Designation: ~~D3984 – 13~~ D3984 – 19

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~~ 92 and 600 K at pressures to ~~20 MPa.~~ 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~~23, REFPROP, version ~~9.0.~~10.0.

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

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

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."~~10.0." 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 ($J \cdot mol^{-1}$)

[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~~April 1, 2019. Published ~~May 2013~~June 2019. Originally approved in 1982. Last previous edition approved in ~~2008~~2013 as ~~D3984 – 08.~~D3984 – 13. DOI: ~~10.1520/D3984-13.~~10.1520/D3984-19.

[2] Available from Standard Reference Data, National Institute of Standards and Technology (NIST), 100 Bureau ~~Drive,~~Dr., Stop ~~3460,~~1070, Gaithersburg, MD ~~20899.~~20899-1070, http://www.nist.gov.

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~~184.57 K and ~~0.10133MPa~~0.10133 MPa (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

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

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

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}
90.4	1.1518E-06	21.667	-6588.5	-49.729	48.255	69.928	2008.5	1290	255.42
92	1.7410E-06	21.608	-6476.9	-48.505	47.848	69.604	1996.7	1207.2	254.17
94	2.8559E-06	21.535	-6338	-47.012	47.394	69.271	1982.1	1114	252.59
96	4.5809E-06	21.462	-6199.7	-45.557	46.994	69.006	1967.5	1030.9	250.98
98	7.1951E-06	21.389	-6061.9	-44.136	46.639	68.798	1952.9	956.63	249.34
100	1.1081E-05	21.316	-5924.5	-42.748	46.324	68.639	1938.4	889.99	247.68
102	1.6752E-05	21.243	-5787.4	-41.39	46.043	68.521	1924	830.08	245.99
104	2.4891E-05	21.17	-5650.4	-40.06	45.791	68.438	1909.5	776.1	244.27
106	3.6383E-05	21.097	-5513.6	-38.757	45.564	68.385	1895.1	727.35	242.53
108	5.2368E-05	21.024	-5376.9	-37.479	45.358	68.357	1880.8	683.2	240.77
110	7.4287E-05	20.951	-5240.1	-36.225	45.172	68.351	1866.4	643.14	238.99
112	1.0394E-04	20.878	-5103.4	-34.993	45.003	68.363	1852	606.7	237.18
114	1.4357E-04	20.805	-4966.7	-33.783	44.848	68.39	1837.6	573.48	235.36
116	1.9587E-04	20.731	-4829.9	-32.593	44.706	68.431	1823.2	543.14	233.52
118	2.6414E-04	20.658	-4692.9	-31.423	44.574	68.482	1808.8	515.35	231.67

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}
120	3.5230E-04	20.584	-4555.9	-30.271	44.453	68.544	1794.4	489.85	229.79
122	4.6500E-04	20.511	-4418.8	-29.138	44.341	68.614	1780	466.41	227.91
124	6.0768E-04	20.437	-4281.5	-28.022	44.236	68.691	1765.5	444.8	226.01
126	7.8667E-04	20.363	-4144	-26.922	44.138	68.775	1751	424.85	224.1
128	0.0010093	20.289	-4006.3	-25.838	44.047	68.864	1736.5	406.38	222.18
130	0.0012839	20.214	-3868.5	-24.77	43.962	68.959	1722	389.26	220.25
132	0.0016200	20.14	-3730.5	-23.716	43.882	69.058	1707.5	373.35	218.31
134	0.0020283	20.065	-3592.2	-22.677	43.806	69.162	1692.9	358.54	216.36
136	0.0025209	19.991	-3453.8	-21.652	43.736	69.271	1678.3	344.73	214.41
138	0.0031110	19.916	-3315.1	-20.64	43.669	69.383	1663.7	331.81	212.45
140	0.0038136	19.84	-3176.2	-19.64	43.607	69.499	1649.1	319.72	210.49
142	0.0046448	19.765	-3037.1	-18.654	43.548	69.619	1634.4	308.38	208.53
144	0.0056226	19.689	-2897.7	-17.679	43.494	69.743	1619.7	297.72	206.56
146	0.0067664	19.613	-2758	-16.717	43.443	69.871	1605	287.68	204.58
148	0.0080973	19.537	-2618.1	-15.765	43.395	70.003	1590.3	278.22	202.61
150	0.0096380	19.461	-2477.9	-14.825	43.351	70.139	1575.5	269.28	200.64
152	0.011413	19.384	-2337.4	-13.895	43.311	70.279	1560.7	260.82	198.66
154	0.013448	19.307	-2196.6	-12.976	43.273	70.424	1545.9	252.8	196.69
156	0.015772	19.23	-2055.5	-12.066	43.24	70.574	1531.1	245.18	194.72
158	0.018414	19.152	-1914.2	-11.167	43.209	70.728	1516.2	237.95	192.75
160	0.021405	19.074	-1772.4	-10.276	43.183	70.888	1501.3	231.06	190.78
162	0.024779	18.996	-1630.4	-9.3949	43.159	71.052	1486.3	224.49	188.81
164	0.028570	18.918	-1488	-8.5225	43.139	71.222	1471.4	218.21	186.85
166	0.032814	18.839	-1345.2	-7.6586	43.123	71.398	1456.4	212.22	184.89
168	0.037551	18.759	-1202.1	-6.803	43.11	71.58	1441.4	206.48	182.93
170	0.042819	18.68	-1058.5	-5.9553	43.1	71.768	1426.3	200.98	180.98
172	0.048660	18.6	-914.61	-5.1155	43.094	71.963	1411.2	195.7	179.03
174	0.055118	18.519	-770.26	-4.2831	43.092	72.164	1396.1	190.63	177.09
176	0.062235	18.438	-625.49	-3.4581	43.094	72.372	1380.9	185.76	175.15
178	0.070060	18.357	-480.27	-2.64	43.099	72.588	1365.7	181.06	173.22
180	0.078638	18.275	-334.59	-1.8288	43.108	72.812	1350.5	176.54	171.3
182	0.088019	18.193	-188.44	-1.0241	43.12	73.043	1335.2	172.18	169.38
184	0.098253	18.11	-41.785	-0.22582	43.137	73.283	1319.9	167.97	167.47
186	0.10939	18.026	105.38	0.56634	43.157	73.532	1304.5	163.9	165.56
188	0.12149	17.942	253.08	1.3526	43.181	73.789	1289.2	159.96	163.66
190	0.13459	17.858	401.33	2.1331	43.21	74.056	1273.7	156.15	161.77
192	0.14876	17.773	550.14	2.9081	43.242	74.333	1258.3	152.46	159.89
194	0.16405	17.687	699.55	3.6778	43.278	74.62	1242.8	148.88	158.01
196	0.18052	17.601	849.57	4.4423	43.318	74.918	1227.2	145.41	156.14
198	0.19823	17.514	1000.2	5.2019	43.363	75.227	1211.7	142.04	154.28
200	0.21723	17.426	1151.5	5.9569	43.411	75.548	1196	138.77	152.43
202	0.23759	17.337	1303.5	6.7072	43.464	75.881	1180.4	135.59	150.58
204	0.25936	17.248	1456.2	7.4532	43.52	76.226	1164.7	132.5	148.75
206	0.28261	17.158	1609.7	8.1951	43.582	76.585	1148.9	129.49	146.93
208	0.30740	17.068	1763.8	8.9329	43.647	76.958	1133.1	126.56	145.12
210	0.33380	16.976	1918.8	9.667	43.717	77.345	1117.3	123.7	143.31
212	0.36185	16.884	2074.6	10.397	43.791	77.748	1101.4	120.91	141.52
214	0.39164	16.79	2231.2	11.124	43.869	78.167	1085.4	118.2	139.73
216	0.42323	16.696	2388.7	11.848	43.952	78.603	1069.5	115.55	137.95
218	0.45667	16.601	2547.1	12.569	44.039	79.057	1053.4	112.96	136.19
220	0.49205	16.504	2706.4	13.287	44.131	79.529	1037.3	110.43	134.43
222	0.52941	16.407	2866.7	14.002	44.228	80.022	1021.2	107.96	132.68
224	0.56884	16.309	3028	14.714	44.329	80.537	1005	105.55	130.93
226	0.61040	16.209	3190.4	15.424	44.435	81.074	988.76	103.19	129.2
228	0.65416	16.108	3353.8	16.133	44.545	81.635	972.46	100.88	127.48
230	0.70018	16.006	3518.4	16.839	44.661	82.221	956.09	98.617	125.76
232	0.74854	15.903	3684.2	17.543	44.781	82.836	939.66	96.401	124.06
234	0.79931	15.798	3851.1	18.246	44.907	83.48	923.17	94.23	122.36
236	0.85256	15.692	4019.3	18.947	45.037	84.155	906.6	92.103	120.67
238	0.90836	15.584	4188.9	19.648	45.173	84.865	889.97	90.016	118.99
240	0.96679	15.475	4359.8	20.347	45.314	85.612	873.25	87.968	117.32
242	1.0279	15.364	4532.2	21.046	45.461	86.398	856.45	85.958	115.66
244	1.0918	15.251	4706.1	21.744	45.614	87.229	839.57	83.984	114
246	1.1585	15.136	4881.5	22.442	45.772	88.107	822.59	82.045	112.35
248	1.2282	15.019	5058.6	23.141	45.937	89.037	805.51	80.138	110.71
250	1.3008	14.901	5237.4	23.839	46.109	90.024	788.33	78.262	109.08
252	1.3766	14.779	5418	24.538	46.287	91.075	771.03	76.415	107.46
254	1.4555	14.656	5600.5	25.239	46.472	92.195	753.6	74.597	105.84
256	1.5376	14.53	5785	25.94	46.665	93.393	736.05	72.805	104.23
258	1.6230	14.401	5971.7	26.643	46.866	94.677	718.36	71.038	102.62
260	1.7118	14.27	6160.6	27.349	47.076	96.059	700.52	69.294	101.02
262	1.8041	14.135	6351.8	28.057	47.294	97.55	682.53	67.571	99.424
264	1.9000	13.997	6545.6	28.768	47.523	99.166	664.38	65.868	97.833
266	1.9996	13.855	6742.1	29.482	47.761	100.93	646.06	64.183	96.247

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}
268	2.1029	13.709	6941.4	30.201	48.01	102.85	627.58	62.514	94.664
270	2.2100	13.559	7143.8	30.924	48.269	104.96	608.92	60.86	93.083
272	2.3210	13.405	7349.6	31.653	48.539	107.3	590.08	59.217	91.506
274	2.4361	13.245	7559	32.388	48.82	109.9	571.04	57.583	89.929
276	2.5554	13.079	7772.4	33.131	49.113	112.82	551.77	55.956	88.354
278	2.6789	12.907	7990	33.882	49.419	116.12	532.23	54.333	86.778
280	2.8067	12.728	8212.4	34.644	49.743	119.89	512.38	52.71	85.203
282	2.9391	12.541	8440.2	35.417	50.09	124.26	492.15	51.083	83.626
284	3.0760	12.345	8673.9	36.204	50.469	129.38	471.46	49.448	82.05
286	3.2177	12.138	8914.4	37.007	50.89	135.48	450.22	47.797	80.475
288	3.3643	11.918	9162.8	37.83	51.369	142.91	428.34	46.125	78.904
290	3.5159	11.684	9420.4	38.677	51.927	152.19	405.7	44.421	77.344
292	3.6728	11.431	9689.1	39.554	52.59	164.16	382.18	42.673	75.81
294	3.8351	11.155	9971.6	40.469	53.394	180.25	357.64	40.863	74.329
296	4.0031	10.849	10272	41.435	54.396	203.18	331.84	38.964	72.96
298	4.1770	10.502	10597	42.473	55.695	238.66	304.47	36.934	71.84
300	4.3573	10.094	10957	43.62	57.488	301.37	274.91	34.698	71.306
302	4.5442	9.5785	11379	44.958	60.283	443.32	241.95	32.091	72.342
304	4.7387	8.8094	11945	46.758	66.07	1064	202.16	28.585	79.577
305	4.8392	8.0469	12448	48.37	74.262	4934.1	175.12	25.666	106.59

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

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}
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

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

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}
90.4	1.1518E-06	1.5324E-06	11295	148.09	26.811	35.126	180.97	2.8552	2.7299
92	1.7410E-06	2.2760E-06	11351	145.27	26.905	35.22	182.48	2.9055	2.822
94	2.8559E-06	3.6541E-06	11421	141.92	27.024	35.339	184.36	2.9684	2.938
96	4.5809E-06	5.7391E-06	11492	138.73	27.143	35.458	186.22	3.0313	3.0547
98	7.1951E-06	8.8304E-06	11563	135.71	27.263	35.578	188.05	3.0941	3.1723
100	1.1081E-05	1.3327E-05	11634	132.84	27.384	35.699	189.86	3.1569	3.2908
102	1.6752E-05	1.9754E-05	11706	130.11	27.505	35.821	191.65	3.2197	3.4101
104	2.4891E-05	2.8787E-05	11778	127.52	27.627	35.944	193.42	3.2825	3.5302
106	3.6383E-05	4.1284E-05	11850	125.05	27.749	36.067	195.17	3.3453	3.6512
108	5.2368E-05	5.8323E-05	11922	122.69	27.873	36.192	196.9	3.408	3.7731
110	7.4287E-05	8.1234E-05	11994	120.45	27.997	36.318	198.61	3.4707	3.8958

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}
112	1.0394E-04	1.1164E-04	12067	118.31	28.124	36.447	200.3	3.5334	4.0194
114	1.4357E-04	1.5150E-04	12139	116.27	28.252	36.578	201.98	3.596	4.1439
116	1.9587E-04	2.0314E-04	12212	114.32	28.382	36.713	203.63	3.6586	4.2693
118	2.6414E-04	2.6932E-04	12286	112.46	28.515	36.85	205.27	3.7212	4.3956
120	3.5230E-04	3.5326E-04	12359	110.69	28.651	36.992	206.89	3.7838	4.5228
122	4.6500E-04	4.5866E-04	12432	108.99	28.791	37.139	208.49	3.8463	4.6509
124	6.0768E-04	5.8981E-04	12506	107.36	28.933	37.29	210.07	3.9088	4.78
126	7.8667E-04	7.5154E-04	12580	105.81	29.079	37.446	211.63	3.9712	4.9101
128	1.0093E-03	9.4934E-04	12654	104.32	29.229	37.606	213.17	4.0336	5.0412
130	1.2839E-03	1.1893E-03	12728	102.89	29.38	37.77	214.69	4.096	5.1733
132	1.6200E-03	1.4783E-03	12802	101.53	29.534	37.937	216.19	4.1583	5.3065
134	2.0283E-03	1.8238E-03	12876	100.22	29.689	38.107	217.68	4.2206	5.4408
136	2.5209E-03	2.2340E-03	12950	98.966	29.845	38.279	219.14	4.2828	5.5763
138	3.1110E-03	2.7181E-03	13025	97.764	30	38.451	220.58	4.345	5.7129
140	3.8136E-03	3.2857E-03	13099	96.61	30.154	38.623	222.01	4.4071	5.8508
142	4.6448E-03	3.9473E-03	13173	95.504	30.306	38.793	223.42	4.4692	5.99
144	5.6226E-03	4.7144E-03	13248	94.442	30.454	38.961	224.8	4.5312	6.1305
146	6.7664E-03	5.5990E-03	13322	93.422	30.599	39.127	226.17	4.5932	6.2723
148	8.0973E-03	6.6141E-03	13397	92.442	30.739	39.289	227.51	4.6551	6.4156
150	9.6380E-03	7.7732E-03	13471	91.501	30.876	39.449	228.84	4.717	6.5604
152	0.011413	9.0909E-03	13545	90.596	31.008	39.607	230.14	4.7788	6.7068
154	0.013448	0.010582	13619	89.726	31.137	39.763	231.42	4.8405	6.8547
156	0.015772	0.012264	13693	88.889	31.264	39.919	232.68	4.9022	7.0043
158	0.018414	0.014151	13767	88.083	31.389	40.076	233.91	4.9639	7.1557
160	0.021405	0.016263	13841	87.308	31.513	40.235	235.12	5.0255	7.3089
162	0.024779	0.018617	13914	86.561	31.637	40.399	236.3	5.0871	7.4639
164	0.028570	0.021232	13988	85.841	31.765	40.569	237.45	5.1486	7.6209
166	0.032814	0.024127	14060	85.146	31.895	40.748	238.57	5.2101	7.7799
168	0.037551	0.027324	14133	84.477	32.031	40.937	239.67	5.2715	7.941
170	0.042819	0.030843	14205	83.831	32.173	41.138	240.73	5.3329	8.1042
172	0.048660	0.034706	14277	83.207	32.322	41.353	241.76	5.3943	8.2697
174	0.055118	0.038935	14348	82.604	32.48	41.583	242.76	5.4557	8.4375
176	0.062235	0.043553	14419	82.021	32.648	41.829	243.72	5.5171	8.6077
178	0.070060	0.048584	14489	81.458	32.826	42.093	244.65	5.5785	8.7803
180	0.078638	0.054053	14559	80.912	33.015	42.375	245.54	5.6399	8.9555
182	0.088019	0.059985	14628	80.385	33.214	42.676	246.39	5.7013	9.1333
184	0.09825	0.066405	14697	79.874	33.425	42.996	247.2	5.7628	9.3139
186	0.10939	0.073340	14764	79.379	33.646	43.335	247.98	5.8243	9.4972
188	0.12149	0.080817	14832	78.899	33.878	43.693	248.71	5.8859	9.6835
190	0.13459	0.088865	14898	78.433	34.12	44.07	249.41	5.9475	9.8728
192	0.14876	0.097512	14964	77.982	34.371	44.465	250.06	6.0092	10.065
194	0.16405	0.10679	15030	77.543	34.631	44.878	250.67	6.0711	10.261
196	0.18052	0.11672	15094	77.118	34.9	45.309	251.24	6.1331	10.46
198	0.19823	0.12735	15158	76.704	35.175	45.756	251.77	6.1952	10.662
200	0.21723	0.13870	15221	76.302	35.457	46.22	252.26	6.2575	10.868
202	0.23759	0.15080	15283	75.911	35.745	46.699	252.7	6.3201	11.077
204	0.25936	0.16370	15344	75.53	36.037	47.195	253.1	6.3828	11.291
206	0.28261	0.17742	15404	75.16	36.334	47.705	253.45	6.4458	11.508
208	0.30740	0.19200	15464	74.799	36.634	48.23	253.76	6.5091	11.729
210	0.33380	0.20749	15523	74.447	36.937	48.771	254.02	6.5727	11.955
212	0.36185	0.22392	15580	74.103	37.243	49.327	254.24	6.6367	12.185
214	0.39164	0.24133	15637	73.768	37.551	49.899	254.41	6.7012	12.419
216	0.42323	0.25976	15693	73.44	37.861	50.488	254.54	6.766	12.658
218	0.45667	0.27927	15747	73.119	38.173	51.094	254.62	6.8314	12.902
220	0.49205	0.29989	15801	72.806	38.486	51.718	254.65	6.8973	13.152
222	0.52941	0.32168	15853	72.498	38.8	52.363	254.63	6.9639	13.406
224	0.56884	0.34468	15904	72.197	39.116	53.029	254.56	7.0311	13.667
226	0.61040	0.36896	15954	71.901	39.434	53.718	254.44	7.0991	13.933
228	0.65416	0.39457	16003	71.61	39.755	54.433	254.27	7.1679	14.206
230	0.70018	0.42157	16050	71.324	40.077	55.176	254.05	7.2376	14.485
232	0.74854	0.45003	16096	71.042	40.402	55.949	253.78	7.3084	14.771
234	0.79931	0.48000	16140	70.764	40.731	56.756	253.45	7.3802	15.064
236	0.85256	0.51158	16183	70.489	41.063	57.601	253.07	7.4533	15.365
238	0.90836	0.54482	16225	70.218	41.4	58.487	252.64	7.5277	15.675
240	0.96679	0.57983	16264	69.948	41.742	59.419	252.14	7.6036	15.993
242	1.0279	0.61668	16302	69.681	42.089	60.401	251.59	7.6811	16.321
244	1.0918	0.65547	16338	69.416	42.443	61.439	250.98	7.7603	16.658
246	1.1585	0.69630	16372	69.151	42.803	62.539	250.31	7.8415	17.007
248	1.2282	0.73929	16404	68.888	43.171	63.709	249.58	7.9249	17.367
250	1.3008	0.78456	16434	68.624	43.548	64.956	248.79	8.0107	17.74
252	1.3766	0.83224	16461	68.36	43.934	66.288	247.93	8.099	18.127
254	1.4555	0.88247	16486	68.096	44.33	67.717	247	8.1902	18.529
256	1.5376	0.93543	16509	67.829	44.737	69.255	246.01	8.2846	18.947
258	1.6230	0.99127	16528	67.561	45.155	70.914	244.95	8.3825	19.383

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}
260	1.7118	1.0502	16545	67.29	45.586	72.712	243.81	8.4843	19.838
262	1.8041	1.1124	16559	67.015	46.03	74.668	242.61	8.5905	20.316
264	1.9000	1.1782	16569	66.737	46.488	76.805	241.33	8.7014	20.818
266	1.9996	1.2478	16576	66.453	46.963	79.154	239.97	8.8176	21.348
268	2.1029	1.3215	16579	66.163	47.457	81.749	238.54	8.9399	21.908
270	2.2100	1.3998	16578	65.865	47.971	84.634	237.02	9.0688	22.504
272	2.3210	1.4829	16572	65.56	48.511	87.865	235.42	9.2053	23.139
274	2.4361	1.5713	16562	65.245	49.078	91.508	233.73	9.3504	23.82
276	2.5554	1.6657	16546	64.918	49.677	95.649	231.95	9.5052	24.554
278	2.6789	1.7666	16524	64.579	50.312	100.4	230.07	9.671	25.351
280	2.8067	1.8748	16495	64.224	50.986	105.91	228.1	9.8497	26.22
282	2.9391	1.9913	16459	63.852	51.705	112.36	226.01	10.043	27.177
284	3.0760	2.1172	16414	63.458	52.475	120.03	223.82	10.254	28.239
286	3.2177	2.2540	16360	63.04	53.303	129.31	221.51	10.486	29.431
288	3.3643	2.4034	16294	62.592	54.2	140.75	219.07	10.742	30.786
290	3.5159	2.5679	16215	62.107	55.181	155.23	216.5	11.029	32.349
292	3.6728	2.7507	16120	61.577	56.268	174.14	213.78	11.355	34.187
294	3.8351	2.9566	16005	60.99	57.494	199.9	210.88	11.73	36.402
296	4.0031	3.1925	15864	60.326	58.915	237.1	207.77	12.171	39.166
298	4.1770	3.4695	15687	59.556	60.627	295.46	204.37	12.706	42.787
300	4.3573	3.8079	15458	58.625	62.82	399.89	200.51	13.388	47.922
302	4.5442	4.2525	15141	57.416	65.958	637.9	195.74	14.334	56.352
304	4.7387	4.9503	14617	55.547	71.737	1657.3	188.14	15.947	76.685
305	4.8392	5.6788	14058	53.648	78.86	7440.9	178.83	17.943	123.96

TABLE 3 ~~Themophysical~~Thermophysical 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~~				
				Pressure = 0.1 MPa				
~~92~~	~~21.609~~	~~-6473~~	~~-48.513~~	~~47.851~~	~~69.603~~	~~1997.1~~	~~1193.8~~	~~254.38~~
92	21.609	-6473	-48.513	47.851	69.603	1997.1	1208.1	254.21
~~100~~	~~21.317~~	~~-5920.6~~	~~-42.756~~	~~46.328~~	~~68.636~~	~~1938.8~~	~~873.92~~	~~247.88~~
100	21.317	-5920.6	-42.756	46.328	68.636	1938.8	890.65	247.72
~~110~~	~~20.952~~	~~-5236.3~~	~~-36.233~~	~~45.176~~	~~68.347~~	~~1866.8~~	~~633.84~~	~~239.17~~
110	20.952	-5236.3	-36.233	45.176	68.347	1866.8	643.61	239.04
~~120~~	~~20.586~~	~~-4552.1~~	~~-30.280~~	~~44.457~~	~~68.539~~	~~1794.9~~	~~486.12~~	~~229.96~~
120	20.586	-4552.1	-30.28	44.457	68.539	1794.9	490.2	229.85
~~130~~	~~20.216~~	~~-3864.8~~	~~-24.779~~	~~43.966~~	~~68.953~~	~~1722.5~~	~~388.43~~	~~220.40~~
130	20.216	-3864.8	-24.779	43.966	68.953	1722.5	389.53	220.31
~~140~~	~~19.842~~	~~-3172.6~~	~~-19.650~~	~~43.611~~	~~69.492~~	~~1649.6~~	~~319.99~~	~~210.63~~
140	19.842	-3172.6	-19.65	43.611	69.492	1649.6	319.94	210.55
~~150~~	~~19.463~~	~~-2474.6~~	~~-14.834~~	~~43.355~~	~~70.131~~	~~1576.1~~	~~269.72~~	~~200.77~~
150	19.463	-2474.6	-14.834	43.355	70.131	1576.1	269.45	200.7
~~160~~	~~19.076~~	~~-1769.7~~	~~-10.285~~	~~43.186~~	~~70.879~~	~~1501.8~~	~~231.29~~	~~190.89~~
160	19.076	-1769.7	-10.285	43.186	70.879	1501.8	231.19	190.83
~~170~~	~~18.681~~	~~-1056.6~~	~~-5.9619~~	~~43.103~~	~~71.760~~	~~1426.7~~	~~200.92~~	~~181.08~~
170	18.681	-1056.6	-5.9619	43.103	71.76	1426.7	201.07	181.02
~~180~~	~~18.276~~	~~-333.90~~	~~-1.8314~~	~~43.109~~	~~72.808~~	~~1350.6~~	~~176.21~~	~~171.36~~
180	18.276	-333.9	-1.8314	43.109	72.808	1350.6	176.57	171.32
~~184.33~~	~~18.096~~	~~-17.904~~	~~-9.6671E-02~~	~~43.140~~	~~73.323~~	~~1317.4~~	~~166.87~~	~~167.20~~
184.33	18.096	-17.904	-0.096671	43.14	73.323	1317.4	167.3	167.16
~~184.33~~	~~6.7496E-02~~	~~14708~~	~~79.792~~	~~33.460~~	~~43.050~~	~~247.33~~	~~5.8773~~	~~9.4707~~
184.33	0.067496	14708	79.792	33.46	43.05	247.33	5.7728	9.3435
~~190~~	~~6.5270E-02~~	~~14953~~	~~81.102~~	~~33.858~~	~~43.314~~	~~251.25~~	~~6.0553~~	~~9.9122~~
190	0.065270	14953	81.102	33.858	43.314	251.25	5.9502	9.7796
~~200~~	~~6.1716E-02~~	~~15388~~	~~83.336~~	~~34.553~~	~~43.810~~	~~257.90~~	~~6.3683~~	~~10.723~~
200	0.061716	15388	83.336	34.553	43.81	257.9	6.2613	10.579
~~210~~	~~5.8558E-02~~	~~15829~~	~~85.487~~	~~35.286~~	~~44.388~~	~~264.25~~	~~6.6803~~	~~11.574~~
210	0.058558	15829	85.487	35.286	44.388	264.25	6.5708	11.419
~~220~~	~~5.5728E-02~~	~~16276~~	~~87.567~~	~~36.089~~	~~45.071~~	~~270.34~~	~~6.9911~~	~~12.468~~
220	0.055728	16276	87.567	36.089	45.071	270.34	6.8787	12.3
~~230~~	~~5.3174E-02~~	~~16731~~	~~89.587~~	~~36.962~~	~~45.851~~	~~276.18~~	~~7.3003~~	~~13.405~~
230	0.053174	16731	89.587	36.962	45.851	276.18	7.185	13.225
~~240~~	~~5.0854E-02~~	~~17194~~	~~91.557~~	~~37.898~~	~~46.713~~	~~281.81~~	~~7.6078~~	~~14.386~~
240	0.050854	17194	91.557	37.898	46.713	281.81	7.4899	14.193
~~250~~	~~4.8735E-02~~	~~17665~~	~~93.482~~	~~38.889~~	~~47.644~~	~~287.25~~	~~7.9133~~	~~15.412~~
250	0.048735	17665	93.482	38.889	47.644	287.25	7.7934	15.206
~~260~~	~~4.6792E-02~~	~~18147~~	~~95.370~~	~~39.929~~	~~48.634~~	~~292.53~~	~~8.2168~~	~~16.482~~
260	0.046792	18147	95.37	39.929	48.634	292.53	8.0953	16.266
~~270~~	~~4.5003E-02~~	~~18638~~	~~97.225~~	~~41.012~~	~~49.676~~	~~297.65~~	~~8.5182~~	~~17.598~~
270	0.045003	18638	97.225	41.012	49.676	297.65	8.3959	17.372
~~280~~	~~4.3349E-02~~	~~19140~~	~~99.051~~	~~42.134~~	~~50.763~~	~~302.63~~	~~8.8172~~	~~18.760~~
280	0.043349	19140	99.051	42.134	50.763	302.63	8.6949	18.525

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}
~~290~~	~~4.1815E-02~~	~~19654~~	~~100.85~~	~~43.290~~	~~51.888~~	~~307.49~~	~~9.1138~~	~~19.966~~
290	0.041815	19654	100.85	43.29	51.888	307.49	8.9924	19.725
~~300~~	~~4.0388E-02~~	~~20178~~	~~102.63~~	~~44.475~~	~~53.048~~	~~312.23~~	~~9.4081~~	~~21.218~~
300	0.040388	20178	102.63	44.475	53.048	312.23	9.2884	20.971
~~310~~	~~3.9057E-02~~	~~20715~~	~~104.39~~	~~45.686~~	~~54.236~~	~~316.88~~	~~9.6998~~	~~22.513~~
310	0.039057	20715	104.39	45.686	54.236	316.88	9.5829	22.264
~~320~~	~~3.7813E-02~~	~~21263~~	~~106.13~~	~~46.919~~	~~55.449~~	~~321.43~~	~~9.9891~~	~~23.851~~
320	0.037813	21263	106.13	46.919	55.449	321.43	9.8758	23.603
~~330~~	~~3.6646E-02~~	~~21824~~	~~107.86~~	~~48.169~~	~~56.682~~	~~325.89~~	~~10.276~~	~~25.232~~
330	0.036646	21824	107.86	48.169	56.682	325.89	10.167	24.987
~~340~~	~~3.5551E-02~~	~~22397~~	~~109.57~~	~~49.434~~	~~57.931~~	~~330.28~~	~~10.560~~	~~26.654~~
340	0.035551	22397	109.57	49.434	57.931	330.28	10.457	26.414
~~350~~	~~3.4519E-02~~	~~22982~~	~~111.26~~	~~50.710~~	~~59.193~~	~~334.59~~	~~10.842~~	~~28.115~~
350	0.034519	22982	111.26	50.71	59.193	334.59	10.745	27.884
~~360~~	~~3.3547E-02~~	~~23581~~	~~112.95~~	~~51.993~~	~~60.465~~	~~338.84~~	~~11.121~~	~~29.615~~
360	0.033547	23581	112.95	51.993	60.465	338.84	11.031	29.395
~~370~~	~~3.2629E-02~~	~~24192~~	~~114.62~~	~~53.282~~	~~61.742~~	~~343.02~~	~~11.398~~	~~31.151~~
370	0.032629	24192	114.62	53.282	61.742	343.02	11.315	30.946
~~380~~	~~3.1760E-02~~	~~24816~~	~~116.29~~	~~54.573~~	~~63.023~~	~~347.15~~	~~11.672~~	~~32.723~~
380	0.031760	24816	116.29	54.573	63.023	347.15	11.598	32.535
~~390~~	~~3.0937E-02~~	~~25452~~	~~117.94~~	~~55.864~~	~~64.305~~	~~351.22~~	~~11.944~~	~~34.328~~
390	0.030937	25452	117.94	55.864	64.305	351.22	11.878	34.16
~~400~~	~~3.0155E-02~~	~~26102~~	~~119.58~~	~~57.153~~	~~65.586~~	~~355.24~~	~~12.213~~	~~35.965~~
400	0.030155	26102	119.58	57.153	65.586	355.24	12.157	35.82
~~410~~	~~2.9413E-02~~	~~26764~~	~~121.22~~	~~58.438~~	~~66.864~~	~~359.21~~	~~12.480~~	~~37.632~~
410	0.029413	26764	121.22	58.438	66.864	359.21	12.434	37.513
~~420~~	~~2.8706E-02~~	~~27439~~	~~122.85~~	~~59.718~~	~~68.137~~	~~363.13~~	~~12.744~~	~~39.329~~
420	0.028706	27439	122.85	59.718	68.137	363.13	12.709	39.238
~~430~~	~~2.8033E-02~~	~~28127~~	~~124.46~~	~~60.991~~	~~69.404~~	~~367.01~~	~~13.006~~	~~41.053~~
430	0.028033	28127	124.46	60.991	69.404	367.01	12.981	40.993
~~440~~	~~2.7391E-02~~	~~28827~~	~~126.07~~	~~62.255~~	~~70.663~~	~~370.85~~	~~13.266~~	~~42.802~~
440	0.027391	28827	126.07	62.255	70.663	370.85	13.252	42.776
~~450~~	~~2.6778E-02~~	~~29540~~	~~127.68~~	~~63.511~~	~~71.912~~	~~374.65~~	~~13.523~~	~~44.577~~
450	0.026778	29540	127.68	63.511	71.912	374.65	13.52	44.585
~~460~~	~~2.6192E-02~~	~~30265~~	~~129.27~~	~~64.756~~	~~73.153~~	~~378.40~~	~~13.779~~	~~46.374~~
460	0.026192	30265	129.27	64.756	73.153	378.4	13.787	46.42
~~470~~	~~2.5631E-02~~	~~31003~~	~~130.86~~	~~65.990~~	~~74.382~~	~~382.13~~	~~14.032~~	~~48.193~~
470	0.025631	31003	130.86	65.99	74.382	382.13	14.051	48.277
~~480~~	~~2.5094E-02~~	~~31753~~	~~132.44~~	~~67.212~~	~~75.600~~	~~385.81~~	~~14.282~~	~~50.033~~
480	0.025094	31753	132.44	67.212	75.6	385.81	14.313	50.156
~~490~~	~~2.4579E-02~~	~~32515~~	~~134.01~~	~~68.422~~	~~76.807~~	~~389.47~~	~~14.531~~	~~51.892~~
490	0.024579	32515	134.01	68.422	76.807	389.47	14.572	52.056
~~500~~	~~2.4084E-02~~	~~33289~~	~~135.57~~	~~69.620~~	~~78.001~~	~~393.08~~	~~14.778~~	~~53.769~~
500	0.024084	33289	135.57	69.62	78.001	393.08	14.829	53.974
~~510~~	~~2.3610E-02~~	~~34075~~	~~137.13~~	~~70.804~~	~~79.182~~	~~396.67~~	~~15.022~~	~~55.663~~
510	0.023610	34075	137.13	70.804	79.182	396.67	15.084	55.91
~~520~~	~~2.3154E-02~~	~~34872~~	~~138.68~~	~~71.976~~	~~80.351~~	~~400.22~~	~~15.264~~	~~57.574~~
520	0.023154	34872	138.68	71.976	80.351	400.22	15.336	57.861
~~530~~	~~2.2715E-02~~	~~35682~~	~~140.22~~	~~73.135~~	~~81.506~~	~~403.75~~	~~15.505~~	~~59.500~~
530	0.022715	35682	140.22	73.135	81.506	403.75	15.586	59.827
~~540~~	~~2.2292E-02~~	~~36503~~	~~141.75~~	~~74.280~~	~~82.649~~	~~407.24~~	~~15.743~~	~~61.440~~
540	0.022292	36503	141.75	74.28	82.649	407.24	15.833	61.806
~~550~~	~~2.1885E-02~~	~~37335~~	~~143.28~~	~~75.411~~	~~83.778~~	~~410.71~~	~~15.980~~	~~63.394~~
550	0.021885	37335	143.28	75.411	83.778	410.71	16.077	63.797
~~560~~	~~2.1493E-02~~	~~38178~~	~~144.80~~	~~76.530~~	~~84.894~~	~~414.15~~	~~16.214~~	~~65.360~~
560	0.021493	38178	144.8	76.53	84.894	414.15	16.319	65.798
~~570~~	~~2.1115E-02~~	~~39033~~	~~146.31~~	~~77.635~~	~~85.997~~	~~417.56~~	~~16.447~~	~~67.339~~
570	0.021115	39033	146.31	77.635	85.997	417.56	16.558	67.809
~~580~~	~~2.0749E-02~~	~~39898~~	~~147.82~~	~~78.726~~	~~87.086~~	~~420.94~~	~~16.678~~	~~69.328~~
580	0.020749	39898	147.82	78.726	87.086	420.94	16.794	69.827
~~590~~	~~2.0397E-02~~	~~40774~~	~~149.31~~	~~79.805~~	~~88.163~~	~~424.30~~	~~16.907~~	~~71.328~~
590	0.020397	40774	149.31	79.805	88.163	424.3	17.028	71.853
~~600~~	~~2.0056E-02~~	~~41661~~	~~150.80~~	~~80.870~~	~~89.227~~	~~427.63~~	~~17.135~~	~~73.338~~
600	0.020056	41661	150.8	80.87	89.227	427.63	17.258	73.884
				Pressure = 1.0 MPa				
~~92~~	~~21.620~~	~~-6437.8~~	~~-48.584~~	~~47.886~~	~~69.587~~	~~2000.7~~	~~1203.5~~	~~254.77~~
92	21.609	-6473	-48.513	47.851	69.603	1997.1	1193.8	254.38
~~100~~	~~21.329~~	~~-5885.6~~	~~-42.828~~	~~46.362~~	~~68.612~~	~~1942.4~~	~~880.24~~	~~248.30~~
100	21.329	-5885.6	-42.828	46.362	68.612	1942.4	896.64	248.15
~~110~~	~~20.965~~	~~-5201.6~~	~~-36.308~~	~~45.210~~	~~68.315~~	~~1870.5~~	~~638.01~~	~~239.64~~
110	20.965	-5201.6	-36.308	45.21	68.315	1870.5	647.85	239.5
~~120~~	~~20.600~~	~~-4517.8~~	~~-30.358~~	~~44.491~~	~~68.498~~	~~1798.9~~	~~489.15~~	~~230.47~~
120	20.600	-4517.8	-30.358	44.491	68.498	1798.9	493.36	230.35
~~130~~	~~20.232~~	~~-3830.9~~	~~-24.860~~	~~44.000~~	~~68.903~~	~~1727.0~~	~~390.80~~	~~220.95~~

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}
130	20.232	-3830.9	-24.86	44	68.903	1727	392	220.85
140	19.860	-3139.3	-19.735	43.646	69.430	1654.5	321.96	211.21
140	19.860	-3139.3	-19.735	43.646	69.43	1654.5	321.97	211.13
150	19.482	-2442.0	-14.925	43.391	70.054	1581.4	271.41	201.39
150	19.482	-2442	-14.925	43.391	70.054	1581.4	271.18	201.32
160	19.098	-1737.9	-10.381	43.223	70.783	1507.7	232.81	191.55
160	19.098	-1737.9	-10.381	43.223	70.783	1507.7	232.72	191.49
170	18.706	-1025.9	-6.0646	43.140	71.640	1433.2	202.31	181.78
170	18.706	-1025.9	-6.0646	43.14	71.64	1433.2	202.47	181.72
180	18.303	-304.56	-1.9418	43.146	72.657	1357.9	177.52	172.11
180	18.303	-304.56	-1.9418	43.146	72.657	1357.9	177.88	172.06
190	17.888	427.90	2.0181	43.245	73.871	1281.5	156.88	162.59
190	17.888	427.9	2.02E+00	43.245	73.871	1281.5	157.36	162.54
200	17.457	1173.7	5.8431	43.441	75.331	1204.0	139.33	153.30
200	17.457	1173.7	5.8431	43.441	75.331	1204	139.84	153.18
210	17.007	1935.5	9.5599	43.739	77.101	1124.9	124.13	144.15
210	17.007	1935.5	9.5599	43.739	77.101	1124.9	124.6	144
220	16.532	2717.0	13.195	44.145	79.278	1044.0	110.74	135.16
220	16.532	2717	13.195	44.145	79.278	1044	111.13	134.99
230	16.026	3523.0	16.777	44.665	82.014	960.67	98.760	126.31
230	16.026	3523	16.777	44.665	82.014	960.67	99.039	126.13
240	15.477	4360.1	20.339	45.314	85.578	873.85	87.848	117.56
240	15.477	4360.1	20.339	45.314	85.578	873.85	88.018	117.37
241.1	15.414	4454.3	20.731	45.394	86.038	864.04	86.702	116.60
241.1	15.414	4454.3	20.731	45.394	86.038	864.04	86.86	116.41
241.1	0.59982	16285	69.802	41.932	59.951	251.85	7.9293	16.358
241.1	0.59982	16285	69.802	41.932	59.951	251.85	7.6459	16.172
250	0.56362	16807	71.926	41.694	57.595	260.39	8.1910	17.042
250	0.56362	16807	71.926	41.694	57.595	260.39	7.922	16.842
260	0.52980	17376	74.161	42.098	56.525	268.91	8.4855	17.916
260	0.52980	17376	74.161	42.098	56.525	268.91	8.2297	17.703
270	0.50106	17939	76.286	42.760	56.158	276.67	8.7793	18.877
270	0.50106	17939	76.286	42.76	56.158	276.67	8.535	18.653
280	0.47613	18501	78.328	43.567	56.201	283.85	9.0719	19.913
280	0.47613	18501	78.328	43.567	56.201	283.85	8.8378	19.68
290	0.45416	19064	80.305	44.483	56.527	290.57	9.3628	21.014
290	0.45416	19064	80.305	44.483	56.527	290.57	9.1383	20.774
300	0.43455	19632	82.230	45.482	57.061	296.92	9.6518	22.177
300	0.43455	19632	82.23	45.482	57.061	296.92	9.4366	21.932
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
320	0.40085	20788	85.958	47.665	58.56	308.73	10.027	24.421
330	0.38619	21378	87.773	48.823	59.460	314.29	10.506	25.991
330	0.38619	21378	87.773	48.823	59.46	314.29	10.319	25.746
340	0.37271	21977	89.563	50.013	60.431	319.64	10.786	27.362
340	0.37271	21977	89.563	50.013	60.431	319.64	10.609	27.122
350	0.36027	22586	91.329	51.227	61.457	324.83	11.064	28.777
350	0.36027	22586	91.329	51.227	61.457	324.83	10.897	28.546
360	0.34872	23206	93.075	52.458	62.526	329.86	11.339	30.236
360	0.34872	23206	93.075	52.458	62.526	329.86	11.183	30.017
370	0.33797	23837	94.804	53.703	63.629	334.76	11.612	31.736
370	0.33797	23837	94.804	53.703	63.629	334.76	11.467	31.53
380	0.32793	24479	96.515	54.956	64.758	339.54	11.883	33.274
380	0.32793	24479	96.515	54.956	64.758	339.54	11.749	33.086
390	0.31853	25132	98.212	56.215	65.906	344.20	12.151	34.849
390	0.31853	25132	98.212	56.215	65.906	344.2	12.029	34.681
400	0.30970	25797	99.896	57.476	67.069	348.76	12.417	36.459
400	0.30970	25797	99.896	57.476	67.069	348.76	12.307	36.314
410	0.30138	26474	101.57	58.736	68.241	353.23	12.681	38.101
410	0.30138	26474	101.57	58.736	68.241	353.23	12.583	37.982
420	0.29353	27162	103.22	59.994	69.419	357.62	12.942	39.775
420	0.29353	27162	103.22	59.994	69.419	357.62	12.857	39.684
430	0.28611	27862	104.87	61.247	70.601	361.92	13.201	41.478
430	0.28611	27862	104.87	61.247	70.601	361.92	13.128	41.418
440	0.27908	28574	106.51	62.494	71.783	366.15	13.458	43.208
440	0.27908	28574	106.51	62.494	71.783	366.15	13.398	43.181
450	0.27241	29298	108.13	63.733	72.963	370.32	13.713	44.964
450	0.27241	29298	108.13	63.733	72.963	370.32	13.665	44.973
460	0.26607	30033	109.75	64.964	74.140	374.41	13.965	46.745
460	0.26607	30033	109.75	64.964	74.14	374.41	13.93	46.79
470	0.26004	30781	111.36	66.185	75.311	378.45	14.215	48.548
470	0.26004	30781	111.36	66.185	75.311	378.45	14.193	48.633
480	0.25428	31540	112.96	67.396	76.477	382.43	14.463	50.374
480	0.25428	31540	112.96	67.396	76.477	382.43	14.453	50.497