



Designation: D3956 – 23

# Standard Specification for Methane Thermophysical Property Tables<sup>1</sup>

This standard is issued under the fixed designation D3956; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 The thermophysical property tables for methane are for use in the calculation of the pressure-volume-temperature (PVT), thermodynamic, and transport properties of methane for process design and operations. Three tables are provided for gaseous and liquid methane at temperatures between 90 K and 600 K at pressures to 30 MPa. Two tables provide properties for the liquid and vapor phases at liquid-vapor equilibrium (saturation properties). The 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 10.0<sup>2</sup>.

1.2 *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. Referenced Documents

2.1 *ASTM Standards:*<sup>3</sup>

D4150 Terminology Relating to Gaseous Fuels

## 3. Applicability

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

<sup>1</sup> 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.

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<sup>2</sup> Lemmon, E.W., Bell, I.H., Huber, M.L., McLinden, M.O. NIST Standard Reference Database 23: Reference Fluid Thermodynamic and Transport Properties-REFPROP, Version 10.0, National Institute of Standards and Technology, Standard Reference Data Program, Gaithersburg, 2018.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

## 4. Terminology

4.1 *Definitions:*

4.1.1 For definitions of general terms used in D03 Gaseous Fuels standards, refer to Terminology D4150.

4.2 *Abbreviations:*

4.2.1 LNG—Liquefied Natural Gas

## 5. Tables

5.1 *Thermophysical Properties of Methane Liquid at Liquid-Vapor Equilibrium*, in SI units.

5.2 *Thermophysical Properties of Methane Vapor at Liquid-Vapor Equilibrium*, in SI units.

5.3 *Thermophysical Properties of Methane Along Isobars*, in SI units. The tabulated properties are:

$\rho$  = molar density ( $\text{mol}\cdot\text{L}^{-1}$ )

$H$  = molar enthalpy ( $\text{J}\cdot\text{mol}^{-1}$ )

$S$  = molar entropy ( $\text{J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$ )

$C_v$  = constant volume molar heat capacity ( $\text{J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$ )

$C_p$  = constant pressure molar heat capacity ( $\text{J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$ )

$c$  = speed of sound ( $\text{m}\cdot\text{s}^{-1}$ )

$\eta$  = viscosity ( $\mu\text{Pa}\cdot\text{s}$ )

$\lambda$  = thermal conductivity ( $\text{mW}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ )

These tables were produced by equations from a computer package, “NIST Standard Reference Database 23; Reference Fluid Thermodynamic and Transport Properties Database (REFPROP): Version 10.0.” A wide selection of units (SI units, engineering units, chemical units) and additional properties are available with this program.<sup>4</sup>

## 6. Additional Information

6.1 The Reference States for enthalpy and entropy have been updated in this version of the standard.

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 298.15 K and 0.101325 MPa ( $H = 10018 \text{ J/mol}$  and  $S = 186.266 \text{ J/(mol K)}$ ). The molar mass of methane is 16.043 g/mol.

<sup>4</sup> Available from Standard Reference Data, National Institute of Standards and Technology (NIST), 100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899.

## **7. Keywords**

7.1 methane gas tables; natural gas; thermodynamic properties of methane; transport properties of methane

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**TABLE 1 Thermophysical Properties of Methane Liquid at Liquid-Vapor Equilibrium**

$T$ K	$p$ MPa	$\rho$ mol·L <sup>-1</sup>	$H$ J·mol <sup>-1</sup>	$S$ J·mol <sup>-1</sup> ·K <sup>-1</sup>	$C_v$ J·mol <sup>-1</sup> ·K <sup>-1</sup>	$C_p$ J·mol <sup>-1</sup> ·K <sup>-1</sup>	$c$ m·s <sup>-1</sup>	$\eta$ μPa·s	$\lambda$ mW·m <sup>-1</sup> ·K <sup>-1</sup>
90.7	0.011705	28.141	-5732.1	67.803	34.775	54.029	1538.5	193.53	211.18
92	0.013801	28.033	-5661.7	68.572	34.641	54.102	1526.7	186.13	209.64
94	0.017613	27.866	-5553.3	69.737	34.445	54.226	1508.4	175.87	207.2
96	0.022233	27.698	-5444.6	70.879	34.258	54.366	1489.8	166.73	204.71
98	0.027778	27.528	-5335.6	72.001	34.08	54.517	1471	158.48	202.16
100	0.034376	27.357	-5226.2	73.103	33.908	54.681	1452	150.97	199.56
102	0.042160	27.185	-5116.5	74.187	33.741	54.854	1432.9	144.06	196.92
104	0.051275	27.01	-5006.4	75.253	33.579	55.039	1413.6	137.66	194.24
106	0.061868	26.835	-4895.8	76.302	33.421	55.234	1394.1	131.71	191.53
108	0.074099	26.657	-4784.9	77.335	33.266	55.439	1374.5	126.14	188.79
110	0.08813	26.478	-4673.4	78.352	33.115	55.656	1354.7	120.9	186.02
112	0.10413	26.297	-4561.5	79.355	32.966	55.885	1334.8	115.97	183.24
114	0.12228	26.113	-4449.1	80.344	32.82	56.127	1314.7	111.3	180.44
116	0.14275	25.928	-4336.1	81.319	32.677	56.383	1294.4	106.88	177.62
118	0.16574	25.74	-4222.6	82.282	32.537	56.653	1274	102.68	174.79
120	0.19143	25.551	-4108.4	83.233	32.4	56.941	1253.5	98.68	171.95
122	0.22002	25.358	-3993.7	84.172	32.265	57.246	1232.7	94.873	169.11
124	0.2517	25.163	-3878.2	85.101	32.133	57.571	1211.9	91.243	166.26
126	0.28667	24.966	-3762	86.019	32.005	57.917	1190.8	87.777	163.41
128	0.32514	24.765	-3645.1	86.928	31.879	58.288	1169.5	84.465	160.55
130	0.36732	24.562	-3527.3	87.827	31.757	58.684	1148.1	81.298	157.69
132	0.41341	24.355	-3408.7	88.718	31.639	59.11	1126.4	78.266	154.83
134	0.46363	24.145	-3289.2	89.601	31.525	59.567	1104.6	75.363	151.98
136	0.51819	23.931	-3168.7	90.477	31.414	60.06	1082.5	72.581	149.12
138	0.5773	23.713	-3047.2	91.346	31.308	60.593	1060.2	69.913	146.27
140	0.64118	23.491	-2924.5	92.209	31.206	61.169	1037.7	67.353	143.41
142	0.71006	23.265	-2800.7	93.066	31.109	61.795	1014.9	64.896	140.56
144	0.78415	23.034	-2675.6	93.918	31.018	62.477	991.81	62.536	137.71
146	0.86368	22.798	-2549.2	94.767	30.932	63.221	968.46	60.267	134.87
148	0.94887	22.556	-2421.3	95.611	30.852	64.036	944.81	58.085	132.02
150	1.0400	22.309	-2291.8	96.453	30.78	64.932	920.85	55.984	129.18
152	1.1372	22.055	-2160.6	97.293	30.714	65.922	896.54	53.96	126.33
154	1.2408	21.794	-2027.5	98.132	30.656	67.019	871.87	52.008	123.49
156	1.3509	21.526	-1892.5	98.97	30.608	68.241	846.82	50.124	120.64
158	1.4680	21.249	-1755.2	99.81	30.569	69.611	821.35	48.303	117.79
160	1.5921	20.964	-1615.5	100.65	30.541	71.156	795.43	46.541	114.93
162	1.7235	20.668	-1473.2	101.5	30.526	72.912	769.03	44.832	112.06
164	1.8626	20.36	-1327.9	102.35	30.525	74.924	742.1	43.172	109.18
166	2.0096	20.04	-1179.3	103.2	30.541	77.252	714.59	41.556	106.29
168	2.1647	19.706	-1027	104.07	30.576	79.979	686.42	39.978	103.38
170	2.3283	19.355	-870.41	104.94	30.634	83.218	657.52	38.432	100.46
172	2.5007	18.984	-708.97	105.84	30.721	87.13	627.77	36.911	97.508
174	2.6822	18.591	-541.82	106.75	30.843	91.954	597.05	35.407	94.534
176	2.8732	18.17	-367.86	107.68	31.011	98.06	565.18	33.911	91.535
178	3.0740	17.716	-185.61	108.65	31.24	106.05	531.94	32.411	88.513
180	3.2852	17.218	7.086	109.66	31.554	116.99	497.01	30.888	85.482
182	3.5071	16.664	213.47	110.72	31.996	132.94	459.94	29.32	82.478
184	3.7405	16.028	438.97	111.88	32.641	158.52	420	27.665	79.598
186	3.9860	15.267	693.95	113.17	33.654	206.68	375.88	25.848	77.15
188	4.2448	14.27	1003.7	114.73	35.503	332.7	324.57	23.683	76.438
190	4.5186	12.515	1488.3	117.19	41.746	1508.2	250.31	20.291	94.152

**TABLE 2 Thermophysical Properties of Methane Vapor at Liquid-Vapor Equilibrium**

$T$ K	$p$ MPa	$\rho$ mol·L <sup>-1</sup>	$H$ J·mol <sup>-1</sup>	$S$ J·mol <sup>-1</sup> ·K <sup>-1</sup>	$C_V$ J·mol <sup>-1</sup> ·K <sup>-1</sup>	$C_P$ J·mol <sup>-1</sup> ·K <sup>-1</sup>	$c$ m·s <sup>-1</sup>	$\eta$ μPa·s	$\lambda$ mW·m <sup>-1</sup> ·K <sup>-1</sup>
90.7	0.011705	0.015641	2999.3	164.07	25.244	33.851	249.13	3.598	8.7991
92	0.013801	0.018199	3040	163.16	25.272	33.916	250.76	3.6414	8.9478
94	0.017613	0.022777	3102.1	161.82	25.32	34.025	253.2	3.7087	9.1797
96	0.022233	0.028198	3163.6	160.55	25.372	34.145	255.57	3.7765	9.4154
98	0.027778	0.034587	3224.3	159.35	25.427	34.279	257.87	3.8449	9.6551
100	0.034376	0.042048	3284.2	158.21	25.487	34.425	260.09	3.9139	9.8989
102	0.04216	0.050695	3343.3	157.13	25.55	34.585	262.24	3.9832	10.147
104	0.051275	0.060649	3401.5	156.1	25.617	34.76	264.31	4.053	10.4
106	0.061868	0.072034	3458.7	155.12	25.688	34.95	266.29	4.1232	10.657
108	0.074099	0.08498	3514.8	154.18	25.763	35.156	268.2	4.1938	10.92
110	0.08813	0.099622	3569.9	153.29	25.842	35.378	270.01	4.2647	11.188
112	0.10413	0.1161	3623.8	152.44	25.925	35.619	271.75	4.336	11.461
114	0.12228	0.13455	3676.5	151.62	26.011	35.879	273.39	4.4077	11.74
116	0.14275	0.15514	3727.9	150.84	26.102	36.159	274.94	4.4797	12.026
118	0.16574	0.17801	3777.9	150.08	26.196	36.461	276.4	4.5521	12.318
120	0.19143	0.20332	3826.5	149.36	26.295	36.786	277.76	4.625	12.617
122	0.22002	0.23125	3873.6	148.66	26.397	37.137	279.03	4.6983	12.923
124	0.2517	0.26197	3919.1	147.98	26.505	37.514	280.21	4.7721	13.237
126	0.28667	0.29567	3963	147.33	26.616	37.922	281.28	4.8465	13.56
128	0.32514	0.33254	4005.1	146.69	26.733	38.361	282.25	4.9215	13.891
130	0.36732	0.37278	4045.5	146.08	26.854	38.836	283.13	4.9972	14.232
132	0.41341	0.41662	4083.9	145.48	26.981	39.35	283.9	5.0738	14.583
134	0.46363	0.46428	4120.4	144.9	27.113	39.907	284.57	5.1512	14.944
136	0.51819	0.51601	4154.7	144.33	27.252	40.511	285.13	5.2297	15.317
138	0.5773	0.57209	4186.9	143.77	27.397	41.169	285.58	5.3094	15.703
140	0.64118	0.63279	4216.8	143.22	27.549	41.885	285.93	5.3904	16.102
142	0.71006	0.69843	4244.2	142.68	27.709	42.668	286.16	5.473	16.515
144	0.78415	0.76935	4269.2	142.15	27.877	43.525	286.29	5.5573	16.945
146	0.86368	0.84593	4291.4	141.62	28.054	44.467	286.3	5.6436	17.391
148	0.94887	0.92857	4310.8	141.1	28.241	45.507	286.19	5.7323	17.857
150	1.04	1.0177	4327.2	140.58	28.439	46.657	285.97	5.8236	18.344
152	1.1372	1.114	4340.5	140.06	28.649	47.936	285.63	5.9179	18.854
154	1.2408	1.2178	4350.3	139.55	28.872	49.365	285.16	6.0157	19.39
156	1.3509	1.3299	4356.4	139.03	29.11	50.971	284.57	6.1176	19.957
158	1.468	1.4511	4358.7	138.51	29.363	52.785	283.86	6.2242	20.557
160	1.5921	1.5821	4356.7	137.98	29.636	54.849	283.01	6.3362	21.197
162	1.7235	1.7241	4350.2	137.44	29.928	57.217	282.03	6.4546	21.884
164	1.8626	1.8782	4338.6	136.9	30.244	59.958	280.91	6.5803	22.625
166	2.0096	2.0459	4321.5	136.34	30.588	63.165	279.65	6.7148	23.433
168	2.1647	2.2289	4298.2	135.77	30.962	66.963	278.23	6.8598	24.322
170	2.3283	2.4294	4268.1	135.17	31.374	71.527	276.66	7.0175	25.314
172	2.5007	2.65	4230	134.55	31.829	77.111	274.93	7.1906	26.436
174	2.6822	2.8944	4182.9	133.9	32.337	84.089	273.02	7.3827	27.732
176	2.8732	3.1671	4125.2	133.21	32.912	93.049	270.92	7.5989	29.263
178	3.074	3.4744	4054.5	132.47	33.57	104.95	268.6	7.846	31.127
180	3.2852	3.8257	3967.9	131.66	34.338	121.51	266.04	8.1346	33.484
182	3.5071	4.2349	3860.4	130.76	35.257	146.04	263.17	8.4811	36.62
184	3.7405	4.7255	3724.4	129.73	36.397	185.97	259.89	8.9141	41.1
186	3.986	5.3422	3545	128.5	37.893	262.03	255.97	9.4902	48.246
188	4.2448	6.1945	3286.5	126.88	40.109	461.61	250.72	10.354	62.294
190	4.5186	7.8027	2783.9	124.01	45.796	2259	238.55	12.237	120.52

**TABLE 3 Thermophysical Properties of Methane Along Isobars**

$T$ K	$\rho$ mol·L <sup>-1</sup>	$H$ J·mol <sup>-1</sup>	$S$ J·mol <sup>-1</sup> ·K <sup>-1</sup>	$C_v$ J·mol <sup>-1</sup> ·K <sup>-1</sup>	$C_p$ J·mol <sup>-1</sup> ·K <sup>-1</sup>	$c$ m·s <sup>-1</sup>	$\eta$ μPa·s	$\lambda$ mW·m <sup>-1</sup> ·K <sup>-1</sup>
Pressure = 0.1 MPa								
92	28.037	-5659.5	68.563	34.645	54.093	1527.3	186.43	209.71
100	27.36	-5224.6	73.096	33.911	54.672	1452.6	151.12	199.62
110	26.478	-4673.2	78.35	33.115	55.654	1354.8	120.92	186.04
111.51	26.341	-4589.1	79.109	33.003	55.828	1339.7	117.16	183.93
111.51	0.11186	3610.7	152.64	25.904	35.558	271.33	4.3184	11.393
120	0.10316	3909.4	155.23	25.568	34.879	282.84	4.6534	12.31
130	0.094632	4255.8	158	25.364	34.427	295.56	5.0442	13.444
140	0.087479	4598.5	160.54	25.25	34.15	307.59	5.4326	14.602
150	0.081375	4939.1	162.89	25.186	33.972	319.04	5.8185	15.771
160	0.076095	5278.2	165.08	25.154	33.858	330.01	6.2015	16.945
170	0.071476	5616.4	167.13	25.146	33.788	340.55	6.5812	18.12
180	0.067399	5954.1	169.06	25.161	33.755	350.71	6.9573	19.301
190	0.06377	6291.6	170.88	25.198	33.754	360.51	7.3293	20.501
200	0.060518	6629.3	172.62	25.259	33.784	369.98	7.6973	21.648
210	0.057586	6967.4	174.27	25.345	33.845	379.14	8.0609	22.817
220	0.054929	7306.3	175.84	25.459	33.937	388.01	8.42	24
230	0.052508	7646.2	177.35	25.602	34.063	396.6	8.7748	25.197
240	0.050295	7987.6	178.81	25.776	34.221	404.91	9.1251	26.412
250	0.048261	8330.8	180.21	25.981	34.414	412.96	9.4709	27.647
260	0.046387	8676	181.56	26.218	34.64	420.77	9.8124	28.904
270	0.044655	9023.7	182.87	26.487	34.899	428.34	10.149	30.188
280	0.043047	9374.1	184.15	26.788	35.192	435.68	10.482	31.499
290	0.041552	9727.6	185.39	27.119	35.515	442.81	10.811	32.841
300	0.040158	10085	186.6	27.479	35.869	449.74	11.136	34.214
310	0.038855	10445	187.78	27.866	36.251	456.48	11.456	35.62
320	0.037635	10810	188.94	28.28	36.659	463.05	11.773	37.059
330	0.036489	11178	190.07	28.718	37.092	469.45	12.085	38.532
340	0.035411	11552	191.19	29.178	37.548	475.7	12.394	40.04
350	0.034395	11929	192.28	29.658	38.025	481.81	12.7	41.581
360	0.033436	12312	193.36	30.157	38.52	487.79	13.002	43.156
370	0.032529	12700	194.42	30.672	39.032	493.64	13.3	44.764
380	0.03167	13093	195.47	31.202	39.56	499.38	13.595	46.405
390	0.030855	13491	196.5	31.745	40.1	505.02	13.887	48.077
400	0.030082	13895	197.53	32.3	40.652	510.56	14.176	49.779
410	0.029346	14304	198.54	32.864	41.215	516.01	14.461	51.512
420	0.028646	14719	199.54	33.437	41.786	521.38	14.744	53.272
430	0.027978	15140	200.53	34.018	42.364	526.66	15.023	55.061
440	0.027341	15566	201.51	34.604	42.949	531.88	15.3	56.876
450	0.026732	15999	202.48	35.195	43.539	537.03	15.574	58.716
460	0.02615	16437	203.44	35.791	44.133	542.11	15.845	60.581
470	0.025593	16882	204.4	36.389	44.73	547.13	16.113	62.469
480	0.025059	17332	205.35	36.99	45.329	552.09	16.38	64.38
490	0.024546	17788	206.29	37.592	45.931	557	16.643	66.312
500	0.024055	18250	207.22	38.196	46.533	561.86	16.904	68.264
510	0.023583	18719	208.15	38.8	47.136	566.66	17.163	70.237
520	0.023129	19193	209.07	39.403	47.738	571.43	17.419	72.228
530	0.022692	19674	209.98	40.006	48.34	576.14	17.674	74.237
540	0.022271	20160	210.89	40.608	48.941	580.82	17.926	76.263
550	0.021866	20652	211.8	41.208	49.541	585.45	18.175	78.306
560	0.021475	21151	212.7	41.807	50.139	590.04	18.423	80.365
570	0.021098	21655	213.59	42.404	50.735	594.59	18.669	82.438
580	0.020734	22165	214.48	42.998	51.329	599.11	18.913	84.526
590	0.020382	22682	215.36	43.59	51.92	603.59	19.155	86.628
600	0.020042	23204	216.24	44.179	52.509	608.04	19.395	88.743
Pressure = 1 MPa								
92	28.074	-5636.1	68.468	34.682	54.01	1533.5	189.65	210.52
100	27.403	-5202	72.993	33.95	54.562	1459.6	153.31	200.5
110	26.529	-4651.9	78.235	33.156	55.497	1363.2	122.5	187.02
120	25.606	-4091.1	83.114	32.437	56.733	1262.4	99.852	172.95
130	24.616	-3515.7	87.719	31.786	58.434	1156.6	82.137	158.57
140	23.532	-2919.7	92.134	31.22	60.937	1043.7	67.819	143.99
149.14	22.416	-2347.7	96.091	30.81	64.535	931.21	56.879	130.4
149.14	0.97852	4320.6	140.8	28.353	46.147	286.08	5.7839	18.131
150	0.96844	4360	141.07	28.165	45.565	287.76	5.827	18.161
160	0.8705	4792.5	143.86	26.991	41.516	305.18	6.2798	18.759
170	0.79596	5196.6	146.31	26.47	39.472	320.2	6.6918	19.629
180	0.73599	5584.4	148.53	26.161	38.186	333.74	7.0849	20.636
190	0.68611	5961.7	150.57	25.976	37.322	346.2	7.466	21.786
200	0.64363	6331.7	152.46	25.879	36.73	357.81	7.8383	22.739
210	0.60682	6696.9	154.25	25.85	36.325	368.73	8.2036	23.806
220	0.5745	7058.7	155.93	25.878	36.06	379.06	8.5629	24.914
230	0.54581	7418.4	157.53	25.956	35.903	388.88	8.9166	26.05
240	0.52011	7777.1	159.06	26.078	35.834	398.24	9.2652	27.214

**TABLE 3** *Continued*

<i>T</i> K	$\rho$ mol·L <sup>-1</sup>	<i>H</i> J·mol <sup>-1</sup>	<i>S</i> J·mol <sup>-1</sup> ·K <sup>-1</sup>	<i>C<sub>v</sub></i> J·mol <sup>-1</sup> ·K <sup>-1</sup>	<i>C<sub>p</sub></i> J·mol <sup>-1</sup> ·K <sup>-1</sup>	<i>c</i> m·s <sup>-1</sup>	$\eta$ μPa·s	$\lambda$ mW·m <sup>-1</sup> ·K <sup>-1</sup>
250	0.49693	8135.4	160.52	26.242	35.84	407.2	9.609	28.404
260	0.47587	8494.1	161.92	26.446	35.911	415.79	9.9481	29.623
270	0.45665	8853.8	163.28	26.688	36.04	424.04	10.283	30.872
280	0.43902	9215.1	164.6	26.966	36.221	431.98	10.613	32.153
290	0.42278	9578.4	165.87	27.277	36.45	439.64	10.939	33.467
300	0.40776	9944.2	167.11	27.621	36.721	447.04	11.261	34.815
310	0.39381	10313	168.32	27.995	37.031	454.19	11.579	36.197
320	0.38084	10685	169.5	28.397	37.376	461.13	11.893	37.615
330	0.36872	11061	170.66	28.824	37.753	467.87	12.203	39.069
340	0.35738	11440	171.79	29.275	38.16	474.42	12.51	40.558
350	0.34675	11824	172.9	29.747	38.592	480.8	12.813	42.083
360	0.33674	12212	174	30.239	39.048	487.02	13.113	43.642
370	0.32732	12605	175.07	30.748	39.524	493.09	13.409	45.235
380	0.31842	13003	176.13	31.272	40.019	499.04	13.702	46.862
390	0.31001	13405	177.18	31.81	40.531	504.86	13.991	48.52
400	0.30205	13813	178.21	32.36	41.056	510.57	14.278	50.211
410	0.29449	14226	179.23	32.92	41.595	516.18	14.562	51.931
420	0.28731	14645	180.24	33.489	42.143	521.69	14.842	53.681
430	0.28048	15069	181.24	34.066	42.702	527.11	15.12	55.459
440	0.27397	15499	182.23	34.65	43.268	532.44	15.395	57.264
450	0.26776	15935	183.21	35.238	43.84	537.7	15.667	59.095
460	0.26184	16376	184.18	35.831	44.418	542.89	15.937	60.951
470	0.25617	16823	185.14	36.427	45.001	548.01	16.204	62.831
480	0.25075	17276	186.09	37.025	45.587	553.06	16.468	64.733
490	0.24556	17735	187.04	37.626	46.176	558.05	16.73	66.658
500	0.24058	18200	187.98	38.227	46.766	562.99	16.99	68.603
510	0.2358	18670	188.91	38.829	47.358	567.87	17.247	70.568
520	0.23121	19147	189.83	39.431	47.95	572.7	17.502	72.552
530	0.2268	19629	190.75	40.032	48.543	577.48	17.755	74.555
540	0.22255	20118	191.66	40.633	49.135	582.21	18.006	76.575
550	0.21847	20612	192.57	41.232	49.726	586.9	18.255	78.612
560	0.21453	21112	193.47	41.83	50.316	591.55	18.501	80.665
570	0.21073	21618	194.37	42.425	50.905	596.15	18.746	82.733
580	0.20707	22130	195.26	43.019	51.492	600.71	18.989	84.815
590	0.20353	22648	196.14	43.61	52.077	605.24	19.229	86.912
600	0.20012	23172	197.02	44.198	52.659	609.73	19.468	89.022
Pressure = 2 MPa								
92	28.115	-5610.1	68.364	34.722	53.921	1540.4	193.22	211.4
100	27.45	-5176.8	72.88	33.992	54.445	1467.4	155.72	201.47
110	26.585	-4628.1	78.109	33.201	55.329	1372.3	124.23	188.1
120	25.674	-4069.3	82.97	32.483	56.489	1273.3	101.28	174.16
130	24.701	-3497	87.551	31.831	58.063	1169.7	83.443	159.94
140	23.641	-2905.8	91.931	31.258	60.331	1060.1	69.093	145.58
150	22.453	-2286.2	96.204	30.798	63.871	941.45	57.245	131.01
160	21.055	-1619.4	100.51	30.526	70.193	807.65	47.125	115.92
165.87	20.061	-1188.9	103.15	30.539	77.093	716.36	41.658	106.48
165.87	2.0348	4322.7	136.38	30.565	62.944	279.73	6.706	23.379
170	1.9032	4565.8	137.82	29.192	55.613	290.52	6.9116	23.04
180	1.677	5075.7	140.74	27.775	47.612	311.34	7.3293	23.101
190	1.518	5531.1	143.2	27.121	43.836	328.4	7.7102	23.852
200	1.3957	5957.4	145.39	26.741	41.587	343.3	8.0758	24.329
210	1.2969	6365.5	147.38	26.521	40.122	356.7	8.4324	25.179
220	1.2143	6761.4	149.22	26.415	39.129	368.98	8.7824	26.138
230	1.1437	7149.1	150.95	26.394	38.447	380.37	9.1271	27.163
240	1.0823	7531.1	152.57	26.443	37.986	391.03	9.4672	28.239
250	1.0283	7909.3	154.12	26.552	37.689	401.07	9.8029	29.357
260	0.98014	8285.3	155.59	26.712	37.521	410.57	10.135	30.515
270	0.93689	8660.1	157.01	26.919	37.457	419.61	10.462	31.712
280	0.89775	9034.7	158.37	27.168	37.48	428.22	10.786	32.948
290	0.8621	9409.9	159.68	27.457	37.576	436.47	11.106	34.221
300	0.82945	9786.5	160.96	27.781	37.736	444.38	11.423	35.534
310	0.7994	10165	162.2	28.138	37.951	452	11.736	36.884
320	0.77164	10546	163.41	28.526	38.215	459.34	12.045	38.273
330	0.7459	10929	164.59	28.941	38.521	466.43	12.351	39.701
340	0.72194	11316	165.75	29.382	38.865	473.3	12.653	41.166
350	0.69958	11707	166.88	29.845	39.243	479.96	12.952	42.668
360	0.67864	12101	167.99	30.328	39.65	486.45	13.248	44.207
370	0.659	12500	169.08	30.83	40.084	492.76	13.541	45.781
380	0.64052	12903	170.16	31.348	40.54	498.91	13.831	47.39
390	0.62311	13311	171.22	31.881	41.017	504.93	14.117	49.033
400	0.60667	13723	172.26	32.425	41.511	510.82	14.401	50.708
410	0.59111	14141	173.29	32.981	42.021	516.59	14.681	52.414
420	0.57636	14564	174.31	33.546	42.544	522.24	14.959	54.15
430	0.56236	14992	175.32	34.119	43.079	527.8	15.234	55.916