Toluene Thermophysical Properties from 178 to 800 K at Pressures to 1000 Bar

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The thermodynamic data for toluene have been evaluated and fit to a highly constrained, nonanalytic equation of state. Comparisons of the equation with the selected *PVT* and derived property data are given. Extensive tables are presented providing tabular values for coexisting liquid and vapor as well as for the single phase along isobars. The equation of state and tables cover the range from the triple point (178.15 K) to 800 K, with pressures to 1000 bar.

Key words: compressibility factor; density; enthalpy; entropy; equation of state; fugacity; heat of vaporization; ideal gas; Joule–Thomson coefficient; orthobaric densities; specific heat; speed of sound; thermodynamic property; toluene; vapor pressure; virial coefficient.

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Symbols and Units

Subscripts c and t refer to critical and to triple points
Subscripts g and ℓ refer to saturated vapor and liquid
Subscript σ refers to liquid–vapor coexistence

$\alpha,\beta,\gamma,\epsilon,\eta,p$	exponents in various functions
$C_\sigma(T)$	saturated liquid heat capacity, J/(mol K)
$C_v(\rho,T)$	isochoric heat capacity, J/(mol K)
$C_v(T_{\sigma,g})$	isochoric heat capacity at the vapor boundary, J/(mol K)
$C_v(T_{\sigma,\ell})$	isochoric heat capacity at the liquid boundary, J/(mol K)
$C_p(\rho,T)$	isobaric heat capacity, J/(mol K)
f	fugacity, bar
f/P	fugacity/pressure ratio
$F(\rho,T)$	defined function in the EOS
$G(\rho,T)$	Gibbs energy, J/mol
$H(\rho,T)$	enthalpy, J/mol
H_0^0	enthalpy for ideal gas state at $T=0$
$\Delta_{vap}H$	enthalpy of vaporization, J/mol
J	joule, 1 N m
L	liter, 10^{-3}m^3
molar mass	92.141 g/mol
P	pressure in bar, 1 bar $\equiv 10^5$ Pa
P^0	standard state pressure, 1 atm = 1.01325 bar = 0.101325 MPa
$P_\sigma(T)$	vapor pressure of saturated liquid, bar
$P_\sigma(\rho)$	$P_\sigma[T_\sigma(\rho)]$, vapor pressure as function of density
R	gas constant, 8.3145 J/(mol K)
ρ	density, mol/L
σ	ρ/ρ_c, reduced density
$S(\rho,T)$	entropy, J/(mol K)
T	temperature, K
$T_\sigma(\rho)$	liquid–vapor coexistence temperature, K
$\theta(\rho)$	defined locus of temperatures for the EOS, K
$U(\rho,T)$	internal energy, J/mol
$U_0^0 = H_0^0$	36 566.792 J/mol (selected)
$u(\rho,T)$	$T/T_\sigma(\rho)$ for the EOS
v	$1/\rho$, molal volume, L/mol
μ	Joule–Thomson coefficient
$\omega(\rho,T)$	$[1-\theta(\rho)/T]$, for the EOS
$W(\rho,T)$	speed of sound, m/s
$x(T)$	T/T_c, reduced temperature for the EOS
$x_\sigma(\rho)$	$T_\sigma(\rho)/T_c$, reduced coexistence temperature for the EOS
$Z(P,\rho,T)$	$P/(\rho\cdot R\cdot T)$, the "compressibility factor"

1. Introduction

In 1969 Zotov *et al.*[1] reported an approximate calculation of some properties of toluene on the saturation line, and in 1977 Vargaftik[2] gave brief tables which included the one-phase domain. In 1974 Yaws[3] published a compendium of physical properties of important substances, including toluene. Counsell *et al.*[4] gave the thermodynamic properties of toluene in a report from the National Physical Laboratory in 1976. Some properties at coexistence again were reported in 1978 by Zavarykina *et al.*[5] at temperatures from 20 to 190 °C.

In this report we use a version of the nonanalytic equation of state (EOS) which was used recently for benzene.[6] Some reported critical temperatures for toluene appear in Table 1.[7–11] Selected fixed-point values used here are in Table 2. The triple-point temperature is from Scott *et al.*[12] A

Table 1. Literature values of critical temperature for toluene

Authors	Year	T_c, K
Francis[7]	1957	593.95
Ambrose et al.[8]	1960	591.72
Akhundov and Abdullaev[9]	1969	593.95
Hales and Townsend[10]	1972	591.80
Zotov et al.[11]	1975	592.2

critical density of $\rho_c = 3.15$ mol/L was reported by Hales and Townsend,[10] taken from Simon.[13] After evaluating the critical parameters in the literature, the fixed point values, especially T_c, are chosen to give the best overall EOS, given the fact that the EOS is constrained to the vapor–liquid coexistence boundary and to the locus of temperatures inside the coexistence curve as described below. Although the chosen T_c is higher than some sources, it is quite consistent with the earlier value of Francis[7] and the more recent work of Akhundov and Abdullaev.[9] The latter results include saturated density measurements approaching the critical region. The fixed–point pressures and densities in Table 2 are from Eqs. (2), (3), and (4) below.

2. Developing the Equation of State

This EOS is constrained to a given liquid–vapor coexistence boundary and is designed to yield a maximum (infinity) in the calculated isochoric specific heats at the critical point. The EOS is Eq. (6) in Sec. 2.5 below. We first formulate the melting line, the vapor pressures, and the orthobaric densities. Table 3 gives some sources[7,9,10,14–36] of $P\rho T$ data at coexistence.

2.1. Melting and Vapor Pressures

2.1.a. The Melting Line

Data of Osugi *et al.*[37–39] occur at pressures from 4.9 to 8.4 kilobar, as given by Kragas *et al.*[36] Coefficients for the melting pressure P_m have been determined graphically:

$$P_m = P_t + 1000\,(a + bx)x, \text{ bar}, \tag{1}$$

where $x \equiv (T/T_t - 1)$, $a = 5.60$, $b = 11.727$.

2.1.b. The Vapor Pressures

In Table 4 selected vapor pressure data for toluene[9,14–26,30] are compared with values calculated from the formula (P_σ in bar)

$$\ln(P_\sigma) = a/x + b + cx + dx^2 + ex^3 + f(1-x)^p, \tag{2}$$

where $x = T/T_c$ and $p = 1.70$.[40] The coefficients are

$a = -10.417\,847\,024$, $b = 21.157\,100\,329$,
$c = -15.996\,426\,537$, $d = 14.015\,482\,796$,
$e = -5.011\,987\,136$, $f = 4.772\,432\,450$.

The rms relative deviation for 129 selected data is 0.058%.

2.2. The Orthobaric Densities

2.2.a. Saturated Liquid Densities

In Table 5 selected liquid density data for toluene[10,27,29,32,34] are compared with values calculated from the formula

$$\rho/\rho_c - 1 = au^\beta + bu, \tag{3}$$

where $u \equiv (1 - T/T_c)$, $\beta = 0.35$, and $a = 2.073\,2589$, $b = 0.691\,2043$. For 65 selected data the rms relative deviation is 0.066 percent.

2.2.b. Saturated Vapor Densities

Table 6 presents data[32,41,42] and calculated values. At temperatures from 298.15 to 591.5 K data are derived using the Clapeyron equation with Eqs. (2) and (3), and enthalpies of vaporization from the simple formula,

$$\Delta H_{\text{vap}} = 38.0[(T_c - T)/(T_c - 298.15)]^{0.38}, \text{ kJ/mol},$$

which is based on the experimental enthalpy of vaporization at 25 °C of Osborne and Ginnings.[43] At temperatures from 298.15 to 591.5 K, the Clapeyron equation is used with enthalpies of vaporization estimated by the procedure of Sivaraman *et al.*[41] At temperatures from 178.15 to 500 K, temperatures are derived from Eq. (2) and the virial Eq. (5), below. Data of Akhundov and Abdullaev[32] occur at temperatures from 298.15 to 498.15 K. A selected rectilinear diameter and Eq. (3) give data at temperatures from 500 to 591.5 K, and a Van Poolen and Magee[42] modified rule of the rectilinear diameter is used at temperatures from 500 to 591.5 K.

The fitting function for saturated vapor densities is expressed in terms of the compressibility factor by using Eq. (2) for the vapor pressures,

Table 2. Selected fixed-point values for toluene

	Triple Point	Boiling Point	Critical Point
T/K	178.15	383.764	593.95
P/bar	$4.362 \cdot 10^{-7}$	1.01325	42.365
ρ/mol/L			
vapor	$2.945 \cdot 10^{-7}$	0.03295	3.15
liquid	10.4387	8.4606	3.15

Critical compressibility factor, $Z_c = 0.27234$

Table 3. Sources of coexistence data for toluene

Authors	Year: Pressures	Year: Densities
Kahlbaum[14]	1898	--
Barker[15]	1910	--
Drucker et al.[16]	1915	--
Krase and Goodman[17]	1930	--
Zmaczynski[18]	1930	--
Linder[19]	1931	--
Schmidt[20]	1934	--
Schouteden and Deveux[21]	1936	--
Griswold et al.[22]	1943	--
Pitzer and Scott[23]	1943	--
Willingham et al.[24]	1945	--
Forziati et al.[25]	1949	--
Dreyer et al.[26]	1955	--
Francis[7]	--	1957
Shraiber and Pechenyuk[27]	--	1965
Ambrose et al.[28]	1967	--
Akhundov and Abdullaev[9]	1969	--
Akhundov and Abdullaev[29]	--	1970
Hales and Townsend[10]	--	1972
Besley and Bottomley[30]	1974	--
Mamedov et al.[31]	--	1976
Akhundov and Abdullaev[32]	1977	1977
Munday et al.[33]	1980	--
Rudenko et al.[34]	--	1981
Natarajan and Viswanath[35]	1985	--
Kragas et al.[36]	1988	1988

Table 4. Comparison of reported vapor pressures with values calculated from Eq. (2)

Ref. No.	Wt.	T K	P bar	P(calc) bar	% Dev.
16	0.00	181.250	0.000002	0.000001	174.05
16	0.00	188.150	0.000004	0.000002	86.53
16	0.00	191.450	0.000006	0.000003	72.30
16	0.00	195.750	0.000010	0.000006	56.94
16	0.00	205.650	0.000027	0.000023	17.46
16	0.00	208.850	0.000039	0.000034	15.42
16	0.00	215.450	0.000081	0.000072	12.82
16	0.00	225.050	0.000184	0.000196	-6.31
16	0.00	235.150	0.000524	0.000512	2.44
16	0.00	192.550	0.000006	0.000004	47.20
16	0.00	208.750	0.000032	0.000033	-4.17
16	0.00	214.850	0.000081	0.000067	20.56
16	0.00	221.950	0.000161	0.000143	12.22
16	0.00	225.650	0.000248	0.000208	18.97
16	0.00	235.450	0.000671	0.000526	27.68
16	0.00	238.250	0.000841	0.000674	24.87
16	0.00	240.750	0.001037	0.000836	24.08
16	0.00	248.650	0.001917	0.001599	19.85
16	0.00	248.950	0.001960	0.001638	19.67
16	0.00	248.850	0.001893	0.001625	16.50
16	0.00	255.650	0.002893	0.002734	5.80
16	0.00	263.550	0.004866	0.004812	1.11
16	0.00	270.250	0.007626	0.007541	1.12
16	0.00	278.550	0.012826	0.012702	0.98
16	0.00	288.150	0.022358	0.022216	0.64
15	0.00	195.150	0.000008	0.000006	36.35
15	0.00	252.150	0.002146	0.002100	2.17
15	0.00	273.150	0.009146	0.009087	0.65
15	0.00	287.950	0.022398	0.021968	1.96
15	0.00	298.950	0.038330	0.039618	-3.25
19	0.00	263.450	0.004706	0.004779	-1.53
19	0.00	264.450	0.005026	0.005120	-1.83
19	0.00	265.950	0.005560	0.005670	-1.94
19	0.00	268.750	0.006639	0.006835	-2.87
19	0.00	268.800	0.006666	0.006858	-2.80
19	0.00	269.450	0.007066	0.007157	-1.28
19	0.00	269.650	0.007146	0.007252	-1.46
19	0.00	270.400	0.007426	0.007615	-2.48
30	1.00	273.143	0.009075	0.009082	-0.08
30	1.00	273.878	0.009506	0.009515	-0.09
30	1.00	274.604	0.009953	0.009959	-0.06
30	1.00	275.336	0.010416	0.010425	-0.09
30	1.00	276.057	0.010898	0.010903	-0.04
30	1.00	276.796	0.011404	0.011412	-0.07
30	1.00	277.561	0.011952	0.011960	-0.06
30	1.00	278.309	0.012514	0.012517	-0.03
30	1.00	279.027	0.013070	0.013074	-0.03
30	1.00	279.728	0.013632	0.013637	-0.04
30	1.00	280.323	0.014130	0.014131	-0.01
30	1.00	281.076	0.014776	0.014779	-0.02
30	1.00	281.773	0.015401	0.015401	-0.00
30	1.00	282.496	0.016065	0.016070	-0.03
30	1.00	284.065	0.017609	0.017608	0.00
30	1.00	284.887	0.018462	0.018463	-0.01
30	1.00	285.634	0.019274	0.019270	0.02
30	1.00	286.359	0.020092	0.020083	0.05
30	1.00	287.084	0.020932	0.020924	0.04
30	1.00	287.804	0.021800	0.021789	0.05
30	1.00	288.526	0.022703	0.022687	0.07
30	1.00	289.271	0.023667	0.023647	0.09
30	1.00	289.989	0.024619	0.024604	0.06
30	1.00	290.707	0.025615	0.025594	0.08
30	1.00	291.456	0.026690	0.026663	0.10
30	1.00	292.195	0.027783	0.027754	0.10
30	1.00	292.927	0.028898	0.028873	0.09

Table 4. Comparison of reported vapor pressures with values calculated from Eq. (2) - Continued

Ref. No.	Wt.	T K	P bar	P(calc) bar	% Dev.
30	1.00	293.639	0.030016	0.029997	0.06
30	1.00	294.343	0.031179	0.031145	0.11
30	1.00	295.084	0.032425	0.032394	0.10
30	1.00	295.794	0.033647	0.033629	0.05
30	1.00	296.474	0.034872	0.034850	0.06
30	1.00	297.182	0.036180	0.036161	0.05
30	1.00	297.901	0.037552	0.037535	0.05
23	0.00	273.150	0.008999	0.009087	-0.96
23	0.00	285.650	0.019198	0.019288	-0.47
23	0.00	298.150	0.037864	0.038021	-0.41
23	0.00	310.650	0.070261	0.070282	-0.03
23	0.00	323.150	0.122657	0.122840	-0.15
17	0.00	273.150	0.009426	0.009087	3.74
17	0.00	304.750	0.053996	0.052983	1.91
17	0.00	335.150	0.204650	0.200479	2.08
17	0.00	362.850	0.540089	0.537271	0.52
17	0.00	383.850	1.013250	1.015720	-0.24
17	0.00	402.650	1.702527	1.682952	1.16
17	0.00	422.650	2.837100	2.722077	4.23
17	0.00	434.150	3.901013	3.508670	11.18
17	0.00	448.650	5.248902	4.733554	10.89
17	0.00	459.650	6.200823	5.859271	5.83
17	0.00	467.150	7.072752	6.734652	5.02
17	0.00	476.650	8.369978	7.980001	4.89
17	0.00	487.550	10.020510	9.612635	4.24
17	0.00	499.150	12.037680	11.611614	3.67
17	0.00	507.650	13.425560	13.262566	1.23
17	0.00	519.150	16.212000	15.768974	2.81
17	0.00	523.150	17.275910	16.719156	3.33
17	0.00	526.650	17.691880	17.585486	0.61
17	0.00	530.350	17.923860	18.537860	-3.31
17	0.00	537.150	21.672890	20.389976	6.29
17	0.00	552.650	25.139270	25.143115	-0.02
17	0.00	553.150	25.432580	25.309608	0.49
17	0.00	556.150	26.344500	26.326906	0.07
17	0.00	574.650	32.829300	33.352829	-1.57
17	0.00	593.150	42.029880	41.945672	0.20
33	0.00	273.150	0.009013	0.009087	-0.81
33	0.00	279.210	0.013092	0.013219	-0.96
33	0.00	284.170	0.017625	0.017715	-0.51
33	0.00	293.140	0.029038	0.029205	-0.57
33	0.00	303.040	0.048636	0.048698	-0.13
33	0.00	312.750	0.077434	0.077481	-0.06
33	0.00	322.410	0.118697	0.119016	-0.27
20	0.00	286.870	0.020398	0.020673	-1.33
20	0.00	290.830	0.026265	0.025767	1.93
20	0.00	298.000	0.037464	0.037727	-0.70
20	0.00	298.290	0.038930	0.038296	1.66
20	0.00	301.570	0.044930	0.045251	-0.71
20	0.00	305.390	0.054795	0.054666	0.24
20	0.00	309.500	0.066928	0.066583	0.52
20	0.00	315.240	0.086926	0.086805	0.14
20	0.00	325.190	0.135322	0.133913	1.05
20	0.00	331.020	0.170119	0.170185	-0.04
20	0.00	333.110	0.185318	0.185007	0.17
20	0.00	336.720	0.213449	0.213096	0.17
20	0.00	339.680	0.237980	0.238647	-0.28
20	0.00	342.470	0.264512	0.264967	-0.17
20	0.00	347.380	0.315841	0.316998	-0.37
20	0.00	351.100	0.360370	0.361691	-0.37
20	0.00	352.970	0.386102	0.386005	0.03
20	0.00	355.660	0.423299	0.423277	0.01
20	0.00	358.730	0.468095	0.469295	-0.26
20	0.00	361.620	0.513824	0.516202	-0.46
21	0.00	295.130	0.029331	0.032473	-9.67

Table 4. Comparison of reported vapor pressures with values calculated from Eq. (2) - Continued

Ref. No.	Wt.	T K	P bar	P(calc) bar	% Dev.
21	0.00	303.240	0.045996	0.049184	-6.48
21	0.00	313.440	0.077327	0.079976	-3.31
21	0.00	323.500	0.123323	0.124684	-1.09
21	0.00	333.770	0.188518	0.189901	-0.73
21	0.00	343.740	0.276911	0.277706	-0.29
21	0.00	354.030	0.398501	0.400363	-0.46
21	0.00	364.100	0.558487	0.559381	-0.16
21	0.00	373.360	0.744739	0.746749	-0.27
14	0.00	300.690	0.043730	0.043288	1.02
14	0.00	301.030	0.044396	0.044038	0.81
14	0.00	302.000	0.046663	0.046238	0.92
14	0.00	302.350	0.047463	0.047054	0.87
14	0.00	302.960	0.048929	0.048505	0.87
14	0.00	303.730	0.050796	0.050391	0.80
14	0.00	304.230	0.051996	0.051648	0.67
14	0.00	304.790	0.053462	0.053087	0.71
14	0.00	305.390	0.055062	0.054666	0.72
14	0.00	306.530	0.058129	0.057776	0.61
14	0.00	307.120	0.059862	0.059443	0.70
14	0.00	308.530	0.063995	0.063591	0.64
14	0.00	308.770	0.064795	0.064320	0.74
14	0.00	309.100	0.065728	0.065335	0.60
14	0.00	309.630	0.067328	0.066992	0.50
14	0.00	310.100	0.068794	0.068492	0.44
14	0.00	310.690	0.070661	0.070413	0.35
14	0.00	312.310	0.076127	0.075923	0.27
14	0.00	313.520	0.080393	0.080270	0.15
14	0.00	314.770	0.085193	0.084977	0.25
14	0.00	316.130	0.090526	0.090356	0.19
14	0.00	317.510	0.096259	0.096102	0.16
14	0.00	318.690	0.101325	0.101253	0.07
14	0.00	318.840	0.101992	0.101924	0.07
24	1.00	308.516	0.063568	0.063548	0.03
24	1.00	312.493	0.076540	0.076568	-0.04
24	1.00	315.960	0.089619	0.089669	-0.06
24	1.00	319.098	0.103032	0.103086	-0.05
24	1.00	322.017	0.116990	0.117025	-0.03
24	1.00	325.952	0.138175	0.138254	-0.06
24	1.00	330.443	0.166213	0.166269	-0.03
24	1.00	335.001	0.199224	0.199315	-0.05
24	1.00	339.229	0.234501	0.234600	-0.04
24	1.00	344.888	0.289523	0.289645	-0.04
24	1.00	350.092	0.348971	0.349107	-0.04
24	1.00	356.352	0.433204	0.433318	-0.03
24	1.00	362.817	0.536529	0.536697	-0.03
24	1.00	369.709	0.667518	0.667709	-0.03
24	1.00	377.187	0.837171	0.837379	-0.02
24	1.00	382.462	0.976026	0.976310	-0.03
24	1.00	383.029	0.991985	0.992261	-0.03
24	1.00	383.553	1.006904	1.007184	-0.03
24	1.00	384.141	1.023849	1.024139	-0.03
24	1.00	384.659	1.039035	1.039261	-0.02
25	1.00	308.654	0.063981	0.063967	0.02
25	1.00	312.587	0.076900	0.076901	-0.00
25	1.00	319.147	0.103285	0.103309	-0.02
25	1.00	322.044	0.117190	0.117161	0.02
25	1.00	325.998	0.138402	0.138520	-0.09
25	1.00	330.465	0.166320	0.166417	-0.06
25	1.00	335.019	0.199424	0.199455	-0.02
25	1.00	339.257	0.234727	0.234850	-0.05
25	1.00	344.908	0.289763	0.289856	-0.03
25	1.00	350.115	0.349238	0.349390	-0.04
25	1.00	356.380	0.433591	0.433729	-0.03
25	1.00	362.845	0.536969	0.537184	-0.04
25	1.00	369.730	0.667945	0.668144	-0.03

Table 4. Comparison of reported vapor pressures with values calculated from Eq. (2) - Continued

Ref. No.	Wt.	T K	P bar	P(calc) bar	% Dev.
25	1.00	377.202	0.837478	0.837751	-0.03
25	1.00	382.478	0.976440	0.976757	-0.03
25	1.00	383.044	0.992318	0.992685	-0.04
25	1.00	383.570	1.007237	1.007671	-0.04
25	1.00	384.168	1.024609	1.024923	-0.03
25	1.00	384.695	1.039981	1.040318	-0.03
26	0.00	312.880	0.077594	0.077946	-0.45
26	0.00	322.910	0.121990	0.121589	0.33
26	0.00	333.560	0.187985	0.188333	-0.18
26	0.00	342.730	0.267978	0.267535	0.17
26	0.00	352.600	0.381569	0.381093	0.12
26	0.00	363.410	0.547555	0.547088	0.09
26	0.00	372.160	0.721007	0.719993	0.14
26	0.00	383.400	1.000451	1.002808	-0.24
18	1.00	352.922	0.385435	0.385365	0.02
18	1.00	358.999	0.473428	0.473511	-0.02
18	1.00	365.121	0.578086	0.577975	0.02
18	1.00	371.287	0.700956	0.701011	-0.01
18	1.00	377.499	0.845131	0.845135	-0.00
18	1.00	383.756	1.013250	1.013012	0.02
18	1.00	390.058	1.208034	1.207542	0.04
18	1.00	396.404	1.432682	1.431803	0.06
18	1.00	402.796	1.690661	1.689205	0.09
18	1.00	409.232	1.985437	1.983234	0.11
18	1.00	415.713	2.321143	2.317725	0.15
18	1.00	422.239	2.701511	2.696716	0.18
18	1.00	428.806	3.129609	3.124209	0.17
22	0.00	411.150	2.078924	2.078068	0.04
22	0.00	462.150	6.171413	6.140945	0.50
22	0.00	500.150	12.067010	11.797392	2.29
22	0.00	526.150	17.583350	17.459691	0.71
22	0.00	568.150	31.167360	30.728089	1.43
28	0.00	591.720	41.055290	41.209758	-0.37
9	0.00	423.150	2.760000	2.753177	0.25
9	0.00	433.150	3.441000	3.434130	0.20
9	1.00	443.150	4.242000	4.236120	0.14
9	1.00	448.150	4.692000	4.686596	0.12
9	1.00	453.150	5.176000	5.172310	0.07
9	1.00	458.150	5.696000	5.694993	0.02
9	1.00	463.150	6.255000	6.256414	-0.02
9	1.00	468.150	6.857000	6.858376	-0.02
9	1.00	473.150	7.500000	7.502727	-0.04
9	1.00	478.150	8.185000	8.191352	-0.08
9	1.00	483.150	8.918000	8.926185	-0.09
9	1.00	488.150	9.700000	9.709209	-0.09
9	1.00	493.150	10.531000	10.542459	-0.11
9	1.00	498.150	11.424000	11.428032	-0.04
9	1.00	503.150	12.362000	12.368087	-0.05
9	1.00	508.150	13.353000	13.364861	-0.09
9	1.00	513.150	14.411000	14.420671	-0.07
9	1.00	518.150	15.530000	15.537929	-0.05
9	1.00	523.150	16.715000	16.719156	-0.02
9	1.00	528.150	17.960000	17.966995	-0.04
9	1.00	533.150	19.288000	19.284235	0.02
9	1.00	538.150	20.678000	20.673833	0.02
9	1.00	543.150	22.150000	22.138947	0.05
9	1.00	548.150	23.695000	23.682975	0.05
9	1.00	553.150	25.336000	25.309608	0.10
9	1.00	558.150	27.038000	27.022898	0.06
9	1.00	563.150	28.840000	28.827356	0.04
9	1.00	568.150	30.730000	30.728089	0.01
9	1.00	573.150	32.717000	32.731009	-0.04
9	1.00	576.150	33.985000	33.984686	0.00
9	1.00	578.150	34.880000	34.843182	0.11
9	1.00	583.150	37.070000	37.073475	-0.01

Table 4. Comparison of reported vapor pressures with values calculated from Eq. (2) - Continued

Ref. No.	Wt.	T K	P bar	P(calc) bar	% Dev.
9	1.00	585.150	37.998000	38.001207	-0.01
9	1.00	587.150	38.947000	38.950716	-0.01
9	1.00	588.150	39.427000	39.434020	-0.02
9	1.00	588.150	39.426000	39.434020	-0.02
9	1.00	589.150	39.920000	39.923275	-0.01
9	1.00	590.150	40.421000	40.418712	0.01
9	1.00	591.150	40.927000	40.920626	0.02
9	1.00	592.150	41.428000	41.429408	-0.00
9	1.00	593.150	41.942000	41.945672	-0.01
9	1.00	593.150	41.941000	41.945672	-0.01
9	1.00	593.350	42.046000	42.049914	-0.01
9	1.00	593.550	42.146000	42.154522	-0.02
9	1.00	593.750	42.254000	42.259525	-0.01

129 data points. rms deviation 0.058%.
References: Akhundov/Abdullaev[9], Ambrose et al.[28], Barker[15], Besley/Bottomley[30], Dreyer et al.[26], Drucker et al.[16], Forziati et al.[25], Griswold et al.[22], Kahlbaum[14], Krase/Goodman[17], Linder[19], Munday et al.[33], Pitzer/Scott[23], Schmidt[20], Schouteden/Deveux[21], Willingham et al.[24], Zmaczynski[18]

Table 5. Comparison of reported saturated liquid densities with values calculated from Eq. (3)

Ref. No.	Wt.	T K	ρ mol/L	ρ(calc) mol/L	% Dev.	$d\rho_l/dT$ mol/(L·K)
	1.00	178.15	10.439	10.439	0.00	-0.00852
34	0.00	293.15	9.408	9.400	0.09	-0.00965
27	1.00	293.15	9.403	9.400	0.04	-0.00965
10	1.00	293.15	9.408	9.400	0.09	-0.00965
10	1.00	298.15	9.357	9.351	0.07	-0.00972
29	1.00	298.15	9.366	9.351	0.16	-0.00972
34	0.00	303.15	9.307	9.302	0.05	-0.00979
27	1.00	303.15	9.302	9.302	-0.00	-0.00979
10	1.00	303.15	9.307	9.302	0.05	-0.00979
34	0.00	313.15	9.207	9.204	0.03	-0.00993
27	1.00	313.15	9.200	9.204	-0.04	-0.00993
10	1.00	320.00	9.135	9.135	-0.00	-0.01003
34	0.00	323.15	9.103	9.104	-0.00	-0.01008
27	1.00	323.15	9.098	9.104	-0.06	-0.01008
29	1.00	323.15	9.106	9.104	0.02	-0.01008
34	0.00	333.15	9.000	9.002	-0.02	-0.01024
27	1.00	333.15	8.994	9.002	-0.09	-0.01024
10	1.00	340.00	8.927	8.932	-0.05	-0.01035
27	1.00	343.15	8.890	8.899	-0.10	-0.01041
29	1.00	348.15	8.845	8.847	-0.02	-0.01049
34	0.00	353.15	8.790	8.794	-0.05	-0.01059
27	1.00	353.15	8.784	8.794	-0.11	-0.01059
10	1.00	360.00	8.715	8.721	-0.07	-0.01072
34	0.00	363.15	8.642	8.687	-0.52	-0.01078
27	1.00	363.15	8.677	8.687	-0.12	-0.01078
10	1.00	370.00	8.607	8.613	-0.07	-0.01092
34	0.00	373.15	8.546	8.578	-0.38	-0.01099
29	1.00	373.15	8.585	8.578	0.07	-0.01099
34	0.00	383.15	8.462	8.467	-0.06	-0.01121
10	1.00	390.00	8.386	8.390	-0.05	-0.01138
34	0.00	393.15	8.344	8.354	-0.12	-0.01145
29	1.00	398.15	8.302	8.297	0.07	-0.01158
34	0.00	403.15	8.196	8.238	-0.51	-0.01172

Table 5. Comparison of reported saturated liquid densities with values calculated from Eq. (3) - Continued

Ref. No.	Wt.	T K	ρ mol/L	ρ(calc) mol/L	% Dev.	$d\rho_l/dT$ mol/(L·K)
10	1.00	410.00	8.155	8.157	-0.03	-0.01191
34	0.00	413.15	8.100	8.120	-0.25	-0.01200
34	0.00	423.15	7.957	7.998	-0.51	-0.01232
29	1.00	423.15	7.999	7.998	0.01	-0.01232
10	1.00	430.00	7.914	7.913	0.01	-0.01255
34	0.00	433.15	7.850	7.873	-0.30	-0.01266
34	0.00	443.15	7.698	7.745	-0.60	-0.01305
29	1.00	448.15	7.684	7.679	0.06	-0.01325
10	1.00	450.00	7.658	7.654	0.05	-0.01333
34	0.00	453.15	7.576	7.612	-0.47	-0.01347
34	0.00	463.15	7.465	7.475	-0.14	-0.01396
10	1.00	470.00	7.385	7.378	0.09	-0.01432
34	0.00	473.15	7.301	7.333	-0.44	-0.01450
29	1.00	473.15	7.337	7.333	0.05	-0.01450
10	1.00	480.00	7.239	7.232	0.09	-0.01492
34	0.00	483.15	7.149	7.185	-0.50	-0.01513
10	1.00	490.00	7.087	7.080	0.10	-0.01561
34	0.00	493.15	6.996	7.030	-0.49	-0.01585
29	1.00	498.15	6.957	6.950	0.10	-0.01626
29	1.00	523.15	6.512	6.512	0.00	-0.01900
29	1.00	548.15	5.980	5.981	-0.02	-0.02402
29	0.00	573.15	5.209	5.247	-0.71	-0.03767
32	1.00	298.15	9.360	9.351	0.09	-0.00972
32	1.00	303.15	9.312	9.302	0.10	-0.00979
32	1.00	313.15	9.209	9.204	0.06	-0.00993
32	1.00	323.15	9.108	9.104	0.04	-0.01008
32	1.00	333.15	9.003	9.002	0.01	-0.01024
32	1.00	343.15	8.899	8.899	0.01	-0.01041
32	1.00	348.15	8.834	8.847	-0.15	-0.01049
32	1.00	353.15	8.793	8.794	-0.01	-0.01059
32	1.00	363.15	8.689	8.687	0.02	-0.01078
32	1.00	373.15	8.570	8.578	-0.10	-0.01099
32	1.00	383.15	8.466	8.467	-0.02	-0.01121
32	1.00	393.15	8.352	8.354	-0.02	-0.01145
32	1.00	398.15	8.297	8.297	0.01	-0.01158
32	1.00	403.15	8.236	8.238	-0.03	-0.01172
32	1.00	413.15	8.116	8.120	-0.04	-0.01200
32	1.00	423.15	7.999	7.998	0.01	-0.01232
32	1.00	433.15	7.869	7.873	-0.05	-0.01266
32	1.00	443.15	7.740	7.745	-0.06	-0.01305
32	1.00	448.15	7.674	7.679	-0.06	-0.01325
32	1.00	453.15	7.608	7.612	-0.06	-0.01347
32	1.00	463.15	7.470	7.475	-0.06	-0.01396
32	1.00	473.15	7.340	7.333	0.10	-0.01450
32	1.00	483.15	7.181	7.185	-0.06	-0.01513
32	1.00	493.15	7.027	7.030	-0.04	-0.01585
32	0.00	498.15	6.927	6.950	-0.32	-0.01626
32	1.00	503.15	6.865	6.867	-0.04	-0.01671
32	1.00	513.15	6.693	6.695	-0.03	-0.01774
32	1.00	523.15	6.512	6.512	-0.00	-0.01900
32	1.00	533.15	6.314	6.314	0.00	-0.02060
32	1.00	543.15	6.102	6.098	0.06	-0.02269
32	1.00	548.15	5.989	5.981	0.13	-0.02402
32	1.00	553.15	5.861	5.857	0.06	-0.02561
32	0.00	563.15	5.556	5.581	-0.45	-0.03001
32	0.00	573.15	5.188	5.247	-1.12	-0.03767
32	0.00	583.15	4.707	4.796	-1.86	-0.05572

65 data points, rms deviation 0.066%.
References: Akhundov/Abdullaev[29], Akhundov/Abdullaev[32], Hales/Townsend[10], Rudenko et al.[34], Shraiber/Pechenyuk[27]

Table 6. Comparison of reported saturated vapor densities with values calculated from Eq. (4)

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	$d\rho_g/dT$ mol/(L·K)
a	1.00	298.15	0.001539086	0.001538560	0.03	0.744E-04
a	1.00	310.00	0.002656384	0.002657741	-0.05	0.117E-03
a	1.00	320.00	0.004054454	0.004058154	-0.09	0.165E-03
a	1.00	330.00	0.006001687	0.006008052	-0.11	0.227E-03
a	1.00	340.00	0.008643894	0.008652518	-0.10	0.305E-03
a	1.00	350.00	0.012147121	0.012156514	-0.08	0.399E-03
a	1.00	360.00	0.016697752	0.016705103	-0.04	0.514E-03
a	1.00	370.00	0.022502750	0.022503949	-0.01	0.650E-03
a	1.00	380.00	0.029790257	0.029780306	0.03	0.810E-03
a	1.00	390.00	0.038810741	0.038784661	0.07	0.996E-03
a	1.00	400.00	0.049838921	0.049793176	0.09	0.121E-02
a	1.00	410.00	0.063176690	0.063111064	0.10	0.146E-02
a	1.00	420.00	0.079157319	0.079077026	0.10	0.174E-02
a	1.00	430.00	0.098151286	0.098068938	0.08	0.206E-02
a	1.00	440.00	0.120574210	0.120511085	0.05	0.243E-02
a	1.00	450.00	0.146897562	0.146883473	0.01	0.285E-02
a	1.00	460.00	0.177663173	0.177734097	-0.04	0.333E-02
a	1.00	470.00	0.213503061	0.213695703	-0.09	0.388E-02
a	1.00	480.00	0.255167006	0.255509556	-0.13	0.450E-02
a	1.00	490.00	0.303561743	0.304060498	-0.16	0.523E-02
a	1.00	500.00	0.359808276	0.360430550	-0.17	0.607E-02
a	1.00	510.00	0.425328639	0.425983780	-0.15	0.707E-02
a	1.00	520.00	0.501982865	0.502505715	-0.10	0.827E-02
a	1.00	530.00	0.592296777	0.592442498	-0.02	0.977E-02
a	1.00	540.00	0.699866685	0.699334548	0.08	0.117E-01
a	1.00	550.00	0.830143461	0.828664594	0.18	0.143E-01
a	1.00	560.00	0.992144243	0.989704305	0.25	0.182E-01
a	1.00	570.00	1.202910905	1.200248270	0.22	0.246E-01
a	1.00	580.00	1.503129546	1.502654499	0.03	0.379E-01
a	1.00	590.00	2.066511566	2.069231983	-0.13	0.938E-01
a	1.00	591.00	2.171304240	2.172389342	-0.05	0.114E+00
a	1.00	591.50	2.233481334	2.233038257	0.02	0.129E+00
41	0.00	298.15	0.001539044	0.001538560	0.03	0.744E-04
41	0.00	310.00	0.002652789	0.002657741	-0.19	0.117E-03
41	0.00	320.00	0.004044376	0.004058154	-0.34	0.165E-03
41	0.00	330.00	0.005979921	0.006008052	-0.47	0.227E-03
41	0.00	340.00	0.008602636	0.008652518	-0.58	0.305E-03
41	0.00	350.00	0.012075191	0.012156514	-0.67	0.399E-03
41	0.00	360.00	0.016579720	0.016705103	-0.75	0.514E-03
41	0.00	370.00	0.022317990	0.022503949	-0.83	0.650E-03
41	0.00	380.00	0.029511934	0.029780306	-0.90	0.810E-03
41	0.00	390.00	0.038404763	0.038784661	-0.98	0.996E-03
41	0.00	400.00	0.049262877	0.049793176	-1.07	0.121E-02
41	0.00	410.00	0.062378817	0.063111064	-1.16	0.146E-02
41	0.00	420.00	0.078075545	0.079077026	-1.27	0.174E-02
41	0.00	430.00	0.096712438	0.098068938	-1.38	0.206E-02
41	0.00	440.00	0.118693496	0.120511085	-1.51	0.243E-02
41	0.00	450.00	0.144478541	0.146883473	-1.64	0.285E-02
41	0.00	460.00	0.174598525	0.177734097	-1.76	0.333E-02
41	0.00	470.00	0.209676686	0.213695703	-1.88	0.388E-02
41	0.00	480.00	0.250458335	0.255509556	-1.98	0.450E-02
41	0.00	490.00	0.297853777	0.304060498	-2.04	0.523E-02
41	0.00	500.00	0.353002001	0.360430550	-2.06	0.607E-02
41	0.00	510.00	0.417368611	0.425983780	-2.02	0.707E-02
41	0.00	520.00	0.492902991	0.502505715	-1.91	0.827E-02
41	0.00	530.00	0.582304171	0.592442498	-1.71	0.977E-02
41	0.00	540.00	0.689501295	0.699334548	-1.41	0.117E-01
41	0.00	550.00	0.820599962	0.828664594	-0.97	0.143E-01
41	0.00	560.00	0.985978259	0.989704305	-0.38	0.182E-01
41	0.00	570.00	1.205799653	1.200248270	0.46	0.246E-01
41	0.00	580.00	1.529286422	1.502654499	1.77	0.379E-01
41	0.00	590.00	2.163241695	2.069231983	4.54	0.938E-01
41	0.00	591.00	2.281571438	2.172389342	5.03	0.114E+00
41	0.00	591.50	2.351082872	2.233038257	5.29	0.129E+00
b	0.00	178.15	0.000000029	0.000000029	0.00	0.482E-08
b	0.00	190.00	0.000000179	0.000000179	-0.00	0.252E-07
b	1.00	200.00	0.000000676	0.000000676	0.00	0.849E-07

Table 6. Comparison of reported saturated vapor densities with values calculated from Eq. (4) - Continued

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	$d\rho_g/dT$ mol/(L·K)
b	1.00	210.00	0.000002215	0.000002215	-0.00	0.248E-06
b	1.00	220.00	0.000006404	0.000006404	-0.00	0.644E-06
b	1.00	230.00	0.000016620	0.000016620	-0.00	0.150E-05
b	1.00	240.00	0.000039284	0.000039285	-0.00	0.321E-05
b	1.00	250.00	0.000085590	0.000085590	-0.00	0.635E-05
b	1.00	260.00	0.000173631	0.000173631	0.00	0.117E-04
b	1.00	270.00	0.000330806	0.000330802	0.00	0.204E-04
b	1.00	280.00	0.000596299	0.000596276	0.00	0.336E-04
b	1.00	290.00	0.001023434	0.001023347	0.01	0.530E-04
b	1.00	300.00	0.001681717	0.001681452	0.02	0.801E-04
b	1.00	310.00	0.002658435	0.002657741	0.03	0.117E-03
b	1.00	320.00	0.004059782	0.004058154	0.04	0.165E-03
b	1.00	330.00	0.006011516	0.006008052	0.06	0.227E-03
b	1.00	340.00	0.008659311	0.008652518	0.08	0.305E-03
b	1.00	350.00	0.012168922	0.012156514	0.10	0.399E-03
b	0.00	360.00	0.016726398	0.016705103	0.13	0.514E-03
b	0.00	370.00	0.022538581	0.022503949	0.15	0.650E-03
b	0.00	380.00	0.029834019	0.029780306	0.18	0.810E-03
b	0.00	390.00	0.038864717	0.038784661	0.21	0.996E-03
b	0.00	400.00	0.049908756	0.049793176	0.23	0.121E-02
b	0.00	410.00	0.063274196	0.063111064	0.26	0.146E-02
b	0.00	420.00	0.079304506	0.079077026	0.29	0.174E-02
b	0.00	430.00	0.098385972	0.098068938	0.32	0.206E-02
b	0.00	440.00	0.120957627	0.120511085	0.37	0.243E-02
b	0.00	450.00	0.147524541	0.146883473	0.44	0.285E-02
b	0.00	460.00	0.178675661	0.177734097	0.53	0.333E-02
b	0.00	470.00	0.215108531	0.213695703	0.66	0.388E-02
b	0.00	480.00	0.257662005	0.255509556	0.84	0.450E-02
b	0.00	490.00	0.307365297	0.304060498	1.09	0.523E-02
b	0.00	500.00	0.365507437	0.360430550	1.41	0.607E-02
32	0.00	298.15	0.001535133	0.001538560	-0.22	0.744E-04
32	0.00	303.15	0.001947483	0.001950027	-0.13	0.906E-04
32	0.00	313.15	0.003047121	0.003047576	-0.01	0.131E-03
32	0.00	323.15	0.004607094	0.004606622	0.01	0.183E-03
32	0.00	333.15	0.006761530	0.006758719	0.04	0.250E-03
32	0.00	343.15	0.009659931	0.009655196	0.05	0.332E-03
32	0.00	348.15	0.011440999	0.011435311	0.05	0.380E-03
32	0.00	353.15	0.013471862	0.013467313	0.03	0.433E-03
32	0.00	363.15	0.018401038	0.018386548	0.08	0.554E-03
32	0.00	373.15	0.024648948	0.024625233	0.10	0.697E-03
32	0.00	383.15	0.032464648	0.032417727	0.14	0.865E-03
32	0.00	393.15	0.042098262	0.042022301	0.18	0.106E-02
32	0.00	398.15	0.047684235	0.047592014	0.19	0.117E-02
32	0.00	403.15	0.053860704	0.053723854	0.25	0.129E-02
32	0.00	413.15	0.068000827	0.067837618	0.24	0.154E-02
32	0.00	423.15	0.085187849	0.084713952	0.56	0.184E-02
32	0.00	433.15	0.105368271	0.104744486	0.60	0.217E-02
32	0.00	443.15	0.129063288	0.128369935	0.54	0.256E-02
32	0.00	448.15	0.142501732	0.141684327	0.58	0.277E-02
32	0.00	453.15	0.156947678	0.156090223	0.55	0.300E-02
32	0.00	463.15	0.189637112	0.188477965	0.62	0.349E-02
32	0.00	473.15	0.228002771	0.226197097	0.80	0.406E-02
32	0.00	483.15	0.272412950	0.270029635	0.88	0.472E-02
32	0.00	493.15	0.324549400	0.320915591	1.13	0.548E-02
32	0.00	498.15	0.353861491	0.349355084	1.29	0.590E-02
c	0.00	500.00	0.360000000	0.360430550	-0.12	0.607E-02
c	0.00	510.00	0.424694702	0.425983780	-0.30	0.707E-02
c	0.00	520.00	0.500073963	0.502505715	-0.48	0.827E-02
c	0.00	530.00	0.588644878	0.592442498	-0.64	0.977E-02
c	0.00	540.00	0.694019396	0.699334548	-0.76	0.117E-01
c	0.00	550.00	0.821722288	0.828664594	-0.84	0.143E-01
c	0.00	560.00	0.980946979	0.989704305	-0.88	0.182E-01
c	0.00	570.00	1.189088425	1.200248270	-0.93	0.246E-01
c	0.00	580.00	1.487370122	1.502654499	-1.02	0.379E-01
c	0.00	590.00	2.047005879	2.069231983	-1.07	0.938E-01
c	0.00	591.00	2.149965459	2.172389342	-1.03	0.114E+00
c	0.00	591.50	2.210776338	2.233038257	-1.00	0.129E+00

Table 6. Comparison of reported saturated vapor densities with values calculated from Eq. (4) - Continued

Ref. No.	Wt.	T K	ρ mol/L	ρ(calc) mol/L	% Dev.	$d\rho_g/dT$ mol/(L·K)
42	0.00	500.00	0.355492363	0.360430550	-1.37	0.607E-02
42	0.00	510.00	0.421185792	0.425983780	-1.13	0.707E-02
42	0.00	520.00	0.497395937	0.502505715	-1.02	0.827E-02
42	0.00	530.00	0.586632804	0.592442498	-0.98	0.977E-02
42	0.00	540.00	0.692514019	0.699334548	-0.98	0.117E-01
42	0.00	550.00	0.820574612	0.828664594	-0.98	0.143E-01
42	0.00	560.00	0.980026387	0.989704305	-0.98	0.182E-01
42	0.00	570.00	1.188298713	1.200248270	-1.00	0.246E-01
42	0.00	580.00	1.486687506	1.502654499	-1.06	0.379E-01
42	0.00	590.00	2.046614687	2.069231983	-1.09	0.938E-01
42	0.00	591.00	2.149638481	2.172389342	-1.05	0.114E+00
42	0.00	591.50	2.210486816	2.233038257	-1.01	0.129E+00

48 data points, rms deviation 0.091%.
References: Akhundov/Abdullaev[32], Sivaraman et al.[41], Van Poolen/Magee[42]
a - Derived from Clapeyron equation
b - Derived from virial equation
c - Derived from rectilinear diameter

$$\ln[(Z-1)/(Z_c-1)] = f(x),$$
$$f(x) = A_1 \cdot u^\beta + A_2 \cdot u^\gamma + A_3 \cdot (1 - 1/x) + A_4 \cdot u + A_5 \cdot u^2 + A_6 \cdot u^3 + A_7 \cdot u^4, \quad (4)$$

where $x \equiv T/T_c$, $u \equiv (1-x)$, $\beta = 0.35$, $\gamma = 0.70$, and
$A_1 = -0.775\,952\,790$, $A_2 = -1.217\,003\,068$,
$A_3 = 14.102\,518\,006$, $A_4 = 11.367\,854\,381$,
$A_5 = 18.093\,597\,212$, $A_6 = -28.939\,898\,986$,
$A_7 = 54.091\,784\,231$.
For 48 selected data the rms relative deviation is 0.09%.

2.3. The Virial Coefficients

The virial equation of state may be written

$$Z(\rho,T) = 1 + B(T)\rho + C(T)\rho^2 + \ldots. \quad (5)$$

where the density ρ is in mol/L. Data for $B(T)$ are from Dymond and Smith,[44] and for $C(T)$ from Akhundov and Abdullaev.[32] Using $x \equiv T/100$, the second virial coefficient, B(T), is represented by

$$B(T) = B_1/x + B_2/x^2 + B_3/x^3 + B_4/x^4, \text{ L/mol.} \quad (5a)$$

$B_1 = 3.77429$, $B_2 = -60.74276$, $B_3 = 189.3876$, $B_4 = -293.1742$. For 55 data from 373 to 673 K the average absolute deviation in $B(T)$ is 0.0016 L/mol.

The argument of an equation for the third virial coefficient is $u(T) = T/478.0$,

$$C(T) = (1 - 1/u)\cdot\exp[C_1 + C_2 \cdot u + C_3 \cdot u^2 + C_4 \cdot u^3], \text{ (L/mol)}^2, \quad (5b)$$

$C_1 = 5.02897$, $C_2 = -9.21151$, $C_3 = 6.56013$, $C_4 = -2.50062$. For 16 data from 298 through 673 K the average absolute deviation in $C(T)$ is 0.0035 $(\text{L/mol})^2$.

2.4. Pressure–Density–Temperature Data

Table 7 summarizes $P\rho T$ data [29,36,45–47] used in this work. A survey of the principal, more useful data sets is

Table 7. Summary of $P\rho T$ data used for toluene

Authors	Number of Points	Range of the Data T, K	ρ, mol/L	P, bar
Akhundov and Abdullaev[29]	294	298 - 673	0.3 - 9.7	9.0 - 500
Kashiwagi et al.[45]	95	273 - 373	8.6 - 10.2	1.0 - 2500
Kragas et al.[36]	31	373 - 523	6.5 - 8.6	1.4 - 338
Marcos et al.[46]	46	423 - 498	0.03 - 0.24	1.0 - 8.5
Straty et al.[47]	296	348 - 673	1.5 - 8.8	16. - 345

given by Kragas *et al.*[36] They include new data for liquid states at 373 to 523 K. The data of Marcos *et al.*[46] from 423 to 498 K occur at low, gaseous densities in the realm of the virial equation of state. Quite recently, data at densities from 0.5 to 2.8 times the critical, at temperatures from 348 to 673 K, have been measured by Straty *et al.*[47] at pressures from 16 to 345 bar.

2.5. The Equation of State

This isochoric EOS is constrained to the liquid–vapor coexistence boundary specified by vapor pressure Eq. (2) and by the orthobaric density Eqs. (3) and (4). For any given density (isochore) the coexistence temperature, $T_\sigma(\rho)$, is obtained by iteration from the equations for the orthobaric densities, and thus the vapor pressure, $P_\sigma[T_\sigma(\rho)]$, is a function of density. Thus, the EOS is

$$P - P_\sigma(\rho) = \rho R\,[T - T_\sigma(\rho)] + \sigma(\rho R T_c)\cdot F(\rho,T),\ \text{bar}, \tag{6}$$

$$F(\rho,T) \equiv B_1(x - x_\sigma) + C(\rho)\cdot\Phi(\rho,T) + D(\rho)\cdot\Psi(\rho,T), \tag{6a}$$

where $x \equiv T/T_c$, $x_\sigma \equiv T_\sigma(\rho)/T_c$.

The functions in Eq. (6a) have been developed by trial with $P\rho T$ data, except that the specific heat maximum at the critical point is given by $D(\rho)\cdot\Psi(\rho,T)$ as in previous work.[48]

The temperature-dependent functions in Eq. (6a) are

$$\Phi(\rho,T) \equiv 1 - \exp[(1 - u^2)/2], \tag{6b}$$

where $u(\rho,T) \equiv T/T_\sigma(\rho)$, and

$$\Psi(\rho,T) \equiv \psi(\rho,T) - \psi_\sigma(\rho), \tag{6c}$$

where $\psi_\sigma(\rho)$ is obtained from $\psi(\rho,T)$ by replacing T with $T_\sigma(\rho)$,

$$\psi(\rho,T) \equiv (\omega - \omega^\eta/\eta)/(1 - 1/\eta), \tag{6d}$$

where $\omega(\rho,T) \equiv 1 - \theta(\rho)/T$ and $\theta(\rho)$ is a locus of temperatures inside the coexistence envelope of Fig. 1,

$$\theta(\rho) \equiv T_\sigma(\rho)\cdot\exp[-\alpha\cdot g(\rho)],$$
$$g(\rho) \equiv |\sigma - 1|^3/(\sigma_t - 1)^3, \tag{6e}$$

and σ_t is the reduced density of liquid at the triple point.

The function $\Phi(\rho,T)$ is designed to exhibit zero curvature versus T along isochores at coexistence $[T = T_\sigma(\rho)]$, and to have weak, negative curvature at higher temperatures. The function $\Psi(\rho,T)$ was designed to exhibit infinite curvature versus T along isochores at the low-temperature terminus on the locus of $\theta(\rho)$.

The density-dependent coefficients in Eq. (6a), developed by trial, are

$$C(\rho) \equiv (C_1/\gamma\sigma^2)[1 - \exp(-\gamma\cdot\sigma^4)], \tag{6f}$$

$$D(\rho) \equiv D_1(\sigma - 1)(\sigma - \sigma_0), \tag{6g}$$

where the root σ_0 was found by trial.

At the critical point, the slope of the critical isochore from Eq. (6) is constrained to equal the slope of vapor pressure Eq. (2) via the least-squares program of McCarty.[49]

Parameters and least-squares coefficients found for Eq. (6) are $\alpha = 0.10$, $\gamma = 0.020$, $\eta = 1.10$, $\sigma_0 = 2.40$; $B_1 = 0.677\,597\,307$, $C_1 = 0.345\,621\,104$, $D_1 = 0.228\,295\,984$.

Table 8 presents deviations of experimental densities and pressures from the EOS, Eq. (6). Low weights are given to data that deviate widely from the smooth surface of Eq. (6). Table 9 gives properties computed along the critical isotherm at reduced densities from 0.5 to 1.5.

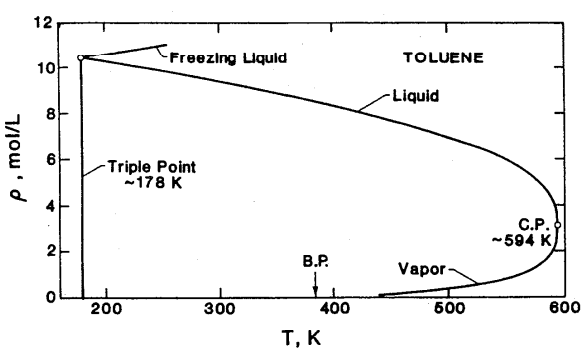

FIG. 1. Density–temperature phase diagram for toluene.

3. Thermal Properties and Computations

3.1. Functions for Ideal Gas States

Data for the hypothetical ideal gas state at $P^0 = 1$ atm are taken from Chao *et al.*[50] Data for $C_p^0(T)$ in Table 10 are formulated using $x(t) \equiv T/100$, and $\epsilon = 2.15$,

$$C_p^0/R = 4.5 + \exp(-\epsilon/x)\sum_{i=1}^{7} A_i\cdot x^{1-i}, \tag{7}$$

$A_1 = 43.479\,585$, $A_2 = -102.327\,150$, $A_3 = -24.712\,398$, $A_4 = 488.306\,590$, $A_5 = -793.156\,335$, $A_6 = 508.778\,466$, $A_7 = -112.980\,758$. Numerical integrations are performed using Eq. (7) to obtain the enthalpy and entropy by starting with values at 300 K. Table 11 gives interpolated values calculated up to 1000 K.

3.2. Saturated Liquid Properties

3.2.a. Enthalpies of Vaporization

The Clapeyron equation,

$$\Delta_{\text{vap}}H = 100T(dP_\sigma/dT)(v_g - v_\ell),\ \text{J/mol}, \tag{8}$$

is used to derive enthalpies of vaporization, $\Delta_{\text{vap}}H$, where dP_σ/dT from Eq. (2) is in units of bar/K, and the orthobaric volumes, v_ℓ and v_g, in L/mol are from Eqs. (3) and (4).

3.2.b. Enthalpies of Saturated Liquid

Data for the enthalpy along the saturation boundary $H_\sigma(T)$ are derived by using the ideal gas enthalpy, the EOS, and $\Delta_{\text{vap}}H$. They are represented using $x(T) \equiv (1 - T/T_c)$, $u(T) \equiv (T - T_t)/(T_c - T_t)$,

$$H_\sigma/H_c = u\cdot\exp\left\{A_i\cdot x^\beta + \sum_{i=1}^{6} A_i\cdot x^{i-1}\right\}, \tag{9}$$

where $\beta = 0.35$, $H_c = 84\,823.508$ J/mol, and

$A_1 = -0.227\,395\,561$, $A_2 = -0.273\,936\,811$,
$A_3 = 0.320\,765\,195$, $A_4 = -3.949\,988\,549$,
$A_5 = 8.206\,865\,501$, $A_6 = -5.379\,947\,162$.

Table 8a. Comparison of $P\rho T$ compressibility data with values calculated from Eq. (6)

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
45	0.00	273.150	9.6114	9.5908	0.21	1.000	32.602	-96.93
45	0.00	273.150	9.7828	9.7442	0.40	249.900	317.564	-21.31
45	0.01	273.150	9.9326	9.8808	0.52	499.500	601.765	-16.99
45	0.01	273.150	10.0650	10.0038	0.61	749.800	884.198	-15.20
45	0.01	273.150	10.1844	10.1154	0.68	1000.000	1165.833	-14.22
45	0.01	273.150	10.2397	10.1678	0.71	1125.000	1305.356	-13.82
45	0.01	273.150	10.2929	10.2181	0.73	1250.000	1444.756	-13.48
45	0.01	273.150	10.3928	10.3135	0.77	1500.000	1720.284	-12.81
45	0.01	273.150	10.4405	10.3590	0.79	1625.000	1858.087	-12.54
45	0.01	273.150	10.4861	10.4032	0.80	1750.000	1992.940	-12.19
45	0.01	273.150	10.5729	10.4885	0.81	2000.000	2257.455	-11.40
45	0.01	273.150	10.6218	10.5377	0.80	2149.000	2409.612	-10.82
45	0.01	273.150	10.6543	10.5705	0.79	2250.000	2511.899	-10.43
45	0.00	298.150	9.3585	9.3519	0.07	1.000	9.419	-89.38
29	0.00	298.150	9.3748	9.3579	0.18	8.700	30.496	-71.47
29	0.00	298.150	9.4182	9.3971	0.22	59.878	88.074	-32.01
29	0.00	298.150	9.4551	9.4315	0.25	106.120	138.675	-23.48
45	0.00	298.150	9.4605	9.4453	0.16	125.100	146.251	-14.46
29	0.00	298.150	9.5332	9.5043	0.30	208.760	251.220	-16.90
45	0.00	298.150	9.5528	9.5323	0.21	249.900	280.557	-10.93
29	0.00	298.150	9.5972	9.5645	0.34	298.450	349.243	-14.54
45	0.00	298.150	9.6396	9.6133	0.27	374.700	417.055	-10.16
29	0.00	298.150	9.6656	9.6283	0.39	398.740	460.019	-13.32
29	0.00	298.150	9.7275	9.6873	0.41	496.510	565.936	-12.27
45	0.01	298.150	9.7210	9.6891	0.33	499.500	554.525	-9.92
45	0.01	298.150	9.7969	9.7606	0.37	625.000	691.570	-9.63
45	0.01	298.150	9.8675	9.8278	0.40	749.800	826.695	-9.30
45	0.01	298.150	9.9348	9.8916	0.44	874.600	962.871	-9.17
45	0.01	298.150	9.9977	9.9525	0.45	1000.000	1096.849	-8.83
45	0.01	298.150	10.0574	10.0106	0.47	1125.000	1229.858	-8.53
45	0.01	298.150	10.1138	10.0662	0.47	1250.000	1360.967	-8.15
45	0.01	298.150	10.1681	10.1198	0.48	1375.000	1491.908	-7.84
45	0.01	298.150	10.2202	10.1714	0.48	1500.000	1622.020	-7.52
45	0.01	298.150	10.2701	10.2214	0.48	1625.000	1750.629	-7.18
45	0.01	298.150	10.3190	10.2699	0.48	1750.000	1879.969	-6.91
45	0.01	298.150	10.3678	10.3171	0.49	1875.000	2012.548	-6.83
45	0.01	298.150	10.4166	10.3632	0.52	2000.000	2148.031	-6.89
45	0.01	298.150	10.4742	10.4170	0.55	2149.000	2310.740	-7.00
45	0.01	298.150	10.5143	10.4528	0.59	2250.000	2425.892	-7.25
45	0.01	298.150	10.5740	10.5053	0.65	2400.000	2598.539	-7.64
45	0.00	313.150	9.2076	9.2046	0.03	1.000	4.446	-77.51
45	0.01	313.150	9.3183	9.3080	0.11	125.100	138.052	-9.38
45	0.01	313.150	9.4193	9.4034	0.17	249.900	271.648	-8.01
45	0.01	313.150	9.5115	9.4914	0.21	374.700	404.521	-7.37
45	0.01	313.150	9.5972	9.5732	0.25	499.500	537.851	-7.13
45	0.01	313.150	9.6765	9.6501	0.27	625.000	669.913	-6.70
45	0.01	313.150	9.7503	9.7220	0.29	749.800	800.899	-6.38
45	0.01	313.150	9.8208	9.7900	0.32	874.600	933.520	-6.31
45	0.01	313.150	9.8859	9.8548	0.32	1000.000	1062.523	-5.88
45	0.01	313.150	9.9489	9.9164	0.33	1125.000	1193.320	-5.73
45	0.01	313.150	10.0086	9.9753	0.33	1250.000	1322.920	-5.51
45	0.01	313.150	10.0650	10.0319	0.33	1375.000	1450.417	-5.20
45	0.01	313.150	10.1193	10.0864	0.33	1500.000	1577.495	-4.91
45	0.01	313.150	10.1714	10.1391	0.32	1625.000	1703.514	-4.61
45	0.01	313.150	10.2213	10.1902	0.31	1750.000	1827.828	-4.26
45	0.01	313.150	10.3157	10.2884	0.27	2000.000	2071.653	-3.46
45	0.01	313.150	10.3613	10.3359	0.25	2125.000	2192.941	-3.10
45	0.01	313.150	10.4047	10.3825	0.21	2250.000	2310.235	-2.61
45	0.01	313.150	10.4546	10.4376	0.16	2400.000	2446.810	-1.91
45	0.00	323.150	9.1045	9.1046	-0.00	1.000	0.893	11.94
29	0.00	323.150	9.1251	9.1199	0.06	17.397	23.089	-24.65
29	0.00	323.150	9.1620	9.1539	0.09	54.691	63.813	-14.30
29	0.01	323.150	9.2087	9.1985	0.11	105.320	117.263	-10.18
29	0.01	323.150	9.2955	9.2795	0.17	202.680	222.843	-9.05
45	0.01	323.150	9.3248	9.3160	0.10	248.900	260.368	-4.40
29	0.01	323.150	9.3737	9.3555	0.19	300.660	325.118	-7.52

Table 8a. Comparison of $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
45	0.01	323.150	9.4008	9.3888	0.13	345.700	362.314	-4.59
29	0.01	323.150	9.4496	9.4276	0.23	399.880	431.523	-7.33
29	0.01	323.150	9.5180	9.4944	0.25	497.500	533.436	-6.74
45	1.00	323.150	9.5126	9.4964	0.17	500.500	525.130	-4.69
45	1.00	323.150	9.6732	9.6514	0.23	749.800	787.552	-4.79
45	1.00	323.150	9.8132	9.7895	0.24	999.800	1045.375	-4.36
45	1.00	323.150	9.9369	9.9148	0.22	1250.000	1296.685	-3.60
45	1.00	323.150	10.0487	10.0299	0.19	1500.000	1542.790	-2.77
45	1.00	323.150	10.1540	10.1372	0.17	1750.000	1790.518	-2.26
45	1.00	323.150	10.2571	10.2386	0.18	2000.000	2046.829	-2.29
45	1.00	323.150	10.3635	10.3354	0.27	2249.000	2322.920	-3.18
45	0.00	348.150	8.8451	8.8475	-0.03	1.000	-1.127	-188.75
29	0.00	348.150	8.8723	8.8701	0.02	21.141	23.099	-8.48
29	0.00	348.150	8.9070	8.9037	0.04	51.904	55.026	-5.67
29	0.00	348.150	8.9634	8.9578	0.06	103.630	109.207	-5.11
29	0.00	348.150	9.0644	9.0556	0.10	204.100	213.616	-4.45
45	0.00	348.150	9.0980	9.0973	0.01	249.900	250.660	-0.30
29	0.00	348.150	9.1566	9.1448	0.13	304.090	317.979	-4.37
29	0.00	348.150	9.2413	9.2275	0.15	404.320	421.694	-4.12
45	0.00	348.150	9.3075	9.3009	0.07	499.500	508.341	-1.74
29	0.00	348.150	9.3172	9.3023	0.16	501.400	521.548	-3.86
45	0.00	348.150	9.4844	9.4746	0.10	749.800	765.006	-1.99
45	0.00	348.150	9.6352	9.6270	0.09	1000.000	1014.328	-1.41
45	1.00	348.150	9.7025	9.6971	0.06	1125.000	1134.937	-0.88
45	1.00	348.150	9.7655	9.7639	0.02	1250.000	1253.097	-0.25
45	1.00	348.150	9.8838	9.8890	-0.05	1500.000	1489.086	0.73
45	1.00	348.150	9.9391	9.9481	-0.09	1625.000	1605.653	1.20
45	1.00	348.150	9.9934	10.0053	-0.12	1750.000	1723.618	1.53
45	1.00	348.150	10.0509	10.0638	-0.13	1882.000	1852.475	1.59
45	1.00	348.150	10.1030	10.1148	-0.12	2000.000	1972.371	1.40
45	1.00	348.150	10.1594	10.1676	-0.08	2125.000	2105.402	0.93
45	1.00	348.150	10.2191	10.2194	-0.00	2250.000	2249.243	0.03
45	1.00	348.150	10.2810	10.2704	0.10	2375.000	2401.107	-1.09
45	1.00	348.150	10.3461	10.3204	0.25	2499.000	2563.157	-2.50
45	0.00	373.150	8.5749	8.5788	-0.05	1.000	-1.815	-155.10
36	0.00	373.150	8.5695	8.5794	-0.12	1.410	-5.717	-124.66
29	0.00	373.150	8.6096	8.6075	0.02	22.107	23.679	-6.64
36	0.00	373.150	8.6313	8.6335	-0.02	41.700	40.080	4.04
29	0.00	373.150	8.6498	8.6465	0.04	51.738	54.310	-4.73
36	0.00	373.150	8.6834	8.6895	-0.07	85.900	80.956	6.11
29	0.00	373.150	8.7182	8.7125	0.06	104.740	109.430	-4.29
45	0.00	373.150	8.7290	8.7368	-0.09	125.100	118.534	5.54
36	1.00	373.150	8.7388	8.7410	-0.03	128.700	126.813	1.49
36	1.00	373.150	8.7898	8.7894	0.00	171.000	171.368	-0.21
29	1.00	373.150	8.8386	8.8304	0.09	208.450	216.157	-3.57
36	1.00	373.150	8.8299	8.8313	-0.02	209.300	208.038	0.61
45	1.00	373.150	8.8647	8.8740	-0.10	249.900	240.918	3.73
36	1.00	373.150	8.8972	8.9034	-0.07	278.900	272.741	2.26
29	1.00	373.150	8.9396	8.9293	0.12	305.000	315.586	-3.35
45	1.00	373.150	8.9884	8.9954	-0.08	374.700	367.139	2.06
29	1.00	373.150	9.0329	9.0220	0.12	404.000	416.130	-2.92
29	1.00	373.150	9.1013	9.0900	0.12	481.850	495.265	-2.71
45	1.00	373.150	9.1013	9.1048	-0.04	499.500	495.265	0.86
45	1.00	373.150	9.2044	9.2054	-0.01	625.000	623.717	0.21
45	1.00	373.150	9.2977	9.2977	0.00	749.800	749.819	-0.00
45	1.00	373.150	9.4627	9.4649	-0.02	1000.000	996.521	0.35
45	1.00	373.150	9.6027	9.6137	-0.11	1250.000	1230.597	1.58
45	1.00	373.150	9.7242	9.7465	-0.23	1495.000	1452.504	2.93
45	1.00	373.150	9.8414	9.8743	-0.33	1750.000	1682.659	4.00
45	1.00	373.150	9.9565	9.9920	-0.36	2000.000	1923.136	4.00
45	1.00	373.150	10.0769	10.1040	-0.27	2250.000	2188.639	2.80
45	1.00	373.150	10.1432	10.1590	-0.16	2376.000	2339.439	1.56
45	1.00	373.150	10.2126	10.2124	0.00	2500.000	2500.411	-0.02
29	0.00	398.150	8.3318	8.3293	0.03	20.968	22.512	-6.86
29	0.00	398.150	8.3817	8.3782	0.04	51.502	53.730	-4.15

Table 8a. Comparison of $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
29	0.00	398.150	8.4620	8.4568	0.06	103.990	107.648	-3.40
29	0.00	398.150	8.5955	8.5887	0.08	202.500	207.921	-2.61
29	0.00	398.150	8.7182	8.7107	0.09	305.840	312.520	-2.14
29	0.00	398.150	8.8223	8.8158	0.07	404.860	411.369	-1.58
29	0.00	398.150	8.8484	8.8420	0.07	431.120	437.574	-1.47
46	1.00	423.260	0.0276	0.0276	0.15	0.947	0.948	-0.14
46	1.00	423.260	0.0321	0.0320	0.24	1.095	1.097	-0.23
46	1.00	423.260	0.0371	0.0370	0.14	1.259	1.261	-0.14
46	1.00	423.260	0.0426	0.0425	0.34	1.437	1.442	-0.32
46	1.00	423.260	0.0509	0.0507	0.42	1.704	1.710	-0.40
46	1.00	423.260	0.0580	0.0579	0.22	1.931	1.935	-0.21
46	1.00	423.260	0.0624	0.0622	0.34	2.067	2.074	-0.32
46	1.00	423.260	0.0684	0.0680	0.57	2.246	2.258	-0.53
46	1.00	423.260	0.0739	0.0734	0.66	2.413	2.428	-0.61
46	1.00	423.260	0.0820	0.0812	0.94	2.649	2.672	-0.86
36	0.00	423.150	8.0030	8.0002	0.03	3.680	4.980	-26.10
29	0.00	423.150	8.0247	8.0288	-0.05	17.203	15.224	13.00
36	0.00	423.150	8.0854	8.0829	0.03	44.100	45.387	-2.83
29	0.00	423.150	8.0919	8.0955	-0.04	50.586	48.750	3.77
36	1.00	423.150	8.1657	8.1675	-0.02	89.700	88.699	1.13
29	1.00	423.150	8.1929	8.1954	-0.03	105.740	104.249	1.43
36	1.00	423.150	8.2471	8.2519	-0.06	139.700	136.782	2.13
36	0.00	423.150	8.3220	8.3318	-0.12	191.500	184.905	3.57
29	1.00	423.150	8.3492	8.3512	-0.02	204.670	203.291	0.68
36	1.00	423.150	8.3947	8.4033	-0.10	241.500	235.346	2.61
36	1.00	423.150	8.4588	8.4686	-0.12	290.500	282.907	2.68
29	1.00	423.150	8.4827	8.4842	-0.02	302.620	301.415	0.40
36	0.00	423.150	8.5130	8.5281	-0.18	337.800	325.592	3.75
29	1.00	423.150	8.6053	8.6087	-0.04	406.320	403.340	0.74
29	1.00	423.150	8.7106	8.7147	-0.05	504.360	500.361	0.80
46	1.00	448.130	0.0275	0.0275	-0.10	1.001	1.000	0.10
46	1.00	448.130	0.0361	0.0361	-0.13	1.305	1.303	0.13
46	1.00	448.130	0.0425	0.0425	-0.14	1.530	1.528	0.13
46	1.00	448.130	0.0486	0.0486	0.08	1.739	1.741	-0.07
46	1.00	448.130	0.0576	0.0576	-0.03	2.047	2.046	0.03
46	1.00	448.130	0.0641	0.0640	0.12	2.261	2.264	-0.11
46	1.00	448.130	0.0734	0.0731	0.43	2.564	2.575	-0.40
46	1.00	448.130	0.0831	0.0827	0.49	2.876	2.889	-0.45
46	1.00	448.130	0.0923	0.0919	0.43	3.172	3.185	-0.39
46	1.00	448.130	0.1014	0.1008	0.63	3.454	3.474	-0.57
46	1.00	448.130	0.1116	0.1114	0.18	3.783	3.789	-0.17
29	0.00	448.150	7.6741	7.6809	-0.09	5.361	2.945	82.04
29	0.00	448.150	7.6893	7.6866	0.04	7.395	8.380	-11.76
29	0.00	448.150	7.6969	7.6951	0.02	10.492	11.141	-5.82
29	0.00	448.150	7.7392	7.7395	-0.00	27.144	27.048	0.35
29	0.00	448.150	7.8022	7.7999	0.03	51.450	52.393	-1.80
29	0.00	448.150	7.8456	7.8430	0.03	69.950	71.077	-1.59
29	0.00	448.150	7.9140	7.9117	0.03	101.470	102.564	-1.07
29	0.00	448.150	7.9639	7.9615	0.03	125.990	127.194	-0.95
29	0.00	448.150	8.0116	8.0083	0.04	150.330	152.088	-1.16
29	1.00	448.150	8.0572	8.0558	0.02	176.290	177.100	-0.46
29	1.00	448.150	8.1006	8.0992	0.02	201.220	202.084	-0.43
29	1.00	448.150	8.1430	8.1411	0.02	226.430	227.562	-0.50
29	1.00	448.150	8.1831	8.1816	0.02	251.840	252.776	-0.37
29	1.00	448.150	8.2178	8.2178	0.00	275.400	275.420	-0.01
29	1.00	448.150	8.2547	8.2546	0.00	300.270	300.345	-0.02
29	1.00	448.150	8.2938	8.2946	-0.01	328.270	327.728	0.17
29	1.00	448.150	8.3285	8.3290	-0.01	353.310	352.940	0.10
29	1.00	448.150	8.3622	8.3609	0.01	377.220	378.160	-0.25
29	1.00	448.150	8.3871	8.3827	0.05	393.930	397.386	-0.87
29	1.00	448.150	8.4219	8.4235	-0.02	426.150	424.874	0.30
29	1.00	448.150	8.4523	8.4551	-0.03	451.980	449.642	0.52
29	1.00	448.150	8.4816	8.4847	-0.04	476.850	474.168	0.57
29	1.00	448.150	8.5098	8.5137	-0.05	501.830	498.388	0.69

Table 8a. Comparison of $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
46	1.00	473.190	0.0270	0.0269	0.37	1.036	1.040	-0.36
46	1.00	473.190	0.0357	0.0357	-0.10	1.367	1.365	0.09
46	1.00	473.190	0.0557	0.0556	0.15	2.098	2.101	-0.14
46	1.00	473.190	0.0662	0.0661	0.13	2.475	2.478	-0.12
46	1.00	473.190	0.0747	0.0745	0.23	2.773	2.779	-0.22
46	1.00	473.190	0.0821	0.0822	-0.18	3.044	3.039	0.17
46	1.00	473.190	0.0879	0.0878	0.06	3.237	3.239	-0.06
46	1.00	473.190	0.0948	0.0946	0.24	3.469	3.476	-0.22
46	1.00	473.190	0.1075	0.1068	0.73	3.881	3.907	-0.67
46	1.00	473.190	0.1672	0.1656	1.02	5.759	5.810	-0.88
29	0.00	473.150	7.3398	7.3340	0.08	7.807	9.354	-16.53
29	0.00	473.150	7.3431	7.3390	0.06	9.138	10.224	-10.62
36	0.00	473.150	7.3474	7.3430	0.06	10.200	11.390	-10.45
29	0.00	473.150	7.3561	7.3521	0.05	12.649	13.747	-7.99
29	0.00	473.150	7.4039	7.4001	0.05	26.174	27.270	-4.02
29	0.00	473.150	7.4809	7.4782	0.04	50.250	51.122	-1.71
36	0.00	473.150	7.5037	7.4990	0.06	57.100	58.668	-2.67
29	0.00	473.150	7.5547	7.5515	0.04	75.232	76.395	-1.52
29	0.00	473.150	7.6231	7.6200	0.04	100.810	102.018	-1.18
36	0.00	473.150	7.6285	7.6330	-0.06	105.900	104.145	1.69
29	0.00	473.150	7.6871	7.6845	0.03	126.920	128.018	-0.86
36	1.00	473.150	7.7371	7.7402	-0.04	151.100	149.681	0.95
29	1.00	473.150	7.7479	7.7453	0.03	153.380	154.556	-0.76
29	1.00	473.150	7.7957	7.7937	0.03	175.770	176.722	-0.54
36	1.00	473.150	7.8391	7.8423	-0.04	199.500	197.906	0.81
29	1.00	473.150	7.8467	7.8465	0.00	201.620	201.716	-0.05
29	1.00	473.150	7.8966	7.8955	0.01	226.940	227.533	-0.26
36	1.00	473.150	7.9357	7.9337	0.03	247.600	248.697	-0.44
29	1.00	473.150	7.9411	7.9404	0.01	251.340	251.704	-0.14
29	1.00	473.150	7.9834	7.9831	0.00	275.530	275.736	-0.07
36	1.00	473.150	8.0062	8.0064	-0.00	289.200	289.105	0.03
29	1.00	473.150	8.0225	8.0235	-0.01	299.430	298.840	0.20
29	1.00	473.150	8.0648	8.0660	-0.01	325.630	324.890	0.23
36	0.00	473.150	8.0648	8.0756	-0.13	331.700	324.890	2.10
29	1.00	473.150	8.1028	8.1049	-0.03	350.580	349.189	0.40
29	1.00	473.150	8.1397	8.1432	-0.04	375.980	373.645	0.62
29	1.00	473.150	8.1755	8.1825	-0.09	403.110	398.200	1.23
29	1.00	473.150	8.2059	8.2115	-0.07	423.690	419.676	0.96
29	1.00	473.150	8.2439	8.2504	-0.08	452.210	447.364	1.08
29	1.00	473.150	8.2743	8.2826	-0.10	476.530	470.199	1.35
29	1.00	473.150	8.3057	8.3146	-0.11	501.420	494.502	1.40
46	1.00	498.290	0.0257	0.0255	0.55	1.039	1.045	-0.54
46	1.00	498.290	0.0305	0.0306	-0.33	1.239	1.235	0.33
46	1.00	498.290	0.0377	0.0378	-0.29	1.527	1.523	0.29
46	1.00	498.290	0.0482	0.0483	-0.26	1.935	1.930	0.25
46	1.00	498.290	0.0545	0.0546	-0.24	2.179	2.174	0.23
46	1.00	498.290	0.0632	0.0632	-0.04	2.509	2.508	0.04
46	1.00	498.290	0.0694	0.0693	0.18	2.738	2.743	-0.18
46	1.00	498.290	0.0764	0.0765	-0.01	3.008	3.008	0.01
46	1.00	498.290	0.0824	0.0824	0.05	3.229	3.231	-0.04
46	1.00	498.290	0.0891	0.0892	-0.12	3.482	3.478	0.11
46	1.00	498.290	0.0994	0.0995	-0.07	3.855	3.853	0.06
46	0.00	498.290	0.1089	0.1071	1.60	4.132	4.193	-1.46
46	1.00	498.290	0.1631	0.1625	0.38	6.043	6.064	-0.34
46	1.00	498.290	0.1920	0.1903	0.86	6.950	7.002	-0.75
46	1.00	498.290	0.2421	0.2400	0.88	8.478	8.540	-0.74
29	0.00	498.150	6.9394	6.9525	-0.19	11.942	9.550	25.05
29	0.00	498.150	6.9741	6.9686	0.08	14.958	16.015	-6.60
29	0.00	498.150	7.0284	7.0236	0.07	25.928	26.913	-3.66
29	0.00	498.150	7.1412	7.1364	0.07	51.567	52.751	-2.25
29	0.00	498.150	7.2335	7.2283	0.07	75.730	77.197	-1.90
29	0.00	498.150	7.2877	7.2815	0.09	91.180	93.050	-2.01
29	0.00	498.150	7.3941	7.3883	0.08	125.460	127.461	-1.57
29	0.00	498.150	7.4668	7.4616	0.07	151.720	153.660	-1.26
29	0.00	498.150	7.5287	7.5233	0.07	175.600	177.747	-1.21

Table 8a. Comparison of $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
29	0.00	498.150	7.5808	7.5761	0.06	197.360	199.363	-1.00
29	0.00	498.150	7.6437	7.6396	0.05	225.300	227.165	-0.82
29	1.00	498.150	7.7284	7.7245	0.05	265.670	267.576	-0.71
29	1.00	498.150	7.7957	7.7932	0.03	300.940	302.273	-0.44
29	1.00	498.150	7.8412	7.8394	0.02	326.070	327.123	-0.32
29	1.00	498.150	7.8792	7.8769	0.03	347.340	348.684	-0.39
29	1.00	498.150	7.9237	7.9237	0.00	374.930	374.950	-0.01
29	1.00	498.150	7.9650	7.9655	-0.01	400.610	400.287	0.08
29	1.00	498.150	8.0040	8.0060	-0.02	426.480	425.189	0.30
29	1.00	498.150	8.0431	8.0458	-0.03	452.820	450.986	0.41
29	1.00	498.150	8.0768	8.0811	-0.05	476.940	473.928	0.64
29	1.00	498.150	8.1104	8.1160	-0.07	501.570	497.556	0.81
29	1.00	523.150	0.0655	0.0657	-0.27	2.742	2.735	0.26
29	1.00	523.150	0.1125	0.1128	-0.26	4.582	4.571	0.25
29	1.00	523.150	0.2160	0.2165	-0.21	8.277	8.262	0.19
29	1.00	523.150	0.3411	0.3399	0.36	12.085	12.120	-0.29
29	1.00	523.150	0.4609	0.4553	1.24	15.087	15.220	-0.87
29	1.00	523.150	6.5356	6.5337	0.03	19.341	19.579	-1.21
36	0.00	523.150	6.5052	6.5447	-0.60	20.700	15.974	29.59
29	1.00	523.150	6.5856	6.5842	0.02	25.802	25.991	-0.73
29	1.00	523.150	6.7440	6.7419	0.03	50.086	50.459	-0.74
36	1.00	523.150	6.7994	6.8069	-0.11	62.000	60.557	2.38
29	1.00	523.150	6.8764	6.8727	0.05	75.250	76.044	-1.04
29	1.00	523.150	6.9969	6.9915	0.08	102.450	103.796	-1.30
36	0.00	523.150	6.9795	6.9965	-0.24	103.700	99.518	4.20
29	1.00	523.150	7.0826	7.0767	0.08	124.740	126.364	-1.29
36	0.00	523.150	7.1260	7.1462	-0.28	144.700	138.739	4.30
29	1.00	523.150	7.1727	7.1662	0.09	150.790	152.780	-1.30
29	1.00	523.150	7.2487	7.2423	0.09	175.190	177.341	-1.21
36	1.00	523.150	7.2650	7.2745	-0.13	186.200	182.887	1.81
29	1.00	523.150	7.3236	7.3168	0.09	201.250	203.707	-1.21
29	1.00	523.150	7.3898	7.3834	0.09	226.390	228.886	-1.09
36	1.00	523.150	7.3811	7.3862	-0.07	227.500	225.481	0.90
29	1.00	523.150	7.4527	7.4463	0.09	251.850	254.524	-1.05
36	1.00	523.150	7.4788	7.4863	-0.10	268.900	265.633	1.23
29	1.00	523.150	7.5102	7.5050	0.07	277.130	279.456	-0.83
29	1.00	523.150	7.5645	7.5590	0.07	301.750	304.341	-0.85
36	0.00	523.150	7.5634	7.5771	-0.18	310.300	303.829	2.13
29	1.00	523.150	7.6155	7.6114	0.05	326.960	328.977	-0.61
29	1.00	523.150	7.6654	7.6615	0.05	352.260	354.294	-0.57
29	1.00	523.150	7.7088	7.7067	0.03	376.150	377.303	-0.31
29	1.00	523.150	7.7555	7.7544	0.01	402.480	403.095	-0.15
29	1.00	523.150	7.7967	7.7962	0.01	426.530	426.822	-0.07
29	1.00	523.150	7.8510	7.8517	-0.01	459.820	459.411	0.09
29	1.00	523.150	7.8727	7.8735	-0.01	473.410	472.891	0.11
29	1.00	523.150	7.9140	7.9162	-0.03	500.690	499.215	0.30
29	1.00	548.150	0.0913	0.0917	-0.47	3.968	3.950	0.45
29	1.00	548.150	0.2080	0.2088	-0.41	8.501	8.470	0.37
29	1.00	548.150	0.3802	0.3790	0.33	14.133	14.171	-0.27
29	1.00	548.150	0.5871	0.5786	1.46	19.413	19.606	-0.99
29	0.00	548.150	5.9995	6.0135	-0.23	25.743	24.825	3.70
29	0.00	548.150	6.0700	6.0833	-0.22	30.790	29.775	3.41
29	0.00	548.150	6.2849	6.2939	-0.14	50.919	49.901	2.04
29	1.00	548.150	6.4792	6.4830	-0.06	76.070	75.492	0.77
29	1.00	548.150	6.7549	6.7527	0.03	125.970	126.444	-0.38
29	1.00	548.150	6.8591	6.8562	0.04	150.200	150.923	-0.48
29	1.00	548.150	6.9578	6.9537	0.06	175.960	177.112	-0.65
29	1.00	548.150	7.0446	7.0401	0.06	201.300	202.709	-0.70
29	1.00	548.150	7.1282	7.1225	0.08	227.850	229.769	-0.84
29	1.00	548.150	7.1955	7.1892	0.09	251.100	253.380	-0.90
29	1.00	548.150	7.2639	7.2580	0.08	276.830	279.117	-0.82
29	1.00	548.150	7.3257	7.3200	0.08	301.630	303.986	-0.77
29	1.00	548.150	7.3854	7.3804	0.07	327.250	329.462	-0.67
29	1.00	548.150	7.4397	7.4355	0.06	351.980	353.931	-0.55
29	1.00	548.150	7.4896	7.4859	0.05	375.760	377.576	-0.48
29	1.00	548.150	7.5395	7.5375	0.03	401.320	402.343	-0.25

Table 8a. Comparison of $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
29	1.00	548.150	7.5884	7.5860	0.03	426.420	427.685	-0.30
29	1.00	548.150	7.6329	7.6320	0.01	451.260	451.759	-0.11
29	1.00	548.150	7.6774	7.6782	-0.01	477.260	476.794	0.10
29	1.00	573.150	0.0830	0.0834	-0.53	3.806	3.786	0.52
29	1.00	573.150	0.1921	0.1934	-0.69	8.374	8.322	0.63
29	1.00	573.150	0.4414	0.4414	-0.01	17.070	17.069	0.01
29	1.00	573.150	0.6392	0.6337	0.86	22.431	22.566	-0.60
29	0.00	573.150	0.8925	0.8729	2.25	27.539	27.886	-1.24
29	0.00	573.150	5.3700	5.4207	-0.94	37.406	35.811	4.46
29	0.00	573.150	5.6772	5.7090	-0.56	50.713	48.845	3.83
29	0.00	573.150	6.0028	6.0204	-0.29	75.460	73.701	2.39
29	0.00	573.150	6.2242	6.2335	-0.15	100.650	99.379	1.28
29	1.00	573.150	6.3891	6.3928	-0.06	124.930	124.310	0.50
29	1.00	573.150	6.5335	6.5349	-0.02	151.160	150.873	0.19
29	1.00	573.150	6.6550	6.6533	0.03	176.730	177.117	-0.22
29	1.00	573.150	6.7549	6.7513	0.05	200.680	201.590	-0.45
29	1.00	573.150	6.8504	6.8451	0.08	226.140	227.663	-0.67
29	1.00	573.150	6.9361	6.9306	0.08	251.710	253.444	-0.68
29	1.00	573.150	7.0088	7.0026	0.09	275.060	277.175	-0.76
29	1.00	573.150	7.0805	7.0747	0.08	300.220	302.317	-0.69
29	1.00	573.150	7.1521	7.1452	0.10	326.610	329.292	-0.81
29	1.00	573.150	7.2085	7.2027	0.08	349.500	351.892	-0.68
29	1.00	573.150	7.2682	7.2617	0.09	374.330	377.140	-0.74
29	1.00	573.150	7.3312	7.3264	0.06	403.140	405.312	-0.54
29	1.00	573.150	7.3789	7.3745	0.06	425.680	427.781	-0.49
29	1.00	573.150	7.4299	7.4259	0.05	450.850	452.858	-0.44
29	1.00	573.150	7.4712	7.4686	0.03	472.660	473.967	-0.28
29	1.00	573.150	7.5243	7.5232	0.01	501.710	502.316	-0.12
29	1.00	598.150	0.5591	0.5595	-0.07	21.980	21.968	0.05
29	1.00	598.150	0.7563	0.7515	0.65	27.310	27.432	-0.44
29	1.00	598.150	0.9151	0.9045	1.18	30.851	31.076	-0.72
29	1.00	598.150	1.1020	1.0819	1.86	34.238	34.577	-0.98
29	1.00	598.150	1.3055	1.2708	2.73	37.088	37.535	-1.19
29	1.00	598.150	1.4972	1.4529	3.05	39.200	39.632	-1.09
29	1.00	598.150	1.6834	1.6254	3.57	40.721	41.142	-1.02
29	1.00	598.150	1.9253	1.8540	3.85	42.160	42.500	-0.80
29	1.00	598.150	2.2423	2.1335	5.10	43.259	43.544	-0.65
29	1.00	598.150	2.5523	2.4096	5.92	43.872	44.074	-0.46
29	1.00	598.150	2.9631	2.8529	3.86	44.363	44.448	-0.19
29	1.00	598.150	3.1976	3.1476	1.59	44.585	44.623	-0.08
29	1.00	598.150	3.4618	3.5009	-1.12	44.873	44.837	0.08
29	1.00	598.150	3.6900	3.7858	-2.53	45.225	45.083	0.31
29	1.00	598.150	3.9020	4.0091	-2.67	45.716	45.446	0.59
29	1.00	598.150	4.1730	4.2714	-2.31	46.793	46.303	1.06
29	1.00	598.150	4.4003	4.4890	-1.97	48.397	47.642	1.58
29	1.00	598.150	4.5857	4.6620	-1.64	50.386	49.415	1.97
29	1.00	598.150	4.9042	4.9646	-1.22	56.165	54.720	2.64
29	1.00	598.150	5.4221	5.4570	-0.64	75.970	73.979	2.69
29	1.00	598.150	5.7770	5.7984	-0.37	102.060	100.028	2.03
29	1.00	598.150	5.9952	6.0094	-0.24	125.580	123.777	1.46
29	1.00	598.150	6.1829	6.1918	-0.14	151.680	150.267	0.94
29	1.00	598.150	6.3132	6.3198	-0.11	173.740	172.505	0.72
29	1.00	598.150	6.4521	6.4562	-0.06	201.080	200.195	0.44
29	1.00	598.150	6.5606	6.5624	-0.03	225.410	224.983	0.19
29	1.00	598.150	6.6626	6.6629	-0.00	251.110	251.043	0.03
29	1.00	598.150	6.7560	6.7547	0.02	277.040	277.408	-0.13
29	1.00	598.150	6.8341	6.8318	0.03	300.740	301.459	-0.24
29	1.00	598.150	6.9111	6.9094	0.03	326.440	327.042	-0.18
29	1.00	598.150	6.9784	6.9763	0.03	350.190	350.975	-0.22
29	1.00	598.150	7.0490	7.0469	0.03	376.920	377.734	-0.22
29	1.00	598.150	7.1087	7.1063	0.03	400.800	401.766	-0.24
29	1.00	598.150	7.1673	7.1657	0.02	425.960	426.647	-0.16
29	1.00	598.150	7.2150	7.2150	0.00	447.860	447.894	-0.01
29	1.00	598.150	7.2726	7.2720	0.01	474.420	474.685	-0.06
29	1.00	598.150	7.3279	7.3292	-0.02	502.400	501.737	0.13

Table 8a. Comparison of $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
29	1.00	623.150	0.1057	0.1065	-0.79	5.267	5.227	0.76
29	1.00	623.150	0.2389	0.2414	-1.05	11.327	11.218	0.97
29	1.00	623.150	0.3573	0.3607	-0.95	16.204	16.070	0.83
29	1.00	623.150	0.4866	0.4903	-0.74	21.035	20.906	0.62
29	1.00	623.150	0.6365	0.6380	-0.23	25.982	25.935	0.18
29	1.00	623.150	0.8117	0.8086	0.39	30.990	31.075	-0.27
29	1.00	623.150	1.0124	1.0038	0.85	35.865	36.058	-0.54
29	1.00	623.150	1.2046	1.1902	1.21	39.746	40.018	-0.68
29	1.00	623.150	1.3800	1.3601	1.46	42.713	43.027	-0.73
29	1.00	623.150	1.7471	1.7206	1.54	47.546	47.837	-0.61
29	1.00	623.150	1.9730	1.9454	1.42	49.799	50.045	-0.49
29	1.00	623.150	2.2825	2.2566	1.15	52.275	52.457	-0.35
29	1.00	623.150	2.5628	2.5370	1.02	54.112	54.270	-0.29
29	1.00	623.150	2.8215	2.7925	1.04	55.643	55.815	-0.31
29	1.00	623.150	3.1980	3.1589	1.24	57.866	58.115	-0.43
29	1.00	623.150	4.6307	4.6595	-0.62	76.140	75.391	0.99
29	1.00	623.150	5.2374	5.2643	-0.51	101.500	99.871	1.63
29	1.00	623.150	5.8085	5.8207	-0.21	151.610	150.099	1.01
29	1.00	623.150	5.9930	5.9997	-0.11	176.330	175.314	0.58
29	1.00	623.150	6.1460	6.1487	-0.04	201.100	200.609	0.24
29	1.00	623.150	6.2763	6.2768	-0.01	225.820	225.709	0.05
29	1.00	623.150	6.3935	6.3923	0.02	251.160	251.428	-0.11
29	1.00	623.150	6.4977	6.4944	0.05	276.160	277.011	-0.31
29	1.00	623.150	6.5942	6.5901	0.06	302.040	303.204	-0.38
29	1.00	623.150	6.6822	6.6779	0.06	327.940	329.258	-0.40
29	1.00	623.150	6.7549	6.7501	0.07	350.920	352.501	-0.45
29	1.00	623.150	6.8243	6.8194	0.07	374.480	376.208	-0.46
29	1.00	623.150	6.9003	6.8966	0.05	402.500	403.900	-0.35
29	0.00	623.150	6.9491	6.9709	-0.31	431.370	422.716	2.05
29	1.00	623.150	7.0240	7.0217	0.03	452.200	453.170	-0.21
29	1.00	623.150	7.0794	7.0768	0.04	475.860	476.970	-0.23
29	1.00	623.150	7.1358	7.1351	0.01	502.090	502.407	-0.06
29	1.00	648.150	0.3242	0.3278	-1.11	15.669	15.513	1.01
29	1.00	648.150	0.5746	0.5780	-0.59	25.520	25.396	0.49
29	1.00	648.150	0.8823	0.8814	0.11	35.398	35.426	-0.08
29	1.00	648.150	1.2752	1.2672	0.63	45.116	45.289	-0.38
29	1.00	648.150	1.8158	1.8068	0.50	54.750	54.882	-0.24
29	1.00	648.150	2.7336	2.7246	0.33	66.010	66.113	-0.16
29	1.00	648.150	3.5811	3.5485	0.92	76.400	76.886	-0.63
29	1.00	648.150	4.1845	4.1707	0.33	87.850	88.176	-0.37
29	1.00	648.150	4.5940	4.6107	-0.36	100.990	100.370	0.62
29	1.00	648.150	4.7876	4.8039	-0.34	109.120	108.360	0.70
29	1.00	648.150	5.1039	5.1221	-0.35	127.200	125.978	0.97
29	1.00	648.150	5.4140	5.4283	-0.26	152.170	150.798	0.91
29	1.00	648.150	5.6370	5.6483	-0.20	176.260	174.874	0.79
29	1.00	648.150	5.8324	5.8391	-0.12	202.390	201.367	0.51
29	1.00	648.150	5.9832	5.9860	-0.05	226.410	225.919	0.22
29	1.00	648.150	6.1145	6.1161	-0.02	250.920	250.613	0.12
29	1.00	648.150	6.2404	6.2394	0.02	277.280	277.526	-0.09
29	1.00	648.150	6.3435	6.3404	0.05	301.360	302.155	-0.26
29	1.00	648.150	6.4434	6.4389	0.07	327.180	328.415	-0.38
29	1.00	648.150	6.5356	6.5307	0.08	353.460	354.936	-0.42
29	1.00	648.150	6.6127	6.6077	0.07	377.270	378.855	-0.42
29	1.00	648.150	6.6887	6.6826	0.09	402.020	404.101	-0.51
29	1.00	648.150	6.7625	6.7563	0.09	428.040	430.283	-0.52
29	1.00	648.150	6.8276	6.8219	0.08	452.600	454.804	-0.48
29	1.00	648.150	6.8894	6.8831	0.09	476.790	479.382	-0.54
29	1.00	648.150	6.9405	6.9352	0.08	498.400	500.621	-0.44
29	1.00	673.150	0.3204	0.3241	-1.16	16.263	16.092	1.06
29	1.00	673.150	0.6593	0.6642	-0.73	30.271	30.090	0.60
29	1.00	673.150	1.1173	1.1180	-0.07	44.987	44.967	0.05
29	1.00	673.150	1.5009	1.5231	-1.46	55.047	54.553	0.91
29	1.00	673.150	2.6610	2.6692	-0.31	75.730	75.593	0.18
29	1.00	673.150	3.4000	3.3834	0.49	88.840	89.186	-0.39
29	1.00	673.150	3.9198	3.9069	0.33	101.280	101.637	-0.35
29	1.00	673.150	4.5694	4.5768	-0.16	125.900	125.541	0.29

Table 8a. Comparison of $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Ref. No.	Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
29	1.00	673.150	4.9820	4.9954	-0.27	151.330	150.344	0.66
29	1.00	673.150	5.2528	5.2655	-0.24	174.560	173.322	0.71
29	1.00	673.150	5.4742	5.4846	-0.19	198.760	197.485	0.65
29	1.00	673.150	5.6772	5.6848	-0.13	226.070	224.929	0.51
29	1.00	673.150	5.8291	5.8355	-0.11	250.510	249.407	0.44
29	1.00	673.150	5.9680	5.9731	-0.08	276.170	275.169	0.36
29	1.00	673.150	6.1091	6.1121	-0.05	305.720	305.044	0.22
29	1.00	673.150	6.2773	6.2786	-0.02	346.480	346.138	0.10
29	1.00	673.150	6.4358	6.4375	-0.03	391.440	390.936	0.13

466 data points, $|\Delta\rho/\rho|$ rms = 0.789%, $\Delta\rho/\rho$ av. = 0.11%, $|\Delta P/P|$ av. = 0.75%, weight = 71.59%.

References: Akhundov/Abduliaev[29], Kashiwagi et al.[45], Kragas et al.[36], Marcos et al.[46]

Table 8b. Comparison of Straty et al.[47] $P\rho T$ compressibility data with values calculated from Eq. (6)

Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
0.00	583.115	1.4583	1.3898	4.93	35.577	36.093	-1.43
0.00	593.165	1.4575	1.4074	3.56	37.749	38.222	-1.24
0.00	603.161	1.4568	1.4204	2.56	39.844	40.253	-1.02
0.00	613.206	1.4560	1.4301	1.81	41.902	42.238	-0.80
0.00	623.111	1.4552	1.4382	1.18	43.907	44.155	-0.56
1.00	633.096	1.4544	1.4444	0.69	45.892	46.055	-0.35
1.00	643.116	1.4536	1.4495	0.28	47.859	47.933	-0.15
1.00	653.164	1.4528	1.4535	-0.05	49.805	49.792	0.03
1.00	663.181	1.4520	1.4567	-0.32	51.726	51.625	0.19
1.00	673.121	1.4513	1.4601	-0.60	53.628	53.427	0.38
0.00	583.163	1.7799	1.5920	11.80	36.886	37.787	-2.38
0.00	593.184	1.7789	1.6768	6.09	39.863	40.415	-1.37
0.00	603.173	1.7779	1.7072	4.14	42.558	43.068	-1.18
0.00	613.186	1.7770	1.7265	2.92	45.189	45.643	-0.99
0.00	623.134	1.7760	1.7401	2.07	47.757	48.143	-0.80
0.00	633.108	1.7751	1.7500	1.43	50.293	50.607	-0.62
1.00	643.186	1.7741	1.7569	0.98	52.813	53.059	-0.46
1.00	653.186	1.7731	1.7627	0.59	55.293	55.461	-0.30
1.00	663.155	1.7722	1.7676	0.26	57.749	57.830	-0.14
1.00	673.139	1.7712	1.7716	-0.02	60.185	60.178	0.01
0.00	583.137	2.2578	1.5949	41.56	36.893	38.601	-4.42
0.00	583.052	2.2578	1.5810	42.81	36.804	38.575	-4.59
0.00	593.098	2.2566	2.0199	11.72	41.278	41.728	-1.08
0.00	603.147	2.2553	2.1347	5.65	44.926	45.354	-0.94
0.00	613.164	2.2541	2.1847	3.17	48.471	48.841	-0.76
0.00	623.129	2.2529	2.2121	1.84	51.949	52.242	-0.56
0.00	633.127	2.2517	2.2291	1.01	55.399	55.604	-0.37
1.00	643.130	2.2504	2.2399	0.47	58.810	58.926	-0.20
1.00	653.161	2.2492	2.2471	0.09	62.197	62.224	-0.04
1.00	663.186	2.2480	2.2527	-0.21	65.560	65.490	0.11
1.00	673.162	2.2467	2.2576	-0.48	68.896	68.713	0.27
0.00	583.160	2.8311	1.5982	77.14	36.914	37.635	-1.91
0.00	593.175	2.8295	2.2075	28.18	41.689	42.016	-0.78
0.00	603.182	2.8280	2.6269	7.65	46.308	46.685	-0.81
0.00	613.186	2.8265	2.7199	3.92	50.882	51.291	-0.80
0.00	623.192	2.8249	2.7547	2.55	55.438	55.854	-0.74
0.00	633.180	2.8234	2.7742	1.77	59.979	60.377	-0.66
0.00	643.119	2.8218	2.7875	1.23	64.498	64.851	-0.54
1.00	653.182	2.8203	2.7950	0.90	69.040	69.358	-0.46
1.00	663.181	2.8187	2.8012	0.63	73.553	73.813	-0.35
1.00	673.105	2.8172	2.8072	0.36	78.045	78.216	-0.22
0.00	583.099	3.3713	1.6019	110.45	36.916	35.848	2.98
0.00	593.163	3.3695	2.2886	47.23	41.791	41.895	-0.25
0.00	603.141	3.3676	3.1780	5.97	47.277	47.626	-0.73
0.00	613.113	3.3658	3.2487	3.61	52.899	53.389	-0.92
0.00	623.160	3.3639	3.2727	2.79	58.606	59.216	-1.03
0.00	633.126	3.3621	3.2910	2.16	64.344	65.005	-1.02
0.00	643.116	3.3602	3.3025	1.75	70.119	70.810	-0.98
0.00	653.173	3.3584	3.3090	1.49	75.928	76.655	-0.95
0.00	663.154	3.3565	3.3163	1.21	81.745	82.450	-0.85
0.00	673.163	3.3547	3.3208	1.02	87.567	88.257	-0.78
0.00	583.121	3.6683	1.6004	129.21	36.914	34.762	6.19
0.00	593.151	3.6663	2.3838	53.80	41.873	41.875	-0.00
0.00	603.149	3.6643	3.5527	3.14	48.009	48.272	-0.54
0.00	613.171	3.6622	3.5757	2.42	54.380	54.816	-0.80
0.00	623.141	3.6602	3.5915	1.91	60.848	61.391	-0.88
1.00	633.176	3.6582	3.6012	1.58	67.427	68.047	-0.91
1.00	643.174	3.6562	3.6093	1.30	74.050	74.703	-0.87
1.00	653.158	3.6542	3.6157	1.07	80.708	81.365	-0.81
1.00	663.118	3.6521	3.6210	0.86	87.389	88.018	-0.72
1.00	673.171	3.6501	3.6236	0.73	94.118	94.740	-0.66
0.00	583.105	3.7110	1.5964	132.45	36.892	34.597	6.63

Table 8b. Comparison of Straty et al.[47] $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
0.00	593.129	3.7090	2.3805	55.81	41.862	41.874	-0.03
0.00	603.157	3.7070	3.5786	3.59	48.073	48.388	-0.65
0.00	613.167	3.7050	3.6048	2.78	54.521	55.042	-0.95
0.00	623.097	3.7029	3.6251	2.15	61.081	61.712	-1.02
0.00	633.129	3.7009	3.6331	1.87	67.740	68.495	-1.10
0.00	643.082	3.6988	3.6422	1.55	74.445	75.250	-1.07
0.00	653.166	3.6968	3.6466	1.38	81.239	82.114	-1.07
0.00	583.110	3.6819	1.5951	130.82	36.887	34.705	6.29
0.00	593.118	3.6799	2.3555	56.23	41.838	41.856	-0.04
0.00	603.159	3.6778	3.5432	3.80	47.995	48.313	-0.66
0.00	613.124	3.6758	3.5770	2.76	54.357	54.857	-0.91
0.00	623.105	3.6738	3.5952	2.19	60.853	61.477	-1.02
0.00	633.121	3.6718	3.6059	1.83	67.441	68.161	-1.06
1.00	603.150	3.9716	3.9340	0.95	49.113	49.264	-0.31
1.00	613.178	3.9694	3.9177	1.32	56.351	56.720	-0.65
1.00	623.183	3.9672	3.9163	1.30	63.737	64.270	-0.83
1.00	633.113	3.9650	3.9200	1.15	71.206	71.831	-0.87
1.00	643.142	3.9628	3.9215	1.05	78.796	79.515	-0.90
1.00	653.128	3.9606	3.9237	0.94	86.424	87.200	-0.89
1.00	663.132	3.9584	3.9253	0.84	94.103	94.922	-0.86
0.00	583.161	4.1212	1.5989	157.76	36.918	33.569	9.98
0.00	593.165	4.1190	4.1973	-1.87	42.500	42.307	0.46
1.00	603.160	4.1167	4.1130	0.09	49.948	49.969	-0.04
1.00	613.176	4.1144	4.0895	0.61	57.684	57.906	-0.38
1.00	623.112	4.1122	4.0850	0.66	65.568	65.907	-0.51
1.00	633.144	4.1099	4.0808	0.71	73.597	74.068	-0.64
1.00	643.147	4.1076	4.0798	0.68	81.708	82.264	-0.68
1.00	653.132	4.1053	4.0796	0.63	89.871	90.486	-0.68
1.00	663.196	4.1030	4.0788	0.59	98.129	98.802	-0.68
1.00	673.178	4.1007	4.0791	0.53	106.385	107.069	-0.64
0.00	583.119	4.5589	1.6016	184.65	36.920	34.532	6.91
0.00	593.167	4.5564	4.6116	-1.20	44.921	44.413	1.14
1.00	603.139	4.5538	4.5815	-0.60	54.200	53.822	0.70
1.00	613.178	4.5513	4.5623	-0.24	63.769	63.569	0.31
1.00	623.146	4.5487	4.5512	-0.06	73.466	73.409	0.08
1.00	633.174	4.5461	4.5430	0.07	83.333	83.419	-0.10
1.00	643.190	4.5436	4.5367	0.15	93.280	93.501	-0.24
1.00	653.166	4.5410	4.5330	0.18	103.302	103.598	-0.29
1.00	663.188	4.5385	4.5288	0.22	113.378	113.787	-0.36
1.00	673.176	4.5360	4.5256	0.23	123.485	123.970	-0.39
0.00	583.150	4.8452	4.9103	-1.33	38.303	37.540	2.03
0.00	593.163	4.8425	4.8912	-1.00	48.847	47.970	1.83
0.00	603.169	4.8397	4.8747	-0.72	59.729	58.906	1.40
0.00	613.176	4.8370	4.8623	-0.52	70.834	70.099	1.05
1.00	623.103	4.8343	4.8543	-0.41	82.060	81.367	0.85
1.00	633.183	4.8315	4.8457	-0.29	93.494	92.925	0.61
1.00	643.200	4.8288	4.8393	-0.22	104.978	104.498	0.46
1.00	653.171	4.8261	4.8344	-0.17	116.507	116.080	0.37
1.00	663.120	4.8233	4.8306	-0.15	128.086	127.673	0.32
1.00	673.128	4.8206	4.8257	-0.11	139.690	139.370	0.23
0.00	583.192	5.1199	5.1588	-0.75	42.981	42.053	2.21
0.00	593.170	5.1170	5.1484	-0.61	55.275	54.306	1.78
0.00	603.181	5.1140	5.1376	-0.46	67.846	66.961	1.32
0.00	613.114	5.1111	5.1295	-0.36	80.552	79.742	1.02
1.00	623.147	5.1082	5.1210	-0.25	93.453	92.806	0.70
1.00	633.168	5.1053	5.1138	-0.17	106.450	105.966	0.46
1.00	643.141	5.1024	5.1081	-0.11	119.501	119.141	0.30
1.00	653.153	5.0995	5.1020	-0.05	132.596	132.424	0.13
1.00	663.143	5.0966	5.0970	-0.01	145.743	145.715	0.02
1.00	673.160	5.0938	5.0925	0.03	158.961	159.072	-0.07
0.00	573.139	5.4912	5.5148	-0.43	40.896	39.948	2.37
0.00	583.168	5.4880	5.5081	-0.36	55.733	54.744	1.81

Table 8b. Comparison of Straty et al.[47] $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
0.00	593.144	5.4848	5.5017	-0.31	70.832	69.858	1.39
1.00	603.171	5.4817	5.4940	-0.22	86.113	85.303	0.95
1.00	613.146	5.4785	5.4876	-0.17	101.501	100.828	0.67
1.00	623.140	5.4754	5.4812	-0.11	116.982	116.508	0.41
1.00	633.123	5.4723	5.4756	-0.06	132.546	132.255	0.22
1.00	643.133	5.4691	5.4698	-0.01	148.161	148.090	0.05
1.00	653.177	5.4660	5.4641	0.03	163.829	164.024	-0.12
1.00	663.119	5.4629	5.4598	0.06	179.457	179.810	-0.20
1.00	673.177	5.4598	5.4545	0.10	195.147	195.784	-0.33
0.00	563.176	5.8013	5.8126	-0.19	39.936	39.256	1.73
0.00	573.159	5.7979	5.8099	-0.21	57.390	56.536	1.51
0.00	583.143	5.7945	5.8048	-0.18	75.048	74.207	1.13
1.00	593.144	5.7911	5.7989	-0.14	92.864	92.151	0.77
1.00	603.132	5.7878	5.7935	-0.10	110.820	110.244	0.52
1.00	613.170	5.7844	5.7874	-0.05	128.859	128.532	0.25
1.00	623.192	5.7811	5.7815	-0.01	146.922	146.876	0.03
1.00	633.170	5.7778	5.7762	0.03	164.974	165.183	-0.13
1.00	643.167	5.7745	5.7710	0.06	183.072	183.546	-0.26
1.00	653.133	5.7712	5.7664	0.08	201.164	201.853	-0.34
1.00	663.168	5.7679	5.7613	0.11	219.269	220.276	-0.46
1.00	673.153	5.7647	5.7569	0.14	237.321	238.590	-0.53
1.00	548.188	6.0586	6.0589	0.01	29.015	28.992	0.08
1.00	553.148	6.0568	6.0601	-0.06	38.837	38.565	0.71
1.00	563.135	6.0532	6.0579	-0.08	58.741	58.302	0.75
1.00	573.136	6.0496	6.0531	-0.06	78.810	78.437	0.48
1.00	583.180	6.0461	6.0476	-0.02	99.075	98.902	0.18
1.00	593.176	6.0425	6.0424	0.00	119.397	119.405	-0.01
1.00	603.149	6.0390	6.0376	0.02	139.778	139.970	-0.14
1.00	613.114	6.0355	6.0325	0.05	160.137	160.576	-0.27
1.00	613.098	6.0355	6.0327	0.05	160.123	160.542	-0.26
1.00	623.160	6.0321	6.0268	0.09	180.568	181.398	-0.46
1.00	633.150	6.0286	6.0219	0.11	200.972	202.089	-0.55
1.00	643.131	6.0252	6.0172	0.13	221.343	222.762	-0.64
1.00	653.176	6.0217	6.0120	0.16	241.707	243.518	-0.74
1.00	663.103	6.0183	6.0081	0.17	261.984	263.993	-0.76
1.00	673.148	6.0149	6.0033	0.19	282.273	284.655	-0.84
0.00	543.087	6.0985	6.1136	-0.25	23.150	22.047	5.00
0.00	553.056	6.0948	6.1091	-0.23	42.834	41.571	3.04
0.00	563.120	6.0912	6.1063	-0.25	63.469	61.943	2.46
0.00	573.096	6.0876	6.1020	-0.24	84.088	82.469	1.96
0.00	583.118	6.0840	6.0963	-0.20	104.828	103.303	1.48
0.00	593.108	6.0804	6.0907	-0.17	125.596	124.205	1.12
1.00	603.093	6.0769	6.0851	-0.13	146.381	145.197	0.82
1.00	613.130	6.0734	6.0784	-0.08	167.136	166.352	0.47
1.00	623.117	6.0699	6.0722	-0.04	187.800	187.421	0.20
1.00	633.135	6.0664	6.0656	0.01	208.421	208.553	-0.06
1.00	643.186	6.0629	6.0583	0.08	228.886	229.734	-0.37
1.00	543.145	6.1208	6.1203	0.01	23.762	23.800	-0.16
1.00	548.148	6.1189	6.1221	-0.05	33.929	33.663	0.79
1.00	553.107	6.1171	6.1220	-0.08	44.096	43.654	1.01
1.00	563.141	6.1134	6.1187	-0.09	64.783	64.238	0.85
1.00	573.109	6.1098	6.1144	-0.08	85.542	85.009	0.63
1.00	583.143	6.1062	6.1091	-0.05	106.484	106.121	0.34
1.00	583.129	6.1062	6.1092	-0.05	106.465	106.091	0.35
1.00	593.161	6.1026	6.1039	-0.02	127.507	127.329	0.14
1.00	603.163	6.0991	6.0986	0.01	148.518	148.597	-0.05
1.00	613.188	6.0956	6.0932	0.04	169.586	169.962	-0.22
1.00	623.108	6.0921	6.0887	0.06	190.535	191.113	-0.30
1.00	633.162	6.0886	6.0834	0.09	211.619	212.552	-0.44
1.00	643.173	6.0851	6.0785	0.11	232.628	233.868	-0.53
1.00	653.159	6.0816	6.0739	0.13	253.564	255.085	-0.60
0.20	538.176	6.2347	6.2318	0.05	22.681	22.929	-1.08

Table 8b. Comparison of Straty et al.[47] $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
0.20	543.153	6.2328	6.2303	0.04	33.148	33.390	-0.72
0.20	548.124	6.2309	6.2298	0.02	43.914	44.030	-0.26
0.20	553.186	6.2290	6.2277	0.02	54.857	55.000	-0.26
0.20	563.188	6.2253	6.2239	0.02	76.771	76.945	-0.23
0.20	573.171	6.2216	6.2195	0.03	98.798	99.082	-0.29
0.20	583.192	6.2179	6.2143	0.06	120.922	121.453	-0.44
0.20	593.148	6.2143	6.2096	0.08	143.045	143.782	-0.51
0.20	603.168	6.2107	6.2043	0.10	165.227	166.309	-0.65
0.20	613.139	6.2071	6.1995	0.12	187.373	188.742	-0.73
0.20	623.160	6.2035	6.1941	0.15	209.497	211.282	-0.85
0.20	633.145	6.2000	6.1892	0.17	231.567	233.730	-0.93
0.20	643.167	6.1965	6.1844	0.20	253.659	256.217	-1.00
0.20	653.160	6.1929	6.1798	0.21	275.656	278.551	-1.04
0.20	663.192	6.1894	6.1752	0.23	297.640	300.918	-1.09
0.20	673.167	6.1858	6.1711	0.24	319.501	323.038	-1.09
0.20	533.172	6.3768	6.3719	0.08	25.067	25.589	-2.04
0.20	538.161	6.3748	6.3707	0.06	36.536	37.005	-1.27
0.20	543.167	6.3729	6.3692	0.06	48.179	48.625	-0.92
0.20	548.162	6.3709	6.3678	0.05	59.907	60.313	-0.67
0.20	553.147	6.3690	6.3661	0.05	71.678	72.068	-0.54
0.20	563.168	6.3652	6.3616	0.06	95.331	95.873	-0.57
0.20	573.181	6.3614	6.3565	0.08	119.013	119.812	-0.67
0.20	583.155	6.3577	6.3518	0.09	142.739	143.761	-0.71
0.20	593.173	6.3540	6.3467	0.11	166.512	167.866	-0.81
0.20	603.174	6.3503	6.3419	0.13	190.276	191.940	-0.87
0.20	613.146	6.3466	6.3372	0.15	213.962	215.926	-0.91
0.20	623.176	6.3430	6.3319	0.18	237.600	240.038	-1.02
0.20	633.140	6.3394	6.3275	0.19	261.171	263.927	-1.04
0.20	643.162	6.3357	6.3226	0.21	284.686	287.860	-1.10
0.20	653.132	6.3321	6.3183	0.22	308.113	311.596	-1.12
0.20	663.152	6.3285	6.3138	0.23	331.486	335.351	-1.15
0.00	523.148	6.5292	0.5185	1159.21	16.498	18.791	-12.20
0.20	528.178	6.5046	6.4966	0.12	27.338	28.332	-3.51
0.20	533.197	6.5026	6.4958	0.10	39.804	40.705	-2.21
0.20	538.175	6.5006	6.4949	0.09	52.291	53.097	-1.52
0.20	543.098	6.4986	6.4940	0.07	64.750	65.435	-1.05
0.20	548.114	6.4967	6.4919	0.07	77.344	78.093	-0.96
0.20	553.140	6.4947	6.4894	0.08	89.949	90.813	-0.95
0.20	563.192	6.4908	6.4843	0.10	115.234	116.376	-0.98
0.20	573.126	6.4870	6.4801	0.11	140.441	141.739	-0.92
0.20	583.122	6.4832	6.4753	0.12	165.703	167.306	-0.96
0.20	593.176	6.4794	6.4700	0.15	191.011	193.030	-1.05
0.20	593.185	6.4794	6.4697	0.15	190.984	193.054	-1.07
0.20	603.110	6.4757	6.4656	0.16	216.147	218.435	-1.05
0.20	613.175	6.4719	6.4602	0.18	241.338	244.113	-1.14
0.20	623.185	6.4682	6.4553	0.20	266.383	269.599	-1.19
0.20	633.178	6.4645	6.4506	0.22	291.327	294.952	-1.23
0.20	643.171	6.4608	6.4461	0.23	316.198	320.199	-1.25
0.20	653.133	6.4571	6.4419	0.24	340.943	345.246	-1.25
0.20	493.108	7.0626	7.0637	-0.02	17.313	17.073	1.40
0.20	498.122	7.0604	7.0530	0.10	32.094	33.711	-4.80
0.20	503.185	7.0581	7.0506	0.11	48.835	50.560	-3.41
0.20	508.120	7.0558	7.0489	0.10	65.365	67.005	-2.45
0.20	513.172	7.0536	7.0463	0.10	82.096	83.899	-2.15
0.20	518.151	7.0514	7.0442	0.10	98.704	100.552	-1.84
0.20	523.120	7.0493	7.0421	0.10	115.294	117.199	-1.63
0.20	528.121	7.0471	7.0398	0.10	131.931	133.926	-1.49
0.20	533.149	7.0450	7.0372	0.11	148.577	150.763	-1.45
0.20	538.156	7.0428	7.0347	0.11	165.148	167.484	-1.39
0.20	543.131	7.0407	7.0326	0.12	181.677	184.101	-1.32
0.20	548.091	7.0387	7.0303	0.12	198.091	200.674	-1.29
0.20	553.116	7.0366	7.0277	0.13	214.632	217.414	-1.28
0.20	563.101	7.0325	7.0230	0.14	247.472	250.605	-1.25
0.20	573.114	7.0283	7.0183	0.14	280.262	283.711	-1.22
0.20	583.135	7.0242	7.0134	0.15	312.855	316.708	-1.22
0.20	593.106	7.0201	7.0091	0.16	345.272	349.345	-1.17

Table 8b. Comparison of Straty et al.[47] $P\rho T$ compressibility data with values calculated from Eq. (6) - Continued

Wt.	T K	ρ mol/L	$\rho(calc)$ mol/L	% Dev.	P bar	$P(calc)$ bar	% Dev.
0.00	438.116	7.8192	7.8312	-0.15	12.384	7.520	64.67
0.00	443.175	7.7938	7.8121	-0.23	30.870	23.447	31.66
0.00	448.160	7.7911	7.8087	-0.23	55.193	47.837	15.38
0.00	453.177	7.7885	7.8053	-0.22	79.506	72.295	9.97
0.00	458.114	7.7859	7.8027	-0.22	103.625	96.221	7.69
0.00	463.136	7.7834	7.7997	-0.21	127.867	120.503	6.11
0.00	468.175	7.7809	7.7967	-0.20	152.041	144.756	5.03
0.00	473.109	7.7785	7.7945	-0.21	175.960	168.415	4.48
0.20	463.196	7.7834	7.7992	-0.20	127.928	120.806	5.90
0.20	468.191	7.7809	7.7966	-0.20	152.056	144.836	4.98
0.20	473.175	7.7784	7.7939	-0.20	176.010	168.699	4.33
0.20	478.107	7.7760	7.7918	-0.20	199.856	192.241	3.96
0.20	483.164	7.7736	7.7889	-0.20	223.832	216.298	3.48
0.20	488.100	7.7713	7.7868	-0.20	247.457	239.695	3.24
0.20	493.163	7.7689	7.7840	-0.19	271.277	263.565	2.93
0.20	498.197	7.7665	7.7813	-0.19	294.905	287.181	2.69
0.20	503.156	7.7642	7.7792	-0.19	318.336	310.371	2.57
0.20	508.192	7.7618	7.7766	-0.19	341.761	333.776	2.39
0.00	403.161	8.2692	8.2607	0.10	14.425	19.351	-25.45
0.20	408.179	8.2436	8.2428	0.01	37.239	37.722	-1.28
0.20	413.172	8.2406	8.2387	0.02	67.377	68.495	-1.63
0.20	418.110	8.2378	8.2354	0.03	97.286	98.724	-1.46
0.20	423.175	8.2350	8.2315	0.04	127.346	129.493	-1.66
0.20	428.167	8.2322	8.2285	0.05	157.220	159.538	-1.45
0.20	418.051	8.2378	8.2359	0.02	97.207	98.345	-1.16
0.20	423.186	8.2350	8.2315	0.04	127.417	129.563	-1.66
0.20	428.172	8.2322	8.2284	0.05	157.211	159.570	-1.48
0.20	433.189	8.2296	8.2253	0.05	186.962	189.659	-1.42
0.20	438.181	8.2269	8.2226	0.05	216.547	219.302	-1.26
0.20	443.162	8.2243	8.2200	0.05	245.948	248.725	-1.12
0.20	448.096	8.2218	8.2179	0.05	275.120	277.717	-0.94
0.20	453.165	8.2192	8.2148	0.05	304.280	307.277	-0.98
0.20	458.103	8.2167	8.2128	0.05	333.214	335.899	-0.80
0.20	463.108	8.2141	8.2103	0.05	362.038	364.670	-0.72
0.00	348.070	8.8355	8.8496	-0.16	2.102	-10.328	-120.35
0.00	353.065	8.8093	8.8207	-0.13	22.504	12.636	78.09
0.00	358.074	8.8058	8.8153	-0.11	62.757	54.477	15.20
0.00	363.118	8.8025	8.8104	-0.09	103.007	96.059	7.23
0.20	368.214	8.7992	8.8059	-0.08	143.434	137.438	4.36
0.20	373.093	8.7962	8.8029	-0.08	182.739	176.639	3.45
0.20	378.187	8.7932	8.7990	-0.07	222.461	217.160	2.44
0.20	383.188	8.7903	8.7958	-0.06	261.591	256.499	1.99
0.20	388.086	8.7875	8.7934	-0.07	300.139	294.631	1.87
0.20	393.196	8.7846	8.7900	-0.06	339.106	334.000	1.53

296 data points, $|\Delta\rho/\rho|$ rms = 0.434%, $\Delta\rho/\rho$ av. = 0.16%, $|\Delta P/P|$ av. = 0.60%, weight = 28.41%.

Table 9. The critical isotherm for toluene

ρ/ρ_c	P bar	Z	$\partial P/\partial \rho$ (bar·L)/mol	$\partial \rho/\partial T$ mol/(L·K)	$\partial P/\partial T$ bar/K	$\partial^2 P/\partial T^2$ bar/K^2
0.50	39.362	0.50607	7.47556	-0.3075E-01	0.22984	-0.000963
0.52	39.807	0.49210	6.64048	-0.3651E-01	0.24245	-0.001097
0.54	40.200	0.47856	5.86841	-0.4349E-01	0.25520	-0.001247
0.56	40.547	0.46546	5.15719	-0.5198E-01	0.26807	-0.001418
0.58	40.851	0.45277	4.50457	-0.6239E-01	0.28104	-0.001612
0.60	41.116	0.44052	3.90817	-0.7525E-01	0.29408	-0.001834
0.62	41.345	0.42868	3.36559	-0.9127E-01	0.30719	-0.002088
0.64	41.541	0.41726	2.87437	-0.1114E+00	0.32035	-0.002383
0.66	41.708	0.40624	2.43207	-0.1371E+00	0.33352	-0.002727
0.68	41.849	0.39562	2.03626	-0.1703E+00	0.34670	-0.003131
0.70	41.966	0.38539	1.68452	-0.2136E+00	0.35986	-0.003611
0.72	42.062	0.37554	1.37446	-0.2714E+00	0.37297	-0.004188
0.74	42.140	0.36607	1.10369	-0.3498E+00	0.38603	-0.004889
0.76	42.202	0.35696	0.86985	-0.4587E+00	0.39899	-0.005755
0.78	42.250	0.34821	0.67056	-0.6142E+00	0.41184	-0.006843
0.80	42.287	0.33980	0.50340	-0.8433E+00	0.42453	-0.008239
0.82	42.314	0.33172	0.36591	-0.1194E+01	0.43705	-0.010075
0.84	42.333	0.32397	0.25554	-0.1758E+01	0.44934	-0.012564
0.86	42.347	0.31654	0.16963	-0.2720E+01	0.46136	-0.016065
0.88	42.355	0.30941	0.10536	-0.4490E+01	0.47306	-0.021233
0.90	42.360	0.30257	0.05978	-0.8102E+01	0.48435	-0.029364
0.92	42.363	0.29601	0.02977	-0.1663E+02	0.49516	-0.043361
0.94	42.364	0.28972	0.01208	-0.4184E+02	0.50535	-0.071003
0.96	42.365	0.28369	0.00338	-0.1522E+03	0.51474	-0.140271
0.98	42.365	0.27790	0.00039	-0.1355E+04	0.52298	-0.437256
1.00	42.365	0.27234	0.00000		0.52900	0.000000
1.02	42.365	0.26700	0.00036	-0.1486E+04	0.53484	0.481479
1.04	42.365	0.26187	0.00318	-0.1707E+03	0.54288	0.161345
1.06	42.366	0.25693	0.01134	-0.4870E+02	0.55215	0.087267
1.08	42.367	0.25218	0.02814	-0.1999E+02	0.56245	0.056815
1.10	42.369	0.24761	0.05731	-0.1001E+02	0.57371	0.040942
1.12	42.374	0.24321	0.10300	-0.5688E+01	0.58589	0.031458
1.14	42.383	0.23899	0.16982	-0.3527E+01	0.59897	0.025265
1.16	42.396	0.23495	0.26288	-0.2332E+01	0.61296	0.020958
1.18	42.417	0.23108	0.38777	-0.1619E+01	0.62788	0.017819
1.20	42.446	0.22738	0.55065	-0.1169E+01	0.64375	0.015447
1.22	42.487	0.22387	0.75819	-0.8713E+00	0.66059	0.013601
1.24	42.542	0.22055	1.01765	-0.6667E+00	0.67842	0.012131
1.26	42.616	0.21742	1.33683	-0.5216E+00	0.69729	0.010937
1.28	42.712	0.21451	1.72415	-0.4160E+00	0.71722	0.009950
1.30	42.835	0.21182	2.18858	-0.3373E+00	0.73824	0.009122
1.32	42.990	0.20936	2.73977	-0.2775E+00	0.76039	0.008419
1.34	43.182	0.20716	3.38778	-0.2313E+00	0.78370	0.007814
1.36	43.419	0.20523	4.14343	-0.1951E+00	0.80821	0.007290
1.38	43.707	0.20360	5.01807	-0.1662E+00	0.83395	0.006830
1.40	44.054	0.20228	6.02362	-0.1429E+00	0.86096	0.006423
1.42	44.469	0.20131	7.17261	-0.1240E+00	0.88927	0.006061
1.44	44.961	0.20071	8.47809	-0.1084E+00	0.91892	0.005736
1.46	45.541	0.20052	9.95371	-0.9544E-01	0.94994	0.005441
1.48	46.219	0.20075	11.61362	-0.8459E-01	0.98236	0.005173
1.50	47.008	0.20146	13.47253	-0.7543E-01	1.01623	0.004927

Table 10. Ideal gas state data of Chao et al.[50] for toluene

T K	$H^\circ(T)-H^\circ_0$ J/mol Data	Calc.	% Dev.	$S^\circ(T)$ J/(mol·K) Data	Calc.	% Dev.	$C^\circ_p(T)$ J/(mol·K) Data	Calc.	% Dev.
50.00	1876.0	1547.3	17.52	220.300	215.158	2.33	38.10	38.10	0.00
100.00	3917.0	3929.8	-0.33	248.300	248.404	-0.04	44.57	44.57	-0.00
150.00	6414.0	6412.2	0.03	268.400	268.372	0.01	56.00	56.00	0.01
200.00	9570.0	9571.0	-0.01	286.500	286.445	0.02	70.72	70.72	-0.01
273.15	15650.0	15649.5	0.00	312.200	312.142	0.02	96.06	96.04	0.02
298.15	18170.0	18164.8	0.03	321.000	320.947	0.02	105.20	105.19	0.01
300.00	18360.0	18360.0	0.00	321.600	321.600	0.00	105.80	105.86	-0.06
400.00	30740.0	30739.8	0.00	357.000	356.971	0.01	141.20	141.14	0.04
500.00	46430.0	46424.6	0.01	391.900	391.844	0.01	171.70	171.65	0.03
600.00	64910.0	64894.1	0.02	425.500	425.447	0.01	196.90	196.92	-0.01
700.00	85670.0	85658.5	0.01	457.500	457.415	0.02	217.60	217.70	-0.05
800.00	108300.0	108315.9	-0.01	487.700	487.644	0.01	234.80	234.92	-0.05
900.00	132500.0	132548.1	-0.04	516.200	516.169	0.01	249.30	249.31	-0.01
1000.00	158100.0	158104.5	-0.00	543.100	543.084	0.00	261.60	261.49	0.04
1100.00	184800.0	184786.7	0.01	568.600	568.507	0.02	272.00	271.89	0.04
1200.00	212400.0	212435.8	-0.02	592.600	592.559	0.01	281.00	280.88	0.04
1300.00	240900.0	240923.3	-0.01	615.400	615.357	0.01	288.70	288.70	0.00
1400.00	270200.0	270144.1	0.02	637.100	637.009	0.01	295.40	295.57	-0.06

For 27 data at $T_t < T < T_c$, the rms relative deviation is 0.025% and the maximum deviation is 34 J/mol at 593.8 K.

3.2.c. Entropies of Saturated Liquid

Data for the entropy along the saturated boundary $S_\sigma(T)$ derived as for the enthalpies above, are represented using $u(T) \equiv (1 - T/T_c)$,

$$(S_\sigma - S_c)/(S_t - S_c) = A_1 \cdot u^\beta + \sum_{i=2}^{5} A_i \cdot u^{i-1}, \quad (10)$$

where $\beta = 0.35$, $S_t = 149.81607$ J/(mol K), $S_c = 370.12545$ J/(mol K), and $A_1 = 0.152\,039\,782$, $A_2 = 0.874\,346\,671$, $A_3 = 0.838\,979\,485$, $A_4 = -1.235\,845\,865$, $A_5 = 1.108\,260\,969$. For 20 data at $T_t \leqslant T < T_c$, the rms relative deviation is 0.032% and the maximum deviation is 0.188 J/(mol K) at 560 K.

3.2.d. Specific Heats at Coexistence

Single-phase isochoric specific heats at the coexistence boundary are formulated for convenience in the computation of properties along isobars. At the saturated vapor boundary, data derived using the EOS are formulated using $x(T) \equiv T/T_c$, $u(T) \equiv (1 - x)$,

$$C_v(T_{\sigma,g}) = A_1/u^\epsilon + \sum_{i=2}^{6} A_i \cdot x^{i-2}, \text{ J/(mol K)}, \quad (11)$$

where $\epsilon = 0.14$, and $A_1 = 67.1962$, $A_2 = -31.5583$, $A_3 = -105.4520$, $A_4 = 742.1177$, $A_5 = -772.0035$, $A_6 = 283.4442$. For 27 data at $T_t \leqslant T < T_c$, the rms relative deviation is 0.045% and all deviations are less than 0.1% except for 0.7% at $T = 593.80$ K.

Data for saturated liquid specific heats, $C_\sigma(T)$ are obtained with $C_\sigma(T) = T(dS_\sigma/dT)$ by using Eq. (10). Then, these data are combined with some experimental data (Sec. 3.4) and the new set represented by

$$C_\sigma(T) = (S_c - S_t)x \times \left\{\beta \cdot A_1 \cdot u^{\beta-1} + \sum_{i=2}^{7} (i-1) \cdot A_i \cdot u^{i-2}\right\}, \quad (12)$$

where $\beta = 0.35$, $x \equiv T/T_c$, $u \equiv (1 - x)$, $S_c = 370.12545$ J/(mol K), $S_t = 149.81607$ J/(mol K), $A_1 = 0.152\,2153$, $A_2 = 0.870\,3985$, $A_3 = 0.936\,8106$, $A_4 = -2.098\,3926$, $A_5 = 4.413\,3846$, $A_6 = -5.729\,0712$, $A_7 = 3.674\,6568$. For 29 selected data, the rms relative deviation is 0.11%.

Finally, data for the single-phase isochoric specific heats at the liquid boundary are derived using Eq. (12) in the relation

$$C_v(T_{\sigma,l}) = C_\sigma(T) + T(\partial P/\partial T)(d\rho_l/dT)\rho_l^2, \quad (13)$$

where ρ_l is the density of the saturated liquid. These data are represented by

$$C_v(T)_\sigma = A_1/u^a + A_2 \cdot u^b + \sum_{i=3}^{6} A_i \cdot x^{i-3}, \text{ J/(mol K)}, \quad (14)$$

where $x \equiv T/T_c$, $u \equiv (1 - x)$, $a = 0.24$, $b = 1.1$, and $A_1 = 49.39843$, $A_2 = -1893.4742$, $A_3 = 1994.1036$, $A_4 = -2474.6918$, $A_5 = 907.7281$, $A_6 = -344.2231$. For 28 data at $T_t \leqslant T \leqslant 593.8$ K, the rms relative deviation is 0.11%.

3.3. Computational Methods

The numerical values for U and H in this report are based on the assigned value $U = 0$ for saturated liquid at the triple point, obtained by adding the selected value $H^0_0 = U^0_0 = 36566.792$ J/mol to the ideal gas state values of $(U^0 - U^0_0)$ and $(H^0 - H^0_0)$ from Eq. (7).

Table 11. Interpolated ideal gas state functions for toluene

T K	$U^\circ(T)-U^\circ_0$ J/mol	$H^\circ(T)-H^\circ_0$ J/mol	$S^\circ(T)$ J/(mol·K)	$C^\circ_v(T)$ J/(mol·K)	$C^\circ_p(T)$ J/(mol·K)
178.15	6618.6	8099.9	278.664	55.70	64.01
180.00	6722.2	8218.8	279.328	56.25	64.56
200.00	7908.1	9571.0	286.445	62.41	70.72
220.00	9221.1	11050.3	293.490	68.96	77.27
240.00	10668.6	12664.1	300.507	75.84	84.15
260.00	12256.2	14418.0	307.522	82.96	91.27
273.15	13378.4	15649.5	312.142	87.73	96.04
280.00	13987.9	16316.0	314.552	90.23	98.54
298.15	15685.8	18164.8	320.947	96.87	105.19
300.00	15865.6	18360.0	321.600	97.55	105.86
320.00	17889.8	20550.4	328.666	104.85	113.17
340.00	20059.2	22886.1	335.744	112.07	120.39
360.00	22371.7	25365.0	342.826	119.16	127.48
380.00	24824.5	27984.0	349.905	126.09	134.40
400.00	27414.0	30739.8	356.971	132.83	141.14
420.00	30136.2	33628.3	364.016	139.36	147.67
440.00	32987.0	36645.4	371.033	145.68	154.00
460.00	35962.0	39786.7	378.013	151.78	160.10
480.00	39056.9	43047.9	384.952	157.67	165.98
500.00	42267.3	46424.6	391.844	163.34	171.65
520.00	45589.0	49912.5	398.683	168.79	177.11
540.00	49017.6	53507.4	405.466	174.04	182.35
560.00	52549.2	57205.3	412.189	179.08	187.40
580.00	56179.7	61002.1	418.851	183.94	192.25
600.00	59905.4	64894.1	425.447	188.60	196.92
620.00	63722.5	68877.5	431.978	193.09	201.40
640.00	67627.7	72949.0	438.441	197.40	205.72
660.00	71617.5	77105.1	444.835	201.55	209.87
680.00	75688.7	81342.6	451.160	205.55	213.86
700.00	79838.3	85658.5	457.415	209.39	217.70
720.00	84063.4	90049.8	463.600	213.09	221.41
740.00	88361.1	94513.8	469.715	216.66	224.97
760.00	92728.8	99047.8	475.761	220.09	228.41
780.00	97164.0	103649.3	481.737	223.41	231.72
800.00	101664.3	108315.9	487.644	226.60	234.92
820.00	106227.3	113045.2	493.483	229.68	238.00
840.00	110851.0	117835.1	499.254	232.66	240.98
860.00	115533.1	122683.6	504.958	235.54	243.85
880.00	120271.7	127588.5	510.596	238.31	246.63
900.00	125065.0	132548.1	516.169	241.00	249.31
920.00	129911.1	137560.4	521.677	243.59	251.91
940.00	134808.2	142623.9	527.122	246.11	254.42
960.00	139754.8	147736.7	532.504	248.54	256.85
980.00	144749.2	152897.4	537.824	250.89	259.21
1000.00	149790.0	158104.5	543.084	253.17	261.49

3.3.a. The Homogeneous Domain

The homogeneous domain of Fig. 1 includes all regions which can be attained by integration along isotherms starting at zero density without crossing the vapor–liquid "dome," and without passing very close to the critical point.

We start our computations with ideal gas state thermodynamic functions at zero density, and then apply the Romberg numerical integration technique[51] along isotherms by using equation of state (6) in the following relations,

$$\Delta E = \int [P - T(\partial P/\partial T)]d\rho/\rho^2, \tag{15}$$

$$\Delta C_v = -T\int (\partial^2 P/\partial T^2)d\rho/\rho^2, \tag{16}$$

$$\Delta S = R\cdot \ln[P^0/(\rho RT)] + \int_0^\rho [R - (\partial P/\partial T)/\rho]d\rho/\rho. \tag{17}$$

Equation (17) is for use with initial entropies in hypothetical ideal gas states at $P^0 = 1$ atm (1.01325 bar). For all other initial states we use

$$\Delta S = -\int (\partial P/\partial T)d\rho/\rho^2. \tag{17a}$$

At each (ρ,T) state, reached by above integrations, we compute

$$H = U + P/\rho, \tag{18}$$

$$C_p = C_v + T[(\partial P/\partial T)^2/(\partial P/\partial \rho)]/\rho^2, \tag{19}$$

$$W^2 = C_p(\partial P/\partial \rho)/C_v. \tag{20}$$

The fugacity/pressure ratio f/P for any state is computed by reference to the hypothetical ideal gas state at the same temperature and at $P^0 = 1$ atm (1.01325 bar).

$$f/P = (P^0/P)\exp(\Delta G/RT),$$

$$\Delta G = (H - U_0^0) - H^0 - T(S - S^0), \tag{21}$$

where ΔG is the isothermal Gibbs free energy change, and the selected value U_0^0 was added to the tabulated values for $H(\rho,T)$ relative to $(H^0 - H_0^0)$ from Eq. (7).

3.3.b. The Saturated Liquid

At temperatures from the triple point to the critical point, thermodynamic functions for the saturated vapor are obtained via Eqs. (16)–(18). Then Eq. (8) for the enthalpy of vaporization $\Delta_{vap}H$ is used to compute

$$\Delta H = -\Delta_{vap}H, \quad \Delta S = \Delta H/T, \tag{22}$$

such that the free energy of vaporization, $\Delta G \equiv \Delta H - T\Delta S$, is zero. See Sec. 3.2 for consistency of the formulations. Having obtained H and S for the saturated liquid, $U = H - Pv$ is computed.

3.3.c. The Compressed Liquid

Starting with the above values for U, S, and $C_v(T)_\sigma$ on the saturated liquid boundary at $T < T_c$, we use Eqs. (15), (16), and (17a) to integrate along isotherms, and then obtain H, C_p, and W via Eqs. (18)–(20).

3.4. Comparisons

(a) Enthalpies of vaporization calculated by Eq. (8) are compared with reported data[35,43,52] in Table 12. Some data are up to about 2% lower than calculated values in the range 298–521 K.

(b) Saturated liquid heat capacity data[12,53] are compared with calculated values from Eq. (12) in Table 13. Agreement is excellent if the C_p data of Nefedov and Filippov[53] are excluded.

(c) Single-phase, isobaric specific heat data[53–55] $C_p(\rho,T)$ are compared with predicted values computed using the EOS in Tables 14a, 14b, and 14c. Predictions within a few percent are considered to be satisfactory.

(d) Speed of sound data for saturated vapor,[56] saturated liquid[11] and for the single phase domain[57] are compared with predicted values computed using the EOS in Tables 15a, 15b, and 15c. The greatest relative deviations occur for the saturated liquid at low temperatures, Table 15b.

4. Tables of Thermophysical Properties

All of the following tabulated properties are interpolated or extrapolated in ranges for which no $P\rho T$ compressibility data exist as shown in Table 7.

Table 12. Comparison of reported enthalpies of vaporization with calculated values

Ref. No.	T K	$\Delta_{vap}H$ kJ/mol Data	Calc.	% Dev.
43	298.15	38.000	38.013	-0.03
52	333.15	35.400	36.186	-2.17
52	353.15	34.400	35.119	-2.05
52	373.15	33.400	34.006	-1.78
35	379.63	33.471	33.631	-0.48
35	388.13	33.112	33.128	-0.05
52	393.15	32.400	32.823	-1.29
35	393.26	32.689	32.817	-0.39
35	402.56	32.121	32.237	-0.36
35	408.77	31.585	31.837	-0.79
52	413.15	31.400	31.550	-0.47
35	417.50	31.062	31.259	-0.63
35	424.85	30.620	30.755	-0.44
35	432.03	30.110	30.247	-0.45
52	433.15	30.200	30.166	0.11
35	440.72	29.383	29.611	-0.77
35	445.27	29.155	29.268	-0.39
52	453.15	28.400	28.658	-0.90
35	458.30	28.096	28.248	-0.54
35	470.39	27.067	27.247	-0.66
52	473.15	26.400	27.010	-2.26
52	493.15	24.000	25.198	-4.76
35	498.96	24.469	24.635	-0.67
35	504.50	24.021	24.080	-0.25
35	521.13	22.146	22.286	-0.63

References: Eubank et al.[52], Natarajan/Viswanath[35], Osborne/Ginnings[43]

Table 13. Comparison of reported saturated liquid heat capacities with calculated values

Ref. No.	Wt.	T K	C_σ J/(mol·K) Data	Calc.	% Dev.
12	1.0	178.15	135.44	135.32	0.09
12	1.0	180.00	135.52	135.47	0.04
12	1.0	200.00	137.03	137.29	-0.19
12	1.0	220.00	139.58	139.75	-0.12
12	1.0	240.00	143.01	143.00	0.01
12	1.0	260.00	147.32	147.09	0.16
12	1.0	280.00	152.26	151.97	0.19
12	1.0	300.00	157.74	157.57	0.11
12	1.0	320.00	163.68	163.74	-0.04
12	1.0	340.00	169.79	170.35	-0.33
12	0.0	360.00	176.02	177.29	-0.72
d	1.0	360.00	177.39	177.29	0.06
d	1.0	380.00	184.40	184.43	-0.02
d	1.0	400.00	191.61	191.70	-0.05
d	1.0	420.00	198.99	199.06	-0.03
d	1.0	440.00	206.52	206.48	0.02
d	1.0	460.00	214.16	214.01	0.07
d	1.0	480.00	221.97	221.76	0.09
d	1.0	500.00	230.15	229.97	0.08
d	1.0	520.00	239.26	239.23	0.01
d	1.0	540.00	250.88	251.05	-0.07
d	1.0	560.00	270.22	270.50	-0.10
d	1.0	570.00	288.64	288.86	-0.08
d	1.0	580.00	327.28	327.30	-0.01
d	1.0	585.00	371.52	371.39	0.04
d	1.0	590.00	496.66	496.41	0.05
d	0.1	592.00	674.08	673.91	0.03
d	0.1	593.00	961.65	961.73	-0.01
d	0.1	593.50	1443.20	1443.85	-0.05
d	0.1	593.80	2747.90	2749.97	-0.08
53	0.0	300.00	155.70	157.57	-1.18
53	0.0	320.00	163.60	163.74	-0.08
53	0.0	340.00	169.50	170.35	-0.50
53	0.0	360.00	176.00	177.29	-0.73
53	0.0	380.00	183.40	184.43	-0.56
53	0.0	400.00	188.90	191.70	-1.46
53	0.0	420.00	196.30	199.06	-1.39
53	0.0	440.00	202.70	206.48	-1.83
53	0.0	460.00	210.10	214.01	-1.83
53	0.0	480.00	219.30	221.76	-1.11
53	0.0	500.00	231.30	229.97	0.58
53	0.0	520.00	246.90	239.23	3.21

29 data points, rms deviation 0.11%.
References: Nefedov/Fillipov[53] (C_p), Scott et al.[12]
d - Derived data

Table 14a. Comparison of isobaric heat capacities reported by Akhundov/Eksaev[54] with calculated values

T K	ρ mol/L	C_p J/(mol·K) Data	Calc.	% Dev.
Isobar P = 25 bar, T_σ = 552.22 K				
554.43	0.844	325.3	260.6	24.83
557.51	0.823	268.9	248.5	8.19
566.34	0.774	248.9	232.8	6.92
577.91	0.726	238.7	224.3	6.44
591.39	0.682	228.0	220.0	3.65
620.08	0.613	223.5	218.1	2.47
645.07	0.569	223.9	219.6	1.97
670.51	0.532	225.6	222.2	1.55
Isobar P = 30 bar, T_σ = 566.27 K				
567.77	1.091	353.0	310.3	13.75
571.58	1.044	314.8	278.8	12.89
577.45	0.990	281.4	257.5	9.27
587.87	0.918	256.3	240.6	6.51
601.25	0.851	236.2	231.2	2.15
639.77	0.727	229.9	224.6	2.35
669.53	0.664	229.9	225.6	1.90
Isobar P = 35 bar, T_σ = 578.51 K				
583.32	1.319	384.9	330.5	16.47
587.36	1.251	331.7	296.7	11.81
598.08	1.129	275.4	260.3	5.82
610.37	1.037	256.0	244.3	4.79
627.52	0.946	241.6	235.0	2.83
645.30	0.877	237.2	231.2	2.58
670.45	0.803	235.1	230.0	2.21
Isobar P = 40 bar, T_σ = 589.31 K				
593.96	1.668	486.3	420.1	15.77
600.06	1.494	354.0	325.1	8.88
603.64	1.426	321.7	301.6	6.67
611.48	1.316	288.1	273.7	5.26
619.17	1.237	269.8	259.4	4.00
642.50	1.078	249.5	241.4	3.35
673.54	0.948	240.9	235.3	2.38

Table 14b. Comparison of isobaric heat capacities reported by San Jose et al.[55] with calculated values

T K	P bar	ρ mol/L	C_p J/(mol·K) Data	Calc.	% Dev.
393.15	10.0	8.368	188.9	189.0	-0.06
393.15	15.0	8.376	188.9	188.8	0.03
393.15	20.0	8.384	188.9	188.7	0.11
393.15	25.0	8.392	188.9	188.5	0.19
413.15	10.0	8.135	195.3	196.5	-0.60
413.15	15.0	8.145	195.3	196.3	-0.49
413.15	20.0	8.154	195.3	196.1	-0.39
413.15	25.0	8.163	195.3	195.9	-0.29
433.15	10.0	7.889	203.6	204.2	-0.30
433.15	15.0	7.900	202.7	204.0	-0.61
433.15	20.0	7.912	202.7	203.7	-0.48
433.15	25.0	7.923	202.7	203.4	-0.36
453.15	10.0	7.626	212.8	212.2	0.29
453.15	15.0	7.641	211.9	211.8	0.04
453.15	20.0	7.655	211.9	211.5	0.21
453.15	25.0	7.669	211.0	211.1	-0.05
473.15	10.0	7.342	223.9	220.7	1.45
473.15	15.0	7.361	223.0	220.1	1.30
473.15	20.0	7.379	221.1	219.6	0.71
473.15	25.0	7.396	220.2	219.1	0.53
483.15	10.0	7.189	231.3	225.3	2.67
483.15	15.0	7.211	228.5	224.5	1.77
483.15	20.0	7.231	226.7	223.8	1.26
483.15	25.0	7.251	225.7	223.2	1.13
493.15	15.0	7.052	235.9	229.2	2.89
493.15	20.0	7.076	233.1	228.4	2.07
493.15	25.0	7.099	231.3	227.6	1.62
503.15	15.0	6.883	243.3	234.5	3.75
503.15	20.0	6.911	239.6	233.3	2.68
503.15	25.0	6.937	236.8	232.3	1.95

Table 14c. Comparison of isobaric heat capacities reported by Nefedov/Filippov[53] with calculated values

T K	P bar	ρ mol/L	C_p J/(mol·K) Data	Calc.	% Dev.
300.00	50.0	9.372	159.0	157.2	1.17
300.00	100.0	9.410	158.0	156.7	0.85
300.00	200.0	9.482	156.0	155.8	0.12
300.00	300.0	9.550	154.0	155.1	-0.71
340.00	50.0	8.983	170.0	169.5	0.30
340.00	100.0	9.033	169.0	168.8	0.13
340.00	200.0	9.126	166.0	167.6	-0.96
340.00	300.0	9.211	164.0	166.7	-1.60
380.00	50.0	8.572	182.0	183.2	-0.63
380.00	100.0	8.638	180.0	182.1	-1.16
380.00	200.0	8.757	177.0	180.5	-1.92
380.00	300.0	8.864	174.0	179.2	-2.91
420.00	50.0	8.131	195.0	197.5	-1.26
420.00	100.0	8.220	193.0	195.9	-1.47
420.00	200.0	8.375	188.0	193.5	-2.86
420.00	300.0	8.509	184.0	191.9	-4.11
460.00	50.0	7.648	209.0	212.0	-1.43
460.00	100.0	7.773	206.0	209.4	-1.62
460.00	200.0	7.978	200.0	206.0	-2.89
460.00	300.0	8.146	195.0	203.8	-4.31
500.00	50.0	7.103	225.0	226.9	-0.86
500.00	100.0	7.287	220.0	222.1	-0.95
500.00	200.0	7.563	212.0	216.9	-2.25
500.00	300.0	7.774	206.0	214.0	-3.72
540.00	50.0	6.444	244.0	245.1	-0.46
540.00	100.0	6.745	236.0	234.4	0.70
540.00	200.0	7.127	224.0	225.9	-0.83
540.00	300.0	7.394	217.0	222.0	-2.23
580.00	50.0	5.489	272.0	294.7	-7.69
580.00	100.0	6.111	254.0	254.3	-0.10
580.00	200.0	6.668	238.0	239.2	-0.51
580.00	300.0	7.007	228.0	233.9	-2.54
600.00	100.0	5.740	265.0	271.4	-2.36
600.00	200.0	6.429	245.0	250.5	-2.20
600.00	300.0	6.811	234.0	244.4	-4.25
620.00	50.0	2.083	372.0	392.7	-5.28
620.00	100.0	5.313	277.0	280.7	-1.33
620.00	200.0	6.182	252.0	251.0	0.40
620.00	300.0	6.614	239.0	243.9	-2.03

Table 15a. Comparison of saturated vapor sound velocities reported by Zotov[56] with calculated values

T K	P bar	ρ mol/L	W m/s Data	W m/s Calc.	% Dev.
503.15	0.380	12.368	171.0	172.2	-0.71
513.15	0.449	14.421	167.0	168.3	-0.77
523.15	0.529	16.719	162.0	163.7	-1.04
533.15	0.624	19.284	156.0	158.3	-1.44
543.15	0.737	22.139	148.0	151.9	-2.54
553.15	0.875	25.310	141.0	144.2	-2.22
563.15	1.050	28.827	131.0	135.0	-2.93
573.15	1.283	32.731	120.0	123.7	-2.99
583.15	1.635	37.073	107.0	109.6	-2.35
588.15	1.920	39.434	98.0	100.6	-2.58
589.15	1.997	39.923	96.0	98.5	-2.51

Table 15b. Comparison of saturated liquid sound velocities reported by Zotov et al.[11] with calculated values.

T K	ρ mol/L	P bar	W m/s Data	W m/s Calc.	% Dev.
193.15	10.310	0.000	1818.0	2019.4	-9.97
233.15	9.958	0.000	1613.0	1741.8	-7.40
273.15	9.590	0.009	1417.0	1504.9	-5.84
313.15	9.204	0.079	1240.0	1296.3	-4.34
353.15	8.794	0.388	1074.0	1108.2	-3.08
373.15	8.578	0.742	995.0	1019.9	-2.44
413.15	8.120	2.181	842.0	851.9	-1.16
453.15	7.612	5.172	691.0	691.2	-0.03
473.15	7.333	7.503	615.0	612.2	0.46
513.15	6.695	14.421	462.0	453.4	1.89
553.15	5.857	25.310	296.0	286.4	3.36
573.15	5.247	32.731	200.0	193.6	3.31

Table 15c. Comparison of sound velocities reported by Pankevich/Zotov[57] with calculated values

T K	ρ mol/L	P bar	W m/s Data	W m/s Calc	% Dev.
473.15	7.373	18.555	629.0	629.8	-0.12
483.15	7.331	46.727	633.0	633.6	-0.09
483.15	7.373	59.226	649.0	650.6	-0.25
493.15	7.331	86.583	650.0	653.1	-0.48
493.15	7.373	100.015	668.0	669.5	-0.22
503.15	7.331	126.533	668.0	671.1	-0.47
503.15	7.373	140.858	685.0	687.0	-0.29
513.15	6.775	26.720	488.0	485.3	0.56
513.15	7.331	166.521	684.0	687.9	-0.57
513.15	7.373	181.708	702.0	703.4	-0.20
523.15	6.775	56.098	508.0	509.0	-0.20
523.15	7.331	206.506	700.0	703.7	-0.53

Table 15c. Comparison of sound velocities reported by Pankevich/Zotov[57] with calculated values - Continued

T K	ρ mol/L	P bar	W m/s Data	W m/s Calc	% Dev.
523.15	7.373	222.527	718.0	718.9	-0.12
533.15	6.775	85.888	527.0	529.3	-0.43
533.15	7.331	246.454	715.0	718.7	-0.52
533.15	7.373	263.286	733.0	733.6	-0.08
543.15	6.313	41.644	402.0	401.7	0.08
543.15	6.775	115.943	544.0	547.6	-0.66
543.15	7.331	286.334	729.0	732.9	-0.53
543.15	7.373	303.955	747.0	747.5	-0.07
553.15	6.313	64.784	422.0	424.0	-0.47
553.15	6.775	146.182	561.0	564.5	-0.62
553.15	7.331	326.120	743.0	746.4	-0.45
563.15	5.748	36.188	292.0	290.1	0.66
563.15	6.313	88.329	440.0	443.2	-0.73
563.15	6.775	176.546	576.0	580.2	-0.72
573.15	5.569	43.265	272.0	272.4	-0.16
573.15	5.748	53.129	313.0	314.6	-0.50
573.15	6.313	112.154	457.0	460.4	-0.73
573.15	6.775	206.992	590.0	594.6	-0.78
583.15	4.840	37.490	165.0	152.4	8.29
583.15	5.123	42.063	204.0	204.7	-0.35
583.15	5.217	44.477	224.0	222.3	0.75
583.15	5.569	58.916	292.0	293.5	-0.52
583.15	5.748	70.576	331.0	333.4	-0.73
583.15	6.313	136.185	473.0	475.2	-0.47
583.15	6.775	237.485	603.0	607.2	-0.70
593.15	4.721	46.145	175.0	157.9	10.80
593.15	4.840	47.921	189.0	174.2	8.50
593.15	5.123	54.449	225.0	218.1	3.16
593.15	5.217	57.572	244.0	234.5	4.07
593.15	5.569	74.975	311.0	302.4	2.86
593.15	5.748	88.354	348.0	341.0	2.07
593.15	6.313	160.368	489.0	479.2	2.06
603.15	4.721	56.454	197.0	187.4	5.10
603.15	4.840	58.901	208.0	203.1	2.40
603.15	5.123	67.239	243.0	245.8	-1.15
603.15	5.217	71.041	262.0	261.8	0.07
603.15	5.569	91.315	328.0	328.6	-0.19
603.15	5.748	106.372	363.0	366.8	-1.04
603.15	6.313	184.665	504.0	504.1	-0.01
613.15	4.721	67.056	215.0	205.1	4.84
613.15	4.840	70.167	225.0	220.6	1.99
613.15	5.123	80.291	259.0	262.8	-1.46
613.15	5.217	84.763	278.0	278.6	-0.23
613.15	5.569	107.865	344.0	344.6	-0.18
613.15	5.748	124.573	377.0	382.4	-1.41
613.15	6.313	209.041	519.0	518.1	0.17
623.15	4.721	77.852	231.0	220.7	4.66
623.15	4.840	81.631	240.0	236.2	1.60
623.15	5.123	93.537	274.0	278.2	-1.52
623.15	5.217	98.673	293.0	293.9	-0.31
623.15	5.569	124.576	360.0	359.4	0.17
623.15	5.748	142.915	391.0	396.8	-1.46
623.15	6.313	233.472	534.0	531.3	0.51
633.15	4.721	88.794	245.0	235.0	4.23
633.15	4.840	93.242	254.0	250.6	1.36
633.15	5.123	106.930	288.0	292.5	-1.54
633.15	5.217	112.729	307.0	308.1	-0.37
633.15	5.569	141.414	374.0	373.2	0.22
633.15	5.748	161.369	405.0	410.3	-1.30
633.15	6.313	257.934	546.0	543.8	0.41

Table 16. The Joule-Thomson inversion locus for toluene

T K	ρ mol/L	P bar	T K	ρ mol/L	P bar	T K	ρ mol/L	P bar
480	7.260	15.38	740	5.916	400.11	1000	4.683	490.15
500	7.140	59.17	760	5.821	415.33	1020	4.590	489.93
520	7.026	100.36	780	5.725	428.88	1040	4.498	489.11
540	6.915	138.97	800	5.630	440.83	1060	4.407	487.78
560	6.808	175.08	820	5.535	451.25	1080	4.317	486.03
580	6.703	208.78	840	5.439	460.23	1100	4.229	483.92
600	6.601	240.13	860	5.344	467.86	1120	4.142	481.57
620	6.500	269.22	880	5.249	474.20	1140	4.058	479.01
640	6.401	296.11	900	5.154	479.35	1160	3.975	476.32
660	6.302	320.87	920	5.059	483.39	1180	3.894	473.57
680	6.205	343.58	940	4.965	486.40	1200	3.816	470.81
700	6.108	364.31	960	4.870	488.48	1220	3.741	468.08
720	6.012	383.12	980	4.776	489.70			

Table 17. Properties of saturated liquid toluene

T K	P bar	ρ_l mol/L	ρ_g mol/L	Z_l	Z_g	dP_σ/dT bar/K	$d\rho_l/dT$ mol/(L·K)	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol
178.150	0.0000	10.439	0.00000	0.00000	1.00000	0.00000	-0.00852	26.212	3077.182
180.000	0.0000	10.423	0.00000	0.00000	1.00000	0.00000	-0.00853	25.871	3032.176
190.000	0.0000	10.337	0.00000	0.00000	1.00000	0.00000	-0.00861	24.139	2803.530
200.000	0.0000	10.251	0.00000	0.00000	0.99999	0.00000	-0.00869	22.571	2596.901
210.000	0.0000	10.163	0.00000	0.00000	0.99999	0.00000	-0.00878	21.143	2409.172
220.000	0.0001	10.075	0.00001	0.00000	0.99996	0.00001	-0.00886	19.837	2237.794
230.000	0.0003	9.986	0.00002	0.00000	0.99992	0.00003	-0.00896	18.636	2080.664
240.000	0.0008	9.896	0.00004	0.00000	0.99984	0.00007	-0.00905	17.528	1936.033
250.000	0.0018	9.805	0.00009	0.00001	0.99969	0.00014	-0.00915	16.501	1802.429
255.000	0.0026	9.759	0.00012	0.00001	0.99958	0.00019	-0.00921	16.015	1739.367
260.000	0.0038	9.713	0.00017	0.00002	0.99945	0.00027	-0.00926	15.546	1678.612
265.000	0.0053	9.667	0.00024	0.00002	0.99928	0.00036	-0.00932	15.093	1620.036
270.000	0.0074	9.620	0.00033	0.00003	0.99908	0.00048	-0.00937	14.655	1563.523
275.000	0.0102	9.573	0.00045	0.00005	0.99883	0.00064	-0.00943	14.231	1508.965
280.000	0.0139	9.525	0.00060	0.00006	0.99852	0.00083	-0.00949	13.821	1456.259
285.000	0.0186	9.478	0.00079	0.00008	0.99816	0.00107	-0.00955	13.424	1405.313
290.000	0.0246	9.430	0.00102	0.00011	0.99773	0.00136	-0.00961	13.039	1356.040
295.000	0.0323	9.382	0.00132	0.00014	0.99722	0.00171	-0.00968	12.665	1308.358
298.150	0.0380	9.351	0.00154	0.00016	0.99686	0.00196	-0.00972	12.435	1279.101
300.000	0.0418	9.333	0.00168	0.00018	0.99663	0.00213	-0.00974	12.302	1262.191
305.000	0.0536	9.284	0.00212	0.00023	0.99594	0.00262	-0.00981	11.950	1217.470
310.000	0.0682	9.235	0.00266	0.00029	0.99514	0.00321	-0.00988	11.607	1174.128
315.000	0.0859	9.185	0.00330	0.00036	0.99423	0.00389	-0.00996	11.274	1132.103
320.000	0.1072	9.135	0.00406	0.00044	0.99319	0.00468	-0.01003	10.951	1091.338
325.000	0.1328	9.085	0.00496	0.00054	0.99202	0.00559	-0.01011	10.635	1051.779
330.000	0.1633	9.034	0.00601	0.00066	0.99069	0.00662	-0.01019	10.328	1013.375
335.000	0.1993	8.983	0.00723	0.00080	0.98920	0.00780	-0.01027	10.029	976.079
340.000	0.2416	8.932	0.00865	0.00096	0.98754	0.00913	-0.01035	9.738	939.847
345.000	0.2908	8.880	0.01029	0.00114	0.98569	0.01061	-0.01044	9.453	904.636
350.000	0.3480	8.827	0.01216	0.00135	0.98364	0.01227	-0.01053	9.176	870.407
355.000	0.4139	8.774	0.01429	0.00160	0.98138	0.01412	-0.01062	8.905	837.124
360.000	0.4895	8.721	0.01671	0.00188	0.97889	0.01615	-0.01072	8.641	804.753
365.000	0.5757	8.667	0.01943	0.00219	0.97617	0.01839	-0.01082	8.383	773.260
370.000	0.6738	8.613	0.02250	0.00254	0.97320	0.02085	-0.01092	8.131	742.616
375.000	0.7846	8.558	0.02594	0.00294	0.96997	0.02352	-0.01103	7.884	712.793
380.000	0.9094	8.503	0.02978	0.00339	0.96648	0.02643	-0.01114	7.643	683.762
383.764	1.0133	8.461	0.03295	0.00375	0.96366	0.02878	-0.01123	7.465	662.415
385.000	1.0493	8.447	0.03405	0.00388	0.96270	0.02958	-0.01125	7.407	655.500
390.000	1.2056	8.390	0.03878	0.00443	0.95863	0.03299	-0.01138	7.177	627.983
395.000	1.3796	8.333	0.04402	0.00504	0.95426	0.03665	-0.01150	6.951	601.188
400.000	1.5725	8.275	0.04979	0.00571	0.94958	0.04058	-0.01163	6.730	575.095
405.000	1.7858	8.217	0.05614	0.00645	0.94459	0.04478	-0.01177	6.513	549.684
410.000	2.0208	8.157	0.06311	0.00727	0.93928	0.04927	-0.01191	6.301	524.938
415.000	2.2789	8.097	0.07074	0.00816	0.93364	0.05404	-0.01206	6.094	500.839
420.000	2.5617	8.037	0.07908	0.00913	0.92766	0.05912	-0.01222	5.890	477.372
425.000	2.8706	7.975	0.08817	0.01019	0.92136	0.06449	-0.01238	5.691	454.521
430.000	3.2072	7.913	0.09807	0.01134	0.91471	0.07018	-0.01255	5.496	432.273
435.000	3.5730	7.850	0.10883	0.01258	0.90772	0.07619	-0.01273	5.304	410.616
440.000	3.9696	7.786	0.12051	0.01394	0.90040	0.08253	-0.01292	5.116	389.536
445.000	4.3988	7.721	0.13317	0.01540	0.89273	0.08919	-0.01312	4.932	369.023
450.000	4.8621	7.654	0.14688	0.01698	0.88471	0.09619	-0.01333	4.751	349.067
455.000	5.3613	7.587	0.16171	0.01868	0.87636	0.10354	-0.01356	4.574	329.659
460.000	5.8981	7.519	0.17773	0.02051	0.86766	0.11124	-0.01380	4.400	310.790
465.000	6.4743	7.449	0.19503	0.02248	0.85862	0.11930	-0.01405	4.229	292.451
470.000	7.0917	7.378	0.21369	0.02460	0.84924	0.12773	-0.01432	4.061	274.637
475.000	7.7523	7.306	0.23381	0.02687	0.83951	0.13654	-0.01461	3.897	257.340
480.000	8.4578	7.232	0.25550	0.02930	0.82944	0.14573	-0.01492	3.735	240.556
485.000	9.2102	7.157	0.27887	0.03191	0.81901	0.15531	-0.01525	3.576	224.279
490.000	10.0115	7.080	0.30405	0.03471	0.80822	0.16530	-0.01561	3.421	208.505

Table 17. Properties of saturated liquid toluene - Continued

T K	P bar	ρ_l mol/L	ρ_g mol/L	Z_l	Z_g	dP_σ/dT bar/K	$d\rho_l/dT$ mol/(L·K)	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol
495.000	10.8639	7.000	0.33117	0.03771	0.79706	0.17571	-0.01600	3.268	193.230
500.000	11.7694	6.919	0.36041	0.04091	0.78551	0.18655	-0.01643	3.118	178.453
505.000	12.7302	6.836	0.39193	0.04435	0.77356	0.19784	-0.01689	2.970	164.171
510.000	13.7485	6.750	0.42596	0.04803	0.76118	0.20958	-0.01739	2.825	150.383
515.000	14.8268	6.662	0.46271	0.05197	0.74833	0.22181	-0.01795	2.683	137.089
520.000	15.9674	6.571	0.50247	0.05620	0.73499	0.23453	-0.01857	2.543	124.291
525.000	17.1730	6.476	0.54558	0.06075	0.72110	0.24778	-0.01927	2.406	111.989
530.000	18.4461	6.378	0.59241	0.06563	0.70659	0.26159	-0.02005	2.270	100.187
535.000	19.7898	6.276	0.64347	0.07089	0.69139	0.27598	-0.02094	2.137	88.889
540.000	21.2070	6.168	0.69933	0.07657	0.67541	0.29099	-0.02196	2.006	78.103
545.000	22.7009	6.056	0.76076	0.08273	0.65851	0.30668	-0.02316	1.878	67.834
550.000	24.2750	5.936	0.82873	0.08942	0.64054	0.32310	-0.02457	1.751	58.095
555.000	25.9332	5.809	0.90453	0.09674	0.62131	0.34032	-0.02628	1.625	48.898
560.000	27.6797	5.673	0.98992	0.10479	0.60053	0.35842	-0.02839	1.502	40.260
565.000	29.5191	5.525	1.08742	0.11374	0.57786	0.37753	-0.03109	1.379	32.204
570.000	31.4569	5.361	1.20077	0.12382	0.55277	0.39780	-0.03469	1.257	24.759
575.000	33.4994	5.175	1.33599	0.13540	0.52448	0.41943	-0.03979	1.134	17.967
580.000	35.6541	4.958	1.50377	0.14912	0.49166	0.44278	-0.04775	1.010	11.888
585.000	37.9309	4.687	1.72651	0.16638	0.45168	0.46840	-0.06249	0.882	6.614
590.000	40.3440	4.294	2.07120	0.19152	0.39707	0.49765	-0.10377	0.739	2.324
592.000	41.3527	4.040	2.30449	0.20798	0.36456	0.51128	-0.16204	0.669	0.974
593.000	41.8677	3.840	2.49088	0.22116	0.34091	0.51906	-0.25642	0.625	0.412
593.500	42.1283	3.680	2.64091	0.23200	0.32327	0.52351	-0.41447	0.595	0.172
593.800	42.2858	3.510	2.80136	0.24400	0.30574	0.52667	-0.84266	0.568	0.049
593.950	42.3650	3.150	3.15000	0.27234	0.27234	0.52900		0.529	0.000

Table 17. Properties of saturated liquid toluene - Continued

T K	$\Delta_{vap}H$ J/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_σ J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
178.150	44666.6	-0.0	0.0	149.894	98.9	135.3	135.3	1.00000	-0.0605	2138
180.000	44560.8	224.1	224.1	151.140	98.9	135.5	135.5	1.00000	-0.0604	2123
190.000	43987.1	1457.2	1457.2	157.768	99.2	136.3	136.3	1.00000	-0.0598	2043
200.000	43412.5	2724.2	2724.2	164.227	99.7	137.3	137.3	1.00000	-0.0591	1968
210.000	42839.1	4022.7	4022.7	170.526	100.5	138.4	138.4	1.00000	-0.0583	1896
220.000	42268.6	5350.8	5350.8	176.678	101.5	139.7	139.7	1.00000	-0.0573	1827
230.000	41702.6	6707.2	6707.2	182.691	102.7	141.3	141.3	1.00000	-0.0563	1761
240.000	41142.3	8091.2	8091.2	188.577	104.1	143.0	143.0	1.00000	-0.0551	1698
250.000	40588.5	9502.5	9502.5	194.343	105.8	144.9	144.9	1.00000	-0.0539	1637
255.000	40314.2	10218.3	10218.4	197.185	106.6	146.0	146.0	1.00000	-0.0533	1608
260.000	40041.6	10941.1	10941.2	200.000	107.6	147.1	147.1	1.00000	-0.0526	1579
265.000	39770.8	11670.8	11670.9	202.790	108.5	148.2	148.2	1.00000	-0.0519	1550
270.000	39501.7	12407.6	12407.7	205.556	109.5	149.4	149.4	1.00000	-0.0512	1522
275.000	39234.1	13151.5	13151.6	208.298	110.6	150.7	150.7	1.00000	-0.0505	1494
280.000	38968.1	13902.6	13902.8	211.018	111.7	152.0	152.0	1.00000	-0.0497	1467
285.000	38703.5	14661.1	14661.3	213.716	112.8	153.3	153.3	0.99851	-0.0490	1440
290.000	38440.1	15427.1	15427.3	216.394	114.0	154.7	154.7	0.99644	-0.0482	1414
295.000	38177.8	16200.7	16201.0	219.052	115.2	156.1	156.1	0.99431	-0.0474	1387
298.150	38013.0	16692.0	16692.4	220.717	116.0	157.0	157.0	0.99296	-0.0469	1371
300.000	37916.4	16982.0	16982.4	221.691	116.4	157.6	157.6	0.99216	-0.0467	1362
305.000	37655.5	17771.2	17771.8	224.312	117.7	159.1	159.1	0.98999	-0.0458	1336
310.000	37395.1	18568.4	18569.2	226.916	119.0	160.6	160.6	0.98783	-0.0450	1311
315.000	37134.8	19373.8	19374.8	229.504	120.3	162.1	162.1	0.98568	-0.0442	1287
320.000	36874.3	20187.5	20188.7	232.075	121.7	163.7	163.7	0.98357	-0.0433	1262
325.000	36613.3	21009.7	21011.1	234.632	123.0	165.4	165.4	0.98148	-0.0425	1238
330.000	36351.5	21840.4	21842.2	237.174	124.4	167.0	167.0	0.97943	-0.0416	1214
335.000	36088.5	22679.8	22682.0	239.703	125.9	168.7	168.7	0.97742	-0.0407	1191
340.000	35824.1	23528.0	23530.7	242.218	127.3	170.4	170.4	0.97545	-0.0398	1168
345.000	35557.8	24385.1	24388.4	244.721	128.8	172.1	172.1	0.97350	-0.0389	1145
350.000	35289.2	25251.2	25255.2	247.213	130.3	173.8	173.8	0.97158	-0.0380	1122
355.000	35018.1	26126.4	26131.2	249.692	131.8	175.5	175.5	0.96966	-0.0370	1099
360.000	34743.9	27010.8	27016.5	252.161	133.3	177.3	177.3	0.96773	-0.0360	1077
365.000	34466.4	27904.5	27911.1	254.620	134.8	179.1	179.1	0.96579	-0.0350	1055
370.000	34185.1	28807.4	28815.2	257.069	136.4	180.8	180.8	0.96380	-0.0340	1033
375.000	33899.7	29719.6	29728.8	259.509	137.9	182.6	182.6	0.96174	-0.0330	1011
380.000	33609.9	30641.2	30651.9	261.939	139.5	184.4	184.4	0.95960	-0.0319	990
383.764	33388.4	31341.3	31353.2	263.763	140.7	185.8	185.8	0.95792	-0.0311	974
385.000	33315.1	31572.2	31584.6	264.361	141.1	186.2	186.2	0.95735	-0.0308	969
390.000	33015.2	32512.6	32526.9	266.775	142.7	188.1	188.1	0.95496	-0.0297	947
395.000	32709.8	33462.3	33478.8	269.181	144.3	189.9	190.0	0.95240	-0.0286	926
400.000	32398.5	34421.3	34440.3	271.580	145.8	191.7	191.8	0.94965	-0.0274	906
405.000	32081.0	35389.6	35411.4	273.972	147.4	193.5	193.7	0.94668	-0.0261	885
410.000	31757.1	36367.2	36392.0	276.356	149.0	195.4	195.6	0.94345	-0.0249	864
415.000	31426.5	37354.0	37382.1	278.735	150.6	197.2	197.6	0.93995	-0.0235	844
420.000	31089.0	38349.8	38381.7	281.107	152.2	199.1	199.5	0.93613	-0.0222	823
425.000	30744.2	39354.8	39390.8	283.473	153.8	200.9	201.4	0.93199	-0.0207	803
430.000	30392.1	40368.7	40409.2	285.833	155.4	202.8	203.4	0.92748	-0.0192	783
435.000	30032.2	41391.4	41436.9	288.188	157.0	204.6	205.4	0.92259	-0.0176	763
440.000	29664.5	42423.0	42474.0	290.537	158.6	206.5	207.3	0.91731	-0.0160	743
445.000	29288.7	43463.2	43520.2	292.881	160.1	208.4	209.3	0.91160	-0.0142	723
450.000	28904.6	44512.1	44575.6	295.221	161.7	210.2	211.3	0.90547	-0.0124	703
455.000	28512.0	45569.5	45640.2	297.555	163.2	212.1	213.4	0.89889	-0.0104	683
460.000	28110.5	46635.4	46713.9	299.885	164.8	214.0	215.4	0.89187	-0.0083	664
465.000	27699.9	47709.8	47796.7	302.211	166.3	215.9	217.5	0.88440	-0.0060	644
470.000	27279.9	48792.5	48888.6	304.532	167.8	217.8	219.6	0.87649	-0.0036	624
475.000	26850.0	49883.6	49989.7	306.850	169.3	219.8	221.8	0.86815	-0.0010	604
480.000	26409.8	50983.1	51100.1	309.164	170.8	221.8	224.0	0.85939	0.0019	585
485.000	25958.8	52091.2	52219.9	311.475	172.3	223.8	226.3	0.85024	0.0050	565
490.000	25496.1	53207.8	53349.3	313.782	173.7	225.8	228.6	0.84072	0.0084	545

Table 17. Properties of saturated liquid toluene - Continued

T K	$\Delta_{vap}H$ J/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_σ J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
495.000	25021.0	54333.3	54488.5	316.087	175.2	227.9	231.0	0.83087	0.0121	525
500.000	24532.4	55467.8	55637.9	318.389	176.6	230.0	233.5	0.82072	0.0162	506
505.000	24029.2	56611.6	56797.9	320.690	178.0	232.2	236.1	0.81032	0.0208	486
510.000	23509.9	57765.3	57969.0	322.990	179.5	234.4	238.9	0.79972	0.0260	466
515.000	22972.6	58929.4	59152.0	325.289	180.9	236.8	241.8	0.78897	0.0318	445
520.000	22415.2	60104.6	60347.6	327.589	182.3	239.2	245.0	0.77814	0.0385	425
525.000	21835.1	61291.8	61556.9	329.891	183.8	241.8	248.5	0.76730	0.0461	405
530.000	21229.0	62492.1	62781.3	332.196	185.3	244.6	252.3	0.75650	0.0549	384
535.000	20593.0	63706.9	64022.3	334.506	186.8	247.7	256.6	0.74583	0.0652	364
540.000	19922.2	64938.1	65281.9	336.824	188.4	251.1	261.5	0.73537	0.0774	343
545.000	19210.4	66187.9	66562.8	339.153	190.0	254.8	267.3	0.72519	0.0921	321
550.000	18449.8	67459.2	67868.1	341.498	191.9	259.2	274.2	0.71538	0.1101	300
555.000	17630.2	68755.8	69202.2	343.863	193.9	264.3	282.7	0.70601	0.1325	278
560.000	16738.1	70083.0	70570.9	346.257	196.2	270.5	293.6	0.69718	0.1610	255
565.000	15754.8	71447.8	71982.1	348.693	198.9	278.4	308.2	0.68896	0.1984	232
570.000	14653.4	72860.7	73447.5	351.187	202.3	288.9	328.8	0.68140	0.2494	208
575.000	13391.8	74338.3	74985.6	353.769	206.9	303.8	360.6	0.67453	0.3222	184
580.000	11898.1	75909.2	76628.3	356.492	213.6	327.3	416.2	0.66831	0.4334	158
585.000	10024.7	77633.7	78443.0	359.467	224.8	371.4	537.8	0.66250	0.6204	131
590.000	7338.5	79691.5	80631.1	363.042	251.1	496.4	1002.5	0.65606	0.9913	100
592.000	5641.4	80774.2	81797.9	364.965	279.9	673.9	1947.7	0.65227	1.2671	85
593.000	4340.5	81505.5	82595.9	366.298	315.6	961.7	4125.7	0.64928	1.4719	76
593.500	3321.5	82025.6	83170.4	367.270	360.6	1443.9	9359.1	0.64687	1.6131	69
593.800	2254.1	82527.5	83732.1	368.233	443.8	2750.0	31951.1	0.64432	1.7343	62
593.950	0.0	83478.6	84823.5	370.125				0.63939	1.8904	0

Table 18. Properties of toluene along isobars

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
					0.1 bar							
178.153	10.4387	0.00065	26.21056	3077.145	0	1	149.896	98	135	0.00000	-0.0605	2138
180.000	10.4230	0.00064	25.87051	3032.218	223	224	151.139	98	135	0.00001	-0.0604	2123
190.000	10.3373	0.00061	24.13832	2803.576	1457	1457	157.768	99	136	0.00003	-0.0598	2043
200.000	10.2508	0.00059	22.57019	2596.950	2724	2725	164.226	99	137	0.00011	-0.0591	1968
210.000	10.1635	0.00056	21.14266	2409.223	4022	4023	170.525	100	138	0.00039	-0.0583	1896
220.000	10.0753	0.00054	19.83655	2237.848	5350	5351	176.677	101	139	0.00118	-0.0573	1827
230.000	9.9862	0.00052	18.63601	2080.722	6707	6708	182.690	102	141	0.00321	-0.0563	1761
240.000	9.8961	0.00051	17.52784	1936.093	8090	8092	188.576	104	143	0.00792	-0.0551	1698
250.000	9.8051	0.00049	16.50096	1802.491	9502	9503	194.342	105	145	0.01796	-0.0539	1637
260.000	9.7130	0.00048	15.54601	1678.676	10940	10941	199.999	107	147	0.03780	-0.0526	1579
270.000	9.6198	0.00046	14.65502	1563.588	12407	12408	205.555	109	149	0.07453	-0.0512	1522
280.000	9.5255	0.00045	13.82115	1456.321	13902	13903	211.017	111	152	0.13873	-0.0497	1467
290.000	9.4300	0.00044	13.03855	1356.096	15426	15427	216.393	113	154	0.24539	-0.0482	1414
300.000	9.3332	0.00043	12.30211	1262.237	16981	16982	221.690	116	157	0.41482	-0.0467	1362
310.000	9.2351	0.00042	11.60742	1174.154	18568	18569	226.916	118	160	0.67350	-0.0450	1311
318.408	9.1514	0.00041	11.05281	1104.187	19927	19928	231.258	121	163	0.98424	-0.0436	1270
318.408	0.0038	0.99354	0.00032	26.142	54255	56885	347.327	104	113	0.98424	4.3656	175
320.000	0.0038	0.99363	0.00032	26.278	54428	57072	347.835	105	113	0.99326	4.1945	175
330.000	0.0037	0.99414	0.00031	27.129	55497	58225	351.383	108	117	0.99375	3.5926	178
340.000	0.0036	0.99457	0.00030	27.976	56601	59413	354.931	112	120	0.99418	3.2123	180
350.000	0.0035	0.99495	0.00029	28.821	57741	60637	358.478	115	124	0.99456	2.9182	183
360.000	0.0034	0.99528	0.00028	29.664	58917	61896	362.024	119	127	0.99491	2.6765	185
370.000	0.0033	0.99558	0.00027	30.507	60127	63190	365.569	122	131	0.99522	2.4720	188
380.000	0.0032	0.99586	0.00026	31.348	61371	64518	369.111	126	134	0.99550	2.2956	190
390.000	0.0031	0.99610	0.00026	32.188	62650	65880	372.649	129	137	0.99576	2.1415	192
400.000	0.0030	0.99632	0.00025	33.028	63962	67276	376.183	132	141	0.99600	2.0055	195
410.000	0.0029	0.99653	0.00025	33.867	65308	68705	379.711	136	144	0.99622	1.8845	197
420.000	0.0029	0.99671	0.00024	34.706	66686	70166	383.233	139	147	0.99641	1.7761	199
430.000	0.0028	0.99689	0.00023	35.544	68096	71660	386.748	142	150	0.99660	1.6784	202
440.000	0.0027	0.99704	0.00023	36.382	69538	73185	390.254	145	154	0.99677	1.5901	204
450.000	0.0027	0.99719	0.00022	37.219	71010	74741	393.751	148	157	0.99693	1.5097	206
460.000	0.0026	0.99733	0.00022	38.056	72514	76328	397.238	151	160	0.99707	1.4364	208
470.000	0.0026	0.99745	0.00021	38.893	74047	77945	400.714	154	163	0.99721	1.3692	210
480.000	0.0025	0.99757	0.00021	39.729	75609	79591	404.179	157	166	0.99734	1.3075	213
490.000	0.0025	0.99768	0.00020	40.565	77201	81265	407.633	160	168	0.99746	1.2505	215
500.000	0.0024	0.99778	0.00020	41.401	78820	82968	411.073	163	171	0.99757	1.1979	217
510.000	0.0024	0.99788	0.00020	42.237	80468	84699	414.501	166	174	0.99767	1.1491	219
520.000	0.0023	0.99797	0.00019	43.073	82143	86457	417.915	168	177	0.99777	1.1038	221
530.000	0.0023	0.99805	0.00019	43.908	83844	88242	421.314	171	179	0.99786	1.0616	223
540.000	0.0022	0.99813	0.00019	44.743	85572	90053	424.699	174	182	0.99795	1.0222	225
550.000	0.0022	0.99821	0.00018	45.578	87325	91890	428.070	176	184	0.99803	0.9854	227
560.000	0.0022	0.99828	0.00018	46.413	89104	93752	431.425	179	187	0.99811	0.9509	229
570.000	0.0021	0.99834	0.00018	47.248	90907	95639	434.764	181	189	0.99818	0.9186	231
580.000	0.0021	0.99841	0.00017	48.082	92735	97550	438.087	183	192	0.99825	0.8881	233
585.000	0.0021	0.99844	0.00017	48.500	93658	98514	439.743	185	193	0.99828	0.8736	234
590.000	0.0020	0.99846	0.00017	48.917	94586	99484	441.394	186	194	0.99831	0.8595	235
593.000	0.0020	0.99848	0.00017	49.167	95146	100069	442.383	186	195	0.99833	0.8512	236
595.000	0.0020	0.99849	0.00017	49.334	95521	100460	443.042	187	195	0.99835	0.8458	236
600.000	0.0020	0.99852	0.00017	49.751	96461	101442	444.685	188	196	0.99838	0.8324	237
610.000	0.0020	0.99857	0.00016	50.585	98359	103423	447.959	190	199	0.99844	0.8069	239
620.000	0.0019	0.99862	0.00016	51.420	100279	105426	451.217	193	201	0.99849	0.7828	241
630.000	0.0019	0.99867	0.00016	52.254	102220	107452	454.457	195	203	0.99854	0.7599	243
640.000	0.0019	0.99872	0.00016	53.088	104184	109498	457.680	197	205	0.99859	0.7382	245
660.000	0.0018	0.99880	0.00015	54.755	108174	113655	464.076	201	209	0.99869	0.6981	248
680.000	0.0018	0.99888	0.00015	56.423	112246	117893	470.401	205	213	0.99877	0.6617	252
700.000	0.0017	0.99895	0.00014	58.090	116396	122210	476.657	209	217	0.99885	0.6287	256
750.000	0.0016	0.99910	0.00013	62.257	127094	133325	491.990	218	226	0.99902	0.5579	264
800.000	0.0015	0.99922	0.00013	66.422	138223	144869	506.889	226	234	0.99915	0.5004	273
					0.2 bar							
178.156	10.4387	0.00129	26.20952	3077.109	0	2	149.897	98	135	0.00000	-0.0605	2138
180.000	10.4230	0.00128	25.87007	3032.260	223	225	151.139	98	135	0.00000	-0.0604	2123
190.000	10.3373	0.00122	24.13793	2803.622	1456	1458	157.767	99	136	0.00001	-0.0598	2043
200.000	10.2508	0.00117	22.56985	2596.998	2723	2725	164.225	99	137	0.00006	-0.0591	1968
210.000	10.1635	0.00113	21.14237	2409.275	4022	4024	170.525	100	138	0.00019	-0.0583	1896
220.000	10.0753	0.00109	19.83630	2237.903	5350	5352	176.676	101	139	0.00059	-0.0573	1827
230.000	9.9862	0.00105	18.63580	2080.779	6706	6708	182.689	102	141	0.00161	-0.0563	1761

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
240.000	9.8962	0.00101	17.52767	1936.153	8090	8092	188.575	104	143	0.00396	-0.0551	1698
250.000	9.8051	0.00098	16.50083	1802.555	9501	9504	194.342	105	145	0.00898	-0.0539	1637
260.000	9.7131	0.00095	15.54591	1678.742	10940	10942	199.998	107	147	0.01891	-0.0526	1579
270.000	9.6199	0.00093	14.65495	1563.657	12407	12409	205.554	109	149	0.03728	-0.0512	1522
280.000	9.5256	0.00090	13.82112	1456.393	13902	13904	211.016	111	152	0.06940	-0.0497	1467
290.000	9.4301	0.00088	13.03855	1356.171	15426	15428	216.392	113	154	0.12275	-0.0482	1414
300.000	9.3333	0.00086	12.30214	1262.315	16981	16983	221.689	116	157	0.20750	-0.0467	1362
310.000	9.2351	0.00084	11.60749	1174.235	18567	18570	226.915	118	160	0.33689	-0.0450	1311
320.000	9.1356	0.00082	10.95072	1091.416	20187	20189	232.074	121	163	0.52758	-0.0433	1262
330.000	9.0344	0.00081	10.32844	1013.407	21840	21842	237.174	124	167	0.79989	-0.0416	1214
335.089	8.9824	0.00080	10.02405	975.427	22694	22696	239.748	125	168	0.97739	-0.0407	1190
335.089	0.0073	0.98918	0.00061	27.269	56024	58780	347.432	110	119	0.97739	3.7899	178
340.000	0.0071	0.98962	0.00060	27.698	56576	59373	349.094	112	120	0.98894	3.4260	179
350.000	0.0069	0.99042	0.00058	28.561	57718	60600	352.651	115	124	0.98971	3.0002	182
360.000	0.0067	0.99110	0.00056	29.419	58895	61861	356.204	119	127	0.99038	2.7016	184
370.000	0.0066	0.99170	0.00055	30.274	60106	63157	359.754	122	131	0.99099	2.4649	187
380.000	0.0064	0.99224	0.00053	31.126	61352	64487	363.300	126	134	0.99154	2.2682	189
390.000	0.0062	0.99272	0.00052	31.977	62632	65851	366.842	129	138	0.99204	2.1005	192
400.000	0.0061	0.99316	0.00051	32.825	63945	67248	370.379	132	141	0.99249	1.9551	194
410.000	0.0059	0.99356	0.00049	33.673	65291	68678	373.911	136	144	0.99291	1.8275	197
420.000	0.0058	0.99392	0.00048	34.519	66670	70141	377.435	139	147	0.99329	1.7146	199
430.000	0.0056	0.99425	0.00047	35.364	68081	71635	380.952	142	151	0.99364	1.6138	201
440.000	0.0055	0.99455	0.00046	36.208	69523	73161	384.460	145	154	0.99396	1.5233	203
450.000	0.0054	0.99484	0.00045	37.051	70996	74718	387.958	148	157	0.99426	1.4415	206
460.000	0.0053	0.99509	0.00044	37.894	72500	76306	391.447	151	160	0.99454	1.3674	208
470.000	0.0051	0.99533	0.00043	38.736	74033	77923	394.925	154	163	0.99480	1.2998	210
480.000	0.0050	0.99556	0.00042	39.577	75596	79570	398.392	157	166	0.99504	1.2380	212
490.000	0.0049	0.99576	0.00041	40.418	77188	81245	401.846	160	168	0.99526	1.1813	214
500.000	0.0048	0.99596	0.00040	41.258	78808	82949	405.288	163	171	0.99547	1.1291	216
510.000	0.0047	0.99614	0.00039	42.098	80456	84680	408.716	166	174	0.99567	1.0809	219
520.000	0.0046	0.99631	0.00039	42.937	82131	86439	412.131	168	177	0.99585	1.0363	221
530.000	0.0046	0.99646	0.00038	43.776	83833	88224	415.532	171	179	0.99602	0.9948	223
540.000	0.0045	0.99661	0.00037	44.615	85561	90035	418.918	174	182	0.99619	0.9563	225
550.000	0.0044	0.99675	0.00037	45.453	87314	91872	422.289	176	184	0.99634	0.9203	227
560.000	0.0043	0.99688	0.00036	46.291	89093	93735	425.644	179	187	0.99648	0.8867	229
570.000	0.0042	0.99701	0.00035	47.129	90897	95622	428.984	181	189	0.99662	0.8553	231
580.000	0.0042	0.99712	0.00035	47.967	92725	97533	432.308	183	192	0.99675	0.8258	233
585.000	0.0041	0.99718	0.00034	48.386	93648	98498	433.964	185	193	0.99681	0.8117	234
590.000	0.0041	0.99723	0.00034	48.804	94576	99468	435.616	186	194	0.99687	0.7981	235
593.000	0.0041	0.99727	0.00034	49.055	95136	100053	436.605	186	195	0.99691	0.7901	235
595.000	0.0041	0.99729	0.00034	49.223	95511	100445	437.264	187	195	0.99693	0.7848	236
600.000	0.0040	0.99734	0.00033	49.641	96451	101427	438.907	188	196	0.99699	0.7720	237
610.000	0.0040	0.99744	0.00033	50.478	98349	103408	442.182	190	199	0.99710	0.7474	239
620.000	0.0039	0.99753	0.00032	51.315	100269	105411	445.440	193	201	0.99720	0.7242	241
630.000	0.0038	0.99762	0.00032	52.151	102211	107437	448.681	195	203	0.99730	0.7022	242
640.000	0.0038	0.99771	0.00031	52.988	104175	109484	451.905	197	205	0.99739	0.6814	244
660.000	0.0037	0.99786	0.00030	54.660	108165	113641	458.301	201	209	0.99757	0.6430	248
680.000	0.0035	0.99800	0.00029	56.331	112237	117880	464.627	205	213	0.99773	0.6084	252
700.000	0.0034	0.99813	0.00029	58.002	116387	122197	470.883	209	217	0.99787	0.5769	255
750.000	0.0032	0.99841	0.00027	62.178	127087	133312	486.218	218	226	0.99818	0.5099	264
800.000	0.0030	0.99863	0.00025	66.350	138215	144858	501.118	226	234	0.99843	0.4557	273
					0.5 bar							
178.166	10.4388	0.00323	26.20641	3076.998	1	6	149.901	98	135	0.00000	-0.0605	2138
180.000	10.4231	0.00321	25.86877	3032.386	223	228	151.136	98	135	0.00000	-0.0604	2122
190.000	10.3374	0.00306	24.13678	2803.758	1456	1461	157.764	99	136	0.00001	-0.0598	2043
200.000	10.2509	0.00293	22.56885	2597.144	2723	2728	164.223	99	137	0.00002	-0.0591	1968
210.000	10.1636	0.00282	21.14150	2409.430	4021	4026	170.522	100	138	0.00008	-0.0583	1896
220.000	10.0754	0.00271	19.83556	2238.066	5349	5354	176.673	101	139	0.00024	-0.0573	1827
230.000	9.9863	0.00262	18.63517	2080.952	6706	6711	182.687	102	141	0.00064	-0.0563	1762
240.000	9.8963	0.00253	17.52716	1936.334	8090	8095	188.572	104	143	0.00159	-0.0551	1698
250.000	9.8053	0.00245	16.50043	1802.744	9501	9506	194.339	105	145	0.00360	-0.0539	1637
260.000	9.7132	0.00238	15.54562	1678.940	10939	10944	199.995	107	147	0.00757	-0.0526	1579
270.000	9.6201	0.00232	14.65476	1563.864	12406	12411	205.551	109	149	0.01493	-0.0512	1522
280.000	9.5258	0.00225	13.82104	1456.608	13901	13906	211.013	111	152	0.02780	-0.0498	1467
290.000	9.4303	0.00220	13.03856	1356.395	15425	15430	216.389	113	154	0.04917	-0.0482	1414
300.000	9.3335	0.00215	12.30226	1262.548	16980	16985	221.686	116	157	0.08311	-0.0467	1362

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
310.000	9.2354	0.00210	11.60770	1174.477	18566	18572	226.911	118	160	0.13493	-0.0450	1311
320.000	9.1358	0.00206	10.95103	1091.668	20186	20191	232.071	121	163	0.21129	-0.0433	1262
330.000	9.0347	0.00202	10.32886	1013.668	21839	21844	237.170	124	166	0.32034	-0.0416	1215
340.000	8.9320	0.00198	9.73819	940.080	23526	23532	242.215	127	170	0.47173	-0.0398	1168
350.000	8.8275	0.00195	9.17637	870.549	25250	25256	247.210	130	173	0.67657	-0.0380	1122
360.000	8.7211	0.00192	8.64105	804.763	27010	27016	252.161	133	177	0.94739	-0.0360	1077
360.646	8.7142	0.00191	8.60730	800.632	27125	27131	252.480	133	177	0.96748	-0.0359	1074
360.646	0.0170	0.97856	0.00145	28.704	58905	61839	348.719	120	129	0.96748	3.1589	183
370.000	0.0166	0.98015	0.00140	29.562	60041	63056	351.963	123	132	0.97908	2.6833	185
380.000	0.0161	0.98159	0.00136	30.458	61292	64393	355.528	126	135	0.98040	2.3906	188
390.000	0.0157	0.98286	0.00132	31.345	62576	65763	359.085	129	138	0.98162	2.1700	190
400.000	0.0153	0.98398	0.00128	32.225	63892	67165	362.634	133	141	0.98273	1.9907	193
410.000	0.0149	0.98499	0.00125	33.100	65241	68599	366.176	136	145	0.98373	1.8396	195
420.000	0.0145	0.98589	0.00122	33.971	66622	70065	369.709	139	148	0.98464	1.7097	197
430.000	0.0142	0.98672	0.00119	34.839	68035	71563	373.233	142	151	0.98547	1.5963	200
440.000	0.0138	0.98747	0.00116	35.704	69479	73092	376.748	145	154	0.98624	1.4962	202
450.000	0.0135	0.98816	0.00113	36.567	70954	74651	380.253	148	157	0.98695	1.4072	204
460.000	0.0132	0.98879	0.00111	37.427	72459	76241	383.747	151	160	0.98761	1.3274	207
470.000	0.0129	0.98937	0.00108	38.286	73994	77861	387.229	154	163	0.98821	1.2555	209
480.000	0.0127	0.98991	0.00106	39.142	75559	79509	390.700	157	166	0.98877	1.1903	211
490.000	0.0124	0.99040	0.00104	39.998	77152	81187	394.159	160	169	0.98930	1.1310	213
500.000	0.0121	0.99087	0.00101	40.852	78773	82892	397.604	163	171	0.98979	1.0768	215
510.000	0.0119	0.99130	0.00099	41.704	80422	84625	401.036	166	174	0.99024	1.0271	218
520.000	0.0117	0.99170	0.00097	42.556	82098	86385	404.454	168	177	0.99067	0.9814	220
530.000	0.0114	0.99207	0.00095	43.406	83800	88172	407.857	171	179	0.99107	0.9392	222
540.000	0.0112	0.99242	0.00094	44.256	85529	89985	411.245	174	182	0.99145	0.9001	224
550.000	0.0110	0.99275	0.00092	45.104	87284	91823	414.619	176	185	0.99180	0.8638	226
560.000	0.0108	0.99306	0.00090	45.952	89063	93687	417.977	179	187	0.99213	0.8301	228
570.000	0.0106	0.99335	0.00089	46.799	90867	95575	421.319	181	190	0.99245	0.7986	230
580.000	0.0104	0.99362	0.00087	47.646	92696	97488	424.645	183	192	0.99274	0.7693	232
585.000	0.0103	0.99375	0.00086	48.069	93619	98453	426.301	185	193	0.99288	0.7553	233
590.000	0.0103	0.99388	0.00086	48.492	94548	99424	427.954	186	194	0.99302	0.7418	234
593.000	0.0102	0.99395	0.00085	48.745	95108	100009	428.944	187	195	0.99310	0.7339	235
595.000	0.0102	0.99400	0.00085	48.914	95483	100400	429.603	187	195	0.99316	0.7287	235
600.000	0.0101	0.99412	0.00084	49.337	96424	101383	431.247	188	197	0.99329	0.7160	236
610.000	0.0099	0.99435	0.00083	50.182	98322	103365	434.523	190	199	0.99354	0.6917	238
620.000	0.0098	0.99456	0.00081	51.026	100243	105370	437.783	193	201	0.99377	0.6689	240
630.000	0.0096	0.99477	0.00080	51.869	102185	107396	441.025	195	203	0.99400	0.6474	242
640.000	0.0094	0.99496	0.00079	52.713	104149	109444	444.250	197	205	0.99421	0.6271	244
660.000	0.0092	0.99533	0.00076	54.398	108141	113603	450.648	201	209	0.99461	0.5898	248
680.000	0.0089	0.99565	0.00074	56.081	112213	117843	456.977	205	213	0.99497	0.5562	251
700.000	0.0086	0.99595	0.00072	57.764	116364	122161	463.235	209	217	0.99530	0.5259	255
750.000	0.0080	0.99657	0.00067	61.964	127065	133280	478.574	218	226	0.99600	0.4616	264
800.000	0.0075	0.99708	0.00063	66.159	138196	144828	493.477	226	234	0.99656	0.4101	272
					1.01325 bar							
178.182	10.4388	0.00655	26.20109	3076.811	2	12	149.908	98	135	0.00000	-0.0605	2137
180.000	10.4233	0.00650	25.86654	3032.603	222	232	151.132	98	135	0.00000	-0.0604	2122
190.000	10.3376	0.00620	24.13482	2803.991	1455	1465	157.760	99	136	0.00000	-0.0598	2043
200.000	10.2511	0.00594	22.56713	2597.393	2722	2732	164.218	99	137	0.00001	-0.0591	1968
210.000	10.1638	0.00571	21.14001	2409.695	4020	4030	170.518	100	138	0.00004	-0.0583	1896
220.000	10.0757	0.00550	19.83428	2238.347	5348	5358	176.669	101	139	0.00012	-0.0573	1827
230.000	9.9866	0.00531	18.63411	2081.247	6705	6715	182.682	102	141	0.00032	-0.0563	1762
240.000	9.8966	0.00513	17.52628	1936.644	8088	8099	188.567	104	143	0.00079	-0.0551	1698
250.000	9.8056	0.00497	16.49974	1803.069	9500	9510	194.334	105	145	0.00178	-0.0539	1638
260.000	9.7135	0.00483	15.54512	1679.280	10938	10948	199.990	107	147	0.00375	-0.0526	1579
270.000	9.6204	0.00469	14.65444	1564.218	12404	12415	205.546	109	149	0.00739	-0.0512	1522
280.000	9.5262	0.00457	13.82089	1456.977	13899	13910	211.007	111	152	0.01375	-0.0498	1467
290.000	9.4307	0.00446	13.03858	1356.779	15423	15434	216.383	113	154	0.02432	-0.0482	1414
300.000	9.3339	0.00435	12.30245	1262.947	16978	16989	221.680	116	157	0.04110	-0.0467	1362
310.000	9.2358	0.00426	11.60807	1174.891	18565	18576	226.905	118	160	0.06672	-0.0450	1312
320.000	9.1363	0.00417	10.95157	1092.098	20184	20195	232.064	121	163	0.10449	-0.0434	1263
330.000	9.0352	0.00409	10.32958	1014.115	21836	21848	237.164	124	166	0.15841	-0.0416	1215
340.000	8.9325	0.00401	9.73909	940.543	23524	23535	242.208	127	170	0.23325	-0.0398	1168
350.000	8.8281	0.00394	9.17746	871.030	25248	25259	247.204	130	173	0.33453	-0.0380	1122
360.000	8.7218	0.00388	8.64233	805.262	27008	27019	252.154	133	177	0.46842	-0.0360	1077
370.000	8.6134	0.00382	8.13158	742.959	28805	28817	257.064	136	180	0.64169	-0.0340	1033

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
350.000	8.8609	0.11634	9.24272	898.424	25113	25452	246.818	130	173	0.01265	-0.0387	1136
360.000	8.7572	0.11445	8.71809	833.619	26864	27206	251.752	133	176	0.01767	-0.0369	1092
370.000	8.6517	0.11272	8.21822	772.314	28651	28997	256.644	136	180	0.02417	-0.0350	1050
380.000	8.5443	0.11113	7.74130	714.263	30474	30825	261.499	139	183	0.03241	-0.0330	1008
390.000	8.4349	0.10968	7.28570	659.246	32335	32690	266.318	143	187	0.04265	-0.0310	967
400.000	8.3232	0.10838	6.84994	607.066	34232	34593	271.106	146	190	0.05518	-0.0288	927
410.000	8.2091	0.10720	6.43268	557.544	36166	36532	275.865	149	194	0.07026	-0.0265	887
420.000	8.0924	0.10616	6.03271	510.520	38137	38508	280.598	152	198	0.08812	-0.0241	848
430.000	7.9727	0.10525	5.64888	465.849	40143	40519	285.306	155	202	0.10896	-0.0215	809
440.000	7.8497	0.10447	5.28016	423.396	42185	42567	289.992	158	205	0.13294	-0.0186	771
450.000	7.7231	0.10382	4.92555	383.040	44261	44649	294.658	161	209	0.16015	-0.0155	733
460.000	7.5924	0.10331	4.58408	344.666	46371	46766	299.306	164	213	0.19060	-0.0120	696
470.000	7.4569	0.10295	4.25480	308.170	48515	48918	303.938	167	217	0.22423	-0.0080	658
480.000	7.3159	0.10275	3.93675	273.450	50694	51104	308.556	170	221	0.26095	-0.0034	620
490.000	7.1686	0.10272	3.62890	240.410	52908	53326	313.163	173	225	0.30057	0.0020	582
500.000	7.0136	0.10289	3.33010	208.955	55158	55586	317.764	175	229	0.34290	0.0084	544
510.000	6.8492	0.10329	3.03901	178.988	57450	57888	322.363	178	234	0.38774	0.0164	505
520.000	6.6730	0.10398	2.75391	150.408	59788	60238	326.971	181	239	0.43496	0.0267	465
530.000	6.4815	0.10503	2.47241	123.096	62183	62645	331.602	183	246	0.48451	0.0402	423
540.000	6.2689	0.10659	2.19078	96.904	64649	65128	336.278	186	254	0.53646	0.0594	378
550.000	6.0247	0.10889	1.90210	71.596	67217	67715	341.046	189	266	0.59110	0.0889	330
560.000	5.7263	0.11252	1.58897	46.649	69945	70469	346.003	194	286	0.64891	0.1420	273
566.265	5.4847	0.11617	1.34783	30.260	71800	72347	349.318	199	312	0.68698	0.2098	226
566.265	1.1144	0.57176	0.16857	9.835	85143	87835	376.670	210	342	0.68698	2.0192	131
570.000	1.0622	0.59595	0.14663	12.307	86145	88969	378.322	200	288	0.72286	1.7593	138
580.000	0.9697	0.64154	0.12291	16.582	88539	91633	382.952	195	251	0.73987	1.4057	152
585.000	0.9355	0.65927	0.11550	18.304	89664	92871	385.081	195	243	0.74721	1.2908	157
590.000	0.9061	0.67493	0.10946	19.871	90765	94076	387.136	195	238	0.75421	1.1971	162
593.000	0.8902	0.68354	0.10632	20.753	91418	94788	388.340	195	236	0.75826	1.1484	164
595.000	0.8801	0.68899	0.10438	21.320	91850	95259	389.133	195	234	0.76089	1.1185	166
600.000	0.8569	0.70177	0.09999	22.676	92923	96424	391.086	195	231	0.76730	1.0511	170
610.000	0.8167	0.72428	0.09274	25.170	95048	98722	394.887	196	228	0.77934	0.9406	177
620.000	0.7826	0.74367	0.08689	27.443	97157	100991	398.581	198	226	0.79050	0.8530	184
630.000	0.7529	0.76066	0.08204	29.548	99261	103245	402.190	199	224	0.80087	0.7812	190
640.000	0.7267	0.77576	0.07791	31.519	101364	105492	405.731	201	224	0.81056	0.7211	195
660.000	0.6821	0.80153	0.07119	35.153	105588	109986	412.649	204	225	0.82815	0.6252	204
680.000	0.6449	0.82284	0.06590	38.479	109848	114500	419.389	207	226	0.84373	0.5519	213
700.000	0.6130	0.84083	0.06157	41.574	114154	119048	425.983	211	228	0.85763	0.4936	220
750.000	0.5494	0.87567	0.05345	48.608	125150	130611	441.941	219	234	0.88653	0.3892	237
800.000	0.5007	0.90086	0.04765	54.968	136493	142486	457.270	227	240	0.90920	0.3196	251
					35.0 bar							
179.249	10.4408	0.22493	25.86347	3065.938	84	419	150.363	99	135	0.00000	-0.0605	2127
180.000	10.4345	0.22412	25.72743	3047.867	175	510	150.867	99	135	0.00000	-0.0605	2121
190.000	10.3497	0.21407	24.01309	2820.339	1404	1742	157.488	99	136	0.00000	-0.0599	2042
200.000	10.2642	0.20506	22.46150	2614.783	2666	3007	163.939	100	136	0.00000	-0.0592	1968
210.000	10.1779	0.19695	21.04943	2428.093	3960	4304	170.231	101	138	0.00000	-0.0584	1897
220.000	10.0908	0.18962	19.75787	2257.729	5284	5631	176.374	102	139	0.00000	-0.0575	1829
230.000	10.0028	0.18297	18.57113	2101.594	6635	6985	182.379	103	141	0.00001	-0.0565	1764
240.000	9.9140	0.17692	17.47615	1957.943	8014	8367	188.256	104	142	0.00003	-0.0554	1702
250.000	9.8243	0.17139	16.46195	1825.313	9420	9776	194.013	106	144	0.00006	-0.0542	1642
260.000	9.7336	0.16633	15.51929	1702.464	10853	11212	199.660	108	146	0.00013	-0.0529	1584
270.000	9.6420	0.16170	14.64027	1588.345	12313	12676	205.205	110	149	0.00025	-0.0515	1528
280.000	9.5493	0.15744	13.81816	1482.052	13801	14168	210.656	112	151	0.00046	-0.0501	1474
290.000	9.4555	0.15351	13.04716	1382.810	15319	15689	216.020	114	154	0.00082	-0.0486	1422
300.000	9.3606	0.14990	12.32225	1289.945	16866	17240	221.305	117	157	0.00138	-0.0471	1371
310.000	9.2644	0.14657	11.63908	1202.874	18445	18823	226.517	119	160	0.00223	-0.0455	1322
320.000	9.1670	0.14350	10.99386	1121.085	20055	20437	231.662	122	163	0.00348	-0.0439	1274
330.000	9.0683	0.14067	10.38327	1044.129	21699	22085	236.746	125	166	0.00526	-0.0423	1228
340.000	8.9681	0.13806	9.80438	971.611	23377	23768	241.775	127	169	0.00772	-0.0406	1182
350.000	8.8664	0.13565	9.25462	903.181	25091	25485	246.752	130	173	0.01105	-0.0388	1138
360.000	8.7631	0.13344	8.73170	838.530	26839	27239	251.684	133	176	0.01544	-0.0370	1095
370.000	8.6581	0.13140	8.23360	777.384	28625	29029	256.573	136	179	0.02111	-0.0351	1053
380.000	8.5513	0.12954	7.75851	719.495	30446	30856	261.425	140	183	0.02830	-0.0332	1011
390.000	8.4424	0.12785	7.30480	664.645	32305	32719	266.241	143	187	0.03723	-0.0312	970
400.000	8.3314	0.12631	6.87101	612.637	34200	34620	271.025	146	190	0.04816	-0.0290	930
410.000	8.2180	0.12493	6.45582	563.293	36132	36558	275.780	149	194	0.06130	-0.0268	891

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
420.000	8.1021	0.12370	6.05802	516.453	38100	38532	280.508	152	198	0.07688	-0.0244	852
430.000	7.9833	0.12263	5.67650	471.972	40103	40541	285.211	155	201	0.09505	-0.0219	814
440.000	7.8614	0.12170	5.31024	429.717	42141	42586	289.892	158	205	0.11595	-0.0191	776
450.000	7.7360	0.12092	4.95826	389.567	44213	44666	294.551	161	209	0.13966	-0.0160	739
460.000	7.6067	0.12030	4.61965	351.410	46319	46779	299.192	164	213	0.16620	-0.0127	702
470.000	7.4729	0.11985	4.29350	315.141	48458	48927	303.815	167	216	0.19552	-0.0088	665
480.000	7.3340	0.11958	3.97891	280.663	50631	51108	308.423	170	220	0.22753	-0.0045	628
490.000	7.1891	0.11950	3.67496	247.883	52838	53325	313.018	173	224	0.26207	0.0006	590
500.000	7.0371	0.11964	3.38064	216.711	55080	55578	317.604	175	229	0.29899	0.0067	553
510.000	6.8765	0.12003	3.09481	187.059	57361	57870	322.186	178	233	0.33811	0.0141	515
520.000	6.7054	0.12073	2.81611	158.837	59686	60208	326.770	180	238	0.37933	0.0234	476
530.000	6.5207	0.12180	2.54278	131.952	62062	62599	331.369	183	244	0.42260	0.0355	436
540.000	6.3181	0.12338	2.27232	106.297	64504	65058	336.001	185	251	0.46803	0.0520	395
550.000	6.0900	0.12568	2.00075	81.738	67032	67607	340.699	188	261	0.51589	0.0761	350
560.000	5.8219	0.12912	1.72063	58.070	69689	70290	345.529	192	276	0.56665	0.1150	301
570.000	5.4794	0.13478	1.41312	34.845	72565	73204	350.646	197	306	0.62092	0.1917	242
578.511	5.0270	0.14475	1.04759	13.619	75428	76125	355.661	211	395	0.67011	0.3947	166
578.511	1.4494	0.50202	0.23503	5.716	86084	88498	377.050	223	489	0.67011	2.1715	116
580.000	1.3987	0.51889	0.21163	7.217	86645	89147	377.912	211	395	0.69441	2.0171	121
585.000	1.2883	0.55857	0.18040	10.401	88157	90874	380.878	203	313	0.70427	1.7025	131
590.000	1.2144	0.58750	0.16298	12.823	89476	92358	383.407	200	283	0.71311	1.5030	140
593.000	1.1790	0.60210	0.15514	14.095	90222	93191	384.818	199	272	0.71813	1.4108	144
595.000	1.1579	0.61101	0.15060	14.888	90708	93731	385.727	199	267	0.72139	1.3573	147
600.000	1.1118	0.63104	0.14101	16.725	91891	95039	387.919	199	256	0.72922	1.2435	153
610.000	1.0389	0.66425	0.12666	19.946	94170	97539	392.052	199	244	0.74408	1.0736	163
620.000	0.9821	0.69134	0.11611	22.758	96385	99949	395.975	199	238	0.75732	0.9500	171
630.000	0.9355	0.71424	0.10786	25.289	98568	102309	399.754	201	234	0.76955	0.8545	178
640.000	0.8960	0.73407	0.10115	27.611	100732	104639	403.426	202	231	0.78090	0.7778	185
660.000	0.8315	0.76705	0.09073	31.798	105046	109255	410.533	205	230	0.80140	0.6610	196
680.000	0.7800	0.79366	0.08289	35.547	109370	113857	417.405	208	230	0.81945	0.5752	206
700.000	0.7372	0.81574	0.07669	38.981	113724	118472	424.096	211	231	0.83549	0.5090	214
750.000	0.6544	0.85769	0.06548	46.641	124802	130150	440.215	220	236	0.86872	0.3942	233
800.000	0.5929	0.88747	0.05778	53.437	136197	142100	455.640	227	241	0.89469	0.3199	248
					40.0 bar							
179.404	10.4411	0.25683	25.81606	3064.584	96	479	150.428	99	135	0.00000	-0.0605	2126
180.000	10.4361	0.25610	25.70832	3050.260	168	551	150.828	99	135	0.00000	-0.0605	2121
190.000	10.3515	0.24461	23.99650	2822.885	1396	1783	157.449	99	136	0.00000	-0.0599	2042
200.000	10.2661	0.23431	22.44725	2617.477	2658	3048	163.899	100	136	0.00000	-0.0593	1968
210.000	10.1799	0.22504	21.03736	2430.930	3952	4345	170.189	101	138	0.00000	-0.0585	1897
220.000	10.0930	0.21666	19.74785	2260.705	5275	5671	176.332	102	139	0.00000	-0.0575	1829
230.000	10.0052	0.20906	18.56306	2104.707	6625	7025	182.335	103	140	0.00001	-0.0565	1765
240.000	9.9166	0.20214	17.46994	1961.192	8003	8407	188.211	104	142	0.00002	-0.0554	1702
250.000	9.8271	0.19582	16.45754	1828.695	9408	9815	193.967	106	144	0.00005	-0.0542	1643
260.000	9.7366	0.19004	15.51661	1705.980	10840	11251	199.612	108	146	0.00011	-0.0529	1585
270.000	9.6451	0.18474	14.63928	1591.994	12300	12714	205.156	110	149	0.00022	-0.0516	1529
280.000	9.5527	0.17986	13.81882	1485.834	13787	14206	210.605	112	151	0.00042	-0.0502	1475
290.000	9.4591	0.17538	13.04945	1386.727	15304	15726	215.968	114	154	0.00073	-0.0487	1423
300.000	9.3644	0.17125	12.32615	1293.998	16850	17277	221.251	117	157	0.00123	-0.0472	1373
310.000	9.2686	0.16744	11.64459	1207.065	18427	18859	226.461	119	160	0.00199	-0.0456	1324
320.000	9.1715	0.16392	11.00098	1125.415	20037	20473	231.604	122	163	0.00311	-0.0440	1276
330.000	9.0730	0.16068	10.39201	1048.600	21680	22121	236.686	125	166	0.00469	-0.0424	1230
340.000	8.9732	0.15769	9.81475	976.226	23356	23802	241.712	127	169	0.00689	-0.0407	1185
350.000	8.8719	0.15493	9.26665	907.944	25068	25519	246.687	130	172	0.00986	-0.0389	1141
360.000	8.7691	0.15239	8.74543	843.444	26815	27272	251.616	133	176	0.01377	-0.0371	1097
370.000	8.6645	0.15006	8.24907	782.451	28599	29060	256.503	137	179	0.01882	-0.0353	1055
380.000	8.5582	0.14793	7.77577	724.720	30419	30886	261.351	140	183	0.02522	-0.0334	1014
390.000	8.4499	0.14598	7.32390	670.032	32275	32749	266.164	143	186	0.03318	-0.0314	974
400.000	8.3395	0.14422	6.89203	618.191	34168	34648	270.944	146	190	0.04290	-0.0293	934
410.000	8.2269	0.14263	6.47884	569.017	36098	36584	275.695	149	194	0.05461	-0.0271	895
420.000	8.1117	0.14121	6.08313	522.353	38063	38556	280.419	152	197	0.06847	-0.0247	857
430.000	7.9939	0.13996	5.70382	478.053	40063	40563	285.117	155	201	0.08464	-0.0222	819
440.000	7.8730	0.13888	5.33989	435.985	42098	42606	289.792	158	205	0.10324	-0.0195	781
450.000	7.7488	0.13797	4.99040	396.028	44166	44683	294.446	161	208	0.12433	-0.0166	744
460.000	7.6208	0.13723	4.65446	358.072	46268	46793	299.079	164	212	0.14795	-0.0133	708
470.000	7.4886	0.13669	4.33120	322.013	48403	48937	303.694	167	216	0.17403	-0.0096	671
480.000	7.3516	0.13633	4.01977	287.755	50570	51114	308.292	170	220	0.20251	-0.0054	635

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
490.000	7.2090	0.13619	3.71932	255.207	52770	53325	312.876	173	224	0.23325	-0.0006	598
500.000	7.0597	0.13629	3.42895	224.284	55004	55571	317.449	175	228	0.26611	0.0051	562
510.000	6.9027	0.13666	3.14764	194.901	57275	57855	322.013	178	232	0.30095	0.0120	525
520.000	6.7361	0.13735	2.87428	166.977	59588	60182	326.577	180	237	0.33767	0.0206	487
530.000	6.5575	0.13842	2.60746	140.432	61948	62558	331.148	183	242	0.37625	0.0315	449
540.000	6.3633	0.14001	2.34534	115.178	64368	64996	335.742	185	249	0.41678	0.0459	409
550.000	6.1478	0.14228	2.08526	91.124	66864	67515	340.384	187	257	0.45954	0.0662	368
560.000	5.9012	0.14558	1.82289	68.156	69468	70146	345.120	190	269	0.50498	0.0968	323
570.000	5.6033	0.15063	1.54986	46.104	72239	72953	350.048	195	289	0.55374	0.1490	272
580.000	5.1984	0.15956	1.24399	24.611	75330	76100	355.434	203	338	0.60634	0.2637	210
585.000	4.8921	0.16810	1.05364	13.708	77158	77976	358.596	212	410	0.63382	0.4075	169
589.306	4.3626	0.18713	0.76044	2.849	79368	80285	362.476	245	873	0.65710	0.9196	104
589.306	2.0096	0.40623	0.34812	1.728	86096	88086	375.715	247	1271	0.65710	2.2740	98
590.000	1.9116	0.42656	0.30978	2.841	86669	88762	376.729	225	770	0.66927	2.2166	102
593.000	1.7086	0.47483	0.25800	5.585	88107	90448	379.583	211	453	0.67607	1.9391	113
595.000	1.6292	0.49628	0.23960	6.963	88833	91289	381.000	208	393	0.68031	1.8047	119
600.000	1.4950	0.53634	0.20979	9.788	90383	93059	383.964	204	325	0.69035	1.5617	129
610.000	1.3340	0.59121	0.17611	14.175	93032	96031	388.879	202	277	0.70832	1.2642	145
620.000	1.2301	0.63081	0.15562	17.722	95447	98699	393.219	202	258	0.72430	1.0783	156
630.000	1.1531	0.66226	0.14114	20.786	97757	101226	397.267	202	248	0.73856	0.9466	166
640.000	1.0919	0.68843	0.13009	23.525	100014	103678	401.131	203	242	0.75169	0.8467	174
660.000	0.9979	0.73043	0.11398	28.340	104452	108460	408.495	206	236	0.77521	0.7025	187
680.000	0.9269	0.76327	0.10252	32.553	108858	113173	415.533	209	234	0.79578	0.6018	199
700.000	0.8700	0.78998	0.09379	36.353	113271	117868	422.341	212	234	0.81397	0.5266	208
750.000	0.7639	0.83967	0.07864	44.672	124443	129680	438.643	220	238	0.85149	0.4004	228
800.000	0.6878	0.87428	0.06864	51.921	135896	141711	454.175	227	243	0.88070	0.3213	245
					42.36499 bar							
179.477	10.4413	0.27190	25.79383	3063.965	101	507	150.459	99	135	0.00000	-0.0605	2125
180.000	10.4369	0.27122	25.69939	3051.405	164	570	150.810	99	135	0.00000	-0.0605	2121
190.000	10.3523	0.25905	23.98876	2824.102	1393	1802	157.430	99	135	0.00000	-0.0600	2042
200.000	10.2670	0.24814	22.44061	2618.762	2655	3067	163.879	100	136	0.00000	-0.0593	1968
210.000	10.1809	0.23832	21.03175	2432.282	3948	4364	170.170	101	138	0.00000	-0.0585	1897
220.000	10.0940	0.22945	19.74321	2262.123	5270	5690	176.311	102	139	0.00000	-0.0576	1830
230.000	10.0063	0.22139	18.55934	2106.190	6621	7044	182.315	103	140	0.00001	-0.0565	1765
240.000	9.9178	0.21406	17.46710	1962.738	7998	8425	188.189	104	142	0.00002	-0.0554	1703
250.000	9.8283	0.20737	16.45554	1830.304	9403	9834	193.945	106	144	0.00005	-0.0542	1643
260.000	9.7380	0.20125	15.51543	1707.652	10834	11269	199.589	108	146	0.00011	-0.0529	1585
270.000	9.6466	0.19563	14.63890	1593.728	12293	12733	205.132	110	149	0.00021	-0.0516	1530
280.000	9.5542	0.19047	13.81922	1487.631	13780	14224	210.581	112	151	0.00040	-0.0502	1476
290.000	9.4608	0.18571	13.05061	1388.586	15296	15744	215.943	114	154	0.00070	-0.0487	1424
300.000	9.3663	0.18134	12.32807	1295.921	16842	17295	221.225	117	157	0.00117	-0.0472	1374
310.000	9.2705	0.17730	11.64727	1209.052	18419	18876	226.434	119	160	0.00190	-0.0457	1325
320.000	9.1736	0.17357	11.00442	1127.467	20028	20490	231.576	122	163	0.00296	-0.0440	1277
330.000	9.0753	0.17014	10.39620	1050.719	21670	22137	236.657	125	166	0.00447	-0.0424	1231
340.000	8.9757	0.16697	9.81971	978.412	23347	23819	241.683	128	169	0.00657	-0.0407	1186
350.000	8.8745	0.16404	9.27239	910.198	25057	25535	246.657	130	172	0.00939	-0.0390	1142
360.000	8.7719	0.16135	8.75196	845.768	26804	27287	251.585	133	176	0.01312	-0.0372	1099
370.000	8.6675	0.15888	8.25641	784.847	28587	29076	256.470	137	179	0.01793	-0.0353	1057
380.000	8.5614	0.15662	7.78394	727.190	30406	30901	261.316	140	183	0.02402	-0.0334	1016
390.000	8.4534	0.15455	7.33293	672.576	32261	32763	266.128	143	186	0.03160	-0.0315	975
400.000	8.3433	0.15268	6.90195	620.811	34153	34661	270.906	146	190	0.04086	-0.0294	936
410.000	8.2310	0.15099	6.48968	571.716	36082	36596	275.656	149	194	0.05199	-0.0272	897
420.000	8.1162	0.14947	6.09493	525.132	38046	38568	280.377	152	197	0.06518	-0.0249	859
430.000	7.9988	0.14814	5.71663	480.914	40044	40574	285.073	155	201	0.08058	-0.0224	821
440.000	7.8784	0.14699	5.35377	438.932	42078	42615	289.746	158	205	0.09828	-0.0197	784
450.000	7.7547	0.14601	5.00541	399.063	44145	44691	294.396	161	208	0.11835	-0.0168	747
460.000	7.6274	0.14522	4.67067	361.197	46244	46800	299.026	164	212	0.14082	-0.0136	711
470.000	7.4959	0.14463	4.34870	325.231	48377	48942	303.638	167	216	0.16565	-0.0100	674
480.000	7.3598	0.14423	4.03869	291.070	50541	51117	308.232	170	220	0.19275	-0.0059	638
490.000	7.2182	0.14406	3.73978	258.625	52738	53325	312.810	173	223	0.22201	-0.0011	602
500.000	7.0702	0.14413	3.45111	227.809	54969	55568	317.377	175	227	0.25329	0.0044	566
510.000	6.9147	0.14449	3.17175	198.541	57236	57849	321.934	178	232	0.28646	0.0111	529
520.000	6.7501	0.14516	2.90063	170.742	59543	60171	326.488	180	236	0.32142	0.0193	492
530.000	6.5741	0.14624	2.63648	144.335	61896	62541	331.047	182	241	0.35816	0.0297	455
540.000	6.3834	0.14782	2.37766	119.241	64307	64970	335.624	185	248	0.39678	0.0434	416
550.000	6.1732	0.15007	2.12191	95.377	66790	67476	340.243	187	255	0.43754	0.0622	375

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
560.000	5.9348	0.15331	1.86569	72.652	69373	70087	344.943	190	266	0.48090	0.0899	332
570.000	5.6520	0.15816	1.60269	50.948	72107	72857	349.805	194	284	0.52749	0.1351	284
580.000	5.2850	0.16622	1.31847	30.070	75109	75911	355.030	202	322	0.57787	0.2239	228
585.000	5.0341	0.17302	1.15615	19.807	76809	77651	357.959	209	365	0.60433	0.3143	193
590.000	4.6598	0.18533	0.95540	9.426	78848	79757	361.486	228	491	0.63049	0.5165	148
593.000	4.1943	0.20486	0.76484	2.742	80687	81697	364.762	275	994	0.64325	0.9211	103
595.000	2.2175	0.38618	0.35909	1.835	86667	88578	376.228	224	1075	0.65922	2.1603	97
600.000	1.7993	0.47198	0.26815	5.990	89241	91595	381.283	210	432	0.67109	1.7895	115
610.000	1.5207	0.54930	0.20933	11.256	92334	95120	387.113	204	307	0.69114	1.3817	135
620.000	1.3738	0.59821	0.17984	15.242	94915	97999	391.796	203	273	0.70849	1.1516	149
630.000	1.2733	0.63519	0.16052	18.598	97318	100646	396.035	203	257	0.72385	0.9969	159
640.000	1.1969	0.66518	0.14641	21.554	99636	103175	400.022	204	249	0.73790	0.8831	168
660.000	1.0839	0.71225	0.12655	26.687	104149	108058	407.540	206	240	0.76293	0.7237	183
680.000	1.0012	0.74841	0.11287	31.129	108602	112833	414.672	209	237	0.78471	0.6152	195
700.000	0.9362	0.77752	0.10265	35.106	113047	117572	421.544	212	236	0.80394	0.5354	205
750.000	0.8174	0.83111	0.08529	43.743	124270	129453	437.941	220	239	0.84349	0.4035	226
800.000	0.7337	0.86809	0.07404	51.210	135752	141526	453.527	228	243	0.87422	0.3221	243
						45.0 bar						
179.558	10.4415	0.28868	25.76921	3063.290	107	538	150.493	99	135	0.00000	-0.0605	2125
180.000	10.4377	0.28807	25.68953	3052.689	161	592	150.790	99	135	0.00000	-0.0605	2121
190.000	10.3532	0.27514	23.98022	2825.466	1389	1823	157.409	99	135	0.00000	-0.0600	2042
200.000	10.2680	0.26355	22.43329	2620.203	2650	3089	163.858	100	136	0.00000	-0.0593	1968
210.000	10.1820	0.25312	21.02558	2433.798	3943	4385	170.148	101	138	0.00000	-0.0585	1897
220.000	10.0952	0.24369	19.73812	2263.711	5265	5711	176.289	102	139	0.00000	-0.0576	1830
230.000	10.0076	0.23514	18.55527	2107.849	6615	7065	182.291	103	140	0.00001	-0.0566	1765
240.000	9.9191	0.22735	17.46401	1964.468	7993	8446	188.165	104	142	0.00002	-0.0554	1703
250.000	9.8298	0.22024	16.45339	1832.103	9397	9855	193.920	106	144	0.00005	-0.0542	1643
260.000	9.7395	0.21373	15.51418	1709.520	10828	11290	199.564	108	146	0.00010	-0.0530	1586
270.000	9.6483	0.20776	14.63853	1595.665	12286	12753	205.106	110	149	0.00020	-0.0516	1530
280.000	9.5560	0.20227	13.81972	1489.638	13773	14244	210.554	112	151	0.00038	-0.0502	1477
290.000	9.4627	0.19723	13.05196	1390.663	15289	15764	215.915	114	154	0.00066	-0.0488	1425
300.000	9.3683	0.19257	12.33027	1298.068	16834	17314	221.196	117	157	0.00112	-0.0472	1374
310.000	9.2727	0.18828	11.65031	1211.270	18410	18896	226.405	119	160	0.00181	-0.0457	1325
320.000	9.1759	0.18432	11.00829	1129.757	20019	20509	231.546	122	163	0.00282	-0.0441	1278
330.000	9.0778	0.18067	10.40092	1053.082	21660	22156	236.626	125	166	0.00426	-0.0425	1232
340.000	8.9783	0.17730	9.82528	980.850	23336	23837	241.650	128	169	0.00625	-0.0408	1187
350.000	8.8774	0.17419	9.27882	912.712	25046	25553	246.623	131	172	0.00893	-0.0390	1143
360.000	8.7750	0.17133	8.75927	848.359	26792	27304	251.549	134	176	0.01248	-0.0373	1100
370.000	8.6709	0.16870	8.26461	787.516	28573	29092	256.433	137	179	0.01705	-0.0354	1058
380.000	8.5651	0.16629	7.79305	729.939	30391	30917	261.278	140	183	0.02284	-0.0335	1017
390.000	8.4573	0.16409	7.34299	675.407	32246	32778	266.088	143	186	0.03003	-0.0316	977
400.000	8.3476	0.16209	6.91298	623.726	34137	34676	270.864	146	190	0.03883	-0.0295	938
410.000	8.2356	0.16029	6.50172	574.716	36064	36610	275.611	149	194	0.04941	-0.0273	899
420.000	8.1212	0.15867	6.10803	528.220	38026	38581	280.331	152	197	0.06194	-0.0250	861
430.000	8.0043	0.15725	5.73083	484.093	40024	40586	285.024	155	201	0.07656	-0.0226	823
440.000	7.8844	0.15601	5.36913	442.202	42055	42626	289.694	158	204	0.09337	-0.0199	786
450.000	7.7613	0.15496	5.02199	402.427	44120	44700	294.342	161	208	0.11244	-0.0171	750
460.000	7.6347	0.15411	4.68855	364.659	46218	46807	298.968	164	212	0.13378	-0.0139	714
470.000	7.5040	0.15346	4.36798	328.793	48348	48948	303.575	167	216	0.15736	-0.0104	678
480.000	7.3688	0.15302	4.05946	294.736	50510	51120	308.164	170	219	0.18310	-0.0063	642
490.000	7.2283	0.15281	3.76219	262.398	52703	53326	312.738	173	223	0.21089	-0.0017	606
500.000	7.0817	0.15285	3.47533	231.696	54930	55566	317.297	175	227	0.24060	0.0037	570
510.000	6.9279	0.15318	3.19800	202.548	57193	57842	321.846	178	231	0.27212	0.0101	534
520.000	6.7653	0.15385	2.92920	174.879	59494	60159	326.390	180	236	0.30534	0.0180	498
530.000	6.5921	0.15491	2.66778	148.613	61840	62523	330.937	182	241	0.34026	0.0279	461
540.000	6.4051	0.15648	2.41228	123.678	64240	64943	335.497	185	246	0.37699	0.0407	423
550.000	6.2002	0.15871	2.16077	100.001	66710	67436	340.092	187	254	0.41578	0.0582	383
560.000	5.9699	0.16189	1.91035	77.506	69273	70026	344.756	190	264	0.45707	0.0832	341
570.000	5.7013	0.16654	1.65621	56.110	71972	72761	349.556	194	279	0.50149	0.1223	296
580.000	5.3653	0.17392	1.38857	35.710	74899	75738	354.647	200	309	0.54965	0.1928	244
585.000	5.1500	0.17964	1.24274	25.837	76515	77389	357.423	207	339	0.57503	0.2551	214
590.000	4.8693	0.18839	1.07903	16.142	78335	79259	360.549	224	404	0.60030	0.3608	177
593.000	4.6352	0.19690	0.96311	10.391	79634	80605	362.822	265	511	0.61289	0.4580	147
595.000	4.4159	0.20599	0.86977	6.585	80628	81647	364.457	223	573	0.62985	0.6628	135
600.000	2.6615	0.33892	0.43431	1.350	86347	88037	375.142	223	1406	0.64800	1.9100	96
610.000	1.7985	0.49334	0.26056	7.902	91332	93834	384.741	207	370	0.67165	1.5304	123
620.000	1.5648	0.55786	0.21321	12.446	94225	97101	390.057	205	297	0.69077	1.2414	139

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
630.000	1.4252	0.60278	0.18589	16.149	96773	99931	394.589	205	271	0.70745	1.0569	152
640.000	1.3258	0.63784	0.16712	19.357	99177	102571	398.751	205	258	0.72259	0.9259	162
660.000	1.1862	0.69130	0.14198	24.850	103793	107587	406.474	207	245	0.74935	0.7481	178
680.000	1.0881	0.73149	0.12532	29.548	108305	112441	413.724	210	240	0.77252	0.6303	191
700.000	1.0128	0.76344	0.11318	33.724	112790	117234	420.673	213	238	0.79290	0.5453	202
750.000	0.8784	0.82154	0.09303	42.715	124074	129197	437.185	220	240	0.83472	0.4071	224
800.000	0.7855	0.86122	0.08027	50.424	135590	141318	452.833	228	244	0.86712	0.3232	242
						50.0 bar						
179.712	10.4418	0.32047	25.72290	3062.055	119	598	150.558	99	135	0.00000	-0.0605	2123
180.000	10.4394	0.32003	25.67106	3055.153	154	633	150.751	99	135	0.00000	-0.0605	2121
190.000	10.3550	0.30565	23.96425	2828.079	1381	1864	157.369	99	135	0.00000	-0.0600	2042
200.000	10.2699	0.29278	22.41963	2622.963	2642	3129	163.817	100	136	0.00000	-0.0593	1968
210.000	10.1840	0.28119	21.01409	2436.696	3934	4425	170.106	101	137	0.00000	-0.0585	1898
220.000	10.0974	0.27071	19.72867	2266.746	5256	5751	176.246	102	139	0.00000	-0.0576	1830
230.000	10.0100	0.26120	18.54776	2111.018	6605	7105	182.247	103	140	0.00001	-0.0566	1766
240.000	9.9217	0.25254	17.45834	1967.769	7982	8486	188.120	104	142	0.00002	-0.0555	1704
250.000	9.8325	0.24464	16.44950	1835.536	9385	9894	193.874	106	144	0.00005	-0.0543	1644
260.000	9.7424	0.23741	15.51201	1713.083	10816	11329	199.516	108	146	0.00010	-0.0530	1587
270.000	9.6514	0.23077	14.63803	1599.358	12273	12791	205.057	110	149	0.00019	-0.0517	1531
280.000	9.5594	0.22467	13.82085	1493.461	13759	14282	210.503	112	151	0.00035	-0.0503	1478
290.000	9.4663	0.21906	13.05470	1394.617	15274	15802	215.863	114	154	0.00061	-0.0488	1426
300.000	9.3721	0.21388	12.33460	1302.155	16818	17351	221.142	117	157	0.00103	-0.0473	1376
310.000	9.2768	0.20911	11.65621	1215.490	18393	18932	226.349	119	160	0.00166	-0.0458	1327
320.000	9.1803	0.20470	11.01578	1134.112	20000	20545	231.488	122	163	0.00259	-0.0442	1280
330.000	9.0825	0.20064	10.40999	1057.573	21641	22191	236.566	125	166	0.00391	-0.0425	1234
340.000	8.9834	0.19689	9.83595	985.480	23315	23871	241.588	128	169	0.00574	-0.0409	1189
350.000	8.8829	0.19342	9.29110	917.483	25024	25586	246.558	131	172	0.00820	-0.0392	1145
360.000	8.7809	0.19024	8.77319	853.273	26768	27337	251.482	134	176	0.01144	-0.0374	1103
370.000	8.6772	0.18731	8.28020	792.577	28548	29124	256.363	137	179	0.01563	-0.0356	1061
380.000	8.5719	0.18462	7.81035	735.149	30364	30948	261.206	140	183	0.02094	-0.0337	1020
390.000	8.4647	0.18216	7.36205	680.770	32217	32808	266.012	143	186	0.02753	-0.0317	980
400.000	8.3555	0.17993	6.93385	629.243	34106	34704	270.785	146	190	0.03558	-0.0297	941
410.000	8.2443	0.17791	6.52447	580.391	36030	36637	275.528	149	193	0.04527	-0.0276	903
420.000	8.1307	0.17610	6.13272	534.056	37990	38605	280.244	152	197	0.05674	-0.0253	865
430.000	8.0145	0.17450	5.75755	490.093	39985	40609	284.932	155	201	0.07012	-0.0229	828
440.000	7.8956	0.17310	5.39797	448.370	42014	42647	289.597	158	204	0.08550	-0.0204	791
450.000	7.7736	0.17191	5.05306	408.767	44075	44718	294.239	161	208	0.10295	-0.0176	755
460.000	7.6482	0.17093	4.72198	371.174	46169	46823	298.859	164	212	0.12248	-0.0145	719
470.000	7.5190	0.17017	4.40392	335.488	48294	48959	303.458	167	215	0.14406	-0.0111	684
480.000	7.3855	0.16963	4.09809	301.616	50451	51128	308.039	170	219	0.16761	-0.0072	649
490.000	7.2471	0.16935	3.80373	269.469	52638	53328	312.602	173	223	0.19305	-0.0028	614
500.000	7.1029	0.16933	3.52005	238.965	54858	55562	317.149	175	226	0.22025	0.0023	579
510.000	6.9521	0.16961	3.24623	210.025	57112	57831	321.684	178	230	0.24910	0.0083	543
520.000	6.7933	0.17024	2.98141	182.576	59403	60139	326.211	180	235	0.27953	0.0156	508
530.000	6.6248	0.17127	2.72458	156.548	61736	62491	330.734	182	239	0.31154	0.0247	472
540.000	6.4443	0.17281	2.47454	131.875	64120	64896	335.266	184	245	0.34522	0.0362	435
550.000	6.2481	0.17499	2.22980	108.495	66566	67366	339.820	187	251	0.38083	0.0515	397
560.000	6.0310	0.17806	1.98827	86.351	69096	69925	344.425	189	260	0.41879	0.0725	358
570.000	5.7837	0.18241	1.74680	65.395	71742	72606	349.131	193	272	0.45971	0.1035	316
580.000	5.4887	0.18890	1.49995	45.598	74568	75479	354.043	199	294	0.50422	0.1532	270
585.000	5.3124	0.19350	1.37139	36.140	76090	77031	356.648	206	313	0.52779	0.1906	244
590.000	5.1046	0.19967	1.23615	26.997	77735	78714	359.455	221	349	0.55141	0.2404	215
593.000	4.9571	0.20458	1.14988	21.683	78827	79836	361.349	260	407	0.56335	0.2642	191
595.000	4.8446	0.20862	1.08919	18.227	79565	80597	362.512	217	382	0.57930	0.3420	186
600.000	4.4792	0.22376	0.91900	10.041	81564	82680	365.998	215	466	0.59851	0.5387	153
610.000	2.8813	0.34215	0.47107	3.138	87891	89626	377.471	216	735	0.63213	1.4521	107
620.000	2.0830	0.46565	0.30845	7.431	92459	94859	385.988	209	392	0.65648	1.3882	122
630.000	1.7888	0.53363	0.24976	11.670	95518	98313	391.518	207	313	0.67643	1.1677	138
640.000	1.6160	0.58146	0.21609	15.314	98175	101269	396.179	207	282	0.69377	1.0063	150
660.000	1.4027	0.64956	0.17615	21.450	103054	106618	404.417	208	257	0.72396	0.7938	169
680.000	1.2664	0.69834	0.15198	26.614	107706	111654	411.939	210	247	0.74980	0.6586	184
700.000	1.1670	0.73614	0.13525	31.153	112280	116565	419.059	213	243	0.77238	0.5636	196
750.000	0.9982	0.80329	0.10878	40.798	123691	128701	435.811	221	242	0.81847	0.4139	220
800.000	0.8862	0.84824	0.09273	48.958	135278	140920	451.586	228	246	0.85402	0.3253	239

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
					55.0 bar							
179.865	10.4422	0.35220	25.67713	3060.878	131	658	150.622	99	135	0.00000	-0.0605	2122
180.000	10.4410	0.35197	25.65291	3057.650	147	674	150.713	99	135	0.00000	-0.0605	2121
190.000	10.3568	0.33616	23.94858	2830.725	1374	1905	157.330	100	135	0.00000	-0.0600	2043
200.000	10.2718	0.32200	22.40627	2625.752	2634	3170	163.777	100	136	0.00000	-0.0593	1968
210.000	10.1861	0.30924	21.00288	2439.624	3926	4466	170.064	101	137	0.00000	-0.0585	1898
220.000	10.0996	0.29771	19.71950	2269.809	5247	5791	176.203	102	139	0.00000	-0.0576	1831
230.000	10.0123	0.28725	18.54051	2114.214	6595	7145	182.204	103	140	0.00001	-0.0566	1766
240.000	9.9242	0.27773	17.45293	1971.096	7971	8525	188.075	105	142	0.00002	-0.0555	1704
250.000	9.8352	0.26903	16.44585	1838.992	9374	9933	193.827	106	144	0.00004	-0.0543	1645
260.000	9.7453	0.26107	15.51007	1716.668	10803	11368	199.469	108	146	0.00009	-0.0530	1588
270.000	9.6545	0.25377	14.63775	1603.072	12260	12830	205.008	110	149	0.00017	-0.0517	1532
280.000	9.5627	0.24705	13.82219	1497.303	13745	14320	210.453	112	151	0.00032	-0.0503	1479
290.000	9.4699	0.24087	13.05764	1398.589	15259	15839	215.811	114	154	0.00057	-0.0489	1427
300.000	9.3760	0.23517	12.33912	1306.256	16802	17389	221.089	117	157	0.00095	-0.0474	1377
310.000	9.2809	0.22992	11.66230	1219.722	18376	18969	226.293	119	160	0.00154	-0.0458	1329
320.000	9.1847	0.22507	11.02343	1138.477	19982	20581	231.431	122	163	0.00240	-0.0442	1282
330.000	9.0873	0.22059	10.41920	1062.073	21621	22227	236.506	125	166	0.00363	-0.0426	1236
340.000	8.9885	0.21645	9.84674	990.115	23294	23906	241.526	128	169	0.00532	-0.0410	1191
350.000	8.8883	0.21264	9.30348	922.257	25002	25620	246.494	131	172	0.00760	-0.0393	1148
360.000	8.7867	0.20912	8.78718	858.188	26744	27370	251.416	134	176	0.01060	-0.0375	1105
370.000	8.6835	0.20589	8.29584	797.634	28523	29156	256.294	137	179	0.01448	-0.0357	1064
380.000	8.5787	0.20292	7.82767	740.350	30337	30979	261.133	140	183	0.01939	-0.0339	1023
390.000	8.4720	0.20021	7.38108	686.118	32188	32837	265.937	143	186	0.02549	-0.0319	984
400.000	8.3635	0.19773	6.95465	634.741	34075	34733	270.707	146	190	0.03294	-0.0299	945
410.000	8.2528	0.19550	6.54708	586.042	35997	36664	275.446	149	193	0.04189	-0.0278	907
420.000	8.1400	0.19349	6.15721	539.861	37955	38631	280.157	152	197	0.05250	-0.0256	869
430.000	8.0247	0.19170	5.78398	496.055	39947	40632	284.841	155	200	0.06486	-0.0233	833
440.000	7.9067	0.19014	5.42643	454.491	41972	42668	289.501	158	204	0.07909	-0.0208	796
450.000	7.7858	0.18880	5.08364	415.050	44030	44737	294.137	161	208	0.09521	-0.0180	760
460.000	7.6616	0.18769	4.75479	377.621	46120	46838	298.751	164	211	0.11326	-0.0150	725
470.000	7.5338	0.18682	4.43908	342.104	48241	48971	303.343	167	215	0.13321	-0.0117	690
480.000	7.4019	0.18618	4.13575	308.402	50393	51136	307.915	170	218	0.15498	-0.0080	655
490.000	7.2654	0.18581	3.84406	276.430	52575	53332	312.469	173	222	0.17849	-0.0038	621
500.000	7.1235	0.18572	3.56327	246.106	54788	55561	317.005	175	226	0.20364	0.0010	586
510.000	6.9755	0.18594	3.29262	217.352	57034	57823	321.527	177	230	0.23032	0.0067	552
520.000	6.8201	0.18652	3.03131	190.097	59316	60122	326.036	180	234	0.25848	0.0135	517
530.000	6.6560	0.18752	2.77846	164.274	61637	62463	330.540	182	238	0.28810	0.0218	482
540.000	6.4811	0.18901	2.53305	139.821	64005	64854	335.045	184	243	0.31930	0.0323	447
550.000	6.2926	0.19113	2.29386	116.683	66431	67306	339.565	186	249	0.35230	0.0458	411
560.000	6.0862	0.19409	2.05930	94.812	68933	69837	344.121	189	256	0.38752	0.0639	373
570.000	5.8554	0.19820	1.82716	74.178	71537	72476	348.753	192	267	0.42556	0.0893	334
580.000	5.5885	0.20408	1.59401	54.776	74294	75278	353.539	198	284	0.46704	0.1269	291
585.000	5.4352	0.20805	1.47535	45.554	75759	76771	356.043	204	299	0.48907	0.1527	268
590.000	5.2626	0.21305	1.35382	36.678	77317	78362	358.695	220	326	0.51123	0.1826	243
593.000	5.1466	0.21675	1.27879	31.537	78332	79401	360.448	259	375	0.52251	0.1902	222
595.000	5.0626	0.21960	1.22757	28.196	79000	80087	361.485	215	339	0.53748	0.2395	219
600.000	4.8207	0.22870	1.09363	20.213	80697	81837	364.415	211	364	0.55591	0.3262	194
610.000	4.0664	0.26668	0.78021	7.339	84745	86097	371.453	213	519	0.59096	0.7077	139
620.000	2.9390	0.36303	0.48082	5.300	89873	91744	380.636	213	526	0.62081	1.1722	119
630.000	2.3054	0.45544	0.34677	8.190	93857	96243	387.839	210	384	0.64478	1.1917	127
640.000	1.9886	0.51975	0.28302	11.818	96951	99717	393.313	209	319	0.66498	1.0566	139
660.000	1.6551	0.60558	0.21834	18.330	102219	105542	402.287	209	272	0.69888	0.8312	160
680.000	1.4648	0.66410	0.18330	23.865	107054	110808	410.154	211	256	0.72748	0.6830	177
700.000	1.3342	0.70827	0.16039	28.717	111737	115859	417.478	214	249	0.75229	0.5798	190
750.000	1.1236	0.78498	0.12599	38.958	123297	128192	434.502	221	245	0.80263	0.4199	216
800.000	0.9898	0.83536	0.10605	47.544	134961	140517	450.415	228	247	0.84130	0.3272	236
					60.0 bar							
180.018	10.4425	0.38388	25.63188	3059.758	142	717	150.686	99	135	0.00000	-0.0606	2121
190.000	10.3585	0.36666	23.93321	2833.403	1366	1946	157.291	100	135	0.00000	-0.0600	2043
200.000	10.2737	0.35120	22.39320	2628.571	2626	3210	163.736	100	136	0.00000	-0.0593	1969
210.000	10.1881	0.33729	20.99195	2442.580	3917	4506	170.023	101	137	0.00000	-0.0586	1898
220.000	10.1018	0.32471	19.71059	2272.900	5237	5831	176.161	102	139	0.00000	-0.0576	1831
230.000	10.0147	0.31329	18.53351	2117.436	6585	7185	182.160	103	140	0.00001	-0.0566	1767
240.000	9.9268	0.30290	17.44776	1974.447	7961	8565	188.030	105	142	0.00002	-0.0555	1705
250.000	9.8380	0.29341	16.44244	1842.471	9362	9972	193.781	106	144	0.00004	-0.0543	1646
260.000	9.7483	0.28472	15.50836	1720.274	10791	11407	199.421	108	146	0.00008	-0.0531	1589
270.000	9.6576	0.27675	14.63769	1606.805	12247	12868	204.959	110	149	0.00016	-0.0518	1533

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
280.000	9.5660	0.26942	13.82375	1501.164	13731	14358	210.402	112	151	0.00030	-0.0504	1480
290.000	9.4734	0.26267	13.06078	1402.576	15244	15877	215.759	114	154	0.00053	-0.0489	1429
300.000	9.3798	0.25645	12.34382	1310.372	16786	17426	221.035	117	157	0.00089	-0.0474	1379
310.000	9.2850	0.25071	11.66856	1223.967	18359	19006	226.238	119	159	0.00144	-0.0459	1330
320.000	9.1891	0.24541	11.03123	1142.853	19964	20617	231.373	122	162	0.00225	-0.0443	1283
330.000	9.0920	0.24052	10.42856	1066.580	21602	22262	236.447	125	166	0.00339	-0.0427	1238
340.000	8.9935	0.23600	9.85765	994.756	23274	23941	241.465	128	169	0.00497	-0.0411	1193
350.000	8.8937	0.23183	9.31596	927.032	24980	25654	246.431	131	172	0.00710	-0.0394	1150
360.000	8.7925	0.22798	8.80125	863.100	26721	27403	251.350	134	176	0.00991	-0.0376	1108
370.000	8.6898	0.22444	8.31151	802.685	28498	29188	256.225	137	179	0.01353	-0.0359	1067
380.000	8.5854	0.22119	7.84498	745.543	30311	31010	261.062	140	182	0.01810	-0.0340	1026
390.000	8.4793	0.21822	7.40007	691.453	32160	32867	265.862	143	186	0.02379	-0.0321	987
400.000	8.3713	0.21551	6.97535	640.221	34044	34761	270.629	146	189	0.03074	-0.0301	948
410.000	8.2613	0.21305	6.56954	591.668	35965	36691	275.364	149	193	0.03909	-0.0281	911
420.000	8.1492	0.21084	6.18149	545.636	37920	38656	280.071	152	197	0.04897	-0.0259	873
430.000	8.0347	0.20887	5.81013	501.979	39909	40656	284.751	155	200	0.06050	-0.0236	837
440.000	7.9176	0.20714	5.45452	460.567	41931	42689	289.406	158	204	0.07376	-0.0211	801
450.000	7.7977	0.20565	5.11375	421.279	43986	44756	294.037	161	207	0.08879	-0.0185	766
460.000	7.6747	0.20441	4.78701	384.006	46073	46854	298.644	164	211	0.10561	-0.0156	731
470.000	7.5483	0.20341	4.47351	348.644	48189	48984	303.230	167	214	0.12419	-0.0124	696
480.000	7.4180	0.20267	4.17251	315.102	50336	51145	307.794	170	218	0.14449	-0.0088	662
490.000	7.2833	0.20221	3.88329	283.291	52513	53337	312.338	172	222	0.16640	-0.0048	628
500.000	7.1436	0.20204	3.60515	253.130	54720	55560	316.864	175	225	0.18984	-0.0002	594
510.000	6.9981	0.20219	3.33737	224.543	56959	57816	321.373	177	229	0.21472	0.0052	560
520.000	6.8459	0.20271	3.07920	197.461	59231	60107	325.868	180	233	0.24098	0.0115	526
530.000	6.6858	0.20365	2.82985	171.817	61541	62439	330.352	182	237	0.26862	0.0192	492
540.000	6.5159	0.20509	2.58843	147.553	63896	64817	334.834	184	242	0.29775	0.0288	458
550.000	6.3340	0.20714	2.35392	124.617	66305	67252	339.323	186	247	0.32858	0.0408	423
560.000	6.1368	0.20998	2.12504	102.967	68782	69760	343.838	188	254	0.36153	0.0566	387
570.000	5.9192	0.21388	1.90014	82.579	71352	72366	348.410	192	263	0.39715	0.0780	350
580.000	5.6732	0.21931	1.67691	63.458	74056	75113	353.103	197	277	0.43608	0.1080	310
585.000	5.5354	0.22285	1.56486	54.391	75482	76566	355.537	204	290	0.45679	0.1271	289
590.000	5.3843	0.22716	1.45173	45.675	76986	78101	358.092	219	313	0.47768	0.1473	266
593.000	5.2857	0.23023	1.38297	40.629	77958	79093	359.768	257	357	0.48837	0.1490	247
595.000	5.2159	0.23252	1.33663	37.348	78591	79741	360.741	214	318	0.50247	0.1853	245
600.000	5.0239	0.23940	1.21839	29.474	80164	81358	363.447	210	330	0.52006	0.2374	224
610.000	4.5234	0.26153	0.96536	15.717	83576	84902	369.304	210	387	0.55422	0.4155	177
620.000	3.7527	0.31015	0.68908	7.755	87683	89281	376.423	212	482	0.58578	0.7560	138
630.000	2.9655	0.38626	0.48516	7.577	91927	93950	383.895	212	435	0.61303	0.9769	129
640.000	2.4618	0.45802	0.37460	9.717	95496	97933	390.172	211	363	0.63612	1.0070	134
660.000	1.9499	0.56072	0.27064	15.769	101279	104356	400.067	211	291	0.67412	0.8451	153
680.000	1.6861	0.62941	0.22013	21.446	106346	109904	408.355	212	266	0.70555	0.6980	170
700.000	1.5155	0.68022	0.18905	26.510	111160	115119	415.917	214	256	0.73262	0.5911	185
750.000	1.2549	0.76674	0.14479	37.238	122889	127670	433.245	221	248	0.78718	0.4244	212
800.000	1.0965	0.82264	0.12029	46.206	134637	140109	449.305	228	249	0.82891	0.3285	233
					65.0 bar							
180.170	10.4429	0.41550	25.58714	3058.693	154	776	150.750	99	135	0.00000	-0.0606	2119
190.000	10.3603	0.39715	23.91812	2836.113	1359	1986	157.251	100	135	0.00000	-0.0600	2043
200.000	10.2756	0.38040	22.38040	2631.420	2618	3251	163.696	100	136	0.00000	-0.0594	1969
210.000	10.1902	0.36532	20.98129	2445.565	3909	4547	169.982	101	137	0.00000	-0.0586	1898
220.000	10.1040	0.35169	19.70194	2276.017	5228	5871	176.118	102	139	0.00000	-0.0577	1831
230.000	10.0171	0.33932	18.52677	2120.682	6576	7224	182.116	103	140	0.00001	-0.0567	1767
240.000	9.9293	0.32806	17.44284	1977.821	7950	8605	187.986	105	142	0.00002	-0.0556	1706
250.000	9.8407	0.31777	16.43927	1845.972	9351	10012	193.735	106	144	0.00004	-0.0544	1646
260.000	9.7512	0.30835	15.50687	1723.901	10779	11446	199.374	108	146	0.00008	-0.0531	1589
270.000	9.6607	0.29971	14.63785	1610.558	12234	12907	204.910	110	149	0.00015	-0.0518	1534
280.000	9.5694	0.29177	13.82551	1505.041	13717	14397	210.352	112	151	0.00029	-0.0504	1481
290.000	9.4770	0.28445	13.06411	1406.580	15229	15915	215.707	115	154	0.00050	-0.0490	1430
300.000	9.3836	0.27771	12.34871	1314.501	16770	17463	220.981	117	157	0.00084	-0.0475	1380
310.000	9.2891	0.27148	11.67498	1228.224	18343	19042	226.183	120	159	0.00136	-0.0460	1332
320.000	9.1935	0.26573	11.03919	1147.237	19946	20653	231.316	122	162	0.00212	-0.0444	1285
330.000	9.0966	0.26042	10.43804	1071.094	21583	22297	236.388	125	166	0.00319	-0.0428	1240
340.000	8.9985	0.25552	9.86866	999.401	23253	23976	241.404	128	169	0.00468	-0.0412	1195
350.000	8.8991	0.25099	9.32852	931.809	24958	25688	246.367	131	172	0.00668	-0.0395	1152
360.000	8.7983	0.24682	8.81537	868.011	26698	27436	251.284	134	175	0.00932	-0.0378	1110
370.000	8.6960	0.24297	8.32721	807.731	28473	29221	256.157	137	179	0.01272	-0.0360	1069
380.000	8.5921	0.23944	7.86229	750.725	30284	31041	260.991	140	182	0.01702	-0.0342	1029

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
390.000	8.4865	0.23620	7.41901	696.774	32131	32897	265.788	143	186	0.02236	-0.0323	990
400.000	8.3791	0.23325	6.99596	645.682	34014	34790	270.551	146	189	0.02889	-0.0303	952
410.000	8.2697	0.23057	6.59186	597.270	35932	36718	275.283	149	193	0.03673	-0.0283	914
420.000	8.1583	0.22815	6.20556	551.380	37885	38682	279.986	152	196	0.04601	-0.0262	878
430.000	8.0446	0.22600	5.83601	507.867	39872	40680	284.662	155	200	0.05683	-0.0239	841
440.000	7.9284	0.22410	5.48226	466.599	41891	42711	289.312	158	204	0.06927	-0.0215	806
450.000	7.8095	0.22245	5.14342	427.457	43943	44775	293.937	161	207	0.08338	-0.0189	771
460.000	7.6876	0.22107	4.81867	390.329	46026	46871	298.539	164	211	0.09916	-0.0161	736
470.000	7.5625	0.21995	4.50725	355.115	48138	48998	303.118	167	214	0.11660	-0.0130	702
480.000	7.4337	0.21910	4.20843	321.720	50281	51155	307.675	170	218	0.13564	-0.0096	668
490.000	7.3007	0.21853	3.92152	290.057	52452	53343	312.210	172	221	0.15621	-0.0057	635
500.000	7.1631	0.21828	3.64582	260.046	54653	55561	316.726	175	225	0.17821	-0.0013	601
510.000	7.0201	0.21836	3.38065	231.612	56885	57811	321.223	177	228	0.20157	0.0038	568
520.000	6.8708	0.21881	3.12532	204.684	59149	60095	325.704	179	232	0.22623	0.0097	535
530.000	6.7143	0.21969	2.87908	179.199	61449	62417	330.171	182	236	0.25219	0.0169	502
540.000	6.5489	0.22106	2.64116	155.099	63791	64784	334.631	184	240	0.27957	0.0256	469
550.000	6.3729	0.22304	2.41065	132.335	66184	67204	339.093	186	245	0.30857	0.0365	435
560.000	6.1836	0.22576	2.18652	110.867	68641	69692	343.572	188	251	0.33958	0.0505	400
570.000	5.9769	0.22947	1.96747	90.675	71182	72270	348.094	191	259	0.37316	0.0688	365
580.000	5.7472	0.23453	1.75182	71.764	73844	74975	352.714	197	272	0.40991	0.0934	327
585.000	5.6208	0.23775	1.64458	62.805	75241	76398	355.097	203	283	0.42950	0.1084	308
590.000	5.4846	0.24159	1.53723	54.197	76708	77893	357.585	218	304	0.44928	0.1230	286
593.000	5.3973	0.24426	1.47258	49.210	77651	78856	359.210	257	346	0.45944	0.1222	268
595.000	5.3363	0.24622	1.42931	45.966	78262	79480	360.143	213	306	0.47279	0.1509	267
600.000	5.1724	0.25190	1.32022	38.157	79765	81021	362.722	209	311	0.48958	0.1869	248
610.000	4.7778	0.26824	1.09556	24.154	82911	84272	368.094	209	341	0.52254	0.2932	207
620.000	4.2410	0.29732	0.85915	13.676	86415	87948	374.071	210	396	0.55394	0.4862	167
630.000	3.5633	0.34824	0.63781	9.521	90305	92129	380.761	212	424	0.58266	0.7173	143
640.000	2.9811	0.40975	0.48758	9.929	94007	96188	387.157	212	384	0.60788	0.8318	139
660.000	2.2867	0.51799	0.33455	14.144	100252	103095	397.795	212	312	0.64983	0.8161	150
680.000	1.9309	0.59541	0.26322	19.534	105585	108952	406.546	213	278	0.68408	0.6971	166
700.000	1.7114	0.65257	0.22160	24.636	110550	114348	414.372	215	263	0.71338	0.5947	180
750.000	1.3921	0.74876	0.16528	35.684	122468	127137	432.030	222	251	0.77210	0.4267	209
800.000	1.2062	0.81013	0.13548	44.969	134308	139697	448.246	229	251	0.81685	0.3290	231
					70.0 bar							
180.321	10.4432	0.44707	25.54292	3057.684	166	836	150.813	100	135	0.00000	-0.0606	2118
190.000	10.3621	0.42762	23.90332	2838.853	1352	2027	157.212	100	135	0.00000	-0.0601	2043
200.000	10.2775	0.40958	22.36788	2634.298	2610	3292	163.656	100	136	0.00000	-0.0594	1969
210.000	10.1922	0.39334	20.97090	2448.577	3900	4587	169.940	101	137	0.00000	-0.0586	1899
220.000	10.1062	0.37866	19.69354	2279.160	5219	5912	176.076	102	139	0.00000	-0.0577	1832
230.000	10.0194	0.36534	18.52027	2123.954	6566	7264	182.073	103	140	0.00001	-0.0567	1768
240.000	9.9318	0.35320	17.43815	1981.219	7939	8644	187.941	105	142	0.00002	-0.0556	1706
250.000	9.8434	0.34212	16.43632	1849.495	9340	10051	193.689	106	144	0.00004	-0.0544	1647
260.000	9.7541	0.33197	15.50560	1727.548	10767	11485	199.327	108	146	0.00008	-0.0532	1590
270.000	9.6638	0.32266	14.63820	1614.328	12221	12946	204.862	110	149	0.00015	-0.0518	1536
280.000	9.5727	0.31410	13.82746	1508.937	13704	14435	210.302	112	151	0.00027	-0.0505	1483
290.000	9.4806	0.30622	13.06762	1410.598	15214	15953	215.655	115	154	0.00048	-0.0490	1431
300.000	9.3874	0.29895	12.35376	1318.644	16755	17500	220.928	117	156	0.00080	-0.0476	1382
310.000	9.2932	0.29224	11.68155	1232.491	18326	19079	226.128	120	159	0.00129	-0.0460	1334
320.000	9.1978	0.28604	11.04727	1151.630	19929	20690	231.259	122	162	0.00201	-0.0445	1287
330.000	9.1013	0.28031	10.44764	1075.614	21564	22333	236.329	125	165	0.00303	-0.0429	1242
340.000	9.0035	0.27502	9.87978	1004.049	23233	24010	241.343	128	169	0.00443	-0.0413	1198
350.000	8.9045	0.27014	9.34116	936.587	24936	25722	246.304	131	172	0.00633	-0.0396	1155
360.000	8.8040	0.26563	8.82954	872.919	26675	27470	251.218	134	175	0.00882	-0.0379	1113
370.000	8.7021	0.26148	8.34293	812.771	28448	29253	256.089	137	179	0.01203	-0.0361	1072
380.000	8.5987	0.25766	7.87958	755.898	30258	31072	260.920	140	182	0.01610	-0.0343	1032
390.000	8.4936	0.25416	7.43789	702.081	32103	32927	265.714	143	186	0.02115	-0.0325	993
400.000	8.3868	0.25096	7.01647	651.124	33984	34819	270.474	146	189	0.02731	-0.0305	955
410.000	8.2781	0.24806	6.61403	602.848	35900	36746	275.203	149	193	0.03471	-0.0285	918
420.000	8.1673	0.24543	6.22942	557.095	37850	38708	279.902	152	196	0.04348	-0.0264	882
430.000	8.0544	0.24309	5.86161	513.719	39835	40704	284.574	156	200	0.05369	-0.0242	846
440.000	7.9390	0.24101	5.50965	472.589	41851	42733	289.219	159	203	0.06544	-0.0219	810
450.000	7.8211	0.23921	5.17265	433.585	43900	44795	293.839	161	207	0.07876	-0.0193	776
460.000	7.7004	0.23768	4.84980	396.595	45979	46888	298.435	164	210	0.09365	-0.0166	741
470.000	7.5764	0.23643	4.54035	361.519	48088	49012	303.008	167	214	0.11012	-0.0136	708
480.000	7.4490	0.23546	4.24359	328.262	50226	51166	307.557	170	217	0.12809	-0.0103	674
490.000	7.3177	0.23479	3.95882	296.737	52393	53350	312.085	172	221	0.14751	-0.0066	641

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
500.000	7.1820	0.23445	3.68538	266.864	54588	55563	316.591	175	224	0.16828	-0.0024	609
510.000	7.0413	0.23444	3.42261	238.568	56813	57807	321.077	177	228	0.19034	0.0024	576
520.000	6.8948	0.23482	3.16985	211.780	59069	60085	325.544	179	231	0.21363	0.0081	544
530.000	6.7416	0.23563	2.92642	186.436	61360	62399	329.996	182	235	0.23816	0.0147	511
540.000	6.5804	0.23693	2.69159	162.480	63691	64755	334.437	184	239	0.26404	0.0228	479
550.000	6.4097	0.23882	2.46458	139.864	66070	67162	338.874	186	244	0.29147	0.0327	446
560.000	6.2272	0.24143	2.24449	118.550	68508	69632	343.321	188	249	0.32083	0.0452	413
570.000	6.0298	0.24495	2.03028	98.517	71025	72186	347.801	191	257	0.35265	0.0612	378
580.000	5.8132	0.24970	1.82067	79.769	73653	74857	352.361	197	268	0.38752	0.0819	343
585.000	5.6957	0.25267	1.71710	70.890	75027	76256	354.704	203	278	0.40613	0.0939	324
590.000	5.5705	0.25616	1.61403	62.357	76466	77722	357.142	218	297	0.42495	0.1051	303
593.000	5.4912	0.25855	1.55231	57.411	77389	78664	358.731	256	339	0.43464	0.1031	286
595.000	5.4363	0.26028	1.51118	54.190	77984	79272	359.637	212	297	0.44733	0.1268	286
600.000	5.2909	0.26520	1.40820	46.422	79440	80763	362.132	208	300	0.46340	0.1536	269
610.000	4.9560	0.27848	1.20042	32.305	82436	83848	367.231	208	318	0.49514	0.2261	231
620.000	4.5358	0.29938	0.98854	20.823	85643	87187	372.660	209	350	0.52585	0.3448	194
630.000	4.0065	0.33355	0.77991	13.657	89138	90885	378.578	211	386	0.55484	0.5159	164
640.000	3.4479	0.38153	0.60728	11.715	92735	94765	384.691	212	381	0.58122	0.6549	151
660.000	2.6474	0.48184	0.40908	13.819	99201	101845	395.594	213	327	0.62618	0.7366	151
680.000	2.1961	0.56378	0.31286	18.317	104788	107975	404.752	214	289	0.66315	0.6742	163
700.000	1.9209	0.62614	0.25827	23.203	109913	113558	412.848	216	270	0.69461	0.5877	177
750.000	1.5350	0.73129	0.18755	34.341	122036	126597	430.853	222	255	0.75740	0.4261	206
800.000	1.3188	0.79796	0.15165	43.862	133974	139282	447.232	229	253	0.80510	0.3283	229
						80.0 bar						
180.623	10.4440	0.51005	25.45596	3055.827	188	954	150.938	100	135	0.00000	-0.0606	2116
190.000	10.3656	0.48855	23.87455	2844.422	1337	2109	157.134	100	135	0.00000	-0.0601	2043
200.000	10.2813	0.46792	22.34362	2640.139	2595	3373	163.576	100	136	0.00000	-0.0594	1969
210.000	10.1963	0.44936	20.95087	2454.681	3883	4668	169.858	101	137	0.00000	-0.0586	1899
220.000	10.1106	0.43257	19.67749	2285.521	5201	5992	175.992	102	139	0.00000	-0.0577	1833
230.000	10.0241	0.41733	18.50798	2130.567	6546	7344	181.986	103	140	0.00001	-0.0567	1769
240.000	9.9368	0.40345	17.42945	1988.080	7918	8724	187.852	105	142	0.00001	-0.0557	1708
250.000	9.8488	0.39078	16.43107	1856.601	9317	10130	193.598	107	144	0.00003	-0.0545	1649
260.000	9.7598	0.37917	15.50367	1734.898	10743	11563	199.233	108	146	0.00007	-0.0532	1592
270.000	9.6700	0.36852	14.63950	1621.921	12196	13023	204.765	110	148	0.00013	-0.0519	1538
280.000	9.5793	0.35873	13.83190	1516.771	13676	14511	210.202	112	151	0.00025	-0.0506	1485
290.000	9.4876	0.34970	13.07516	1418.674	15185	16028	215.552	115	154	0.00044	-0.0491	1434
300.000	9.3950	0.34138	12.36432	1326.963	16724	17575	220.822	117	156	0.00073	-0.0477	1385
310.000	9.3013	0.33370	11.69513	1241.054	18293	19153	226.018	120	159	0.00118	-0.0462	1337
320.000	9.2065	0.32660	11.06383	1160.439	19893	20762	231.146	122	162	0.00183	-0.0446	1291
330.000	9.1106	0.32003	10.46716	1084.669	21526	22404	236.213	125	165	0.00276	-0.0430	1246
340.000	9.0135	0.31397	9.90227	1013.352	23193	24080	241.222	128	169	0.00403	-0.0414	1202
350.000	8.9151	0.30836	9.36662	946.140	24893	25791	246.179	131	172	0.00575	-0.0398	1160
360.000	8.8154	0.30319	8.85799	882.724	26629	27536	251.089	134	175	0.00802	-0.0381	1118
370.000	8.7144	0.29841	8.37440	822.830	28400	29318	255.954	137	179	0.01093	-0.0364	1078
380.000	8.6119	0.29402	7.91409	766.212	30206	31135	260.780	140	182	0.01461	-0.0346	1038
390.000	8.5078	0.28998	7.47549	712.651	32048	32988	265.568	143	185	0.01919	-0.0328	1000
400.000	8.4020	0.28629	7.05719	661.951	33925	34877	270.322	146	189	0.02477	-0.0309	962
410.000	8.2945	0.28293	6.65792	613.934	35837	36801	275.044	149	192	0.03147	-0.0290	926
420.000	8.1851	0.27989	6.27655	568.438	37783	38760	279.736	153	196	0.03940	-0.0270	889
430.000	8.0736	0.27715	5.91204	525.321	39762	40753	284.400	156	199	0.04864	-0.0248	854
440.000	7.9599	0.27472	5.56344	484.448	41773	42778	289.036	159	203	0.05926	-0.0226	820
450.000	7.8439	0.27259	5.22988	445.700	43816	44836	293.646	162	206	0.07130	-0.0201	785
460.000	7.7252	0.27076	4.91058	408.965	45889	46924	298.231	164	210	0.08477	-0.0175	752
470.000	7.6036	0.26924	4.60477	374.141	47990	49043	302.792	167	213	0.09966	-0.0147	719
480.000	7.4789	0.26802	4.31176	341.135	50120	51190	307.328	170	217	0.11591	-0.0116	686
490.000	7.3507	0.26713	4.03089	309.858	52278	53366	311.840	172	220	0.13346	-0.0082	654
500.000	7.2186	0.26658	3.76152	280.231	54462	55571	316.328	175	223	0.15225	-0.0043	623
510.000	7.0821	0.26639	3.50302	252.179	56675	57805	320.794	177	227	0.17220	0.0000	591
520.000	6.9406	0.26660	3.25478	225.633	58917	60070	325.237	179	230	0.19328	0.0050	560
530.000	6.7933	0.26724	3.01620	200.531	61191	62369	329.660	181	233	0.21550	0.0109	529
540.000	6.6394	0.26837	2.78663	176.816	63502	64707	334.067	183	237	0.23895	0.0179	498
550.000	6.4777	0.27007	2.56543	154.442	65856	67091	338.462	185	241	0.26384	0.0262	466
560.000	6.3066	0.27244	2.35190	133.370	68263	69532	342.856	187	246	0.29052	0.0364	435
570.000	6.1242	0.27563	2.14529	113.579	70740	72047	347.267	190	252	0.31947	0.0490	403
580.000	5.9278	0.27985	1.94477	95.065	73315	74664	351.735	196	262	0.35127	0.0645	371
585.000	5.8232	0.28245	1.84651	86.295	74655	76029	354.019	202	270	0.36827	0.0730	353
590.000	5.7136	0.28542	1.74940	77.859	76054	77454	356.387	217	288	0.38551	0.0802	334

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
593.000	5.6451	0.28743	1.69165	72.962	76949	78366	357.926	255	328	0.39442	0.0774	319
595.000	5.5983	0.28886	1.65334	69.769	77523	78952	358.795	211	286	0.40601	0.0947	319
600.000	5.4763	0.29283	1.55816	62.044	78919	80380	361.184	207	285	0.42085	0.1118	304
610.000	5.2083	0.30285	1.36999	47.801	81744	83280	365.978	206	295	0.45036	0.1533	272
620.000	4.8992	0.31677	1.18426	35.482	84670	86303	370.894	207	310	0.47938	0.2122	239
630.000	4.5376	0.33658	1.00227	25.719	87733	89496	376.004	209	329	0.50755	0.2954	209
640.000	4.1250	0.36446	0.83109	19.375	90937	92876	381.328	211	345	0.53432	0.3971	185
660.000	3.3199	0.43912	0.57335	16.518	97338	99748	391.908	213	332	0.58246	0.5341	167
680.000	2.7483	0.51485	0.42860	18.502	103200	106111	401.413	215	304	0.62349	0.5650	168
700.000	2.3670	0.58071	0.34362	22.052	108605	111985	409.932	217	284	0.65880	0.5365	176
750.000	1.8354	0.69898	0.23749	32.456	121149	125508	428.605	223	261	0.72931	0.4141	203
800.000	1.5518	0.77506	0.18698	42.129	133294	138450	445.316	229	257	0.78262	0.3226	226
						90.0 bar						
180.923	10.4448	0.57281	25.37093	3054.179	211	1073	151.062	100	135	0.00000	-0.0606	2114
190.000	10.3691	0.54943	23.84684	2850.107	1323	2191	157.056	100	135	0.00000	-0.0601	2043
200.000	10.2851	0.52622	22.32039	2646.088	2579	3454	163.496	101	136	0.00000	-0.0595	1970
210.000	10.2004	0.50532	20.93181	2460.888	3866	4749	169.776	101	137	0.00000	-0.0587	1900
220.000	10.1150	0.48643	19.66237	2291.978	5183	6072	175.908	102	139	0.00000	-0.0578	1834
230.000	10.0288	0.46928	18.49659	2137.270	6527	7424	181.900	104	140	0.00001	-0.0568	1770
240.000	9.9419	0.45366	17.42161	1995.025	7898	8803	187.763	105	142	0.00001	-0.0557	1709
250.000	9.8541	0.43939	16.42663	1863.786	9295	10208	193.507	107	144	0.00003	-0.0545	1651
260.000	9.7656	0.42632	15.50252	1742.319	10719	11641	199.139	108	146	0.00006	-0.0533	1594
270.000	9.6762	0.41432	14.64153	1629.578	12170	13100	204.669	110	148	0.00013	-0.0520	1540
280.000	9.5859	0.40329	13.83703	1524.663	13649	14588	210.103	113	151	0.00023	-0.0506	1488
290.000	9.4947	0.39312	13.08332	1426.802	15156	16104	215.450	115	153	0.00040	-0.0492	1437
300.000	9.4025	0.38375	12.37547	1335.325	16693	17650	220.717	117	156	0.00068	-0.0478	1388
310.000	9.3093	0.37508	11.70922	1249.652	18260	19227	225.910	120	159	0.00109	-0.0463	1341
320.000	9.2151	0.36708	11.08083	1169.272	19858	20835	231.034	123	162	0.00169	-0.0448	1295
330.000	9.1197	0.35967	10.48706	1093.740	21489	22476	236.097	125	165	0.00255	-0.0432	1250
340.000	9.0233	0.35283	9.92506	1022.661	23153	24150	241.102	128	168	0.00373	-0.0416	1206
350.000	8.9256	0.34650	9.39229	955.688	24851	25860	246.055	131	172	0.00531	-0.0400	1164
360.000	8.8267	0.34065	8.88656	892.512	26584	27604	250.960	134	175	0.00740	-0.0383	1123
370.000	8.7265	0.33525	8.40587	832.859	28352	29383	255.821	137	178	0.01009	-0.0366	1083
380.000	8.6248	0.33027	7.94847	776.482	30155	31198	260.641	140	182	0.01348	-0.0349	1044
390.000	8.5217	0.32570	7.51281	723.163	31993	33049	265.424	143	185	0.01768	-0.0331	1006
400.000	8.4170	0.32151	7.09748	672.704	33867	34936	270.172	146	189	0.02282	-0.0313	969
410.000	8.3106	0.31768	6.70122	624.927	35775	36857	274.888	150	192	0.02898	-0.0294	933
420.000	8.2025	0.31420	6.32288	579.671	37716	38813	279.573	153	196	0.03627	-0.0274	897
430.000	8.0924	0.31107	5.96145	536.791	39691	40803	284.228	156	199	0.04476	-0.0254	862
440.000	7.9803	0.30827	5.61597	496.153	41697	42825	288.857	159	203	0.05452	-0.0232	828
450.000	7.8660	0.30580	5.28559	457.638	43734	44878	293.458	162	206	0.06557	-0.0209	795
460.000	7.7493	0.30366	4.96952	421.132	45801	46962	298.033	164	209	0.07794	-0.0184	762
470.000	7.6299	0.30185	4.66701	386.534	47896	49075	302.582	167	213	0.09161	-0.0158	730
480.000	7.5077	0.30037	4.37737	353.750	50018	51217	307.105	170	216	0.10653	-0.0129	698
490.000	7.3823	0.29924	4.09996	322.691	52167	53386	311.603	172	219	0.12265	-0.0097	667
500.000	7.2535	0.29846	3.83415	293.277	54342	55582	316.075	175	222	0.13990	-0.0061	636
510.000	7.1207	0.29807	3.57934	265.432	56543	57807	320.522	177	226	0.15823	-0.0021	605
520.000	6.9836	0.29807	3.33497	239.090	58772	60061	324.944	179	229	0.17761	0.0024	575
530.000	6.8415	0.29852	3.10044	214.186	61032	62347	329.343	181	232	0.19804	0.0076	545
540.000	6.6938	0.29946	2.87520	190.665	63325	64669	333.720	183	235	0.21962	0.0137	515
550.000	6.5396	0.30095	2.65867	168.480	65658	67034	338.080	185	239	0.24254	0.0209	485
560.000	6.3778	0.30307	2.45027	147.591	68040	69451	342.431	187	243	0.26713	0.0294	456
570.000	6.2071	0.30595	2.24940	127.973	70486	71936	346.789	190	249	0.29386	0.0397	426
580.000	6.0256	0.30973	2.05545	109.615	73020	74514	351.187	196	257	0.32326	0.0519	395
585.000	5.9302	0.31202	1.96086	100.913	74337	75854	353.430	201	265	0.33901	0.0583	379
590.000	5.8312	0.31463	1.86777	92.533	75707	77251	355.749	216	282	0.35499	0.0634	361
593.000	5.7699	0.31636	1.81260	87.664	76583	78143	357.255	255	321	0.36327	0.0606	346
595.000	5.7282	0.31759	1.77609	84.484	77145	78716	358.101	211	279	0.37401	0.0740	347
600.000	5.6208	0.32096	1.68576	76.776	78502	80103	360.423	207	277	0.38785	0.0862	334
610.000	5.3906	0.32918	1.50887	62.448	81230	82899	365.045	206	282	0.41549	0.1138	304
620.000	5.1358	0.33994	1.33684	49.737	84016	85768	369.711	207	291	0.44290	0.1499	275
630.000	4.8515	0.35415	1.17016	38.951	86882	88737	374.461	208	302	0.46985	0.1976	247
640.000	4.5352	0.37293	1.01106	30.525	89838	91822	379.322	210	314	0.49596	0.2577	222
660.000	3.8498	0.42601	0.73812	22.003	95914	98252	389.219	213	323	0.54470	0.3815	190
680.000	3.2525	0.48942	0.55489	21.546	101813	104580	398.671	215	307	0.58788	0.4384	182

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
700.000	2.8107	0.55016	0.44084	23.441	107357	110559	407.342	217	291	0.62588	0.4500	184
750.000	2.1475	0.67207	0.29433	31.856	120252	124443	426.513	223	267	0.70288	0.3870	203
800.000	1.7923	0.75494	0.22626	41.173	132606	137628	443.539	230	261	0.76134	0.3104	225
						100.0 bar						
181.220	10.4456	0.63537	25.28778	3052.734	234	1191	151.185	100	135	0.00000	-0.0606	2112
190.000	10.3726	0.61027	23.82015	2855.903	1308	2272	156.978	100	135	0.00000	-0.0602	2044
200.000	10.2889	0.58448	22.29813	2652.142	2563	3535	163.416	101	136	0.00000	-0.0595	1971
210.000	10.2044	0.56125	20.91369	2467.192	3850	4830	169.695	102	137	0.00000	-0.0587	1901
220.000	10.1193	0.54024	19.64814	2298.527	5165	6153	175.824	103	139	0.00000	-0.0578	1835
230.000	10.0335	0.52118	18.48605	2144.058	6507	7504	181.814	104	140	0.00001	-0.0569	1771
240.000	9.9469	0.50381	17.41458	2002.049	7877	8882	187.675	105	142	0.00001	-0.0558	1711
250.000	9.8595	0.48794	16.42296	1871.043	9273	10287	193.416	107	144	0.00003	-0.0546	1652
260.000	9.7713	0.47341	15.50209	1749.807	10696	11719	199.046	109	146	0.00006	-0.0534	1596
270.000	9.6823	0.46007	14.64424	1637.295	12145	13178	204.573	111	148	0.00012	-0.0521	1542
280.000	9.5924	0.44779	13.84279	1532.608	13622	14665	210.005	113	151	0.00022	-0.0507	1490
290.000	9.5016	0.43648	13.09206	1434.974	15128	16180	215.349	115	153	0.00038	-0.0493	1440
300.000	9.4099	0.42605	12.38714	1343.725	16662	17725	220.613	117	156	0.00064	-0.0479	1391
310.000	9.3173	0.41640	11.72377	1258.279	18227	19301	225.802	120	159	0.00102	-0.0464	1344
320.000	9.2236	0.40749	11.09823	1178.127	19824	20908	230.923	123	162	0.00159	-0.0449	1298
330.000	9.1288	0.39924	10.50729	1102.823	21452	22548	235.982	125	165	0.00239	-0.0434	1254
340.000	9.0330	0.39161	9.94809	1031.972	23114	24221	240.984	128	168	0.00349	-0.0418	1211
350.000	8.9360	0.38455	9.41813	965.228	24809	25929	245.932	131	172	0.00497	-0.0402	1169
360.000	8.8378	0.37802	8.91518	902.280	26540	27671	250.833	134	175	0.00692	-0.0386	1128
370.000	8.7384	0.37199	8.43729	842.855	28305	29449	255.689	137	178	0.00942	-0.0369	1089
380.000	8.6376	0.36643	7.98270	786.707	30105	31262	260.505	140	182	0.01258	-0.0352	1050
390.000	8.5354	0.36131	7.54985	733.615	31940	33111	265.282	143	185	0.01650	-0.0335	1013
400.000	8.4318	0.35660	7.13734	683.382	33810	34995	270.024	147	188	0.02128	-0.0317	976
410.000	8.3265	0.35230	6.74392	635.830	35714	36915	274.734	150	192	0.02702	-0.0298	940
420.000	8.2196	0.34839	6.36845	590.796	37651	38868	279.412	153	195	0.03380	-0.0279	905
430.000	8.1109	0.34485	6.00990	548.136	39621	40854	284.060	156	199	0.04170	-0.0259	871
440.000	8.0003	0.34167	5.66733	507.715	41623	42873	288.680	159	202	0.05077	-0.0238	837
450.000	7.8876	0.33885	5.33988	469.411	43654	44922	293.273	162	206	0.06105	-0.0216	804
460.000	7.7727	0.33638	5.02678	433.114	45715	47002	297.838	164	209	0.07255	-0.0192	772
470.000	7.6554	0.33427	4.72727	398.719	47803	49110	302.377	167	212	0.08526	-0.0167	740
480.000	7.5355	0.33251	4.44068	366.132	49918	51246	306.889	170	215	0.09913	-0.0140	709
490.000	7.4127	0.33112	4.16636	335.265	52059	53408	311.373	172	219	0.11411	-0.0110	679
500.000	7.2869	0.33011	3.90371	306.036	54225	55598	315.831	175	222	0.13015	-0.0077	648
510.000	7.1575	0.32948	3.65215	278.372	56417	57814	320.261	177	225	0.14719	-0.0040	619
520.000	7.0243	0.32927	3.41112	252.202	58635	60058	324.664	179	228	0.16521	0.0001	589
530.000	6.8868	0.32951	3.18006	227.464	60881	62333	329.041	181	231	0.18422	0.0048	560
540.000	6.7445	0.33023	2.95846	204.102	63159	64641	333.393	183	234	0.20432	0.0102	531
550.000	6.5967	0.33149	2.74579	182.068	65474	66990	337.723	185	237	0.22568	0.0164	503
560.000	6.4426	0.33336	2.54153	161.320	67835	69387	342.038	187	241	0.24861	0.0237	474
570.000	6.2812	0.33593	2.34517	141.830	70255	71847	346.352	190	246	0.27356	0.0323	446
580.000	6.1115	0.33931	2.15620	123.582	72758	74394	350.696	195	254	0.30104	0.0422	417
585.000	6.0229	0.34135	2.06434	114.923	74056	75716	352.907	201	261	0.31578	0.0473	402
590.000	5.9318	0.34366	1.97415	106.577	75405	77091	355.190	216	277	0.33076	0.0512	385
593.000	5.8756	0.34519	1.92081	101.722	76268	77970	356.673	254	317	0.33853	0.0486	370
595.000	5.8376	0.34627	1.88557	98.549	76819	78532	357.502	210	273	0.34858	0.0594	372
600.000	5.7403	0.34920	1.79856	90.844	78150	79892	359.778	206	271	0.36160	0.0686	359
610.000	5.5350	0.35622	1.62908	76.444	80813	82620	364.286	205	274	0.38768	0.0887	332
620.000	5.3132	0.36510	1.46555	63.487	83514	85396	368.801	206	280	0.41368	0.1136	306
630.000	5.0725	0.37636	1.30817	52.144	86267	88239	373.351	207	288	0.43944	0.1448	280
640.000	4.8113	0.39059	1.15791	42.656	89082	91161	377.954	209	296	0.46466	0.1832	255
660.000	4.2387	0.42992	0.88852	30.231	94868	97227	387.292	212	308	0.51279	0.2735	218
680.000	3.6754	0.48122	0.68255	26.196	100670	103390	396.497	215	305	0.55680	0.3408	200
700.000	3.2118	0.53495	0.54316	26.692	106259	109372	405.172	218	293	0.59638	0.3650	197
750.000	2.4586	0.65225	0.35685	32.672	119380	123447	424.605	224	272	0.67834	0.3480	207
800.000	2.0358	0.73847	0.26919	41.105	131922	136835	441.893	230	264	0.74134	0.2922	226
						120.0 bar						
181.810	10.4473	0.75984	25.12686	3050.427	278	1427	151.427	100	135	0.00000	-0.0606	2108
190.000	10.3796	0.73183	23.76968	2867.811	1280	2436	156.824	100	135	0.00000	-0.0602	2045
200.000	10.2964	0.70086	22.25639	2664.545	2533	3698	163.258	101	136	0.00000	-0.0596	1972
210.000	10.2125	0.67297	20.88009	2480.077	3816	4991	169.532	102	137	0.00000	-0.0588	1903
220.000	10.1280	0.64774	19.62219	2311.881	5129	6314	175.658	103	139	0.00000	-0.0579	1837

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
230.000	10.0428	0.62483	18.46734	2157.873	6469	7664	181.644	104	140	0.00001	-0.0570	1774
240.000	9.9568	0.60397	17.40276	2016.316	7836	9041	187.500	105	142	0.00001	-0.0559	1714
250.000	9.8701	0.58490	16.41773	1885.757	9229	10445	193.237	107	144	0.00003	-0.0547	1656
260.000	9.7827	0.56743	15.50321	1764.963	10649	11876	198.862	109	146	0.00006	-0.0535	1601
270.000	9.6945	0.55139	14.65149	1652.889	12095	13333	204.383	111	148	0.00011	-0.0522	1547
280.000	9.6054	0.53663	13.85600	1548.638	13569	14818	209.810	113	151	0.00020	-0.0509	1495
290.000	9.5155	0.52302	13.11108	1451.438	15071	16332	215.148	115	153	0.00035	-0.0495	1446
300.000	9.4247	0.51045	12.41185	1360.621	16602	17875	220.406	118	156	0.00058	-0.0481	1397
310.000	9.3330	0.49884	11.75407	1275.606	18163	19449	225.589	120	159	0.00093	-0.0467	1351
320.000	9.2404	0.48809	11.13404	1195.884	19755	21054	230.703	123	162	0.00144	-0.0452	1306
330.000	9.1468	0.47815	10.54853	1121.008	21380	22692	235.755	126	165	0.00216	-0.0437	1262
340.000	9.0522	0.46893	9.99472	1050.586	23037	24362	240.749	129	168	0.00314	-0.0421	1220
350.000	8.9565	0.46040	9.47010	984.269	24728	26067	245.690	131	171	0.00447	-0.0406	1178
360.000	8.8598	0.45250	8.97248	921.747	26452	27807	250.583	134	175	0.00622	-0.0390	1138
370.000	8.7618	0.44519	8.49988	862.746	28212	29582	255.430	138	178	0.00846	-0.0374	1100
380.000	8.6627	0.43844	8.05056	807.018	30006	31391	260.236	141	181	0.01128	-0.0357	1062
390.000	8.5623	0.43220	7.62298	754.342	31835	33236	265.003	144	185	0.01478	-0.0340	1025
400.000	8.4606	0.42647	7.21573	704.521	33698	35116	269.734	147	188	0.01904	-0.0323	989
410.000	8.3574	0.42120	6.82757	657.375	35595	37031	274.432	150	191	0.02416	-0.0306	954
420.000	8.2528	0.41638	6.45735	612.742	37524	38979	279.098	153	195	0.03019	-0.0288	920
430.000	8.1466	0.41200	6.10406	570.474	39486	40959	283.733	156	198	0.03722	-0.0269	886
440.000	8.0388	0.40804	5.76675	530.436	41478	42971	288.338	159	202	0.04529	-0.0249	854
450.000	7.9292	0.40449	5.44457	492.505	43500	45014	292.914	162	205	0.05444	-0.0229	822
460.000	7.8177	0.40134	5.13674	456.570	45550	47085	297.462	165	208	0.06466	-0.0207	791
470.000	7.7041	0.39859	4.84252	422.525	47627	49184	301.982	167	211	0.07594	-0.0184	760
480.000	7.5884	0.39624	4.56124	390.275	49729	51310	306.472	170	214	0.08826	-0.0160	730
490.000	7.4703	0.39429	4.29226	359.730	51855	53462	310.934	172	217	0.10158	-0.0134	701
500.000	7.3497	0.39274	4.03499	330.811	54005	55638	315.365	175	220	0.11583	-0.0105	672
510.000	7.2263	0.39162	3.78887	303.439	56179	57840	319.767	177	223	0.13097	-0.0073	644
520.000	7.0999	0.39092	3.55337	277.547	58377	60067	324.137	179	226	0.14700	-0.0039	616
530.000	6.9701	0.39069	3.32796	253.070	60601	62322	328.477	181	229	0.16391	-0.0000	589
540.000	6.8367	0.39093	3.11216	229.951	62853	64608	332.786	183	231	0.18181	0.0044	561
550.000	6.6993	0.39170	2.90551	208.139	65139	66930	337.067	185	234	0.20085	0.0093	535
560.000	6.5574	0.39303	2.70755	187.590	67465	69295	341.325	187	238	0.22132	0.0149	508
570.000	6.4104	0.39499	2.51786	168.270	69845	71717	345.572	189	242	0.24364	0.0213	482
580.000	6.2579	0.39764	2.33602	150.154	72301	74219	349.837	195	249	0.26827	0.0284	455
585.000	6.1793	0.39925	2.24793	141.542	73572	75514	352.002	201	255	0.28149	0.0319	442
590.000	6.0990	0.40108	2.16168	133.227	74892	76860	354.235	215	271	0.29495	0.0344	426
593.000	6.0501	0.40228	2.11078	128.380	75736	77719	355.685	254	310	0.30196	0.0326	412
595.000	6.0170	0.40313	2.07721	125.209	76274	78268	356.491	210	266	0.31098	0.0399	415
600.000	5.9331	0.40543	1.99450	117.490	77569	79592	358.706	205	263	0.32274	0.0458	404
610.000	5.7592	0.41082	1.83422	102.961	80148	82232	363.070	204	265	0.34642	0.0581	380
620.000	5.5765	0.41744	1.68070	89.678	82746	84898	367.406	205	268	0.37017	0.0724	356
630.000	5.3842	0.42549	1.53391	77.706	85374	87603	371.735	206	272	0.39390	0.0892	333
640.000	5.1816	0.43521	1.39408	67.132	88037	90353	376.068	208	277	0.41740	0.1089	311
660.000	4.7477	0.46059	1.13774	50.596	93469	95996	384.755	211	286	0.46330	0.1562	272
680.000	4.2928	0.49442	0.91985	40.646	98995	101791	393.409	214	291	0.50692	0.2064	244
700.000	3.8582	0.53439	0.74846	36.520	104509	107619	401.860	217	290	0.54763	0.2429	229
750.000	3.0312	0.63486	0.49155	38.016	117814	121773	421.400	224	276	0.63543	0.2624	225
800.000	2.5108	0.71852	0.36361	43.738	130619	135398	438.994	231	269	0.70546	0.2437	235
					150.0 bar							
182.681	10.4500	0.94504	24.89811	3048.332	343	1779	151.780	101	135	0.00000	-0.0607	2102
190.000	10.3900	0.91387	23.70067	2886.405	1237	2681	156.594	101	135	0.00000	-0.0603	2047
200.000	10.3076	0.87512	22.20012	2683.833	2487	3942	163.023	101	136	0.00000	-0.0597	1975
210.000	10.2246	0.84022	20.83570	2500.038	3767	5234	169.292	102	137	0.00000	-0.0589	1906
220.000	10.1409	0.80864	19.58895	2332.498	5076	6556	175.411	103	138	0.00000	-0.0581	1841
230.000	10.0566	0.77997	18.44463	2179.133	6413	7904	181.391	104	140	0.00000	-0.0571	1779
240.000	9.9716	0.75384	17.39006	2038.208	7776	9280	187.241	106	142	0.00001	-0.0561	1719
250.000	9.8860	0.72996	16.41459	1908.270	9165	10682	192.971	107	144	0.00002	-0.0549	1662
260.000	9.7996	0.70807	15.50925	1788.091	10580	12111	198.588	109	146	0.00005	-0.0537	1607
270.000	9.7125	0.68796	14.66638	1676.625	12022	13567	204.103	111	148	0.00010	-0.0525	1554
280.000	9.6246	0.66944	13.87946	1572.977	13491	15050	209.521	113	150	0.00018	-0.0512	1503
290.000	9.5360	0.65237	13.14287	1476.376	14988	16561	214.852	116	153	0.00032	-0.0498	1454
300.000	9.4466	0.63659	12.45176	1386.151	16514	18102	220.101	118	156	0.00052	-0.0484	1407
310.000	9.3563	0.62200	11.80192	1301.726	18069	19673	225.275	121	159	0.00084	-0.0470	1361
320.000	9.2652	0.60848	11.18968	1222.589	19656	21275	230.380	123	161	0.00130	-0.0456	1317
330.000	9.1733	0.59596	10.61183	1148.296	21274	22909	235.422	126	165	0.00194	-0.0441	1274

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
340.000	9.0804	0.58435	10.06556	1078.450	22924	24576	240.405	129	168	0.00283	-0.0426	1233
350.000	8.9866	0.57358	9.54838	1012.704	24608	26277	245.335	132	171	0.00401	-0.0411	1192
360.000	8.8918	0.56359	9.05810	950.749	26326	28013	250.216	135	174	0.00557	-0.0396	1153
370.000	8.7960	0.55433	8.59276	892.306	28078	29783	255.051	138	177	0.00756	-0.0380	1116
380.000	8.6992	0.54575	8.15064	837.129	29864	31588	259.843	141	181	0.01007	-0.0365	1079
390.000	8.6013	0.53781	7.73017	784.996	31684	33428	264.597	144	184	0.01317	-0.0349	1043
400.000	8.5022	0.53047	7.32997	735.707	33537	35302	269.313	147	187	0.01694	-0.0333	1008
410.000	8.4020	0.52371	6.94878	689.080	35424	37209	273.995	150	191	0.02146	-0.0316	974
420.000	8.3005	0.51749	6.58547	644.953	37343	39150	278.643	153	194	0.02680	-0.0299	941
430.000	8.1978	0.51179	6.23901	603.175	39293	41123	283.260	156	197	0.03300	-0.0282	909
440.000	8.0936	0.50659	5.90847	563.612	41273	43127	287.846	159	201	0.04011	-0.0264	878
450.000	7.9881	0.50188	5.59299	526.138	43282	45160	292.401	162	204	0.04816	-0.0246	847
460.000	7.8810	0.49764	5.29178	490.640	45317	47221	296.926	165	207	0.05716	-0.0227	817
470.000	7.7723	0.49386	5.00411	457.011	47378	49308	301.421	167	210	0.06709	-0.0207	788
480.000	7.6620	0.49054	4.72931	425.156	49464	51421	305.884	170	213	0.07793	-0.0185	760
490.000	7.5498	0.48767	4.46676	394.984	51572	53559	310.316	172	216	0.08963	-0.0163	732
500.000	7.4358	0.48524	4.21586	366.412	53702	55719	314.715	175	219	0.10216	-0.0139	705
510.000	7.3197	0.48327	3.97607	339.364	55853	57903	319.081	177	221	0.11548	-0.0113	678
520.000	7.2014	0.48176	3.74686	313.768	58027	60110	323.412	179	224	0.12958	-0.0085	652
530.000	7.0808	0.48073	3.52775	289.561	60224	62342	327.708	181	226	0.14447	-0.0055	626
540.000	6.9577	0.48017	3.31826	266.683	62446	64602	331.969	183	229	0.16024	-0.0022	601
550.000	6.8319	0.48012	3.11797	245.080	64698	66894	336.195	184	231	0.17704	0.0015	577
560.000	6.7032	0.48060	2.92646	224.706	66987	69225	340.391	186	234	0.19512	0.0056	553
570.000	6.5713	0.48165	2.74335	205.518	69325	71607	344.568	189	237	0.21487	0.0101	529
580.000	6.4361	0.48329	2.56827	187.484	71732	74063	348.753	194	244	0.23670	0.0149	504
585.000	6.3672	0.48434	2.48364	178.890	72976	75332	350.874	200	250	0.24845	0.0173	492
590.000	6.2973	0.48557	2.40089	170.575	74268	76650	353.059	215	265	0.26042	0.0191	477
593.000	6.2549	0.48639	2.35214	165.719	75093	77491	354.479	253	304	0.26667	0.0182	464
595.000	6.2264	0.48697	2.32000	162.537	75619	78028	355.264	209	260	0.27468	0.0224	468
600.000	6.1545	0.48855	2.24093	154.774	76881	79318	357.424	205	256	0.28519	0.0260	458
610.000	6.0076	0.49229	2.08812	140.070	79387	81884	361.665	204	256	0.30642	0.0333	437
620.000	5.8563	0.49687	1.94228	126.463	81901	84463	365.859	204	258	0.32784	0.0413	416
630.000	5.7004	0.50235	1.80324	113.961	84433	87064	370.022	206	261	0.34938	0.0502	396
640.000	5.5398	0.50884	1.67096	102.582	86986	89694	374.165	207	264	0.37089	0.0602	376
660.000	5.2053	0.52513	1.42681	83.297	92161	95043	382.400	210	270	0.41354	0.0832	340
680.000	4.8571	0.54622	1.21112	68.808	97418	100506	390.560	214	275	0.45520	0.1093	309
700.000	4.5060	0.57196	1.02611	59.092	102728	106057	398.608	217	278	0.49531	0.1351	286
750.000	3.7166	0.64721	0.69928	50.963	115963	119999	417.850	224	276	0.58614	0.1718	261
800.000	3.1369	0.71889	0.51611	53.238	128938	133719	435.566	231	272	0.66217	0.1724	260
					200.0 bar							
184.097	10.4549	1.24977	24.54730	3048.128	449	2362	152.347	101	135	0.00000	-0.0608	2095
190.000	10.4072	1.21648	23.60138	2919.127	1168	3090	156.217	101	135	0.00000	-0.0605	2051
200.000	10.3261	1.16473	22.12111	2717.576	2413	4350	162.638	102	136	0.00000	-0.0599	1980
210.000	10.2444	1.11811	20.77557	2534.773	3688	5640	168.897	103	137	0.00000	-0.0591	1912
220.000	10.1622	1.07593	19.54652	2368.200	4991	6959	175.007	104	138	0.00000	-0.0583	1848
230.000	10.0794	1.03761	18.41887	2215.781	6322	8306	180.977	105	140	0.00000	-0.0574	1787
240.000	9.9959	1.00267	17.38010	2075.785	7678	9679	186.817	106	141	0.00001	-0.0563	1728
250.000	9.9119	0.97073	16.41968	1946.761	9061	11079	192.536	108	143	0.00002	-0.0552	1672
260.000	9.8272	0.94143	15.52873	1827.481	10469	12505	198.143	110	145	0.00005	-0.0541	1619
270.000	9.7419	0.91450	14.69968	1716.902	11904	13957	203.645	112	148	0.00009	-0.0528	1567
280.000	9.6560	0.88969	13.92607	1614.128	13366	15437	209.052	114	150	0.00017	-0.0516	1517
290.000	9.5694	0.86679	13.20236	1518.391	14855	16945	214.370	116	153	0.00029	-0.0503	1470
300.000	9.4821	0.84561	12.52374	1429.021	16372	18481	219.606	119	155	0.00049	-0.0489	1423
310.000	9.3941	0.82599	11.88604	1345.437	17919	20048	224.766	121	158	0.00077	-0.0475	1379
320.000	9.3054	0.80781	11.28563	1267.132	19496	21646	229.856	124	161	0.00119	-0.0462	1336
330.000	9.2160	0.79093	10.71932	1193.658	21105	23275	234.883	127	164	0.00178	-0.0447	1294
340.000	9.1258	0.77525	10.18433	1124.620	22745	24937	239.851	129	167	0.00258	-0.0433	1254
350.000	9.0349	0.76068	9.67819	1059.668	24419	26632	244.764	132	170	0.00364	-0.0419	1215
360.000	8.9431	0.74714	9.19871	998.491	26125	28362	249.627	135	173	0.00504	-0.0404	1178
370.000	8.8506	0.73455	8.74396	940.810	27865	30125	254.443	138	177	0.00682	-0.0390	1141
380.000	8.7572	0.72284	8.31220	886.377	29639	31922	259.216	141	180	0.00905	-0.0375	1106
390.000	8.6630	0.71197	7.90188	834.968	31445	33754	263.949	144	183	0.01181	-0.0361	1072
400.000	8.5680	0.70187	7.51162	786.380	33285	35620	268.644	147	187	0.01516	-0.0346	1038
410.000	8.4720	0.69251	7.14016	740.431	35157	37518	273.302	150	190	0.01915	-0.0331	1006
420.000	8.3751	0.68384	6.78636	696.956	37061	39449	277.927	153	193	0.02386	-0.0316	975
430.000	8.2772	0.67583	6.44920	655.802	38994	41411	282.517	156	196	0.02933	-0.0300	944
440.000	8.1784	0.66846	6.12774	616.833	40957	43402	287.075	159	199	0.03559	-0.0285	914

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
450.000	8.0785	0.66168	5.82111	579.922	42946	45422	291.601	162	202	0.04266	-0.0269	886
460.000	7.9776	0.65548	5.52853	544.953	44962	47469	296.095	165	205	0.05055	-0.0253	858
470.000	7.8756	0.64985	5.24926	511.820	47001	49541	300.556	168	208	0.05926	-0.0236	830
480.000	7.7725	0.64475	4.98264	480.423	49064	51637	304.983	170	211	0.06875	-0.0219	804
490.000	7.6682	0.64019	4.72803	450.673	51147	53755	309.377	173	214	0.07899	-0.0201	778
500.000	7.5626	0.63614	4.48486	422.484	53250	55895	313.734	175	216	0.08995	-0.0182	753
510.000	7.4559	0.63260	4.25257	395.780	55374	58056	318.055	177	219	0.10160	-0.0162	728
520.000	7.3477	0.62956	4.03067	370.488	57516	60238	322.337	179	221	0.11393	-0.0141	704
530.000	7.2382	0.62702	3.81866	346.542	59679	62442	326.580	181	223	0.12696	-0.0119	681
540.000	7.1273	0.62499	3.61611	323.881	61865	64671	330.783	182	225	0.14076	-0.0096	658
550.000	7.0149	0.62346	3.42258	302.448	64078	66929	334.947	184	228	0.15548	-0.0070	636
560.000	6.9010	0.62244	3.23769	282.193	66324	69222	339.074	186	230	0.17136	-0.0043	614
570.000	6.7854	0.62193	3.06107	263.069	68615	71562	343.176	189	233	0.18872	-0.0014	593
580.000	6.6682	0.62195	2.89236	245.035	70971	73970	347.278	194	239	0.20795	0.0017	571
585.000	6.6090	0.62216	2.81087	236.415	72187	75214	349.354	200	245	0.21831	0.0032	560
590.000	6.5494	0.62251	2.73124	228.054	73450	76504	351.493	214	259	0.22888	0.0046	547
593.000	6.5133	0.62278	2.68435	223.160	74258	77328	352.885	253	298	0.23440	0.0049	534
595.000	6.4893	0.62299	2.65344	219.949	74771	77853	353.650	209	254	0.24147	0.0064	538
600.000	6.4287	0.62362	2.57743	212.094	76002	79113	355.758	205	250	0.25080	0.0083	530
610.000	6.3063	0.62530	2.43065	197.129	78440	81612	359.889	203	249	0.26968	0.0122	512
620.000	6.1821	0.62758	2.29065	183.134	80880	84115	363.960	204	250	0.28881	0.0164	493
630.000	6.0561	0.63046	2.15722	170.093	83331	86633	367.989	205	252	0.30817	0.0209	476
640.000	5.9285	0.63397	2.03017	157.989	85796	89169	371.985	207	254	0.32761	0.0257	459
660.000	5.6684	0.64296	1.79459	136.553	90775	94303	379.889	210	258	0.36660	0.0361	427
680.000	5.4035	0.65465	1.58296	118.754	95819	99520	387.682	213	262	0.40537	0.0477	398
700.000	5.1364	0.66902	1.39465	104.508	100920	104814	395.357	217	266	0.44359	0.0598	373
750.000	4.4884	0.71457	1.02214	83.038	113837	118293	413.958	224	271	0.53402	0.0866	329
800.000	3.9254	0.76599	0.77295	76.383	126820	131915	431.545	232	272	0.61413	0.0993	312
					250.0 bar							
185.473	10.4603	1.54982	24.22990	3051.532	551	2941	152.889	102	135	0.00000	-0.0608	2089
190.000	10.4243	1.51811	23.51878	2953.713	1102	3500	155.848	102	135	0.00000	-0.0606	2056
200.000	10.3444	1.45334	22.05763	2753.017	2341	4758	162.260	103	136	0.00000	-0.0600	1986
210.000	10.2640	1.39498	20.72985	2571.046	3611	6047	168.511	103	137	0.00000	-0.0593	1919
220.000	10.1831	1.34214	19.51738	2405.287	4909	7364	174.612	104	138	0.00000	-0.0585	1856
230.000	10.1017	1.29414	18.40533	2253.664	6234	8708	180.573	106	139	0.00000	-0.0576	1796
240.000	10.0198	1.25036	17.38128	2114.448	7584	10079	186.403	107	141	0.00001	-0.0566	1738
250.000	9.9373	1.21030	16.43483	1986.189	8961	11476	192.112	109	143	0.00002	-0.0555	1683
260.000	9.8543	1.17356	15.55717	1867.661	10363	12900	197.708	110	145	0.00005	-0.0544	1631
270.000	9.7707	1.13976	14.74083	1757.821	11791	14349	203.200	112	147	0.00009	-0.0532	1580
280.000	9.6866	1.10860	13.97941	1655.774	13245	15826	208.596	115	150	0.00017	-0.0519	1532
290.000	9.6019	1.07982	13.26742	1560.749	14727	17331	213.902	117	152	0.00029	-0.0507	1485
300.000	9.5166	1.05318	12.60009	1472.080	16237	18864	219.126	119	155	0.00048	-0.0494	1440
310.000	9.4307	1.02849	11.97329	1389.184	17776	20427	224.273	122	158	0.00076	-0.0480	1396
320.000	9.3442	1.00557	11.38343	1311.552	19345	22020	229.351	124	161	0.00117	-0.0467	1355
330.000	9.2571	0.98427	10.82734	1238.737	20944	23645	234.364	127	164	0.00173	-0.0453	1314
340.000	9.1694	0.96446	10.30225	1170.342	22576	25302	239.317	130	167	0.00250	-0.0440	1275
350.000	9.0810	0.94602	9.80570	1106.017	24239	26992	244.216	133	170	0.00352	-0.0426	1237
360.000	8.9921	0.92884	9.33553	1045.450	25936	28716	249.063	136	173	0.00485	-0.0412	1201
370.000	8.9024	0.91284	8.88981	988.360	27665	30474	253.863	139	176	0.00655	-0.0398	1166
380.000	8.8122	0.89792	8.46681	934.497	29428	32265	258.619	142	179	0.00867	-0.0385	1132
390.000	8.7212	0.88402	8.06499	883.637	31223	34090	263.334	145	183	0.01128	-0.0371	1099
400.000	8.6296	0.87107	7.68295	835.575	33051	35948	268.010	148	186	0.01444	-0.0357	1067
410.000	8.5373	0.85901	7.31944	790.128	34910	37838	272.649	151	189	0.01821	-0.0343	1036
420.000	8.4443	0.84779	6.97333	747.128	36800	39760	277.253	154	192	0.02263	-0.0329	1006
430.000	8.3507	0.83737	6.64358	706.423	38719	41713	281.822	157	195	0.02776	-0.0315	976
440.000	8.2562	0.82769	6.32927	667.874	40667	43695	286.357	160	198	0.03362	-0.0301	948
450.000	8.1611	0.81873	6.02951	631.353	42641	45704	290.859	162	201	0.04023	-0.0287	921
460.000	8.0652	0.81045	5.74353	596.745	44639	47739	295.327	165	204	0.04760	-0.0273	894
470.000	7.9686	0.80283	5.47059	563.940	46661	49799	299.762	168	207	0.05571	-0.0259	868
480.000	7.8712	0.79583	5.21002	532.841	48705	51881	304.161	170	210	0.06455	-0.0244	843
490.000	7.7731	0.78943	4.96120	503.355	50769	53985	308.524	173	212	0.07408	-0.0229	819
500.000	7.6741	0.78362	4.72355	475.398	52852	56109	312.850	175	215	0.08426	-0.0213	795
510.000	7.5743	0.77838	4.49652	448.891	54953	58253	317.137	177	217	0.09508	-0.0198	772
520.000	7.4738	0.77368	4.27961	423.762	57072	60417	321.384	179	219	0.10653	-0.0181	750
530.000	7.3723	0.76952	4.07235	399.943	59210	62601	325.589	181	221	0.11863	-0.0164	728
540.000	7.2701	0.76590	3.87429	377.373	61370	64809	329.752	183	223	0.13145	-0.0146	707
550.000	7.1670	0.76279	3.68502	355.995	63555	67043	333.872	184	225	0.14512	-0.0127	686

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
560.000	7.0631	0.76019	3.50415	335.754	65771	69311	337.954	186	227	0.15987	-0.0107	666
570.000	6.9583	0.75810	3.33132	316.602	68030	71623	342.007	189	230	0.17602	-0.0086	646
580.000	6.8526	0.75652	3.16618	298.496	70353	74001	346.057	194	235	0.19392	-0.0063	626
585.000	6.7995	0.75591	3.08639	289.822	71552	75229	348.106	200	241	0.20358	-0.0051	616
590.000	6.7461	0.75543	3.00841	281.394	72797	76503	350.216	214	256	0.21343	-0.0038	603
593.000	6.7140	0.75521	2.96247	276.453	73593	77316	351.590	253	295	0.21859	-0.0027	591
595.000	6.6926	0.75508	2.93220	273.208	74099	77834	352.344	209	251	0.22518	-0.0027	596
600.000	6.6388	0.75485	2.85772	265.259	75310	79076	354.422	204	246	0.23389	-0.0016	588
610.000	6.5307	0.75477	2.71382	250.057	77709	81537	358.489	203	245	0.25154	0.0009	572
620.000	6.4218	0.75519	2.57646	235.759	80106	83999	362.493	204	246	0.26947	0.0035	555
630.000	6.3121	0.75611	2.44539	222.337	82511	86472	366.451	205	248	0.28765	0.0062	539
640.000	6.2018	0.75754	2.32040	209.766	84929	88960	370.371	206	249	0.30597	0.0091	524
660.000	5.9795	0.76189	2.08784	187.091	89807	93988	378.113	210	253	0.34290	0.0153	494
680.000	5.7558	0.76823	1.87733	167.577	94744	99088	385.729	213	256	0.37992	0.0219	467
700.000	5.5319	0.77648	1.68765	151.078	99737	104256	393.223	216	260	0.41678	0.0287	443
750.000	4.9837	0.80444	1.29747	121.916	112420	117436	411.411	225	266	0.50586	0.0453	396
800.000	4.4788	0.83917	1.01301	107.026	125297	130879	428.766	232	270	0.58733	0.0570	367
						300.0 bar						
186.812	10.4661	1.84543	23.94135	3058.051	650	3516	153.407	102	134	0.00000	-0.0609	2085
190.000	10.4411	1.81880	23.45006	2989.873	1037	3910	155.485	103	135	0.00000	-0.0607	2062
200.000	10.3624	1.74098	22.00690	2789.874	2272	5167	161.889	103	135	0.00000	-0.0602	1993
210.000	10.2833	1.67083	20.69579	2608.585	3536	6454	168.132	104	137	0.00000	-0.0595	1927
220.000	10.2038	1.60732	19.49886	2443.494	4829	7769	174.224	105	138	0.00000	-0.0587	1865
230.000	10.1237	1.54959	18.40136	2292.523	6148	9112	180.177	106	139	0.00001	-0.0578	1805
240.000	10.0432	1.49693	17.39102	2153.948	7494	10481	185.998	108	141	0.00001	-0.0568	1749
250.000	9.9623	1.44873	16.45751	2026.318	8864	11875	191.698	109	143	0.00003	-0.0558	1695
260.000	9.8808	1.40449	15.59213	1908.406	10260	13296	197.285	111	145	0.00005	-0.0547	1643
270.000	9.7988	1.36379	14.78748	1799.170	11682	14743	202.767	113	147	0.00010	-0.0535	1594
280.000	9.7164	1.32624	14.03722	1697.714	13130	16217	208.152	115	149	0.00018	-0.0523	1546
290.000	9.6335	1.29153	13.33590	1603.269	14605	17719	213.447	117	152	0.00030	-0.0510	1500
300.000	9.5500	1.25938	12.67880	1515.166	16107	19249	218.660	120	155	0.00049	-0.0498	1456
310.000	9.4661	1.22956	12.06182	1432.823	17639	20808	223.796	122	157	0.00078	-0.0485	1414
320.000	9.3817	1.20186	11.48139	1355.729	19200	22398	228.862	125	160	0.00119	-0.0472	1373
330.000	9.2967	1.17609	10.93439	1283.437	20792	24019	233.863	128	163	0.00176	-0.0459	1334
340.000	9.2113	1.15209	10.41804	1215.550	22415	25672	238.803	130	166	0.00253	-0.0445	1296
350.000	9.1253	1.12971	9.92992	1151.715	24070	27357	243.688	133	169	0.00355	-0.0432	1259
360.000	9.0389	1.10884	9.46786	1091.621	25757	29076	248.522	136	172	0.00487	-0.0419	1224
370.000	8.9519	1.08936	9.02994	1034.986	27477	30828	253.307	139	176	0.00655	-0.0406	1189
380.000	8.8644	1.07116	8.61445	981.558	29229	32614	258.049	142	179	0.00864	-0.0393	1156
390.000	8.7763	1.05416	8.21984	931.112	31014	34432	262.748	145	182	0.01121	-0.0380	1124
400.000	8.6878	1.03828	7.84473	883.443	32831	36284	267.408	148	185	0.01432	-0.0367	1094
410.000	8.5987	1.02345	7.48786	838.366	34679	38168	272.030	151	188	0.01801	-0.0354	1064
420.000	8.5092	1.00960	7.14811	795.712	36557	40083	276.616	154	191	0.02233	-0.0341	1035
430.000	8.4191	0.99667	6.82444	755.329	38464	42027	281.167	157	194	0.02733	-0.0328	1007
440.000	8.3285	0.98462	6.51592	717.077	40399	44001	285.683	160	197	0.03304	-0.0315	980
450.000	8.2373	0.97339	6.22167	680.827	42359	46001	290.165	163	200	0.03946	-0.0303	953
460.000	8.1457	0.96294	5.94093	646.463	44344	48027	294.612	165	203	0.04661	-0.0290	928
470.000	8.0535	0.95324	5.67295	613.876	46351	50076	299.024	168	206	0.05447	-0.0277	903
480.000	7.9609	0.94424	5.41707	582.967	48380	52148	303.401	171	209	0.06301	-0.0264	879
490.000	7.8677	0.93593	5.17267	553.644	50427	54240	307.740	173	211	0.07222	-0.0251	856
500.000	7.7740	0.92826	4.93917	525.821	52493	56352	312.041	175	213	0.08205	-0.0238	833
510.000	7.6798	0.92122	4.71603	499.421	54576	58483	316.302	177	216	0.09248	-0.0225	812
520.000	7.5852	0.91478	4.50276	474.371	56677	60632	320.521	179	218	0.10351	-0.0211	790
530.000	7.4900	0.90892	4.29888	450.602	58796	62802	324.698	181	220	0.11516	-0.0197	770
540.000	7.3944	0.90363	4.10396	428.053	60936	64993	328.830	183	221	0.12750	-0.0183	750
550.000	7.2983	0.89888	3.91758	406.665	63099	67210	332.919	184	223	0.14067	-0.0168	731
560.000	7.2017	0.89467	3.73938	386.385	65293	69459	336.967	186	225	0.15487	-0.0152	712
570.000	7.1047	0.89097	3.56898	367.162	67529	71752	340.985	189	228	0.17042	-0.0136	693
580.000	7.0073	0.88778	3.40604	348.951	69828	74109	344.999	194	233	0.18768	-0.0117	674
585.000	6.9584	0.88637	3.32728	340.212	71014	75325	347.029	200	239	0.19698	-0.0107	664
590.000	6.9095	0.88509	3.25026	331.709	72246	76588	349.120	214	254	0.20649	-0.0093	652
593.000	6.8801	0.88438	3.20487	326.720	73034	77395	350.482	253	292	0.21146	-0.0077	640
595.000	6.8605	0.88392	3.17496	323.439	73535	77908	351.228	209	248	0.21782	-0.0087	645
600.000	6.8113	0.88288	3.10133	315.397	74733	79138	353.286	204	244	0.22622	-0.0080	638
610.000	6.7128	0.88115	2.95897	299.978	77104	81573	357.312	203	243	0.24326	-0.0063	623
620.000	6.6141	0.87988	2.82292	285.420	79473	84009	361.272	204	243	0.26058	-0.0045	608
630.000	6.5151	0.87908	2.69293	271.690	81849	86454	365.184	205	245	0.27816	-0.0026	593

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
640.000	6.4159	0.87872	2.56877	258.760	84236	88912	369.058	206	246	0.29590	-0.0006	578
660.000	6.2172	0.87932	2.33709	235.198	89050	93876	376.701	210	249	0.33177	0.0035	550
680.000	6.0186	0.88162	2.12631	214.541	93921	98906	384.214	213	253	0.36788	0.0079	525
700.000	5.8210	0.88550	1.93501	196.614	98847	104000	391.600	216	256	0.40402	0.0123	502
750.000	5.3377	0.90130	1.53388	162.641	111376	116996	409.534	225	263	0.49234	0.0231	454
800.000	4.8840	0.92346	1.22860	141.849	124151	130294	426.701	232	268	0.57459	0.0319	421
					350.0 bar							
188.117	10.4723	2.13680	23.67783	3067.266	746	4088	153.904	103	134	0.00000	-0.0610	2082
190.000	10.4577	2.11856	23.39291	3027.371	974	4321	155.128	103	135	0.00000	-0.0609	2069
200.000	10.3802	2.02766	21.96666	2827.922	2204	5576	161.525	104	135	0.00000	-0.0603	2000
210.000	10.3024	1.94570	20.67119	2647.173	3464	6861	167.760	104	136	0.00000	-0.0596	1935
220.000	10.2241	1.87148	19.48881	2482.609	4752	8175	173.845	105	138	0.00000	-0.0589	1874
230.000	10.1454	1.80400	18.40490	2332.160	6066	9516	179.789	107	139	0.00001	-0.0580	1816
240.000	10.0662	1.74242	17.40730	2194.096	7406	10883	185.602	108	141	0.00001	-0.0570	1760
250.000	9.9867	1.68605	16.48580	2066.967	8771	12276	191.293	110	143	0.00003	-0.0560	1707
260.000	9.9067	1.63429	15.63178	1949.548	10161	13694	196.871	111	145	0.00006	-0.0549	1656
270.000	9.8263	1.58664	14.83789	1840.794	11577	15139	202.344	113	147	0.00011	-0.0538	1607
280.000	9.7455	1.54266	14.09786	1739.810	13019	16610	207.720	116	149	0.00019	-0.0526	1560
290.000	9.6643	1.50198	13.40627	1645.824	14487	18109	213.005	118	152	0.00032	-0.0514	1516
300.000	9.5826	1.46429	12.75846	1558.169	15983	19636	218.208	120	154	0.00052	-0.0501	1472
310.000	9.5005	1.42930	12.15036	1476.261	17508	21192	223.334	123	157	0.00082	-0.0489	1431
320.000	9.4180	1.39677	11.57843	1399.589	19062	22778	228.388	125	160	0.00124	-0.0476	1391
330.000	9.3350	1.36647	11.03955	1327.706	20646	24395	233.378	128	163	0.00183	-0.0463	1353
340.000	9.2517	1.33823	10.53097	1260.211	22261	26044	238.307	131	166	0.00262	-0.0450	1315
350.000	9.1679	1.31188	10.05030	1196.754	23908	27726	243.180	134	169	0.00367	-0.0438	1280
360.000	9.0837	1.28726	9.59536	1137.021	25587	29440	248.001	137	172	0.00502	-0.0425	1245
370.000	8.9991	1.26424	9.16426	1080.730	27298	31188	252.774	140	175	0.00673	-0.0412	1212
380.000	8.9141	1.24271	8.75527	1027.629	29042	32968	257.502	143	178	0.00885	-0.0400	1180
390.000	8.8287	1.22256	8.36688	977.490	30817	34782	262.187	146	181	0.01145	-0.0387	1149
400.000	8.7429	1.20369	7.99769	930.109	32624	36628	266.833	149	185	0.01458	-0.0375	1119
410.000	8.6568	1.18602	7.64647	885.300	34462	38505	271.440	152	188	0.01829	-0.0363	1090
420.000	8.5702	1.16948	7.31207	842.895	36330	40414	276.011	154	191	0.02264	-0.0351	1062
430.000	8.4833	1.15399	6.99349	802.738	38226	42352	280.546	157	194	0.02764	-0.0339	1035
440.000	8.3960	1.13948	6.68977	764.691	40150	44318	285.045	160	197	0.03335	-0.0327	1009
450.000	8.3083	1.12592	6.40006	728.624	42098	46311	289.510	163	200	0.03976	-0.0315	983
460.000	8.2203	1.11323	6.12359	694.420	44071	48329	293.940	166	202	0.04687	-0.0304	959
470.000	8.1319	1.10139	5.85962	661.971	46066	50370	298.334	168	205	0.05468	-0.0292	935
480.000	8.0433	1.09033	5.60748	631.177	48081	52432	302.692	171	208	0.06317	-0.0281	912
490.000	7.9543	1.08003	5.36657	601.946	50115	54515	307.011	173	210	0.07229	-0.0269	890
500.000	7.8650	1.07045	5.13631	574.193	52167	56617	311.292	175	212	0.08202	-0.0258	868
510.000	7.7754	1.06155	4.91617	547.839	54235	58737	315.532	177	215	0.09234	-0.0246	847
520.000	7.6855	1.05331	4.70565	522.811	56321	60875	319.729	179	217	0.10323	-0.0234	827
530.000	7.5954	1.04570	4.50430	499.042	58424	63032	323.882	181	218	0.11473	-0.0223	808
540.000	7.5050	1.03870	4.31167	476.469	60547	65211	327.991	183	220	0.12691	-0.0211	789
550.000	7.4144	1.03227	4.12738	455.034	62694	67415	332.056	184	222	0.13989	-0.0198	770
560.000	7.3236	1.02641	3.95103	434.682	64871	69650	336.079	186	224	0.15390	-0.0186	752
570.000	7.2326	1.02109	3.78228	415.364	67089	71928	340.071	189	227	0.16923	-0.0172	734
580.000	7.1415	1.01629	3.62078	397.031	69368	74269	344.057	194	232	0.18625	-0.0156	716
585.000	7.0959	1.01408	3.54266	388.222	70545	75478	346.073	200	237	0.19543	-0.0147	707
590.000	7.0502	1.01199	3.46624	379.642	71768	76732	348.151	215	252	0.20481	-0.0132	695
593.000	7.0228	1.01080	3.42118	374.603	72550	77534	349.504	253	290	0.20971	-0.0112	683
595.000	7.0046	1.01003	3.39148	371.289	73047	78044	350.244	209	247	0.21600	-0.0129	689
600.000	6.9589	1.00819	3.31835	363.155	74235	79265	352.287	205	242	0.22428	-0.0126	682
610.000	6.8675	1.00486	3.17683	347.533	76586	81682	356.283	203	241	0.24108	-0.0113	668
620.000	6.7761	1.00199	3.04142	332.741	78933	84099	360.213	204	242	0.25816	-0.0100	653
630.000	6.6847	0.99956	2.91189	318.746	81288	86524	364.094	205	243	0.27552	-0.0086	639
640.000	6.5934	0.99757	2.78799	305.518	83653	88962	367.935	207	244	0.29304	-0.0071	625
660.000	6.4112	0.99483	2.55622	281.249	88423	93882	375.511	210	247	0.32850	-0.0041	599
680.000	6.2300	0.99366	2.34452	259.726	93248	98866	382.955	213	250	0.36429	-0.0009	575
700.000	6.0503	0.99393	2.15142	240.762	98128	103912	390.272	217	253	0.40021	0.0022	552
750.000	5.6120	1.00013	1.74165	203.420	110550	116787	408.038	225	260	0.48852	0.0099	505
800.000	5.1978	1.01233	1.42185	178.385	123245	129978	425.067	232	266	0.57165	0.0164	470

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
					400.0 bar							
189.390	10.4788	2.42413	23.43607	3078.827	839	4657	154.382	104	134	0.00000	-0.0610	2080
190.000	10.4741	2.41742	23.34538	3066.014	913	4732	154.778	104	134	0.00000	-0.0610	2076
200.000	10.3978	2.31341	21.93505	2866.972	2139	5986	161.168	104	135	0.00000	-0.0605	2008
210.000	10.3211	2.21962	20.65427	2686.626	3394	7270	167.396	105	136	0.00000	-0.0598	1944
220.000	10.2440	2.13466	19.48550	2522.465	4677	8582	173.473	106	137	0.00000	-0.0590	1884
230.000	10.1666	2.05740	18.41429	2372.413	5987	9921	179.410	107	139	0.00001	-0.0582	1826
240.000	10.0888	1.98688	17.42856	2234.741	7321	11286	185.215	109	141	0.00001	-0.0572	1771
250.000	10.0106	1.92230	16.51821	2107.999	8681	12677	190.898	110	142	0.00003	-0.0562	1719
260.000	9.9321	1.86299	15.67469	1990.959	10066	14093	196.467	112	144	0.00006	-0.0552	1669
270.000	9.8532	1.80836	14.89073	1882.576	11476	15536	201.932	114	147	0.00012	-0.0540	1621
280.000	9.7739	1.75792	14.16009	1781.955	12912	17004	207.299	116	149	0.00021	-0.0529	1575
290.000	9.6943	1.71124	13.47742	1688.324	14374	18500	212.575	118	151	0.00035	-0.0517	1531
300.000	9.6142	1.66797	12.83808	1601.012	15864	20025	217.768	121	154	0.00056	-0.0505	1488
310.000	9.5339	1.62777	12.23803	1519.437	17382	21578	222.884	123	157	0.00088	-0.0492	1448
320.000	9.4532	1.59037	11.67377	1443.087	18930	23161	227.929	126	160	0.00133	-0.0480	1409
330.000	9.3721	1.55551	11.14219	1371.512	20507	24775	232.908	128	162	0.00195	-0.0468	1371
340.000	9.2907	1.52299	10.64058	1304.314	22115	26420	237.826	131	165	0.00278	-0.0455	1335
350.000	9.2089	1.49261	10.16653	1241.139	23754	28098	242.689	134	168	0.00387	-0.0443	1300
360.000	9.1269	1.46420	9.71790	1181.674	25426	29808	247.498	137	172	0.00527	-0.0430	1266
370.000	9.0445	1.43760	9.29280	1125.636	27129	31552	252.260	140	175	0.00705	-0.0418	1234
380.000	8.9617	1.41269	8.88953	1072.772	28864	33328	256.976	143	178	0.00924	-0.0406	1203
390.000	8.8787	1.38934	8.50655	1022.855	30631	35137	261.649	146	181	0.01193	-0.0394	1172
400.000	8.7954	1.36744	8.14250	975.679	32430	36978	266.282	149	184	0.01514	-0.0382	1143
410.000	8.7118	1.34689	7.79613	931.058	34259	38850	270.876	152	187	0.01895	-0.0371	1115
420.000	8.6280	1.32760	7.46632	888.822	36117	40753	275.434	155	190	0.02339	-0.0359	1088
430.000	8.5438	1.30949	7.15205	848.818	38003	42685	279.955	158	193	0.02851	-0.0348	1062
440.000	8.4594	1.29250	6.85239	810.904	39917	44645	284.440	161	196	0.03431	-0.0337	1036
450.000	8.3748	1.27654	6.56649	774.953	41855	46632	288.891	163	199	0.04083	-0.0326	1012
460.000	8.2900	1.26157	6.29357	740.846	43817	48642	293.305	166	202	0.04805	-0.0315	988
470.000	8.2049	1.24753	6.03290	708.475	45801	50676	297.684	169	204	0.05596	-0.0305	965
480.000	8.1197	1.23437	5.78384	677.740	47805	52731	302.025	171	207	0.06454	-0.0294	943
490.000	8.0343	1.22203	5.54576	648.549	49827	54806	306.329	173	209	0.07375	-0.0284	921
500.000	7.9487	1.21049	5.31810	620.817	51867	56899	310.592	176	212	0.08356	-0.0274	900
510.000	7.8629	1.19969	5.10033	594.466	53923	59010	314.814	178	214	0.09395	-0.0263	880
520.000	7.7771	1.18961	4.89197	569.422	55996	61139	318.994	179	216	0.10490	-0.0253	861
530.000	7.6911	1.18021	4.69256	545.618	58086	63287	323.129	181	217	0.11646	-0.0243	842
540.000	7.6051	1.17146	4.50168	522.991	60196	65456	327.219	183	219	0.12868	-0.0233	824
550.000	7.5190	1.16333	4.31892	501.483	62329	67649	331.264	185	221	0.14171	-0.0222	806
560.000	7.4328	1.15580	4.14392	481.039	64491	69873	335.267	187	223	0.15576	-0.0212	789
570.000	7.3467	1.14883	3.97633	461.609	66694	72139	339.238	189	225	0.17114	-0.0200	772
580.000	7.2606	1.14242	3.81581	443.146	68959	74468	343.204	194	230	0.18821	-0.0186	755
585.000	7.2175	1.13941	3.73810	434.264	70129	75671	345.209	200	236	0.19742	-0.0177	745
590.000	7.1745	1.13653	3.66205	425.606	71343	76918	347.275	215	251	0.20682	-0.0162	734
593.000	7.1487	1.13486	3.61720	420.518	72121	77716	348.622	253	289	0.21173	-0.0138	722
595.000	7.1315	1.13378	3.58762	417.169	72615	78223	349.357	209	245	0.21805	-0.0161	728
600.000	7.0885	1.13115	3.51478	408.948	73795	79438	351.390	205	241	0.22634	-0.0159	722
610.000	7.0026	1.12625	3.37371	393.133	76130	81842	355.363	204	240	0.24316	-0.0150	708
620.000	6.9169	1.12182	3.23859	378.126	78461	84244	359.270	204	240	0.26027	-0.0140	694
630.000	6.8313	1.11784	3.10917	363.893	80799	86655	363.127	205	241	0.27764	-0.0128	680
640.000	6.7460	1.11429	2.98522	350.403	83148	89077	366.945	207	242	0.29519	-0.0117	667
660.000	6.5762	1.10842	2.75288	325.536	87884	93967	374.472	210	245	0.33073	-0.0094	642
680.000	6.4079	1.10408	2.53995	303.308	92675	98917	381.867	213	249	0.36663	-0.0070	619
700.000	6.2414	1.10115	2.34499	283.525	97521	103930	389.135	217	252	0.40270	-0.0046	597
750.000	5.8362	1.09909	1.92772	243.623	109865	116719	406.783	225	259	0.49170	0.0011	551
800.000	5.4525	1.10291	1.59659	215.389	122497	129833	423.713	233	265	0.57599	0.0061	515
					500.0 bar							
191.850	10.4926	2.98736	23.00690	3107.800	1020	5785	155.288	105	134	0.00000	-0.0611	2079
200.000	10.4322	2.88222	21.89168	2947.470	2014	6807	160.473	105	135	0.00000	-0.0607	2025
210.000	10.3578	2.76470	20.63766	2767.569	3261	8088	166.688	106	136	0.00000	-0.0601	1963
220.000	10.2831	2.65821	19.49364	2603.859	4535	9397	172.752	107	137	0.00000	-0.0593	1904
230.000	10.2081	2.56131	18.44539	2454.268	5835	10733	178.674	108	139	0.00001	-0.0585	1847
240.000	10.1328	2.47283	17.48108	2317.060	7161	12095	184.465	109	140	0.00002	-0.0576	1794
250.000	10.0572	2.39176	16.59076	2190.782	8511	13482	190.133	111	142	0.00004	-0.0566	1743
260.000	9.9813	2.31725	15.76603	2074.203	9885	14895	195.687	113	144	0.00008	-0.0556	1694
270.000	9.9051	2.24858	14.99974	1966.275	11285	16333	201.136	115	146	0.00015	-0.0545	1648
280.000	9.8287	2.18514	14.28575	1866.100	12710	17797	206.487	117	148	0.00025	-0.0534	1603
290.000	9.7520	2.12638	13.61879	1772.904	14162	19289	211.747	119	151	0.00043	-0.0522	1561

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
300.000	9.6751	2.07184	12.99431	1686.014	15640	20808	216.923	121	153	0.00068	-0.0511	1520
310.000	9.5979	2.02114	12.40832	1604.846	17146	22356	222.022	124	156	0.00105	-0.0499	1481
320.000	9.5205	1.97390	11.85736	1528.887	18682	23933	227.049	126	159	0.00158	-0.0487	1443
330.000	9.4428	1.92983	11.33839	1457.684	20246	25541	232.010	129	162	0.00229	-0.0475	1407
340.000	9.3649	1.88865	10.84871	1390.840	21842	27181	236.910	132	165	0.00325	-0.0463	1372
350.000	9.2868	1.85012	10.38596	1327.999	23468	28852	241.753	135	168	0.00449	-0.0451	1338
360.000	9.2085	1.81402	9.94804	1268.845	25126	30555	246.543	138	171	0.00607	-0.0440	1306
370.000	9.1300	1.78017	9.53305	1213.095	26815	32291	251.285	141	174	0.00806	-0.0428	1275
380.000	9.0513	1.74839	9.13931	1160.496	28536	34060	255.980	144	177	0.01051	-0.0417	1245
390.000	8.9725	1.71853	8.76534	1110.820	30288	35860	260.633	147	180	0.01348	-0.0406	1216
400.000	8.8935	1.69044	8.40976	1063.859	32071	37693	265.244	150	183	0.01702	-0.0395	1188
410.000	8.8144	1.66401	8.07135	1019.427	33884	39557	269.817	152	186	0.02119	-0.0384	1162
420.000	8.7352	1.63913	7.74901	977.355	35726	41450	274.351	155	189	0.02603	-0.0373	1136
430.000	8.6558	1.61568	7.44171	937.487	37596	43373	278.850	158	192	0.03157	-0.0363	1111
440.000	8.5764	1.59359	7.14856	899.682	39493	45323	283.312	161	195	0.03784	-0.0353	1087
450.000	8.4969	1.57275	6.86870	863.812	41414	47298	287.738	164	198	0.04484	-0.0343	1063
460.000	8.4174	1.55310	6.60136	829.759	43358	49298	292.128	167	201	0.05257	-0.0334	1041
470.000	8.3378	1.53456	6.34585	797.414	45323	51320	296.482	169	203	0.06100	-0.0325	1019
480.000	8.2582	1.51707	6.10151	766.677	47308	53363	300.797	172	206	0.07011	-0.0316	998
490.000	8.1787	1.50057	5.86775	737.456	49311	55425	305.075	174	208	0.07986	-0.0307	978
500.000	8.0991	1.48500	5.64401	709.666	51332	57505	309.312	176	210	0.09021	-0.0298	958
510.000	8.0196	1.47032	5.42977	683.229	53368	59603	313.507	178	212	0.10114	-0.0290	939
520.000	7.9402	1.45647	5.22456	658.072	55420	61717	317.658	180	214	0.11263	-0.0282	921
530.000	7.8608	1.44341	5.02794	634.128	57489	63850	321.765	182	216	0.12473	-0.0274	904
540.000	7.7816	1.43110	4.83949	611.333	59578	66003	325.826	183	218	0.13750	-0.0266	886
550.000	7.7025	1.41951	4.65882	589.629	61689	68180	329.842	185	219	0.15109	-0.0258	870
560.000	7.6236	1.40860	4.48558	568.963	63829	70388	333.815	187	221	0.16573	-0.0249	854
570.000	7.5448	1.39833	4.31942	549.283	66010	72637	337.756	190	224	0.18175	-0.0240	838
580.000	7.4663	1.38867	4.16004	530.542	68252	74949	341.691	195	229	0.19952	-0.0228	822
585.000	7.4271	1.38406	4.08279	521.510	69410	76142	343.681	200	234	0.20911	-0.0220	813
590.000	7.3880	1.37960	4.00712	512.696	70613	77381	345.732	215	249	0.21889	-0.0204	802
593.000	7.3646	1.37699	3.96246	507.511	71384	78173	347.069	253	287	0.22398	-0.0175	790
595.000	7.3490	1.37527	3.93300	504.096	71873	78676	347.798	210	243	0.23060	-0.0205	796
600.000	7.3100	1.37109	3.86039	495.704	73041	79881	349.815	205	239	0.23919	-0.0206	791
610.000	7.2323	1.36310	3.71959	479.526	75352	82266	353.756	204	238	0.25659	-0.0201	778
620.000	7.1549	1.35563	3.58446	464.127	77660	84649	357.631	205	238	0.27428	-0.0194	765
630.000	7.0778	1.34863	3.45477	449.472	79974	87039	361.456	206	239	0.29224	-0.0186	752
640.000	7.0012	1.34210	3.33029	435.529	82299	89441	365.241	207	240	0.31036	-0.0178	740
660.000	6.8491	1.33032	3.09616	409.661	86987	94288	372.703	210	243	0.34704	-0.0163	716
680.000	6.6989	1.32014	2.88049	386.299	91731	99195	380.033	214	246	0.38410	-0.0147	694
700.000	6.5509	1.31139	2.68187	365.243	96531	104163	387.236	217	249	0.42135	-0.0132	674
750.000	6.1920	1.29492	2.25169	321.546	108767	116842	404.732	226	257	0.51342	-0.0095	629
800.000	5.8519	1.28455	1.90285	288.714	121311	129855	421.532	234	263	0.60100	-0.0064	593
					600.0 bar							
194.207	10.5074	3.53634	22.63548	3142.969	1192	6903	156.135	106	134	0.00000	-0.0612	2081
200.000	10.4657	3.44761	21.86678	3030.356	1897	7630	159.802	106	135	0.00000	-0.0609	2044
210.000	10.3934	3.30627	20.63649	2850.460	3136	8909	166.005	107	136	0.00000	-0.0603	1983
220.000	10.3209	3.17816	19.51433	2686.796	4402	10215	172.057	108	137	0.00000	-0.0596	1925
230.000	10.2481	3.06156	18.48629	2537.276	5694	11548	177.967	109	138	0.00001	-0.0588	1870
240.000	10.1752	2.95504	17.54074	2400.161	7010	12907	183.745	110	140	0.00003	-0.0579	1817
250.000	10.1020	2.85739	16.66788	2273.992	8352	14291	189.400	112	142	0.00005	-0.0570	1768
260.000	10.0286	2.76760	15.85945	2157.535	9717	15700	194.941	114	144	0.00010	-0.0560	1720
270.000	9.9550	2.68480	15.10840	2049.734	11107	17135	200.376	115	146	0.00019	-0.0549	1675
280.000	9.8811	2.60825	14.40870	1949.691	12523	18595	205.712	118	148	0.00033	-0.0538	1631
290.000	9.8072	2.53731	13.75516	1856.627	13965	20083	210.958	120	151	0.00054	-0.0527	1590
300.000	9.7330	2.47143	13.14329	1769.867	15433	21597	216.120	122	153	0.00086	-0.0516	1550
310.000	9.6586	2.41011	12.56916	1688.825	16929	23141	221.204	125	156	0.00131	-0.0504	1512
320.000	9.5841	2.35295	12.02937	1612.985	18453	24714	226.216	127	158	0.00195	-0.0493	1476
330.000	9.5095	2.29956	11.52090	1541.893	20007	26317	231.161	130	161	0.00281	-0.0481	1441
340.000	9.4347	2.24961	11.04111	1475.150	21591	27951	236.045	133	164	0.00394	-0.0470	1407
350.000	9.3598	2.20283	10.58767	1412.399	23206	29616	240.872	135	167	0.00541	-0.0459	1374
360.000	9.2848	2.15894	10.15848	1353.323	24852	31314	245.646	138	170	0.00726	-0.0447	1343
370.000	9.2097	2.11772	9.75171	1297.638	26529	33044	250.371	141	173	0.00958	-0.0436	1313
380.000	9.1345	2.07897	9.36568	1245.090	28237	34806	255.050	144	176	0.01240	-0.0425	1284
390.000	9.0592	2.04249	8.99891	1195.450	29977	36600	259.685	147	179	0.01581	-0.0415	1257
400.000	8.9839	2.00811	8.65007	1148.511	31747	38426	264.279	150	182	0.01985	-0.0404	1230
410.000	8.9086	1.97570	8.31795	1104.084	33547	40282	268.833	153	185	0.02459	-0.0394	1204

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
420.000	8.8333	1.94511	8.00144	1062.000	35376	42168	273.350	156	188	0.03005	-0.0385	1179
430.000	8.7579	1.91622	7.69957	1022.104	37232	44083	277.830	159	191	0.03627	-0.0375	1155
440.000	8.6826	1.88891	7.41142	984.254	39114	46025	282.274	162	194	0.04328	-0.0366	1132
450.000	8.6073	1.86309	7.13617	948.322	41021	47992	286.681	164	197	0.05107	-0.0357	1110
460.000	8.5321	1.83866	6.87307	914.188	42950	49983	291.052	167	200	0.05963	-0.0348	1088
470.000	8.4570	1.81552	6.62141	881.746	44901	51996	295.386	170	202	0.06894	-0.0340	1068
480.000	8.3819	1.79362	6.38058	850.894	46871	54029	299.682	172	205	0.07895	-0.0332	1048
490.000	8.3070	1.77286	6.14997	821.540	48859	56082	303.940	174	207	0.08963	-0.0324	1028
500.000	8.2322	1.75319	5.92904	793.600	50864	58152	308.156	177	209	0.10092	-0.0316	1010
510.000	8.1576	1.73453	5.71730	766.995	52884	60239	312.331	179	211	0.11281	-0.0309	992
520.000	8.0831	1.71685	5.51428	741.653	54921	62343	316.462	180	213	0.12527	-0.0302	974
530.000	8.0089	1.70007	5.31954	717.505	56974	64465	320.548	182	215	0.13835	-0.0295	957
540.000	7.9349	1.68415	5.13268	694.490	59046	66607	324.588	184	216	0.15212	-0.0289	941
550.000	7.8611	1.66905	4.95333	672.548	61140	68773	328.583	186	218	0.16675	-0.0282	925
560.000	7.7876	1.65472	4.78114	651.627	63264	70969	332.536	187	220	0.18249	-0.0275	910
570.000	7.7144	1.64112	4.61578	631.674	65428	73206	336.455	190	222	0.19970	-0.0268	895
580.000	7.6414	1.62821	4.45694	612.644	67654	75505	340.369	195	227	0.21878	-0.0257	879
585.000	7.6051	1.62201	4.37988	603.460	68803	76692	342.348	201	233	0.22907	-0.0249	871
590.000	7.5689	1.61597	4.30433	594.491	69998	77925	344.388	216	248	0.23955	-0.0232	860
593.000	7.5472	1.61241	4.25973	589.209	70763	78713	345.719	254	286	0.24498	-0.0200	848
595.000	7.5327	1.61008	4.23028	585.730	71249	79214	346.444	210	242	0.25214	-0.0235	855
600.000	7.4966	1.60434	4.15769	577.174	72409	80413	348.450	206	238	0.26129	-0.0237	850
610.000	7.4248	1.59331	4.01675	560.654	74704	82785	352.370	204	236	0.27982	-0.0234	838
620.000	7.3534	1.58284	3.88127	544.895	76995	85154	356.223	205	237	0.29862	-0.0229	826
630.000	7.2824	1.57291	3.75103	529.862	79292	87531	360.027	206	238	0.31768	-0.0223	814
640.000	7.2118	1.56348	3.62581	515.523	81600	89920	363.791	208	239	0.33689	-0.0218	802
660.000	7.0721	1.54605	3.38963	488.807	86255	94739	371.211	211	242	0.37572	-0.0206	779
680.000	6.9345	1.53036	3.17122	464.523	90966	99619	378.500	214	245	0.41486	-0.0194	758
700.000	6.7991	1.51624	2.96921	442.470	95735	104560	385.664	218	248	0.45416	-0.0183	739
750.000	6.4715	1.48679	2.52809	395.941	107900	117171	403.067	226	255	0.55109	-0.0157	696
800.000	6.1613	1.46404	2.16531	359.831	120387	130125	419.790	234	262	0.64316	-0.0135	660
					700.0 bar							
196.473	10.5230	4.07214	22.30764	3182.772	1359	8011	156.932	106	134	0.00000	-0.0613	2085
200.000	10.4982	4.00974	21.85274	3114.839	1787	8454	159.155	107	134	0.00000	-0.0611	2063
210.000	10.4280	3.84453	20.64366	2934.578	3018	9731	165.347	107	135	0.00000	-0.0606	2003
220.000	10.3575	3.69473	19.54096	2770.606	4277	11035	171.387	108	137	0.00001	-0.0599	1946
230.000	10.2869	3.55835	18.53086	2620.827	5561	12366	177.286	110	138	0.00002	-0.0591	1892
240.000	10.2161	3.43372	17.60188	2483.494	6870	13722	183.052	111	140	0.00004	-0.0582	1840
250.000	10.1452	3.31943	16.74440	2357.138	8203	15103	188.696	113	141	0.00007	-0.0573	1792
260.000	10.0740	3.21429	15.95026	2240.519	9560	16509	194.225	114	143	0.00014	-0.0563	1745
270.000	10.0028	3.11729	15.21253	2132.579	10942	17940	199.647	116	145	0.00025	-0.0553	1701
280.000	9.9314	3.02757	14.52526	2032.412	12349	19397	204.972	118	148	0.00043	-0.0542	1659
290.000	9.8598	2.94438	13.88334	1939.236	13782	20881	210.205	120	150	0.00071	-0.0531	1618
300.000	9.7882	2.86707	13.28234	1852.374	15241	22392	215.354	123	153	0.00111	-0.0520	1580
310.000	9.7164	2.79507	12.71839	1771.234	16727	23932	220.425	125	155	0.00168	-0.0509	1542
320.000	9.6446	2.72790	12.18813	1695.300	18242	25500	225.424	128	158	0.00247	-0.0498	1507
330.000	9.5727	2.66511	11.68859	1624.116	19786	27099	230.356	131	161	0.00353	-0.0487	1473
340.000	9.5007	2.60633	11.21717	1557.279	21360	28728	235.226	133	164	0.00491	-0.0476	1440
350.000	9.4286	2.55121	10.77156	1494.433	22965	30389	240.040	136	167	0.00668	-0.0465	1408
360.000	9.3565	2.49946	10.34970	1435.258	24600	32082	244.800	139	170	0.00891	-0.0454	1378
370.000	9.2844	2.45079	9.94977	1379.470	26267	33807	249.510	142	173	0.01167	-0.0443	1349
380.000	9.2123	2.40498	9.57013	1326.813	27965	35563	254.175	145	176	0.01501	-0.0433	1321
390.000	9.1401	2.36181	9.20931	1277.058	29693	37352	258.795	148	179	0.01902	-0.0422	1294
400.000	9.0680	2.32107	8.86600	1229.996	31452	39172	263.375	151	182	0.02375	-0.0412	1268
410.000	8.9960	2.28260	8.53901	1185.440	33241	41022	267.915	154	185	0.02924	-0.0403	1243
420.000	8.9240	2.24623	8.22725	1143.218	35058	42902	272.416	157	188	0.03556	-0.0394	1219
430.000	8.8521	2.21182	7.92975	1103.176	36903	44810	276.881	159	191	0.04272	-0.0384	1196
440.000	8.7802	2.17923	7.64562	1065.171	38773	46746	281.310	162	194	0.05073	-0.0376	1174
450.000	8.7085	2.14835	7.37405	1029.075	40668	48706	285.702	165	196	0.05961	-0.0367	1152
460.000	8.6369	2.11907	7.11429	994.768	42585	50690	290.057	168	199	0.06931	-0.0359	1131
470.000	8.5655	2.09128	6.86567	962.142	44524	52696	294.376	170	202	0.07982	-0.0352	1111
480.000	8.4942	2.06489	6.62756	931.096	46481	54722	298.657	173	204	0.09107	-0.0344	1092
490.000	8.4231	2.03982	6.39938	901.539	48456	56767	302.898	175	206	0.10302	-0.0337	1073
500.000	8.3522	2.01599	6.18061	873.385	50448	58829	307.099	177	208	0.11562	-0.0330	1056
510.000	8.2816	1.99332	5.97074	846.556	52456	60909	311.259	179	210	0.12882	-0.0324	1038
520.000	8.2112	1.97175	5.76934	820.979	54480	63005	315.374	181	212	0.14262	-0.0318	1022
530.000	8.1411	1.95122	5.57597	796.587	56520	65118	319.444	183	214	0.15706	-0.0312	1005

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
540.000	8.0712	1.93166	5.39025	773.316	58579	67252	323.469	184	216	0.17222	-0.0306	990
550.000	8.0017	1.91302	5.21180	751.110	60661	69409	327.448	186	217	0.18830	-0.0300	975
560.000	7.9324	1.89525	5.04029	729.912	62772	71596	331.384	188	219	0.20557	-0.0294	960
570.000	7.8636	1.87831	4.87539	709.673	64923	73825	335.288	191	221	0.22442	-0.0288	945
580.000	7.7950	1.86215	4.71682	690.345	67135	76115	339.186	196	227	0.24531	-0.0278	930
585.000	7.7609	1.85435	4.63981	681.009	68278	77298	341.158	201	232	0.25658	-0.0269	922
590.000	7.7269	1.84673	4.56428	671.885	69466	78525	343.190	216	247	0.26804	-0.0252	912
593.000	7.7065	1.84224	4.51966	666.509	70228	79311	344.516	255	285	0.27395	-0.0217	900
595.000	7.6930	1.83929	4.49019	662.967	70711	79810	345.238	211	241	0.28183	-0.0256	907
600.000	7.6592	1.83201	4.41752	654.250	71865	81004	347.236	206	237	0.29177	-0.0259	902
610.000	7.5919	1.81795	4.27628	637.401	74146	83367	351.141	205	235	0.31186	-0.0257	891
620.000	7.5250	1.80453	4.14035	621.302	76425	85727	354.980	206	236	0.33220	-0.0254	879
630.000	7.4586	1.79169	4.00948	605.919	78709	88095	358.768	207	237	0.35279	-0.0249	867
640.000	7.3927	1.77943	3.88348	591.219	81005	90474	362.518	208	238	0.37350	-0.0245	856
660.000	7.2623	1.75648	3.64530	563.748	85636	95275	369.909	212	241	0.41526	-0.0235	834
680.000	7.1341	1.73546	3.42435	538.665	90324	100136	377.170	215	244	0.45723	-0.0226	814
700.000	7.0081	1.71619	3.21932	515.767	95070	105058	384.307	219	247	0.49925	-0.0217	795
750.000	6.7037	1.67452	2.76876	466.937	107185	117627	401.651	227	254	0.60250	-0.0197	753
800.000	6.4155	1.64036	2.39445	428.265	119632	130543	418.325	235	261	0.70010	-0.0180	718
					800.0 bar							
198.657	10.5391	4.59567	22.01221	3225.953	1520	9111	157.685	107	134	0.00000	-0.0614	2091
200.000	10.5299	4.56878	21.84354	3200.269	1683	9280	158.529	107	134	0.00000	-0.0613	2083
210.000	10.4616	4.37964	20.65360	3019.324	2908	10555	164.711	108	135	0.00000	-0.0608	2023
220.000	10.3931	4.20811	19.56840	2854.748	4159	11857	170.741	109	136	0.00001	-0.0601	1967
230.000	10.3245	4.05190	18.57438	2704.432	5437	13185	176.630	110	138	0.00002	-0.0593	1914
240.000	10.2557	3.90910	17.66022	2566.617	6738	14539	182.386	112	139	0.00005	-0.0585	1863
250.000	10.1869	3.77810	16.81644	2439.828	8064	15917	188.019	113	141	0.00011	-0.0576	1816
260.000	10.1179	3.65756	16.03500	2322.815	9414	17320	193.537	115	143	0.00020	-0.0566	1770
270.000	10.0488	3.54631	15.30906	2214.515	10788	18749	198.949	117	145	0.00035	-0.0556	1727
280.000	9.9796	3.44336	14.63275	2114.015	12187	20203	204.262	119	147	0.00059	-0.0546	1685
290.000	9.9104	3.34785	14.00105	2020.530	13611	21684	209.484	121	150	0.00094	-0.0535	1645
300.000	9.8410	3.25906	13.40957	1933.377	15062	23191	214.622	124	152	0.00146	-0.0524	1608
310.000	9.7716	3.17632	12.85451	1851.962	16540	24727	219.681	126	155	0.00219	-0.0513	1571
320.000	9.7022	3.09908	12.33254	1775.765	18047	26292	224.669	129	158	0.00319	-0.0502	1536
330.000	9.6328	3.02684	11.84075	1704.328	19582	27887	229.589	131	160	0.00451	-0.0491	1503
340.000	9.5633	2.95916	11.37656	1637.245	21147	29513	234.448	134	163	0.00622	-0.0481	1471
350.000	9.4938	2.89565	10.93768	1574.159	22743	31169	239.249	137	166	0.00841	-0.0470	1440
360.000	9.4243	2.83597	10.52211	1514.749	24369	32858	243.997	140	169	0.01113	-0.0459	1411
370.000	9.3549	2.77981	10.12803	1458.728	26026	34578	248.696	143	172	0.01447	-0.0449	1382
380.000	9.2855	2.72689	9.75383	1405.841	27715	36330	253.348	145	175	0.01850	-0.0439	1355
390.000	9.2161	2.67696	9.39806	1355.856	29434	38114	257.956	148	178	0.02329	-0.0429	1329
400.000	9.1468	2.62980	9.05943	1308.564	31183	39929	262.523	151	181	0.02890	-0.0419	1304
410.000	9.0777	2.58521	8.73676	1263.777	32962	41775	267.051	154	184	0.03540	-0.0410	1279
420.000	9.0086	2.54301	8.42898	1221.324	34769	43649	271.540	157	187	0.04282	-0.0401	1256
430.000	8.9396	2.50303	8.13514	1181.047	36603	45552	275.992	160	190	0.05119	-0.0392	1233
440.000	8.8708	2.46512	7.85436	1142.806	38464	47482	280.408	163	193	0.06051	-0.0384	1212
450.000	8.8022	2.42913	7.58584	1106.470	40348	49437	284.788	166	196	0.07077	-0.0376	1191
460.000	8.7337	2.39496	7.32884	1071.920	42255	51415	289.131	168	198	0.08195	-0.0368	1171
470.000	8.6654	2.36247	7.08271	1039.047	44183	53415	293.437	171	201	0.09399	-0.0361	1151
480.000	8.5974	2.33156	6.84682	1007.751	46130	55435	297.705	173	203	0.10684	-0.0354	1133
490.000	8.5296	2.30214	6.62062	977.939	48095	57474	301.934	175	206	0.12042	-0.0347	1115
500.000	8.4620	2.27411	6.40358	949.526	50076	59530	306.122	178	208	0.13467	-0.0341	1097
510.000	8.3947	2.24739	6.19522	922.433	52073	61603	310.269	180	210	0.14956	-0.0335	1080
520.000	8.3277	2.22191	5.99510	896.587	54086	63693	314.372	182	212	0.16507	-0.0330	1064
530.000	8.2610	2.19759	5.80280	871.920	56116	65800	318.430	183	213	0.18123	-0.0324	1049
540.000	8.1946	2.17437	5.61794	848.370	58164	67927	322.442	185	215	0.19816	-0.0319	1034
550.000	8.1285	2.15218	5.44016	825.878	60236	70077	326.409	187	217	0.21607	-0.0314	1019
560.000	8.0628	2.13097	5.26914	804.390	62336	72258	330.333	189	218	0.23528	-0.0309	1005
570.000	7.9975	2.11069	5.10455	783.855	64476	74480	334.225	191	221	0.25622	-0.0303	991
580.000	7.9326	2.09127	4.94611	764.225	66678	76763	338.112	196	226	0.27941	-0.0293	976
585.000	7.9003	2.08188	4.86911	754.736	67816	77942	340.077	202	231	0.29190	-0.0285	968
590.000	7.8681	2.07268	4.79355	745.456	68999	79167	342.104	217	246	0.30460	-0.0267	958
593.000	7.8488	2.06726	4.74889	739.987	69758	79951	343.427	255	284	0.31111	-0.0230	946
595.000	7.8360	2.06368	4.71939	736.382	70239	80448	344.146	211	241	0.31992	-0.0272	953
600.000	7.8040	2.05487	4.64661	727.507	71388	81639	346.139	207	236	0.33085	-0.0276	949
610.000	7.7404	2.03781	4.50504	710.339	73659	83994	350.032	206	235	0.35290	-0.0275	937
620.000	7.6772	2.02144	4.36863	693.914	75927	86348	353.859	206	235	0.37518	-0.0272	926

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
630.000	7.6144	2.00574	4.23716	678.199	78202	88709	357.637	207	236	0.39767	-0.0268	915
640.000	7.5522	1.99067	4.11043	663.161	80488	91081	361.376	209	237	0.42025	-0.0264	904
660.000	7.4293	1.96229	3.87043	634.995	85100	95869	368.746	212	240	0.46563	-0.0256	883
680.000	7.3084	1.93607	3.64721	609.191	89770	100717	375.988	216	243	0.51108	-0.0248	863
700.000	7.1898	1.91178	3.43951	585.548	94500	105626	383.107	219	247	0.55644	-0.0241	845
750.000	6.9035	1.85833	2.98084	534.741	106577	118166	400.410	228	254	0.66728	-0.0225	804
800.000	6.6327	1.81332	2.59677	493.945	118996	131057	417.052	236	261	0.77129	-0.0211	769
					900.0 bar							
200.768	10.5556	5.10773	21.74019	3271.471	1678	10204	158.403	108	134	0.00000	-0.0615	2097
210.000	10.4942	4.91176	20.66174	3104.181	2804	11380	164.096	109	135	0.00001	-0.0609	2043
220.000	10.4276	4.71845	19.59248	2938.751	4049	12680	170.118	110	136	0.00002	-0.0603	1988
230.000	10.3609	4.54236	18.61306	2787.665	5320	14006	175.997	111	138	0.00004	-0.0595	1936
240.000	10.2941	4.38135	17.71234	2649.152	6615	15358	181.743	112	139	0.00008	-0.0587	1886
250.000	10.2272	4.23361	16.88093	2521.725	7934	16734	187.367	114	141	0.00015	-0.0578	1839
260.000	10.1602	4.09762	16.11093	2404.127	9277	18135	192.875	116	143	0.00028	-0.0569	1794
270.000	10.0931	3.97206	15.39558	2295.287	10644	19561	198.277	118	145	0.00048	-0.0559	1751
280.000	10.0260	3.85584	14.72911	2194.285	12035	21012	203.581	120	147	0.00080	-0.0549	1710
290.000	9.9589	3.74798	14.10653	2100.330	13453	22490	208.793	122	150	0.00127	-0.0538	1672
300.000	9.8917	3.64765	13.52354	2012.735	14896	23995	213.921	124	152	0.00195	-0.0528	1634
310.000	9.8245	3.55413	12.97639	1930.902	16367	25527	218.970	127	155	0.00289	-0.0517	1599
320.000	9.7573	3.46678	12.46178	1854.307	17865	27089	223.947	129	157	0.00417	-0.0506	1565
330.000	9.6901	3.38504	11.97683	1782.490	19393	28681	228.857	132	160	0.00584	-0.0495	1532
340.000	9.6229	3.30841	11.51902	1715.043	20950	30303	233.705	135	163	0.00800	-0.0485	1500
350.000	9.5558	3.23647	11.08608	1651.603	22538	31956	238.496	137	166	0.01072	-0.0474	1470
360.000	9.4887	3.16882	10.67602	1591.851	24156	33641	243.234	140	169	0.01408	-0.0464	1441
370.000	9.4217	3.10511	10.28707	1535.498	25805	35357	247.922	143	172	0.01818	-0.0454	1414
380.000	9.3547	3.04504	9.91762	1482.286	27484	37105	252.564	146	175	0.02309	-0.0444	1387
390.000	9.2879	2.98831	9.56626	1431.982	29195	38885	257.161	149	178	0.02889	-0.0434	1361
400.000	9.2211	2.93470	9.23170	1384.378	30936	40696	261.718	152	181	0.03565	-0.0425	1337
410.000	9.1545	2.88395	8.91278	1339.283	32706	42537	266.235	155	184	0.04341	-0.0416	1313
420.000	9.0880	2.83588	8.60846	1296.526	34504	44407	270.713	158	187	0.05223	-0.0407	1290
430.000	9.0217	2.79029	8.31778	1255.948	36330	46306	275.155	161	190	0.06212	-0.0399	1268
440.000	8.9556	2.74701	8.03989	1217.409	38181	48231	279.560	163	193	0.07309	-0.0391	1247
450.000	8.8896	2.70589	7.77399	1180.777	40057	50181	283.929	166	195	0.08510	-0.0383	1227
460.000	8.8239	2.66679	7.51937	1145.932	41955	52154	288.262	169	198	0.09812	-0.0376	1207
470.000	8.7584	2.62956	7.27538	1112.766	43874	54150	292.557	171	200	0.11207	-0.0369	1188
480.000	8.6931	2.59411	7.04140	1081.176	45812	56165	296.815	174	203	0.12689	-0.0362	1170
490.000	8.6281	2.56031	6.81688	1051.071	47768	58199	301.034	176	205	0.14249	-0.0356	1152
500.000	8.5634	2.52807	6.60132	1022.364	49740	60250	305.212	178	207	0.15880	-0.0350	1135
510.000	8.4990	2.49728	6.39424	994.977	51728	62318	309.349	180	209	0.17575	-0.0345	1119
520.000	8.4349	2.46787	6.19520	968.836	53732	64402	313.441	182	211	0.19335	-0.0339	1103
530.000	8.3711	2.43976	6.00380	943.873	55753	66504	317.489	184	213	0.21163	-0.0334	1088
540.000	8.3077	2.41286	5.81967	920.026	57792	68626	321.492	186	214	0.23073	-0.0330	1073
550.000	8.2446	2.38711	5.64245	897.235	59855	70771	325.449	187	216	0.25087	-0.0325	1059
560.000	8.1819	2.36245	5.47182	875.445	61946	72946	329.364	189	218	0.27243	-0.0320	1045
570.000	8.1196	2.33881	5.30748	854.607	64078	75162	333.246	192	220	0.29592	-0.0315	1031
580.000	8.0577	2.31615	5.14914	834.672	66271	77441	337.124	197	225	0.32190	-0.0306	1017
585.000	8.0269	2.30516	5.07214	825.029	67405	78617	339.085	203	231	0.33589	-0.0297	1010
590.000	7.9962	2.29439	4.99654	815.595	68584	79839	341.107	217	246	0.35009	-0.0278	999
593.000	7.9779	2.28804	4.95184	810.033	69340	80621	342.427	256	284	0.35732	-0.0240	987
595.000	7.9657	2.28385	4.92231	806.366	69819	81118	343.144	212	240	0.36727	-0.0284	995
600.000	7.9352	2.27351	4.84943	797.336	70964	82306	345.133	207	235	0.37939	-0.0288	991
610.000	7.8746	2.25345	4.70756	779.854	73227	84656	349.017	206	234	0.40380	-0.0288	980
620.000	7.8145	2.23416	4.57073	763.114	75487	87004	352.836	207	235	0.42839	-0.0286	969
630.000	7.7548	2.21561	4.43873	747.080	77754	89360	356.606	208	236	0.45316	-0.0282	958
640.000	7.6957	2.19776	4.31135	731.720	80033	91728	360.336	209	237	0.47796	-0.0279	947
660.000	7.5788	2.16402	4.06976	702.901	84630	96505	367.692	213	240	0.52765	-0.0272	927
680.000	7.4641	2.13266	3.84458	676.431	89286	101344	374.919	216	243	0.57719	-0.0265	907
700.000	7.3515	2.10345	3.63458	652.108	94002	106244	382.025	220	246	0.62645	-0.0259	889
750.000	7.0800	2.03852	3.16894	599.544	106052	118763	399.300	229	254	0.74602	-0.0245	849
800.000	6.8231	1.98304	2.77658	556.913	118449	131639	415.922	237	260	0.85723	-0.0233	815
					1000.0 bar							
202.813	10.5726	5.60904	21.48419	3318.439	1832	11290	159.087	109	134	0.00000	-0.0615	2105
210.000	10.5260	5.44103	20.66425	3188.677	2706	12207	163.502	109	135	0.00001	-0.0611	2063
220.000	10.4612	5.22590	19.60970	3022.188	3946	13505	169.515	110	136	0.00002	-0.0605	2009

Table 18. Properties of toluene along isobars - Continued

T K	ρ mol/L	Z	$\partial P/\partial T$ bar/K	$\partial P/\partial \rho$ (bar·L)/mol	U J/mol	H J/mol	S J/(mol·K)	C_v J/(mol·K)	C_p J/(mol·K)	f/P	μ K/bar	W m/s
230.000	10.3962	5.02991	18.64374	2870.140	5210	14829	175.385	112	137	0.00005	-0.0597	1957
240.000	10.3312	4.85065	17.75535	2730.751	6499	16179	181.123	113	139	0.00011	-0.0589	1908
250.000	10.2662	4.68613	16.93531	2602.521	7812	17553	186.738	115	141	0.00022	-0.0581	1861
260.000	10.2011	4.53465	16.17578	2484.182	9148	18951	192.238	116	143	0.00039	-0.0571	1817
270.000	10.1360	4.39476	15.47011	2374.655	10509	20375	197.631	118	145	0.00067	-0.0562	1775
280.000	10.0708	4.26522	14.81261	2273.014	11894	21824	202.926	120	147	0.00110	-0.0552	1735
290.000	10.0056	4.14497	14.19835	2178.461	13305	23299	208.129	122	149	0.00174	-0.0541	1696
300.000	9.9405	4.03307	13.62307	2090.305	14741	24801	213.248	125	152	0.00263	-0.0531	1660
310.000	9.8753	3.92873	13.08308	2007.940	16205	26331	218.288	127	154	0.00386	-0.0520	1625
320.000	9.8102	3.83123	12.57513	1930.841	17697	27890	223.256	130	157	0.00551	-0.0510	1591
330.000	9.7450	3.73995	12.09638	1858.543	19217	29479	228.157	132	160	0.00765	-0.0499	1559
340.000	9.6800	3.65435	11.64431	1790.636	20767	31098	232.996	135	163	0.01039	-0.0488	1528
350.000	9.6150	3.57394	11.21672	1726.756	22347	32748	237.778	138	166	0.01381	-0.0478	1499
360.000	9.5501	3.49828	10.81163	1666.579	23958	34429	242.506	141	169	0.01800	-0.0468	1470
370.000	9.4853	3.42699	10.42728	1609.816	25599	36142	247.185	144	172	0.02308	-0.0458	1443
380.000	9.4205	3.35973	10.06211	1556.206	27272	37887	251.817	147	175	0.02911	-0.0448	1417
390.000	9.3559	3.29619	9.71470	1505.517	28975	39663	256.406	150	178	0.03620	-0.0439	1392
400.000	9.2915	3.23607	9.38378	1457.537	30708	41470	260.953	153	181	0.04439	-0.0430	1367
410.000	9.2272	3.17915	9.06823	1412.074	32470	43308	265.461	155	184	0.05376	-0.0421	1344
420.000	9.1631	3.12517	8.76699	1368.958	34261	45174	269.930	158	186	0.06434	-0.0412	1322
430.000	9.0991	3.07395	8.47915	1328.030	36079	47069	274.363	161	189	0.07613	-0.0404	1300
440.000	9.0354	3.02528	8.20384	1289.145	37922	48990	278.759	164	192	0.08914	-0.0396	1279
450.000	8.9718	2.97900	7.94030	1252.174	39790	50936	283.119	167	195	0.10331	-0.0389	1260
460.000	8.9085	2.93494	7.68781	1216.996	41680	52906	287.443	169	198	0.11859	-0.0382	1240
470.000	8.8455	2.89297	7.44573	1183.500	43592	54897	291.730	172	200	0.13489	-0.0375	1222
480.000	8.7827	2.85294	7.21346	1151.585	45522	56908	295.979	174	202	0.15213	-0.0369	1204
490.000	8.7202	2.81475	6.99046	1121.158	47470	58937	300.189	177	205	0.17018	-0.0363	1187
500.000	8.6580	2.77827	6.77623	1092.133	49434	60984	304.359	179	207	0.18897	-0.0357	1170
510.000	8.5961	2.74341	6.57030	1064.430	51415	63048	308.487	181	209	0.20843	-0.0352	1154
520.000	8.5346	2.71006	6.37225	1037.974	53411	65128	312.571	183	211	0.22854	-0.0347	1139
530.000	8.4734	2.67813	6.18167	1012.700	55424	67226	316.611	185	212	0.24936	-0.0343	1124
540.000	8.4125	2.64755	5.99821	988.541	57456	69343	320.606	186	214	0.27104	-0.0338	1110
550.000	8.3520	2.61824	5.82151	965.441	59511	71484	324.555	188	216	0.29385	-0.0334	1096
560.000	8.2919	2.59013	5.65126	943.343	61595	73655	328.462	190	217	0.31822	-0.0330	1082
570.000	8.2322	2.56314	5.48717	922.196	63720	75867	332.337	192	220	0.34473	-0.0324	1069
580.000	8.1729	2.53722	5.32895	901.954	65906	78141	336.207	198	225	0.37405	-0.0315	1055
585.000	8.1434	2.52465	5.25196	892.157	67036	79316	338.165	203	231	0.38982	-0.0307	1047
590.000	8.1140	2.51232	5.17634	882.570	68211	80536	340.183	218	245	0.40581	-0.0288	1037
593.000	8.0965	2.50503	5.13162	876.916	68966	81317	341.501	256	284	0.41389	-0.0248	1025
595.000	8.0848	2.50022	5.10207	873.187	69443	81812	342.217	212	240	0.42522	-0.0294	1033
600.000	8.0556	2.48836	5.02911	864.003	70585	82998	344.202	208	235	0.43874	-0.0299	1029
610.000	7.9976	2.46531	4.88701	846.213	72841	85345	348.080	207	234	0.46590	-0.0299	1018
620.000	7.9401	2.44312	4.74985	829.165	75095	87689	351.893	207	234	0.49320	-0.0297	1007
630.000	7.8831	2.42174	4.61741	812.822	77355	90041	355.656	209	235	0.52062	-0.0294	997
640.000	7.8265	2.40113	4.48950	797.153	79627	92404	359.381	210	237	0.54800	-0.0291	986
660.000	7.7149	2.36206	4.24658	767.712	84212	97174	366.725	213	240	0.60266	-0.0284	966
680.000	7.6053	2.32563	4.01975	740.616	88857	102006	373.941	217	243	0.65690	-0.0278	947
700.000	7.4978	2.29157	3.80782	715.663	93563	106900	381.038	221	246	0.71059	-0.0273	930
750.000	7.2386	2.21537	3.33628	661.500	105590	119405	398.293	229	253	0.83996	-0.0260	890
800.000	6.9936	2.14969	2.93689	617.239	117971	132270	414.902	237	260	0.95904	-0.0250	856

4.1. Joule–Thomson Inversion Locus

The P–ρ–T locus of the Joule–Thomson inversion, $(\partial T/\partial P)_H = 0$, is presented in Table 16. This is computed using the EOS. For each temperature, the density is iterated to satisfy the condition $T(\partial P/\partial T) = \rho(\partial P/\partial \rho)$, by starting with an initial trial density ρ_i,

$$\rho_i/\rho_c = \exp[1.285 - 0.529 \cdot T/T_c]. \quad (23)$$

4.2. Properties at Coexistence

Table 17 gives properties at the saturated liquid coexistence boundary, computed as described in Secs. 3.2 and 3.3 above.

4.3. Properties Along Selected Isobars

Table 18 gives thermophysical properties along selected isobars, computed as described in Sec. 3.3 via the EOS of Eq. (6). Each isobar starts with freezing liquid on the melting line of Eq. (1). At pressures below the critical, each table contains a blank line for the transition from saturated liquid to vapor at the constant coexistence temperature. For compressed liquid states at $T < T_c$, properties are based on the formulated saturated liquid properties of Eqs. (9), (10), (12), and (14). The Joule–Thomson coefficients μ in Table 18 are computed using the EOS and derived C_p values by the relation

$$\mu = 100[T(\partial P/\partial T)/(\partial P/\partial \rho)/\rho - 1]\rho/C_p, \text{ K/bar}. \quad (24)$$

Small discontinuities at $T = T_c$ along isobars at $P > P_c$ are expected, due to change in the paths of computation from $T < T_c$ to $T > T_c$. In particular, the values of C_v, C_p and W for compressed liquid near T_c must be affected by the inherent, wide margin of uncertainty for $C_v(T)_\sigma$ as derived via Eq. (13).

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