

94002

Issued January 1994

Orthobaric densities and molar volumes of liquids

Polycyclic phenyl and cyclohexyl compounds

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ESDU DATA ITEM No.94002

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THE PREPARATION OF THIS DATA ITEM

The work on this particular Data Item was monitored and guided by the Physical Data and Reaction Kinetics Committee, which first met in 1966 and now has the following membership:

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Mr J.Walton	— Independent
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in consultation with Dr D.Ambrose.

The person with overall responsibility for the work in this subject area is Mr S.J.Pugh, Head of Thermofluids Group.

KEEPING UP TO DATE

We are constantly striving to develop new work and review data already issued. Any comments arising out of your use of our data, or any suggestions for new topics or information that might lead to improvements, will help us to provide a better service.

(Continued on inside back cover)

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ORTHOBARIC DENSITIES AND MOLAR VOLUMES OF LIQUIDS
POLYCYCLIC PHENYL AND CYCLOHEXYL COMPOUNDS

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COMPOUND TABLES in the following order

Sheet	Formula	Name	Alternative Names
1.00	C ₁₂ H ₁₀	Biphenyl	*Diphenyl
1.10	C ₁₃ H ₁₂	Diphenylmethane	Benzylbenzene
1.11a	C ₁₃ H ₁₂	2-Methylbiphenyl	2-Phenyltoluene
1.11b	C ₁₃ H ₁₂	3-Methylbiphenyl	3-Phenyltoluene
	C ₁₃ H ₁₂	4-Methylbiphenyl	(not issued)
1.20a	C ₁₄ H ₁₄	1,1-Diphenylethane	
1.20b	C ₁₄ H ₁₄	1,2-Diphenylethane	Bibenzyl
1.30a	C ₁₅ H ₁₆	1,1-Diphenylpropane	
1.30b	C ₁₅ H ₁₆	1,2-Diphenylpropane	
1.30c	C ₁₅ H ₁₆	1,3-Diphenylpropane	Dibenzylmethane
1.30d	C ₁₅ H ₁₆	2,2-Diphenylpropane	
2.00	C ₁₂ H ₁₆	Phenylcyclohexane	Cyclohexylbenzene
2.10	C ₁₂ H ₂₂	Bicyclohexyl	*Dicyclohexyl
3.00a	C ₁₈ H ₁₄	o-Terphenyl	1,2-Diphenylbenzene
3.00b	C ₁₈ H ₁₄	m-Terphenyl	1,3-Diphenylbenzene
3.00c	C ₁₈ H ₁₄	p-Terphenyl	1,4-Diphenylbenzene
5.10	C ₁₂ H ₁₁ N	Diphenylamine	N,N-Diphenylamine
5.15	C ₁₂ H ₂₃ N	Dicyclohexylamine	
5.21	C ₁₃ H ₁₄ N ₂	4,4'-Diaminodiphenylmethane	4,4'-Methylenedianiline
6.10	C ₁₂ H ₁₀ O	Diphenyl ether	
6.15	C ₁₃ H ₁₀ O	Benzophenone	Diphenyl ketone

* These names are not in accordance with current usage.

NB. To allow for the future issue of omitted compounds sheet numbers are not always consecutive.

ORTHOBARIC DENSITIES AND MOLAR VOLUMES OF LIQUIDS
POLYCYCLIC PHENYL AND CYCLOHEXYL COMPOUNDS

1. INTRODUCTION

This Data Item presents orthobaric liquid densities and molar volumes of the polycyclic phenyl and cyclohexyl compounds arranged in the order shown on the Contents page.

Table 1, page 5, gives the constants in the liquid density equation for all the compounds. On the following Sheets, the values of liquid density and liquid molar volume for each compound have been obtained by calculation from the equation given at the top of each Sheet. Using the critical temperature and the critical density given, the numerical values of the coefficients were derived by fitting the equation to the data that had been selected and weighted in accordance with a critical assessment of all the data. The value of the critical temperature for each compound was taken from Item 94001 which gives the vapour pressures.

For completeness all the critical properties of each compound are given in the Tables which also show the density at 298.15 K, where applicable, and for convenience, the normal boiling point and the approximate melting point. Brackets enclose the data at those temperatures which are outside the range of supporting experimental data.

The table of Data at Specified Temperatures for each compound gives the density, the molar volume and their derivatives with respect to temperature. In addition this table also gives an assessment of the data quality indicated, in decreasing order, by one of the letters 'A', 'B' or 'C', at each temperature. The estimated uncertainties in density and molar volume are shown below each letter in the units of density and molar volume rounded to 1, 2 or 5 times a power of 10.

In the main tables the uncertainties in the tabulated values of density and molar volume are shown for each value. The number of decimal places in each value is adjusted to be consistent with the uncertainty. Data quality and uncertainties are discussed at greater length in Section 5.

The sources of information which give liquid density or liquid molar volume data for the compound considered are listed on the reverse side of each sheet. Those sources that were used to derive the critical density and the coefficients of the liquid density/molar volume equation are shown together with the temperature ranges (ambient, low, medium, high or critical) of their data.

2. NOTATION AND UNITS

All temperatures are based on the International Temperature Scale (ITS-90).

d	liquid density
N_1, N_2, N_3, N_4	non-dimensional coefficients in the liquid density/molar volume equation
q	$(1-T/T_c)^{1/3}$
T	kelvin temperature
t	Celsius temperature ($T-273.15$)
V	liquid molar volume

Note. The UNITS of temperature, density and molar volume are shown in each table.

Subscripts

b	denotes value at normal boiling point
c	denotes value at critical point
m	denotes value at normal melting point

3. THE CRITICAL DENSITY

Two widely varying values of the critical density have been reported for biphenyl and one value has been reported for each of the terphenyls. Because of the experimental difficulties at the very high temperatures involved none of these values are thought to be very reliable.

Estimates of the critical density of each compound were made using both the Riedel equation, see Reference 1, and the latest form of Rackett equation, see References 2, 3 and 4. Both of these equations require reliable values of critical temperature and critical pressure but neither represents experimental data over a long range of temperature as satisfactorily as does the equation used in this Item. However, provided the use of the Riedel equation is limited to non-associated liquids, both equations can yield reliable values of the critical density for a wide variety of compounds.

4. EVALUATION AND CORRELATION

Reliable liquid density data for the compounds considered here are confined to medium reduced temperatures and the data for each compound was fitted by the correlation for the alkanes. The critical pressure, and if necessary, the critical temperature also, were adjusted until the critical density given by the Riedel and Rackett equations were in good agreement. As indicated in Item 94001, the corresponding Item on vapour pressures, the adjustment of the critical properties was arranged to give optimum values for the correlation of both the vapour pressure and the liquid density.

5. UNCERTAINTIES

At any temperature, the estimated uncertainties in the tabulated values of density and molar volume are dependent upon the rates of change of these properties with temperature and the quality of the experimental or estimated data upon which they are based. The table of Data at Specified Temperatures shows these derivatives, the assessed data quality (indicated by one of the letters 'A', 'B' or 'C') and the corresponding uncertainties at various points of the liquid range.

At low and medium reduced temperatures average quality data, denoted by the letter 'B', have uncertainties varying from 0.1 to 1 per cent, increasing to between 1 and 10 per cent at the critical point. Data with lower or higher uncertainties than these bands are graded 'A' and 'C' respectively. When the data quality is 'C' it will be appreciated that the uncertainties are necessarily rather speculative and that for some compounds they may be underestimated.

For those compounds for which the data quality at the critical pressure is denoted by 'C' the values of critical temperature and critical density given in the Tables should be regarded only as correlating parameters.

6. REFERENCES

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4. CAMPBELL, S.W. Prediction of saturated-liquid densities and critical volumes THODOS, G. for polar and non-polar substances. J. Chem. Eng. Data, Vol.30, No.1, pp.102-111, 1985.

TABLE 1

Summary of Constants in the Liquid Density equation

$$\ln d = \ln d_c + N_1q + N_2q^2 + N_3q^3 + N_4q^4 \quad \text{where } q = (1-T/T_c)^{1/3}$$

Sheet	Name	T_c K	d_c kg/m ³	N_1	N_2	N_3	N_4
1.00	Biphenyl	770	312	1.87981	-0.74420	0	0.25532
1.10	Diphenylmethane	770	301	1.91397	-0.78664	0	0.27748
1.11a	2-Methylbiphenyl	755	303	1.91948	-0.78810	0	0.27555
1.11b	3-Methylbiphenyl	767	298	1.96679	-0.84323	0	0.30232
	4-Methylbiphenyl (not issued)						
1.20a	1,1-Diphenylethane	768	296	1.95250	-0.83567	0	0.30433
1.20b	1,2-Diphenylethane	781	292	1.94018	-0.81188	0	0.28693
1.30a	1,1-Diphenylpropane	762	289	1.99348	-0.87550	0	0.31854
1.30b	1,2-Diphenylpropane	767	287	1.98111	-0.86045	0	0.31093
1.30c	1,3-Diphenylpropane	782	285	2.03711	-0.92984	0	0.34657
1.30d	2,2-Diphenylpropane	762	291	2.00846	-0.89394	0	0.32796
2.00	Phenylcyclohexane	737	288	1.87810	-0.74236	0	0.25450
2.10	Bicyclohexyl	742	273	1.84502	-0.70849	0	0.24139
3.00a	o-Terphenyl	834	306	2.03721	-0.92997	0	0.34664
3.00b	m-Terphenyl	882	301	2.07469	-0.97808	0	0.37208
3.00c	p-Terphenyl	904	335	2.06955	-0.97141	0	0.36852
5.10	Diphenylamine	833	315	1.95670	-0.83124	0	0.29639
5.15	Dicyclohexylamine	724	278	1.89978	-0.76601	0	0.26523
5.21	4,4'-Diaminodiphenylmethane	890	309	2.06911	-0.97084	0	0.36821
6.10	Diphenyl ether	766.8	324	1.88640	-0.75133	0	0.25852
6.15	Benzophenone	823	324	1.95818	-0.83299	0	0.29726

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C₁₂H₁₀ Biphenyl (*Diphenyl)

CAS Reg. No. 92-52-4

Mol. Wt. 154.21

Orthobaric Liquid Density and Molar Volume

$$\ln(d/d_c) = -\ln(V/V_c) = N_1q + N_2q^2 + N_3q^3 + N_4q^4$$

where d is the density, d_c the critical density, V the molar volume, V_c the critical molar volume and $q = (1-T/T_c)^{1/3}$, T being the temperature and T_c the critical temperature in kelvins.

Critical Temperature	$T_c = 770 \text{ K}$	($t_c = 496.85 \text{ }^\circ\text{C}$)	
Critical Pressure	$p_c = 3250 \text{ kPa}$	($p_c = 32.08 \text{ atm}$)	
Critical Density	$d_c = 312 \text{ kg/m}^3$	($V_c = 494.26 \text{ cm}^3/\text{mol}$)	
Critical Compression Factor	$Z_c = 0.251$		
$N_1 = 1.87981$	$N_2 = -0.74420$	$N_3 = 0.00000$	$N_4 = 0.25532$
Normal Boiling Point	$T_b = 528.15 \text{ K}$	($t_b = 255.00 \text{ }^\circ\text{C}$)	
Normal Melting Point	$T_m = 342 \text{ K}$	($t_m = 69 \text{ }^\circ\text{C}$)	

Data at Specified Temperatures

$t/^\circ\text{C}$	69	100	200	255	300	400	496.85
T/K	342.15	373.15	473.15	528.15	573.15	673.15	770.00
$d/(\text{kg/m}^3)$	(994.33)	969.98	887.65	(838.37)	(794.51)	(674.60)	(312.00)
$(d(d)/dT)/(\text{kg/m}^3 \text{ K})$	(-0.78)	-0.79	-0.86	(-0.93)	(-1.02)	(-1.47)	$-\infty$
$V/(\text{cm}^3/\text{mol})$	(155.09)	158.98	173.73	(183.94)	(194.10)	(228.59)	(494.26)
$(dV/dT)/(\text{cm}^3/\text{mol K})$	(0.12)	0.13	0.17	(0.20)	(0.25)	(0.50)	∞
Data Quality	(B)	B	B	(B)	(B)	(B)	(B)
Uncertainty in d (kg/m^3)	(1)	1	1	(2)	(2)	(5)	(5)
Uncertainty in V (cm^3/mol)	(0.2)	0.2	0.2	(0.5)	(0.5)	(1)	(10)

Orthobaric Liquid Density of BiphenylUnits: kg/m^3 v. $^\circ\text{C}$

t	d	Uncert.	t	d	Uncert.	t	d	Uncert.	t	d	Uncert.
$^\circ\text{C}$	kg/m^3	kg/m^3	$^\circ\text{C}$	kg/m^3	kg/m^3	$^\circ\text{C}$	kg/m^3	kg/m^3	$^\circ\text{C}$	kg/m^3	kg/m^3
			300	(795.)	2	420	(643.)	5	470	(534.)	5
			305	(789.)	2	422	(640.)	5	471	(531.)	5
70	(994.)	1	310	(784.)	2	424	(637.)	5	472	(528.)	5
80	986.	1	315	(779.)	2	426	(633.)	5	473	(524.)	5
90	978.	1	320	(774.)	2	428	(630.)	5	474	(521.)	5
100	970.	1	325	(768.)	2	430	(626.)	5	475	(518.)	5
110	962.	1	330	(763.)	2	432	(622.)	5	476	(514.)	5
120	954.	1	335	(757.)	2	434	(619.)	5	477	(510.)	5
130	946.	1	340	(751.)	2	436	(615.)	5	478	(507.)	5
140	938.	1	345	(746.)	2	438	(611.)	5	479	(503.)	5
150	930.	1	350	(740.)	2	440	(607.)	5	480	(499.)	5
160	921.	1	355	(734.)	5	442	(603.)	5	481	(495.)	5
170	913.	1	360	(728.)	5	444	(599.)	5	482	(490.)	5
180	905.	1	365	(722.)	5	446	(595.)	5	483	(486.)	5
190	896.	1	370	(715.)	5	448	(590.)	5	484	(481.)	5
200	888.	1	375	(709.)	5	450	(586.)	5	485	(476.)	5
210	879.	1	380	(702.)	5	452	(582.)	5	486	(471.)	5
220	870.	1	385	(696.)	5	454	(577.)	5	487	(465.)	5
230	861.	1	390	(689.)	5	456	(572.)	5	488	(459.)	5
240	852.	2	395	(682.)	5	458	(567.)	5	489	(453.)	5
250	843.	2	400	(675.)	5	460	(562.)	5	490	(446.)	5
260	(834.)	2	405	(667.)	5	462	(557.)	5	491	(439.)	5
270	(824.)	2	410	(659.)	5	464	(552.)	5	492	(431.)	5
280	(814.)	2	415	(652.)	5	466	(546.)	5	493	(421.)	5
290	(805.)	2				468	(540.)	5	494	(410.)	5

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Orthobaric Liquid Molar Volume of Biphenyl

Units: cm³/mol v. K

T	V	Uncert.	T	V	Uncert.	T	V	Uncert.	T	V	Uncert.
K	cm ³ /mol	in V	K	cm ³ /mol	in V	K	cm ³ /mol	in V	K	cm ³ /mol	in V
350	156.1	0.2	600	(201.)	1	720	(260.)	2	760	(331.)	2
360	157.3	0.2	605	(203.)	1	722	(262.)	2	761	(335.)	5
370	158.6	0.2	610	(204.)	1	724	(264.)	2	762	(340.)	5
380	159.9	0.2	615	(206.)	1	726	(266.)	2	763	(345.)	5
390	161.2	0.2	620	(207.)	1	728	(268.)	2	764	(350.)	5
400	162.6	0.2	625	(209.)	1	730	(271.)	2	765	(357.)	5
410	164.0	0.2	630	(211.)	1	732	(273.)	2	766	(365.)	5
420	165.4	0.2	635	(213.)	1	734	(275.)	2	767	(374.)	5
430	166.9	0.2	640	(214.)	1	736	(278.)	2	768	(387.)	5
440	168.4	0.2	645	(216.)	1	738	(281.)	2	769	(406.)	5
450	170.0	0.2	650	(218.)	1	740	(284.)	2	770	(494.)	10
460	171.6	0.2	655	(220.)	1	742	(287.)	2			
470	173.2	0.2	660	(222.)	1	744	(290.)	2			
480	174.9	0.2	665	(225.)	1	746	(294.)	2			
490	176.7	0.2	670	(227.)	1	748	(298.)	2			
500	178.5	0.2	675	(230.)	1	750	(302.)	2			
510	180.3	0.2	680	(232.)	1	752	(306.)	2			
520	182.	0.5	685	(235.)	1	754	(311.)	2			
530	(184.)	0.5	690	(238.)	2	756	(317.)	2			
540	(186.)	0.5	695	(241.)	2	758	(323.)	2			
550	(189.)	0.5	700	(244.)	2						
560	(191.)	0.5	705	(248.)	2						
570	(193.)	0.5	710	(251.)	2						
580	(196.)	1	715	(256.)	2						
590	(198.)	1									

The following Sources give liquid density or liquid molar volume data for this compound. Those Sources used to derive the coefficients of the liquid density/molar volume equation are indicated by the temperature range (ambient 'A', low 'L', medium 'M', high 'H' or critical 'C') of their data. An asterisk (*) indicates that the Source is not a primary source of experimental data.

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- TRC Thermodynamic Tables, Texas A & M Univ., Loose leaf data sheets extant 1993.*

C₁₃H₁₂ Diphenylmethane (Benzylbenzene)

CAS Reg. No. 101-81-5

Mol. Wt. 168.24

Orthobaric Liquid Density and Molar Volume

$$\ln(d/d_c) = -\ln(V/V_c) = N_1q + N_2q^2 + N_3q^3 + N_4q^4$$

where d is the density, d_c the critical density, V the molar volume, V_c the critical molar volume and $q = (1-T/T_c)^{1/3}$, T being the temperature and T_c the critical temperature in kelvins.

Critical Temperature	$T_c = 770 \text{ K}$	$(t_c = 496.85 \text{ }^\circ\text{C})$
Critical Pressure	$p_c = 2860 \text{ kPa}$	$(p_c = 28.23 \text{ atm})$
Critical Density	$d_c = 301 \text{ kg/m}^3$	$(V_c = 558.94 \text{ cm}^3/\text{mol})$
Critical Compression Factor	$Z_c = 0.250$	
$N_1 = 1.91397$	$N_2 = -0.78664$	$N_3 = 0.00000$
$N_4 = 0.27748$		
Density at 298.15 K (25 °C)	$d_{25} = 1001.96 \text{ kg/m}^3$	$(V_{25} = 167.91 \text{ cm}^3/\text{mol})$
Normal Boiling Point	$T_b = 538.03 \text{ K}$	$(t_b = 264.88 \text{ }^\circ\text{C})$
Normal Melting Point	$T_m = 298 \text{ K}$	$(t_m = 25 \text{ }^\circ\text{C})$

Data at Specified Temperatures

$t/^\circ\text{C}$	25	100	200	264.88	300	400	496.85
T/K	298.15	373.15	473.15	538.03	573.15	673.15	770.00
$d/(\text{kg/m}^3)$	1001.96	944.49	863.75	(806.50)	(772.79)	(655.95)	(301.00)
$(d(d)/dT)/(\text{kg/m}^3 \text{ K})$	-0.76	-0.78	-0.84	(-0.93)	(-1.00)	(-1.43)	$-\infty$
$V/(\text{cm}^3/\text{mol})$	167.91	178.13	194.78	(208.61)	(217.70)	(256.48)	(558.94)
$(dV/dT)/(\text{cm}^3/\text{mol K})$	0.13	0.15	0.19	(0.24)	(0.28)	(0.56)	∞
Data Quality	B	B	B	(B)	(B)	(B)	(B)
Uncertainty in d (kg/m^3)	1	1	1	(2)	(2)	(5)	(5)
Uncertainty in V (cm^3/mol)	0.2	0.2	0.2	(0.5)	(1)	(2)	(10)

Orthobaric Liquid Density of DiphenylmethaneUnits: kg/m^3 v. $^\circ\text{C}$

t	d	Uncert.	t	d	Uncert.	t	d	Uncert.	t	d	Uncert.
$^\circ\text{C}$	kg/m^3	in d	$^\circ\text{C}$	kg/m^3	in d	$^\circ\text{C}$	kg/m^3	in d	$^\circ\text{C}$	kg/m^3	in d
25	1002.	1	150	905.	1	275	(797.)	2	400	(656.)	5
30	998.	1	155	901.	1	280	(792.)	2	405	(649.)	5
35	994.	1	160	897.	1	285	(787.)	2	410	(641.)	5
40	991.	1	165	893.	1	290	(783.)	2	415	(633.)	5
45	987.	1	170	889.	1	295	(778.)	2	420	(625.)	5
50	983.	1	175	885.	1	300	(773.)	2	425	(617.)	5
55	979.	1	180	880.	1	305	(768.)	2	430	(609.)	5
60	975.	1	185	876.	1	310	(763.)	2	435	(600.)	5
65	972.	1	190	872.	1	315	(758.)	2	440	(590.)	5
70	968.	1	195	868.	1	320	(752.)	2	445	(580.)	5
75	964.	1	200	864.	1	325	(747.)	2	450	(570.)	5
80	960.	1	205	860.	1	330	(742.)	2	455	(558.)	5
85	956.	1	210	855.	1	335	(736.)	2	460	(546.)	5
90	952.	1	215	851.	1	340	(731.)	2	465	(533.)	5
95	948.	1	220	847.	1	345	(725.)	2	470	(519.)	5
100	944.	1	225	842.	1	350	(720.)	2	475	(503.)	5
105	941.	1	230	838.	1	355	(714.)	5	480	(484.)	5
110	937.	1	235	834.	1	360	(708.)	5	485	(462.)	5
115	933.	1	240	829.	2	365	(702.)	5	490	(433.)	5
120	929.	1	245	825.	2	370	(696.)	5	495	(384.)	5
125	925.	1	250	(820.)	2	375	(690.)	5			
130	921.	1	255	(816.)	2	380	(683.)	5			
135	917.	1	260	(811.)	2	385	(677.)	5			
140	913.	1	265	(806.)	2	390	(670.)	5			
145	909.	1	270	(802.)	2	395	(663.)	5			

Orthobaric Liquid Molar Volume of Diphenylmethane

Units: cm³/mol v. K

Uncert. in V			Uncert. in V			Uncert. in V			Uncert. in V		
T	V		T	V		T	V		T	V	
K	cm ³ /mol	cm ³ /mol	K	cm ³ /mol	cm ³ /mol	K	cm ³ /mol	cm ³ /mol	K	cm ³ /mol	cm ³ /mol
300	168.1	0.2	425	186.2	0.2	550	(212.)	0.5	675	(258.)	2
305	168.8	0.2	430	187.1	0.2	555	(213.)	0.5	680	(260.)	2
310	169.4	0.2	435	187.9	0.2	560	(214.)	0.5	685	(264.)	2
315	170.1	0.2	440	188.8	0.2	565	(215.)	1	690	(267.)	2
320	170.7	0.2	445	189.6	0.2	570	(217.)	1	695	(270.)	2
325	171.4	0.2	450	190.5	0.2	575	(218.)	1	700	(274.)	2
330	172.1	0.2	455	191.4	0.2	580	(220.)	1	705	(278.)	2
335	172.7	0.2	460	192.3	0.2	585	(221.)	1	710	(282.)	2
340	173.4	0.2	465	193.2	0.2	590	(223.)	1	715	(287.)	2
345	174.1	0.2	470	194.2	0.2	595	(224.)	1	720	(292.)	2
350	174.8	0.2	475	195.1	0.2	600	(226.)	1	725	(298.)	2
355	175.5	0.2	480	196.1	0.2	605	(227.)	1	730	(304.)	2
360	176.2	0.2	485	197.1	0.2	610	(229.)	1	735	(311.)	2
365	176.9	0.2	490	198.1	0.2	615	(231.)	1	740	(319.)	2
370	177.7	0.2	495	199.1	0.2	620	(233.)	1	745	(328.)	2
375	178.4	0.2	500	200.1	0.2	625	(235.)	1	750	(339.)	2
380	179.1	0.2	505	201.2	0.2	630	(236.)	1	755	(353.)	5
385	179.9	0.2	510	202.	0.5	635	(238.)	1	760	(372.)	5
390	180.6	0.2	515	203.	0.5	640	(240.)	1	765	(402.)	5
395	181.4	0.2	520	204.	0.5	645	(243.)	1	770	(559.)	10
400	182.2	0.2	525	(206.)	0.5	650	(245.)	1			
405	183.0	0.2	530	(207.)	0.5	655	(247.)	1			
410	183.8	0.2	535	(208.)	0.5	660	(250.)	1			
415	184.6	0.2	540	(209.)	0.5	665	(252.)	1			
420	185.4	0.2	545	(210.)	0.5	670	(255.)	2			

The following Sources give liquid density or liquid molar volume data for this compound. Those Sources used to derive the coefficients of the liquid density/molar volume equation are indicated by the temperature range (ambient 'A', low 'L', medium 'M', high 'H' or critical 'C') of their data. An asterisk (*) indicates that the Source is not a primary source of experimental data.

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C₁₃H₁₂ 2-Methylbiphenyl (2-Phenyltoluene)

CAS Reg. No. 643-58-3

Mol. Wt. 168.24

Orthobaric Liquid Density and Molar Volume

$$\ln(d/d_c) = -\ln(V/V_c) = N_1q + N_2q^2 + N_3q^3 + N_4q^4$$

where d is the density, d_c the critical density, V the molar volume, V_c the critical molar volume and $q = (1-T/T_c)^{1/3}$, T being the temperature and T_c the critical temperature in kelvins.

Critical Temperature	$T_c = 755 \text{ K}$	($t_c = 481.85 \text{ }^\circ\text{C}$)
Critical Pressure	$p_c = 2800 \text{ kPa}$	($p_c = 27.63 \text{ atm}$)
Critical Density	$d_c = 303 \text{ kg/m}^3$	($V_c = 555.25 \text{ cm}^3/\text{mol}$)
Critical Compression Factor	$Z_c = 0.248$	
$N_1 = 1.91948$	$N_2 = -0.78810$	$N_3 = 0.00000$
$N_4 = 0.27555$		
Density at 298.15 K (25 °C)	$d_{25} = 1006.74 \text{ kg/m}^3$	($V_{25} = 167.11 \text{ cm}^3/\text{mol}$)
Normal Boiling Point	$T_b = 529.37 \text{ K}$	($t_b = 256.22 \text{ }^\circ\text{C}$)
Normal Melting Point	$T_m = 273 \text{ K}$	($t_m = 0 \text{ }^\circ\text{C}$)

Data at Specified Temperatures

$t/^\circ\text{C}$	0	100	200	256.22	300	400	481.85
T/K	273.15	373.15	473.15	529.37	573.15	673.15	755.00
$d/(\text{kg/m}^3)$	(1026.14)	(947.49)	(863.77)	(812.27)	(768.33)	(641.65)	(303.00)
$(d(d)/dT)/(\text{kg/m}^3 \text{ K})$	(-0.77)	(-0.80)	(-0.88)	(-0.96)	(-1.06)	(-1.60)	$-\infty$
$V/(\text{cm}^3/\text{mol})$	(163.95)	(177.56)	(194.77)	(207.12)	(218.97)	(262.20)	(555.25)
$(dV/dT)/(\text{cm}^3/\text{mol K})$	(0.12)	(0.15)	(0.20)	(0.24)	(0.30)	(0.66)	∞
Data Quality	(B)	(B)	(B)	(C)	(C)	(C)	(C)
Uncertainty in d (kg/m^3)	(2)	(2)	(5)	(5)	(5)	(10)	(10)
Uncertainty in V (cm^3/mol)	(0.2)	(0.5)	(1)	(1)	(2)	(2)	(20)

Orthobaric Liquid Density of 2-MethylbiphenylUnits: kg/m^3 v. $^\circ\text{C}$

t	d	Uncert.	t	d	Uncert.	t	d	Uncert.	t	d	Uncert.
$^\circ\text{C}$	kg/m^3	kg/m^3	$^\circ\text{C}$	kg/m^3	kg/m^3	$^\circ\text{C}$	kg/m^3	kg/m^3	$^\circ\text{C}$	kg/m^3	kg/m^3
0	(1026.)	2	125	(927.)	2	250	(818.)	5	375	(679.)	5
5	(1022.)	2	130	(923.)	2	255	(813.)	5	380	(672.)	10
10	(1018.)	2	135	(919.)	2	260	(809.)	5	385	(665.)	10
15	(1015.)	2	140	(915.)	2	265	(804.)	5	390	(657.)	10
20	(1011.)	2	145	(911.)	2	270	(799.)	5	395	(650.)	10
25	(1007.)	2	150	(907.)	2	275	(794.)	5	400	(642.)	10
30	(1003.)	2	155	(902.)	5	280	(789.)	5	405	(633.)	10
35	(999.)	2	160	(898.)	5	285	(784.)	5	410	(625.)	10
40	(995.)	2	165	(894.)	5	290	(779.)	5	415	(616.)	10
45	(991.)	2	170	(890.)	5	295	(774.)	5	420	(607.)	10
50	(987.)	2	175	(885.)	5	300	(768.)	5	425	(597.)	10
55	(983.)	2	180	(881.)	5	305	(763.)	5	430	(587.)	10
60	(979.)	2	185	(877.)	5	310	(758.)	5	435	(576.)	10
65	(975.)	2	190	(873.)	5	315	(752.)	5	440	(565.)	10
70	(971.)	2	195	(868.)	5	320	(747.)	5	445	(553.)	10
75	(967.)	2	200	(864.)	5	325	(741.)	5	450	(539.)	10
80	(963.)	2	205	(859.)	5	330	(735.)	5	455	(525.)	10
85	(960.)	2	210	(855.)	5	335	(730.)	5	460	(508.)	10
90	(956.)	2	215	(850.)	5	340	(724.)	5	465	(490.)	10
95	(952.)	2	220	(846.)	5	345	(718.)	5	470	(467.)	10
100	(947.)	2	225	(841.)	5	350	(711.)	5	475	(437.)	10
105	(943.)	2	230	(837.)	5	355	(705.)	5	480	(387.)	10
110	(939.)	2	235	(832.)	5	360	(699.)	5			
115	(935.)	2	240	(828.)	5	365	(692.)	5			
120	(931.)	2	245	(823.)	5	370	(686.)	5			

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Orthobaric Liquid Molar Volume of 2-Methylbiphenyl

Units: cm³/mol v. K

T	V	Uncert. in V	T	V	Uncert. in V	T	V	Uncert. in V	T	V	Uncert. in V
K	cm ³ /mol	cm ³ /mol	K	cm ³ /mol	cm ³ /mol	K	cm ³ /mol	cm ³ /mol	K	cm ³ /mol	cm ³ /mol
275	(164.2)	0.2	400	(182.)	0.5	525	(206.)	1	650	(249.)	2
280	(164.8)	0.2	405	(183.)	0.5	530	(207.)	1	655	(251.)	2
285	(165.4)	0.2	410	(183.)	0.5	535	(209.)	1	660	(254.)	2
290	(166.)	0.5	415	(184.)	0.5	540	(210.)	1	665	(257.)	2
295	(167.)	0.5	420	(185.)	0.5	545	(211.)	1	670	(260.)	2
300	(167.)	0.5	425	(186.)	0.5	550	(212.)	1	675	(263.)	2
305	(168.)	0.5	430	(187.)	0.5	555	(214.)	2	680	(267.)	2
310	(169.)	0.5	435	(188.)	1	560	(215.)	2	685	(271.)	5
315	(169.)	0.5	440	(189.)	1	565	(217.)	2	690	(275.)	5
320	(170.)	0.5	445	(189.)	1	570	(218.)	2	695	(279.)	5
325	(171.)	0.5	450	(190.)	1	575	(220.)	2	700	(283.)	5
330	(171.)	0.5	455	(191.)	1	580	(221.)	2	705	(288.)	5
335	(172.)	0.5	460	(192.)	1	585	(223.)	2	710	(294.)	5
340	(173.)	0.5	465	(193.)	1	590	(224.)	2	715	(300.)	5
345	(173.)	0.5	470	(194.)	1	595	(226.)	2	720	(307.)	5
350	(174.)	0.5	475	(195.)	1	600	(228.)	2	725	(315.)	5
355	(175.)	0.5	480	(196.)	1	605	(229.)	2	730	(324.)	5
360	(176.)	0.5	485	(197.)	1	610	(231.)	2	735	(335.)	5
365	(176.)	0.5	490	(198.)	1	615	(233.)	2	740	(349.)	5
370	(177.)	0.5	495	(199.)	1	620	(235.)	2	745	(368.)	10
375	(178.)	0.5	500	(200.)	1	625	(237.)	2	750	(398.)	10
380	(179.)	0.5	505	(201.)	1	630	(239.)	2	755	(555.)	20
385	(179.)	0.5	510	(203.)	1	635	(242.)	2			
390	(180.)	0.5	515	(204.)	1	640	(244.)	2			
395	(181.)	0.5	520	(205.)	1	645	(246.)	2			

The following Sources give liquid density or liquid molar volume data for this compound. Those Sources used to derive the coefficients of the liquid density/molar volume equation are indicated by the temperature range (ambient 'A', low 'L', medium 'M', high 'H' or critical 'C') of their data. An asterisk (*) indicates that the Source is not a primary source of experimental data.

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