665.2	326.34	212.49
150	19.525	-2369.3	-15.123	43.471	69.889	1593.1	275.19	202.75
160	19.145	-1667.0	-10.592	43.304	70.579	1520.6	236.18	193.00
170	18.759	-957.30	-6.2891	43.222	71.386	1447.4	205.40	183.32
180	18.363	-238.81	-2.1826	43.228	72.339	1373.6	180.42	173.75
190	17.956	490.06	1.7579	43.325	73.468	1299.1	159.65	164.34
200	17.535	1231.3	5.5595	43.518	74.813	1223.6	142.03	155.17
210	17.097	1987.2	9.2475	43.809	76.425	1147.1	126.80	146.16
220	16.639	2760.9	12.846	44.203	78.373	1069.3	113.43	137.34
230	16.153	3556.1	16.381	44.703	80.762	989.81	101.51	128.70
240	15.634	4378.1	19.879	45.317	83.760	908.11	90.735	120.22
250	15.068	5234.4	23.374	46.058	87.671	823.20	80.828	111.84
260	14.437	6136.6	26.911	46.959	93.101	733.32	71.535	103.48
270	13.705	7106.0	30.569	48.098	101.50	635.17	62.554	94.974
280	12.786	8191.2	34.514	49.658	117.77	521.43	53.361	85.967
282.9	12.454	8544.4	35.769	50.256	126.45	482.92	50.493	83.150
282.9	2.0466	16440	63.678	52.044	115.64	225.04	10.678	27.719
290	1.8425	17161	66.198	49.968	91.951	239.18	10.661	26.615
300	1.6569	18011	69.081	49.364	79.910	254.11	10.767	26.496
310	1.5249	18780	71.602	49.541	74.457	266.21	10.935	26.966
320	1.4224	19509	73.916	50.058	71.557	276.63	11.135	27.729
330	1.3387	20216	76.091	50.781	69.976	285.91	11.352	28.677
340	1.2681	20911	78.167	51.647	69.181	294.34	11.579	29.757
350	1.2072	21601	80.167	52.615	68.896	302.12	11.814	30.940
360	1.1538	22290	82.108	53.657	68.958	309.38	12.052	32.207
370	1.1062	22981	84.001	54.752	69.268	316.22	12.294	33.545
380	1.0635	23676	85.855	55.885	69.757	322.70	12.537	34.945
390	1.0249	24377	87.674	57.046	70.380	328.88	12.780	36.401
400	0.98955	25084	89.465	58.226	71.104	334.79	13.024	37.906
410	0.95712	25799	91.231	59.418	71.905	340.48	13.268	39.456
420	0.92718	26522	92.974	60.617	72.766	345.97	13.512	41.048
430	0.89942	27254	94.696	61.820	73.673	351.28	13.754	42.677
440	0.87358	27996	96.401	63.024	74.615	356.42	13.996	44.341
450	0.84943	28747	98.088	64.225	75.585	361.42	14.236	46.037
460	0.82680	29508	99.761	65.421	76.575	366.29	14.475	47.763
470	0.80553	30278	101.42	66.612	77.581	371.04	14.713	49.517
480	0.78548	31059	103.06	67.796	78.597	375.68	14.950	51.297
490	0.76654	31850	104.69	68.971	79.621	380.22	15.185	53.100
500	0.74862	32652	106.31	70.137	80.649	384.66	15.419	54.926
510	0.73161	33463	107.92	71.293	81.679	389.01	15.652	56.773
520	0.71546	34285	109.52	72.438	82.709	393.28	15.883	58.639
530	0.70008	35117	111.10	73.572	83.738	397.48	16.112	60.523
540	0.68542	35960	112.68	74.695	84.764	401.60	16.340	62.425
550	0.67143	36813	114.24	75.806	85.785	405.65	16.566	64.342
560	0.65805	37676	115.79	76.905	86.801	409.65	16.791	66.274
570	0.64525	38549	117.34	77.992	87.812	413.58	17.015	68.220
580	0.63298	39432	118.88	79.068	88.815	417.45	17.236	70.179
590	0.62121	40325	120.40	80.131	89.812	421.27	17.457	72.150
600	0.60990	41228	121.92	81.182	90.801	425.03	17.676	74.132
				Pressure = 5.0 MPa				
92	21.668	-6281.5	-48.893	48.047	69.522	2015.9	1248.1	256.48

TABLE 3 *Continued*

T K	ρ mol·l^{-1}	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
100	21.381	-5730.0	-43.144	46.517	68.510	1957.7	909.15	250.17
110	21.022	-5047.1	-36.636	45.357	68.176	1887.0	656.96	241.69
120	20.663	-4364.9	-30.700	44.637	68.324	1816.8	502.86	232.69
130	20.301	-3679.9	-25.217	44.149	68.688	1746.4	401.48	223.33
140	19.936	-2990.7	-20.110	43.799	69.167	1675.7	330.76	213.76
150	19.566	-2296.3	-15.319	43.549	69.732	1604.7	279.00	204.10
160	19.192	-1595.8	-10.798	43.384	70.386	1533.2	239.56	194.43
170	18.811	-888.22	-6.509	43.303	71.149	1461.3	208.49	184.84
180	18.421	-172.38	-2.418	43.309	72.043	1389.0	183.31	175.37
190	18.022	553.18	1.505	43.405	73.098	1316.0	162.41	166.05
200	17.610	1290.2	5.285	43.595	74.345	1242.5	144.70	156.99
210	17.184	2040.8	8.947	43.881	75.823	1168.2	129.42	148.11
220	16.739	2807.6	12.514	44.265	77.584	1093.1	116.05	139.45
230	16.272	3593.7	16.008	44.750	79.701	1016.9	104.18	130.99
240	15.777	4403.2	19.453	45.340	82.285	939.29	93.489	122.72
250	15.245	5241.6	22.875	46.040	85.517	859.81	83.742	114.62
260	14.664	6116.7	26.306	46.864	89.713	777.57	74.718	106.65
270	14.014	7041.0	29.794	47.843	95.498	691.15	66.201	98.732
280	13.259	8036.5	33.414	49.047	104.31	598.06	57.935	90.719
290	12.317	9150.8	37.322	50.690	120.57	492.98	49.497	82.342
300	10.907	10546	42.046	53.743	171.41	359.63	39.648	73.067
310	4.1199	15883	59.485	58.998	261.20	211.10	14.963	45.276
320	3.1778	17533	64.733	54.595	123.06	237.07	13.550	36.401
330	2.7720	18621	68.082	53.867	98.656	254.00	13.215	34.706
340	2.5102	19550	70.857	53.961	88.407	267.54	13.135	34.443
350	2.3176	20404	73.335	54.434	83.013	279.10	13.167	34.794
360	2.1661	21218	75.626	55.132	79.920	289.32	13.260	35.489
370	2.0415	22007	77.789	55.979	78.113	298.55	13.392	36.406
380	1.9362	22782	79.857	56.928	77.099	307.02	13.547	37.482
390	1.8452	23551	81.853	57.948	76.609	314.89	13.720	38.680
400	1.7653	24316	83.790	59.017	76.481	322.27	13.905	39.974
410	1.6943	25081	85.680	60.122	76.612	329.24	14.099	41.349
420	1.6305	25849	87.529	61.250	76.934	335.86	14.299	42.791
430	1.5727	26620	89.345	62.394	77.400	342.17	14.504	44.291
440	1.5199	27397	91.131	63.548	77.975	348.22	14.712	45.844
450	1.4715	28180	92.890	64.706	78.634	354.04	14.923	47.442
460	1.4268	28970	94.626	65.867	79.359	359.65	15.136	49.081
470	1.3853	29767	96.341	67.026	80.136	365.07	15.350	50.757
480	1.3467	30573	98.037	68.182	80.953	370.33	15.564	52.467
490	1.3107	31387	99.715	69.332	81.802	375.43	15.780	54.207
500	1.2769	32209	101.38	70.476	82.676	380.40	15.995	55.976
510	1.2451	33040	103.02	71.611	83.569	385.24	16.210	57.770
520	1.2151	33880	104.65	72.739	84.476	389.96	16.426	59.588
530	1.1869	34730	106.27	73.856	85.395	394.57	16.640	61.429
540	1.1601	35588	107.88	74.964	86.320	399.08	16.855	63.289
550	1.1346	36456	109.47	76.062	87.251	403.50	17.068	65.169
560	1.1105	37333	111.05	77.148	88.185	407.82	17.281	67.065
570	1.0875	38220	112.62	78.224	89.120	412.07	17.493	68.978
580	1.0655	39116	114.18	79.289	90.055	416.24	17.704	70.906
590	1.0446	40021	115.72	80.342	90.988	420.34	17.915	72.847
600	1.0245	40936	117.26	81.384	91.919	424.37	18.124	74.801
				Pressure = 7.5 MPa				
92	21.697	-6183.7	-49.084	48.153	69.484	2025.0	1277.4	257.55
100	21.412	-5632.6	-43.339	46.614	68.450	1967.1	927.93	251.33
110	21.057	-4950.5	-36.838	45.449	68.095	1897.1	669.17	242.96
120	20.701	-4269.2	-30.909	44.727	68.222	1827.7	511.64	234.06
130	20.343	-3585.3	-25.436	44.240	68.564	1758.3	408.29	224.80
140	19.982	-2897.5	-20.339	43.893	69.016	1688.7	336.35	215.33
150	19.618	-2204.8	-15.560	43.645	69.547	1618.8	283.79	205.76
160	19.248	-1506.3	-11.052	43.482	70.161	1548.6	243.81	196.20
170	18.874	-801.22	-6.7778	43.403	70.873	1478.2	212.36	186.71
180	18.492	-88.452	-2.7039	43.409	71.703	1407.5	186.92	177.35
190	18.101	633.31	1.1982	43.504	72.676	1336.5	165.83	168.16
200	17.700	1365.6	4.9542	43.691	73.816	1265.1	148.00	159.21
210	17.286	2110.3	8.5873	43.971	75.155	1193.3	132.66	150.48
220	16.857	2869.5	12.119	44.347	76.727	1121.1	119.26	141.98
230	16.410	3645.8	15.569	44.818	78.580	1048.3	107.40	133.71
240	15.940	4442.3	18.959	45.387	80.782	974.93	96.788	125.68
250	15.441	5262.9	22.308	46.054	83.433	900.66	87.171	117.86
260	14.908	6112.9	25.642	46.823	86.688	825.17	78.361	110.25
270	14.327	6999.5	28.987	47.706	90.808	747.98	70.185	102.81
280	13.683	7933.4	32.383	48.721	96.252	668.37	62.484	95.498
290	12.948	8931.9	35.886	49.914	103.94	585.39	55.083	88.229
300	12.071	10026	39.596	51.371	116.02	497.77	47.758	80.892

TABLE 3 *Continued*

T K	ρ mol·l^{-1}	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
310	10.943	11287	43.726	53.270	138.75	404.11	40.132	73.324
320	9.2863	12897	48.834	55.965	190.63	307.94	31.523	65.561
330	6.8962	15110	55.639	58.192	228.83	249.06	22.696	57.071
340	5.2506	17048	61.431	57.542	160.15	248.56	18.445	48.563
350	4.4175	18440	65.470	57.117	123.32	259.93	16.865	44.533
360	3.9090	19578	68.674	57.223	106.03	271.84	16.143	42.861
370	3.5540	20587	71.440	57.660	96.684	282.93	15.781	42.327
380	3.2854	21524	73.939	58.313	91.149	293.14	15.604	42.427
390	3.0715	22417	76.259	59.114	87.712	302.56	15.536	42.923
400	2.8949	23282	78.450	60.018	85.543	311.31	15.538	43.689
410	2.7453	24130	80.545	60.995	84.196	319.50	15.588	44.650
420	2.6161	24968	82.563	62.023	83.407	327.20	15.672	45.760
430	2.5028	25800	84.520	63.086	83.012	334.49	15.780	46.988
440	2.4021	26629	86.427	64.174	82.905	341.42	15.907	48.311
450	2.3118	27459	88.291	65.278	83.012	348.04	16.048	49.714
460	2.2301	28290	90.118	66.392	83.284	354.37	16.200	51.185
470	2.1557	29125	91.913	67.512	83.681	360.46	16.361	52.715
480	2.0874	29964	93.680	68.633	84.177	366.32	16.529	54.296
490	2.0244	30808	95.422	69.754	84.751	371.99	16.703	55.923
500	1.9661	31659	97.140	70.871	85.387	377.47	16.880	57.589
510	1.9119	32516	98.838	71.983	86.073	382.79	17.062	59.292
520	1.8613	33381	100.52	73.089	86.798	387.95	17.246	61.027
530	1.8139	34252	102.18	74.188	87.555	392.97	17.432	62.792
540	1.7693	35132	103.82	75.278	88.337	397.87	17.621	64.584
550	1.7274	36019	105.45	76.360	89.140	402.65	17.810	66.400
560	1.6878	36915	107.06	77.432	89.958	407.31	18.001	68.238
570	1.6503	37818	108.66	78.494	90.789	411.87	18.192	70.096
580	1.6147	38730	110.25	79.547	91.629	416.34	18.384	71.973
590	1.5809	39651	111.82	80.589	92.476	420.71	18.577	73.866
600	1.5488	40580	113.38	81.620	93.327	425.00	18.769	75.772
				Pressure = 10 MPa				
92	21.726	-6086.0	-49.273	48.262	69.448	2033.8	1307.7	258.61
100	21.444	-5535.2	-43.532	46.712	68.393	1976.2	947.29	252.48
110	21.091	-4853.8	-37.037	45.539	68.017	1907.0	681.68	244.22
120	20.739	-4173.3	-31.116	44.816	68.125	1838.5	520.59	235.43
130	20.384	-3490.6	-25.652	44.330	68.446	1770.1	415.20	226.26
140	20.027	-2804.1	-20.564	43.984	68.873	1701.4	342.00	216.89
150	19.668	-2112.9	-15.796	43.739	69.374	1632.6	288.62	207.41
160	19.304	-1416.3	-11.300	43.578	69.951	1563.7	248.08	197.95
170	18.935	-713.57	-7.0401	43.500	70.617	1494.6	216.25	188.56
180	18.560	-3.6274	-2.9824	43.507	71.391	1425.5	190.52	179.30
190	18.177	714.67	0.90107	43.601	72.292	1356.2	169.24	170.22
200	17.786	1442.7	4.6352	43.786	73.343	1286.7	151.27	161.36
210	17.383	2182.1	8.2424	44.062	74.565	1217.2	135.85	152.78
220	16.968	2934.7	11.743	44.432	75.984	1147.5	122.40	144.43
230	16.538	3702.5	15.156	44.893	77.632	1077.6	110.54	136.33
240	16.089	4488.2	18.500	45.447	79.552	1007.6	99.960	128.48
250	15.618	5294.7	21.791	46.092	81.799	937.43	90.422	120.89
260	15.120	6125.6	25.050	46.829	84.457	866.92	81.743	113.55
270	14.588	6985.6	28.295	47.659	87.646	795.96	73.772	106.45
280	14.013	7880.8	31.551	48.589	91.545	724.40	66.377	99.574
290	13.383	8819.8	34.845	49.630	96.439	652.16	59.445	92.894
300	12.680	9814.5	38.217	50.799	102.80	579.32	52.867	86.388
310	11.877	10883	41.720	52.120	111.44	506.34	46.538	80.029
320	10.934	12055	45.439	53.607	123.56	434.79	40.361	73.809
330	9.8063	13367	49.476	55.233	139.26	369.55	34.331	67.802
340	8.5099	14833	53.852	56.784	152.44	319.90	28.772	62.214
350	7.2361	16359	58.274	57.804	149.40	293.79	24.420	57.249
360	6.2185	17779	62.275	58.354	133.88	286.76	21.620	53.359
370	5.4783	19040	65.733	58.834	119.11	289.09	19.955	50.821
380	4.9360	20175	68.760	59.403	108.48	295.16	18.952	49.401
390	4.5235	21221	71.478	60.088	101.25	302.58	18.331	48.774
400	4.1977	22208	73.976	60.880	96.368	310.38	17.942	48.699
410	3.9321	23154	76.312	61.759	93.051	318.16	17.702	49.016
420	3.7099	24073	78.526	62.705	90.803	325.76	17.563	49.618
430	3.5203	24973	80.644	63.700	89.302	333.12	17.495	50.438
440	3.3557	25860	82.685	64.731	88.336	340.21	17.479	51.427
450	3.2110	26741	84.663	65.787	87.764	347.04	17.502	52.551
460	3.0823	27617	86.588	66.861	87.486	353.62	17.554	53.787
470	2.9667	28491	88.469	67.946	87.433	359.97	17.630	55.114
480	2.8621	29366	90.311	69.037	87.554	366.10	17.724	56.520
490	2.7668	30243	92.118	70.132	87.813	372.03	17.833	57.992
500	2.6794	31122	93.896	71.226	88.180	377.77	17.954	59.523
510	2.5988	32006	95.646	72.318	88.634	383.34	18.085	61.106

TABLE 3 *Continued*

T K	ρ mol·l^{-1}	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η µPa·s	λ mW·m^{-1}·K^{-1}
520	2.5243	32895	97.372	73.405	89.159	388.75	18.224	62.733
530	2.4549	33790	99.076	74.487	89.740	394.01	18.370	64.400
540	2.3903	34690	100.76	75.563	90.367	399.13	18.521	66.103
550	2.3297	35597	102.42	76.630	91.032	404.12	18.677	67.838
560	2.2729	36511	104.07	77.690	91.728	408.99	18.837	69.602
570	2.2193	37432	105.70	78.741	92.449	413.74	19.000	71.392
580	2.1688	38360	107.31	79.782	93.189	418.40	19.166	73.205
590	2.1210	39296	108.91	80.814	93.946	422.95	19.334	75.037
600	2.0757	40239	110.50	81.836	94.716	427.41	19.504	76.885
Pressure = 15 MPa								
100	21.505	-5340.3	-43.911	46.906	68.284	1994.1	987.86	254.77
110	21.159	-4660.1	-37.428	45.716	67.870	1926.5	707.65	246.72
120	20.812	-3981.3	-31.522	44.988	67.944	1859.7	539.04	238.12
130	20.465	-3300.6	-26.073	44.504	68.227	1793.0	429.36	229.15
140	20.116	-2616.5	-21.003	44.163	68.610	1726.2	353.52	219.95
150	19.765	-1928.2	-16.255	43.922	69.058	1659.4	298.42	210.66
160	19.410	-1235.1	-11.782	43.766	69.571	1592.7	256.72	201.37
170	19.053	-536.51	-7.5470	43.691	70.159	1526.1	224.06	192.16
180	18.690	168.40	-3.5181	43.699	70.838	1459.7	197.75	183.10
190	18.322	880.61	0.33247	43.793	71.623	1393.4	176.04	174.22
200	17.947	1601.3	4.0287	43.975	72.528	1327.4	157.76	165.56
210	17.565	2331.6	7.5920	44.246	73.569	1261.6	142.12	157.19
220	17.173	3073.1	11.041	44.606	74.758	1196.1	128.54	149.09
230	16.771	3827.3	14.394	45.055	76.111	1131.0	116.61	141.26
240	16.356	4595.9	17.665	45.590	77.644	1066.3	106.02	133.72
250	15.926	5380.9	20.869	46.209	79.377	1002.2	96.543	126.47
260	15.480	6184.2	24.019	46.909	81.333	938.7	87.988	119.52
270	15.014	7008.4	27.129	47.688	83.542	875.9	80.218	112.87
280	14.525	7856.0	30.212	48.543	86.035	813.9	73.118	106.53
290	14.010	8730.2	33.279	49.471	88.852	753.0	66.597	100.49
300	13.464	9634.2	36.343	50.473	92.028	693.5	60.582	94.767
310	12.883	10572	39.418	51.544	95.598	635.8	55.019	89.358
320	12.263	11548	42.515	52.680	99.574	580.6	49.867	84.283
330	11.600	12565	45.644	53.869	103.89	528.9	45.105	79.564
340	10.896	13626	48.812	55.092	108.29	481.9	40.734	75.236
350	10.159	14729	52.009	56.316	112.18	441.4	36.786	71.345
360	9.4081	15865	55.209	57.498	114.75	408.8	33.318	67.947
370	8.6742	17017	58.366	58.607	115.35	384.6	30.384	65.085
380	7.9885	18165	61.427	59.639	113.90	368.4	28.000	62.780
390	7.3729	19290	64.351	60.618	111.07	358.8	26.128	61.026
400	6.8347	20385	67.121	61.572	107.73	354.1	24.692	59.790
410	6.3702	21445	69.741	62.525	104.48	352.9	23.601	59.018
420	5.9705	22476	72.224	63.490	101.62	354.0	22.777	58.646
430	5.6254	23480	74.586	64.475	99.254	356.7	22.155	58.611
440	5.3257	24462	76.845	65.481	97.380	360.4	21.687	58.857
450	5.0633	25429	79.017	66.506	95.946	364.7	21.336	59.338
460	4.8318	26382	81.114	67.546	94.890	369.4	21.077	60.014
470	4.6258	27327	83.146	68.598	94.148	374.3	20.890	60.855
480	4.4412	28266	85.123	69.658	93.665	379.4	20.759	61.834
490	4.2746	29201	87.051	70.722	93.395	384.5	20.674	62.930
500	4.1234	30135	88.936	71.789	93.300	389.6	20.626	64.128
510	3.9853	31068	90.784	72.855	93.348	394.7	20.608	65.412
520	3.8586	32002	92.598	73.918	93.515	399.8	20.616	66.773
530	3.7418	32939	94.382	74.978	93.780	404.8	20.645	68.200
540	3.6337	33878	96.138	76.033	94.126	409.7	20.691	69.684
550	3.5332	34821	97.869	77.082	94.541	414.6	20.752	71.221
560	3.4395	35769	99.576	78.123	95.011	419.4	20.826	72.802
570	3.3518	36722	101.26	79.157	95.530	424.1	20.911	74.423
580	3.2695	37680	102.93	80.183	96.087	428.7	21.006	76.079
590	3.1922	38644	104.58	81.200	96.679	433.2	21.108	77.764
600	3.1192	39613	106.21	82.208	97.297	437.7	21.217	79.469
Pressure = 20 MPa								
100	21.566	-5145.3	-44.282	47.097	68.184	2011.4	1031.2	257.04
110	21.224	-4466.3	-37.811	45.888	67.735	1945.4	734.99	249.20
120	20.884	-3789.0	-31.917	45.156	67.778	1880.2	558.26	240.79
130	20.543	-3110.0	-26.483	44.674	68.028	1815.2	444.00	231.99
140	20.201	-2428.1	-21.429	44.337	68.374	1750.1	365.35	222.96
150	19.858	-1742.4	-16.699	44.101	68.778	1685.2	308.43	213.84
160	19.512	-1052.3	-12.245	43.948	69.237	1620.5	265.48	204.72
170	19.164	-357.40	-8.0326	43.877	69.762	1556.1	231.95	195.68
180	18.813	343.15	-4.0285	43.887	70.364	1492.0	205.00	186.78
190	18.458	1050.2	-0.20598	43.981	71.057	1428.3	182.82	178.08
200	18.098	1764.6	3.4585	44.162	71.852	1365.1	164.20	169.60
210	17.732	2487.6	6.9857	44.430	72.759	1302.4	148.30	161.38

TABLE 3 *Continued*

T K	ρ mol·l^{-1}	H J·mol^{-1}	S J·mol^{-1}·K^{-1}	C_v J·mol^{-1}·K^{-1}	C_p J·mol^{-1}·K^{-1}	c m·s^{-1}	η μPa·s	λ mW·m^{-1}·K^{-1}
220	17.359	3220.2	10.394	44.784	73.785	1240.3	134.54	153.50
230	16.979	3963.7	13.698	45.225	74.938	1178.9	122.48	145.89
240	16.590	4719.4	16.914	45.749	76.224	1118.3	111.82	138.58
250	16.192	5488.7	20.054	46.353	77.648	1058.6	102.32	131.58
260	15.782	6272.9	23.130	47.034	79.216	999.89	93.778	124.90
270	15.360	7073.5	26.151	47.788	80.932	942.38	86.066	118.55
280	14.925	7892.0	29.128	48.610	82.799	886.21	79.068	112.53
290	14.474	8729.9	32.068	49.496	84.816	831.57	72.693	106.84
300	14.007	9588.8	34.980	50.443	86.976	778.73	66.871	101.50
310	13.523	10470	37.868	51.444	89.266	728.00	61.544	96.512
320	13.021	11374	40.740	52.494	91.657	679.76	56.669	91.879
330	12.502	12303	43.598	53.586	94.106	634.43	52.213	87.614
340	11.966	13257	46.444	54.711	96.546	592.46	48.153	83.728
350	11.418	14234	49.276	55.857	98.866	554.34	44.472	80.232
360	10.861	15233	52.091	57.011	100.91	520.55	41.161	77.136
370	10.302	16251	54.879	58.161	102.52	491.53	38.217	74.446
380	9.7525	17281	57.628	59.296	103.55	467.46	35.635	72.164
390	9.2206	18319	60.324	60.410	103.94	448.25	33.404	70.284
400	8.7155	19358	62.954	61.503	103.74	433.55	31.505	68.792
410	8.2437	20393	65.509	62.580	103.10	422.79	29.911	67.665
420	7.8087	21419	67.983	63.647	102.19	415.36	28.585	66.876
430	7.4113	22436	70.375	64.709	101.16	410.62	27.490	66.395
440	7.0502	23443	72.689	65.769	100.15	408.01	26.591	66.188
450	6.7229	24439	74.929	66.831	99.225	407.05	25.856	66.226
460	6.4264	25428	77.101	67.894	98.430	407.37	25.255	66.479
470	6.1574	26409	79.211	68.959	97.785	408.66	24.767	66.921
480	5.9129	27384	81.264	70.025	97.293	410.71	24.371	67.529
490	5.6900	28355	83.267	71.091	96.947	413.31	24.052	68.283
500	5.4861	29323	85.223	72.155	96.738	416.34	23.796	69.164
510	5.2991	30290	87.137	73.217	96.651	419.68	23.595	70.158
520	5.1268	31257	89.014	74.275	96.673	423.25	23.438	71.250
530	4.9677	32224	90.857	75.328	96.791	426.99	23.320	72.430
540	4.8203	33193	92.668	76.375	96.993	430.85	23.234	73.688
550	4.6832	34164	94.450	77.416	97.268	434.79	23.176	75.013
560	4.5554	35138	96.205	78.449	97.605	438.79	23.142	76.399
570	4.4359	36116	97.936	79.475	97.997	442.81	23.128	77.838
580	4.3238	37098	99.644	80.493	98.436	446.85	23.133	79.323
590	4.2186	38085	101.33	81.502	98.915	450.88	23.153	80.846
600	4.1194	39077	103.00	82.502	99.430	454.90	23.186	82.393