

95003

Issued January 1995

Orthobaric densities and molar volumes of liquids

Glycols and cyclic diols

Endorsed by
The Institution of Chemical Engineers



ESDU DATA ITEM No. 95003

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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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in consultation with Dr D.Ambrose.

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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
GLYCOLS AND CYCLIC DIOLS

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COMPOUND TABLES in the following order

Sheet	Name	Alternative Names	
1.1	C ₂ H ₆ O ₂ Ethylene glycol	Ethane-1,2-diol	1,2-Dihydroxyethane
1.2	C ₄ H ₁₀ O ₃ Diethylene glycol	Diglycol	Digol
1.3	C ₆ H ₁₄ O ₄ Triethylene glycol	Triglycol	Trigol
3.1a	C ₃ H ₈ O ₂ Propane-1,2-diol	1,2-Dihydroxypropane	Propylene glycol
3.1b	,, Propane-1,3-diol	1,3-Dihydroxypropane	Trimethylene glycol
4.1a	C ₄ H ₁₀ O ₂ Butane-1,2-diol	1,2-Dihydroxybutane	
4.1b	,, Butane-1,3-diol	1,3-Dihydroxybutane	
4.1c	,, Butane-1,4-diol	1,4-Dihydroxybutane	Tetramethylene glycol
4.1d	,, Butane-2,3-diol	2,3-Dihydroxybutane	
4.1e	,, 2-Methylpropane-1,2-diol	1,2-Dihydroxy-2-methylpropane	
4.1f	,, 2-Methylpropane-1,3-diol	1,3-Dihydroxy-2-methylpropane	
4.3c	C ₄ H ₈ O ₂ But-2-ene-1,4-diol	1,4-Dihydroxybut-2-ene	
4.5a	C ₄ H ₆ O ₂ But-2-yne-1,4-diol	1,4-Dihydroxybut-2-yne	
5.1a	C ₅ H ₁₂ O ₂ Pentane-1,2-diol	1,2-Dihydroxypentane	
5.1c	,, Pentane-1,4-diol	1,4-Dihydroxypentane	
5.1d	,, Pentane-1,5-diol	1,5-Dihydroxypentane	Pentamethylene glycol
	,, Pentane-2,4-diol (not issued)		
	C ₆ H ₁₄ O ₂ Hexane-1,2-diol (not issued)		
6.1e	,, Hexane-1,6-diol	1,6-Dihydroxyhexane	Hexamethylene glycol
6.1h	,, Hexane-2,5-diol	2,5-Dihydroxyhexane	
6.1m	,, 2-Methylpentane-2,4-diol	2,4-Dihydroxy-2-methylpentane	Hexylene glycol
	,, 2,3-Dimethylbutane-2,3-diol (not issued)		
A6.1a	C ₆ H ₁₂ O ₂ Cyclohexane-1,2,-diol	1,2-Dihydroxycyclohexane	
	,, Cyclohexane-1,3,-diol (not issued)		
	,, Cyclohexane-1,4,-diol (not issued)		
B6.1a	C ₆ H ₆ O ₂ Benzene-1,2,-diol	1,2-Dihydroxybenzene	Pyrocatechol
B6.1b	,, Benzene-1,3,-diol	1,3-Dihydroxybenzene	Resorcinol
	,, Benzene-1,4,-diol (not issued)		

NB. Other alternative names for some compounds are given on the relevant Sheets.

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

ORTHOBARIC DENSITIES AND MOLAR VOLUMES OF LIQUIDS GLYCOLS AND CYCLIC DIOLS

1. INTRODUCTION

This Data Item presents orthobaric liquid densities and molar volumes of the glycols and cyclic diols shown in the order of arrangement 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 95002 which gives the 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.

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. 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

No values of critical density have been reported for any of the compounds considered here. The critical densities of all the compounds were derived with the aid of the latest form of Rackett equation, see References 1, 2 and 3. This equation, even in its latest form, does not represent experimental data over a long range of temperature as satisfactorily as does the equation used in this Item. However, it can yield reliable values of the critical density when used with reliable values of critical temperature and critical pressure.

4. EVALUATION AND CORRELATION

Reliable liquid density data for the compounds considered here are confined to medium reduced temperatures. As is the case with alcohols it was found that the preferred fits were obtained by making the second term in the liquid density zero.

As indicated on page 1 the critical pressure, and if necessary, the critical temperature also, were adjusted until the fitted critical density and the value given by the Rackett equation were in good agreement.

5. UNCERTAINTIES

At any temperature, the estimated uncertainties in the tabulated values of density and molar volume are dependent upon the derivatives with respect to temperature of these properties 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 temperatures below the normal boiling point average quality data, denoted by the letter 'B', have uncertainties varying, approximately, from 0.1 to 0.5 per cent, increasing to between 0.5 and 2 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 point is denoted by 'C' the values of critical temperature and critical density given in the Tables should, in general, be regarded only as correlating parameters.

6. REFERENCES

1. RACKETT, H.G. Equation of state for saturated liquids. J. Chem. Eng. Data, Vol.15, No.4, pp.514-517, 1970.
2. SPENCER, C.F.,
DANNER, R.P. Improved equation for prediction of saturated liquid density. J. Chem. Eng. Data, Vol.17, No.2, pp.236-241, 1972.
3. CAMPBELL, S.W.
THODOS, G. Prediction of saturated-liquid densities and critical volumes 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

$$\ln d = \ln d_c + N_1 q + N_2 q^2 + N_3 q^3 + N_4 q^4 \quad \text{where } q = (1 - T/T_c)^{1/3}$$

Sheet	Name	T_c K	d_c kg/m ³	N_1	N_2	N_3	N_4
1.1	Ethylene glycol	725	360	1.69680	0	-0.93239	0.51229
1.2	Diethylene glycol	760	346	1.74292	0	-1.18693	0.80857
1.3	Triethylene glycol	795	332	1.79495	0	-1.23672	0.85196
3.1a	Propane-1,2-diol	670	312	1.82244	0	-0.94220	0.48731
3.1b	Propane-1,3-diol	735	355	1.63281	0	-0.93234	0.53210
4.1a	Butane-1,2-diol	675	325	1.71817	0	-1.04637	0.63697
4.1b	Butane-1,3-diol	700	333	1.67393	0	-1.02361	0.62598
4.1c	Butane-1,4-diol	745	349	1.60146	0	-0.97048	0.58826
4.1d	Butane-2,3-diol	650	300	1.83415	0	-1.04180	0.59190
4.1e	2-Methylpropane-1,2-diol	650	324	1.72596	0	-0.97344	0.54926
4.1f	2-Methylpropane-1,3-diol	710	321	1.74445	0	-0.96642	0.53538
4.3c	But-2-ene-1,4-diol	755	350	1.67773	0	-0.97141	0.56259
4.5a	But-2-yne-1,4-diol	780	341	1.74183	0	-0.96846	0.53836
5.1a	Pentane-1,2-diol	700	325	1.65793	0	-0.97652	0.57530
5.1c	Pentane-1,4-diol	730	338	1.61451	0	-0.97194	0.58537
5.1d	Pentane-1,5-diol	750	342	1.59513	0	-0.97303	0.59338
	Pentane-2,4-diol (not issued)						
	Hexane-1,2-diol (not issued)						
6.1e	Hexane-1,6-diol	755	335	1.60896	0	-0.97262	0.58787
6.1h	Hexane-2,5-diol	705	327	1.63291	0	-0.97485	0.58195
6.1m	2-Methylpentane-2,4-diol	675	321	1.60952	0	-0.97134	0.58616
	2,3-Dimethylbutane-2,3-diol (not issued)						
A6.1a	Cyclohexane-1,2-diol	740	377	1.58521	0	-0.97094	0.59473
	Cyclohexane-1,3-diol (not issued)						
	Cyclohexane-1,4-diol (not issued)						
B6.1a	Benzene-1,2-diol	755	359	1.82088	0	-0.94322	0.48872
B6.1b	Benzene-1,3-diol	790	355	1.86226	0	-0.94976	0.48420
	Benzene-1,4-diol (not issued)						



Sheet 1.1

Ethylene glycol; Monoethylene glycol; Ethane-1,2-diol; 1,2-Dihydroxyethane

CAS Reg. No. 107-21-1

Mol. Wt. 62.07

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	$T_c = 725 \text{ K}$	$(t_c = 451.85 \text{ }^\circ\text{C})$	
Critical Pressure	$p_c = 8600 \text{ kPa}$	$(p_c = 84.88 \text{ atm})$	
Critical Density	$d_c = 360 \text{ kg/m}^3$	$(V_c = 172.42 \text{ cm}^3/\text{mol})$	
Critical Compression Factor	$Z_c = 0.246$		
$N_1 = 1.69680$	$N_2 = 0.00000$	$N_3 = -0.93239$	$N_4 = 0.51229$
Density at 298.15 K (25 °C)	$d_{25} = 1109.97 \text{ kg/m}^3$	$(V_{25} = 55.92 \text{ cm}^3/\text{mol})$	
Normal Boiling Point	$T_b = 470.65 \text{ K}$	$(t_b = 197.50 \text{ }^\circ\text{C})$	
Normal Melting Point	$T_m = 260 \text{ K}$	$(t_m = -13 \text{ }^\circ\text{C})$	

Data at Specified Temperatures

$t/^\circ\text{C}$	-13	0	25	100	197.50	300	451.85
T/K	260.15	273.15	298.15	373.15	470.65	573.15	725.00
$d/(\text{kg/m}^3)$	(1135.32)	1126.77	1109.97	1056.18	975.04	(864.56)	(360.00)
$(d(d)/dT)/(\text{kg/m}^3 \text{ K})$	(-0.65)	-0.66	-0.68	-0.76	-0.92	(-1.28)	$-\infty$
$V/(\text{cm}^3/\text{mol})$	(54.67)	55.09	55.92	58.77	63.66	(71.79)	(172.42)
$(dV/dT)/(\text{cm}^3/\text{mol K})$	(0.03)	0.03	0.03	0.04	0.06	(0.11)	∞
Data Quality	(B)	B	B	B	B	(B)	(B)
Uncertainty in d (kg/m^3)	(2)	1	1	2	2	(5)	(5)
Uncertainty in V (cm^3/mol)	(0.1)	0.05	0.05	0.1	0.2	(0.2)	(2)

Orthobaric Liquid Density of Ethylene glycol

Units: 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
			100	1056.	2	225	949.	2	350	(792.)	5
			105	1052.	2	230	944.	2	355	(784.)	5
			110	1049.	2	235	939.	2	360	(775.)	5
-10	(1133.)	2	115	1045.	2	240	934.	2	365	(766.)	5
-5	(1130.)	1	120	1041.	2	245	928.	2	370	(757.)	5
0	1127.	1	125	1037.	2	250	923.	2	375	(747.)	5
5	1123.	1	130	1033.	2	255	918.	5	380	(737.)	5
10	1120.	1	135	1029.	2	260	912.	5	385	(726.)	5
15	1117.	1	140	1025.	2	265	907.	5	390	(715.)	5
20	1113.	1	145	1021.	2	270	901.	5	395	(704.)	5
25	1110.	1	150	1017.	2	275	895.	5	400	(692.)	5
30	1107.	1	155	1012.	2	280	(889.)	5	405	(679.)	5
35	1103.	1	160	1008.	2	285	(883.)	5	410	(665.)	5
40	1100.	1	165	1004.	2	290	(877.)	5	415	(650.)	5
45	1096.	1	170	1000.	2	295	(871.)	5	420	(634.)	5
50	1093.	1	175	995.	2	300	(865.)	5	425	(616.)	5
55	1089.	1	180	991.	2	305	(858.)	5	430	(596.)	5
60	1086.	1	185	986.	2	310	(851.)	5	435	(574.)	5
65	1082.	1	190	982.	2	315	(845.)	5	440	(547.)	5
70	1078.	2	195	977.	2	320	(838.)	5	445	(511.)	5
75	1075.	2	200	973.	2	325	(831.)	5	450	(453.)	5
80	1071.	2	205	968.	2	330	(823.)	5			
85	1067.	2	210	963.	2	335	(816.)	5			
90	1064.	2	215	959.	2	340	(808.)	5			
95	1060.	2	220	954.	2	345	(800.)	5			

Issued January 1995

Orthobaric Liquid Molar Volume of Ethylene glycol

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
			375	58.8	0.1	500	65.6	0.2	625	(79.)	0.5
			380	59.1	0.1	505	65.9	0.2	630	(80.)	0.5
			385	59.3	0.1	510	66.3	0.2	635	(80.)	0.5
265	(54.8)	0.05	390	59.5	0.1	515	66.6	0.2	640	(81.)	0.5
270	(55.0)	0.05	395	59.7	0.1	520	67.0	0.2	645	(82.)	0.5
275	55.1	0.05	400	60.0	0.1	525	67.4	0.2	650	(84.)	0.5
280	55.3	0.05	405	60.2	0.1	530	67.8	0.2	655	(85.)	0.5
285	55.5	0.05	410	60.4	0.1	535	68.2	0.2	660	(86.)	0.5
290	55.64	0.05	415	60.7	0.1	540	68.6	0.2	665	(87.)	0.5
295	55.81	0.05	420	60.9	0.1	545	69.1	0.2	670	(89.)	0.5
300	55.98	0.05	425	61.2	0.1	550	69.5	0.2	675	(90.)	0.5
305	56.2	0.05	430	61.4	0.2	555	(70.0)	0.2	680	(92.)	0.5
310	56.3	0.05	435	61.7	0.2	560	(70.5)	0.2	685	(94.)	0.5
315	56.5	0.05	440	61.9	0.2	565	(70.9)	0.2	690	(96.)	0.5
320	56.7	0.05	445	62.2	0.2	570	(71.5)	0.2	695	(99.)	1
325	56.9	0.05	450	62.5	0.2	575	(72.0)	0.2	700	(102.)	1
330	57.1	0.05	455	62.7	0.2	580	(72.5)	0.2	705	(105.)	1
335	57.2	0.05	460	63.0	0.2	585	(73.)	0.5	710	(110.)	1
340	57.4	0.1	465	63.3	0.2	590	(74.)	0.5	715	(116.)	1
345	57.6	0.1	470	63.6	0.2	595	(74.)	0.5	720	(126.)	1
350	57.8	0.1	475	63.9	0.2	600	(75.)	0.5	725	(172.)	2
355	58.0	0.1	480	64.2	0.2	605	(76.)	0.5			
360	58.2	0.1	485	64.6	0.2	610	(76.)	0.5			
365	58.4	0.1	490	64.9	0.2	615	(77.)	0.5			
370	58.6	0.1	495	65.2	0.2	620	(78.)	0.5			

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.

1	WALDEN, P.,	Z. Phys. Chem. Stoech. Verwandt.,	Vol. 59,	p. 304,	1907.	
2	SCHWERS, F.,	Rec. Trav. Chim.,	Vol. 28,	p. 44,	1909.	
3	TAYLOR, C. A., RINKENBACH, W. H.,	Ind. Eng. Chem.,	Vol. 18,	p. 676,	1926.	
4	KAILAN, A., MELKUS, K.,	Monets,	Vol. 48,	p. 9,	1927.	
5	SMYTH, C. P., WALLS, W. S.,	J. Am. Chem. Soc.,	Vol. 53,	p. 2117,	1931.	M
6	SCHIERHOLTZ, O. J., STAPLES, M. L.,	J. Am. Chem. Soc.,	Vol. 57,	p. 2709,	1935.	A
7	TIMMERMAN, J., HENNAUT-ROLAND, M.,	J. Chim. Phys.,	Vol. 32,	p. 501,	1935.	M
8	GALLAUGHER, A. F., HIBBERT, H.,	J. Am. Chem. Soc.,	Vol. 59,	p. 2517,	1937.	
9	GIBSON, R. E., KINCAID, J. F.,	J. Am. Chem. Soc.,	Vol. 59,	p. 579,	1937.	
10	MOUREU, H., DODE, M.,	Bull. Soc. Chim. France, 5,	Vol. 4,	p. 637,	1937.	
11	GIBSON, R. E., LOEFFLER, O. H.,	J. Am. Chem. Soc.,	Vol. 63,	p. 898,	1941.	
12	DANUSSO, -, et al.,	Atti Accad. Naz. Lin., Sci. Fis. Mat.,	Vol. 14,	p. 81,	1953.	M
13	ISHIGURO, T., KATO, S., et al.,	Yakugaku Zasshi,	Vol. 73,	p. 1167,	1953.	A
14	FOGG, E. T., HIXSON, A. N., THOMPSON, A. R.,	Anal. Chem.,	Vol. 27,	p. 1609,	1955.	A
15	CRUETZEN, J. L., JOST, W., SIEG, L.,	Z. Elektrochem.,	Vol. 61,	p. 229,	1957.	A
16	KETELAAR, J. A. A., VAN MEURS, N.,	Rec. Trav. Chim.,	Vol. 76,	p. 437,	1957.	M
17	COSTELLO, J. M., BOWDEN, S. I.,	Rec. Trav. Chim.,	Vol. 77,	p. 36,	1958.	M
18	RABINOWITSCH, I. B., et al.,	Russ. J. Phys. Chem.,	Vol. 34,	p. 937,	1960.	A
19	LUTSKII, A. E., OBUKOVA, E. M.,	J. Gen. Chem. USSR,	Vol. 31,	p. 2692,	1961.	
20	PORMALE, M. Ya., et al.,	J. Org. Chem. USSR,	Vol. 1,	p. 1788,	1965.	
21	GARBER, Yu. N., KOMAROVA, L. F.,	J. Appl. Chem. USSR,	Vol. 39,	p. 1275,	1966.	A
22	KOZLOV, N. A., et al.,	J. Appl. Chem. USSR,	Vol. 39,	p. 1290,	1966.	A
23	KUNDU, K. K., et al.,	J. Chem. Eng. Data,	Vol. 15,	p. 209,	1970.	A
24	PAZ ANDRADE, M. I., et al.,	An. Quim.,	Vol. 66,	p. 961,	1970.	A
25	RASTORGUEV, Yu. L., GAZDIEV, M. A.,	Russ. J. Phys. Chem.,	Vol. 44,	p. 1758,	1970.	A
26	HAYDUK, W., MALIK, V. K.,	J. Chem. Eng. Data,	Vol. 16,	p. 143,	1971.	A
27	JIMENEZ, E., PAZ ANDRADE, M. I.,	An. Quim.,	Vol. 70,	p. 103,	1974.	A
28	KHIMENKO, M. T., GRITSENKO, N. N.,	Russ. J. Phys. Chem.,	Vol. 49,	p. 146,	1975.	M
29	JIMENEZ, E., PAZ ANDRADE, M. I., et al.,	J. Chim. Phys.,	Vol. 76,	p. 46,	1979.	A
30	SAHGAL, A., HAYDUK, W.,	J. Chem. Eng. Data,	Vol. 24,	p. 222,	1979.	A
31	JOO, H.-J., ARLT, W.,	J. Chem. Eng. Data,	Vol. 26,	p. 138,	1981.	A
32	DIZECHI, M., MARSCHALL, E.,	J. Chem. Eng. Data,	Vol. 27,	p. 358,	1982.	A
33	MANDIK, L., LESEK, F.,	Coll. Czech. Chem. Comm.,	Vol. 47,	p. 1686,	1982.	A
34	IDRISS-ALI, K. M., FREEMAN, G. R.,	Can. J. Chem.,	Vol. 62,	p. 2217,	1984.	
35	ZHURAVLEVA, I. K.,	Zh. Obshch. Khim.,	Vol. 55,	p. 1685,	1985.	
36	DOUHERET, G., PAL, A.,	J. Chem. Eng. Data,	Vol. 33,	p. 40,	1988.	A
37	LEE, H., HONG, W. H., KIM, H.,	J. Chem. Eng. Data,	Vol. 35,	p. 371,	1990.	M
38	DOUHERET, G., PAL, A., et al.,	J. Chem. Thermodynamics,	Vol. 23,	p. 569,	1991.	A
39	FENG, H., WANG, Y., SHI, J., BENSON, G. C.,	J. Chem. Thermodynam.,	Vol. 23,	p. 169,	1991.	
40	CHIAVONE-FILHO, O., PROUST, P., RASMUSSEN, P.,	J. Chem. Eng. Data,	Vol. 38,	p. 128,	1993.	A
41	BRUNNER, E.,	Unpublished work at BASF AG, Ludwigshafen, Germany, Priv. Comm.,			1994.	M
42	TRC Thermodynamic Tables,	Texas A & M Univ., Loose leaf data sheets extant			1994.*	



Diethylene glycol; Diglycol; Digol; 3-Oxapentane-1,5-diol;

Bis(2-hydroxyethyl) ether; 2,2'-Oxydiethanol

CAS Reg. No. 111-46-6

Mol. Wt. 106.12

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	$T_c = 760$ K	($t_c = 486.85$ °C)
Critical Pressure	$p_c = 5150$ kPa	($p_c = 50.83$ atm)
Critical Density	$d_c = 346$ kg/m ³	($V_c = 306.71$ cm ³ /mol)
Critical Compression Factor	$Z_c = 0.250$	
$N_1 = 1.74292$	$N_2 = 0.00000$	$N_3 = -1.18693$ $N_4 = 0.80857$
Density at 298.15 K (25 °C)	$d_{25} = 1116.15$ kg/m ³	($V_{25} = 95.08$ cm ³ /mol)
Normal Boiling Point	$T_b = 518.80$ K	($t_b = 245.65$ °C)
Normal Melting Point	$T_m = 263$ K	($t_m = -10$ °C)

Data at Specified Temperatures

$t/^\circ\text{C}$	-10	0	25	100	245.65	300	486.85
T/K	263.15	273.15	298.15	373.15	518.80	573.15	760.00
$d/(\text{kg/m}^3)$	(1143.61)	1135.78	1116.15	1056.28	(928.57)	(872.21)	(346.00)
$(d(d)/dT)/(\text{kg/m}^3 \text{ K})$	(-0.78)	-0.78	-0.79	-0.81	(-0.97)	(-1.11)	$-\infty$
$V/(\text{cm}^3/\text{mol})$	(92.79)	93.43	95.08	100.47	(114.28)	(121.67)	(306.71)
$(dV/dT)/(\text{cm}^3/\text{mol K})$	(0.06)	0.06	0.07	0.08	(0.12)	(0.16)	∞
Data Quality	(B)	B	B	B	(B)	(B)	(C)
Uncertainty in d (kg/m ³)	(2)	2	2	2	(5)	(5)	(10)
Uncertainty in V (cm ³ /mol)	(0.2)	0.2	0.2	0.2	(0.5)	(1)	(10)

Orthobaric Liquid Density of Diethylene glycol

Units: kg/m³ v. °C

t	d	Uncert.	t	d	Uncert.	t	d	Uncert.	t	d	Uncert.
°C	kg/m ³	in d kg/m ³	°C	kg/m ³	in d kg/m ³	°C	kg/m ³	in d kg/m ³	°C	kg/m ³	in d kg/m ³
			100	1056.	2	225	(948.)	5	350	(812.)	5
			105	(1052.)	2	230	(944.)	5	355	(805.)	5
			110	(1048.)	2	235	(939.)	5	360	(798.)	5
-10	(1144.)	2	115	(1044.)	2	240	(934.)	5	365	(791.)	5
-5	(1140.)	2	120	(1040.)	2	245	(929.)	5	370	(784.)	5
0	1136.	2	125	(1036.)	2	250	(924.)	5	375	(776.)	5
5	1132.	2	130	(1032.)	2	255	(919.)	5	380	(769.)	5
10	1128.	2	135	(1027.)	2	260	(914.)	5	385	(761.)	10
15	1124.	2	140	(1023.)	2	265	(909.)	5	390	(753.)	10
20	1120.	2	145	(1019.)	2	270	(904.)	5	395	(745.)	10
25	1116.	2	150	(1015.)	2	275	(899.)	5	400	(736.)	10
30	1112.	2	155	(1011.)	2	280	(894.)	5	405	(727.)	10
35	1108.	2	160	(1006.)	2	285	(889.)	5	410	(718.)	10
40	1104.	2	165	(1002.)	2	290	(883.)	5	415	(708.)	10
45	1100.	2	170	(998.)	2	295	(878.)	5	420	(698.)	10
50	1096.	2	175	(993.)	2	300	(872.)	5	425	(688.)	10
55	1092.	2	180	(989.)	2	305	(867.)	5	430	(677.)	10
60	1088.	2	185	(985.)	2	310	(861.)	5	435	(665.)	10
65	1084.	2	190	(980.)	2	315	(855.)	5	440	(653.)	10
70	1080.	2	195	(976.)	2	320	(849.)	5	445	(640.)	10
75	1076.	2	200	(971.)	2	325	(843.)	5	450	(626.)	10
80	1072.	2	205	(967.)	2	330	(837.)	5	455	(610.)	10
85	1068.	2	210	(962.)	2	335	(831.)	5	460	(593.)	10
90	1064.	2	215	(958.)	2	340	(825.)	5	465	(574.)	10
95	1060.	2	220	(953.)	5	345	(818.)	5	470	(553.)	10

Orthobaric Liquid Molar Volume of Diethylene glycol

Units: cm³/mol v. K

T	V	Uncert.	T	V	Uncert.	T	V	Uncert.	T	V	Uncert.
K	cm ³ /mol	in V cm ³ /mol	K	cm ³ /mol	in V cm ³ /mol	K	cm ³ /mol	in V cm ³ /mol	K	cm ³ /mol	in V cm ³ /mol
			375 (100.6)		0.2	500 (112.)		0.5	625 (131.)		1
			380 (101.0)		0.2	505 (113.)		0.5	630 (132.)		1
			385 (101.4)		0.2	510 (113.)		0.5	635 (133.)		1
265 (92.9)		0.2	390 (101.8)		0.2	515 (114.)		0.5	640 (135.)		1
270 (93.2)		0.2	395 (102.2)		0.2	520 (114.)		0.5	645 (136.)		1
275 93.6		0.2	400 (102.6)		0.2	525 (115.)		0.5	650 (137.)		1
280 93.9		0.2	405 (103.0)		0.2	530 (116.)		0.5	655 (139.)		1
285 94.2		0.2	410 (103.4)		0.2	535 (116.)		0.5	660 (140.)		1
290 94.5		0.2	415 (103.9)		0.2	540 (117.)		0.5	665 (141.)		1
295 94.9		0.2	420 (104.3)		0.2	545 (118.)		0.5	670 (143.)		2
300 95.2		0.2	425 (104.7)		0.2	550 (118.)		0.5	675 (145.)		2
305 95.5		0.2	430 (105.2)		0.2	555 (119.)		0.5	680 (147.)		2
310 95.9		0.2	435 (105.6)		0.2	560 (120.)		0.5	685 (149.)		2
315 96.2		0.2	440 (106.1)		0.2	565 (120.)		1	690 (151.)		2
320 96.6		0.2	445 (106.5)		0.2	570 (121.)		1	695 (153.)		2
325 96.9		0.2	450 (107.0)		0.2	575 (122.)		1	700 (155.)		2
330 97.3		0.2	455 (107.5)		0.2	580 (123.)		1	705 (158.)		2
335 97.6		0.2	460 (108.0)		0.2	585 (124.)		1	710 (161.)		2
340 98.0		0.2	465 (108.4)		0.2	590 (124.)		1	715 (164.)		2
345 98.4		0.2	470 (109.)		0.5	595 (125.)		1	720 (167.)		2
350 98.7		0.2	475 (109.)		0.5	600 (126.)		1	725 (171.)		2
355 99.1		0.2	480 (110.)		0.5	605 (127.)		1	730 (176.)		2
360 99.5		0.2	485 (110.)		0.5	610 (128.)		1	735 (181.)		2
365 99.8		0.2	490 (111.)		0.5	615 (129.)		1	740 (187.)		2
370 100.2		0.2	495 (112.)		0.5	620 (130.)		1	745 (195.)		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.

1	WURTZ, A.,	Ann.Chim.(Paris),	Vol.69,	p.330,	1863.	
2	RINKENBACH, W.H.,	Ind.Eng.Chem.,	Vol.19,	p.474,	1927.	
3	CRATER, W.,	Ind.Eng.Chem.,	Vol.21,	p.674,	1929.	
4	BRIDGMAN, P.,	Proc.Am.Acad.Arts Sci.,	Vol.67,	p.9,	1932.	
5	ROMSTATT, -,	Ind.Chim.Belge.,	Vol.23,	p.567,	1936.	
6	ISHIGURO, T., KATO, S., et al.,	Yakugaku Zasshi,	Vol.63,	p.283,	1943.	
7	WURZSCHMITT, B.,	Z.Anal.Chem.,	Vol.133,	p.12,	1951.	
8	ISHIGURO, T., KATO, S., et al.,	Yakugaku Zasshi,	Vol.73,	p.1167,	1953.	
9	LUTSKII, A.E., OBUKOVA, E.M.,	J.Gen.Chem.USSR,	Vol.31,	p.2522,	1961.	A
10	ADAMCOVA, Z.,	Coll.Czech.Chem.Comm.,	Vol.34,	p.3149,	1969.	
11	ATAVIN, A.S., et al.,	Bull.Acad.Sci.USSR, Div.Chem.Sci.,		p.140,	1970.	A
12	RASTORGUEV, Yu.L., GAZDIEV, M.A.,	Russ.J.Phys.Chem.,	Vol.44,	p.1758,	1970.	A
13	IOFFE, V., KARTSOVA, L.A.,	J.Org.Chem.USSR,	Vol.9,	p.1237,	1973.	A
14	BLOKHRA, R.L., SEHGAL, V.P.,	J.Solution Chem.,	Vol.5,	p.399,	1976.	
15	EICHIS, V.N., ZHITOMIRSKII, A.N.,	Russ.J.Phys.Chem.,	Vol.50,	p.1307,	1976.	
16	KHIMENKO, M.T., GRITSENKO, N.N.,	Russ.J.Phys.Chem.,	Vol.51,	p.275,	1977.	A
17	VISHNYAKOV, M.V., et al.,	J.Appl.Chem.USSR,	Vol.50,	p.637,	1977.	A
18	BLOKHRA, R.L., et al.,	J.Indian Chem.Soc.,	Vol.55,	p.497,	1978.	
19	BRUNNER, E.,	J.Chem.Thermodynamics,	Vol.12,	p.993,	1980.	M
20	KLYUCHEVA, E.S., YARYM-AGAEV, N.L.,	J.Appl.Chem.USSR,	Vol.53,	p.794,	1980.	A
21	MANDIK, L., LESEK, F.,	Coll.Czech.Chem.Comm.,	Vol.47,	p.1686,	1982.	A
22	SLAVTSHEVA, Ju., MINKOV, D., KOLEV, N.,	J.Prakt.Chem.,	Vol.325,	p.188,	1983.	
23	DETHLEFSEN, C., HVIDT, A.,	J.Chem.Thermodynamics,	Vol.17,	p.193,	1985.	A
24	KOTSARENKO, A.A., YARYM-AZAEV, N.L., et al.,	J.Appl.Chem.USSR,	Vol.62,	p.1750,	1989.	A



Sheet 1.3

Triethylene glycol; Triglycol; Trigol; 3,6-Dioxaoctane-1,8-diol;
1,2-Bis(2-hydroxyethoxy)ethane

CAS Reg. No. 112-27-6

Mol. Wt. 150.17

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	$T_c =$	795 K	($t_c =$	521.85 °C)
Critical Pressure	$p_c =$	3500 kPa	($p_c =$	34.54 atm)
Critical Density	$d_c =$	332 kg/m ³	($V_c =$	452.32 cm ³ /mol)
Critical Compression Factor	$Z_c =$	0.240		
$N_1 = 1.79495$	$N_2 = 0.00000$	$N_3 = -1.23672$	$N_4 = 0.85196$	
Density at 298.15 K (25 °C)	$d_{25} =$	1121.13 kg/m ³	($V_{25} =$	133.95 cm ³ /mol)
Normal Boiling Point	$T_b =$	558.15 K	($t_b =$	285.00 °C)
Normal Melting Point	$T_m =$	267, K	($t_m =$	-6 °C)

Data at Specified Temperatures

$t/^\circ\text{C}$	-6	0	25	100	200	285	521.85
T/K	267.15	273.15	298.15	373.15	473.15	558.15	795.00
$d/(\text{kg/m}^3)$	(1145.27)	(1140.60)	1121.13	1062.16	(979.91)	(902.37)	(332.00)
$(d(d)/dT)/(\text{kg/m}^3 \text{ K})$	(-0.78)	(-0.78)	-0.78	-0.80	(-0.86)	(-0.98)	$-\infty$
$V/(\text{cm}^3/\text{mol})$	(131.12)	(131.66)	133.95	141.38	(153.25)	(166.42)	(452.32)
$(dV/dT)/(\text{cm}^3/\text{mol K})$	(0.09)	(0.09)	0.09	0.11	(0.13)	(0.18)	∞
Data Quality	(B)	(B)	B	B	(B)	(B)	(C)
Uncertainty in d (kg/m ³)	(1)	(1)	1	2	(5)	(5)	(10)
Uncertainty in V (cm ³ /mol)	(0.1)	(0.1)	0.1	0.2	(0.5)	(1)	(10)

Orthobaric Liquid Density of Triethylene glycol

Units: kg/m³ v. °C

t	d	Uncert.	t	d	Uncert.	t	d	Uncert.	t	d	Uncert.
°C	kg/m ³	kg/m ³	°C	kg/m ³	kg/m ³	°C	kg/m ³	kg/m ³	°C	kg/m ³	kg/m ³
			100	1062.	2	225	(958.)	5	350	(833.)	5
			105	(1058.)	2	230	(954.)	5	355	(828.)	5
			110	(1054.)	2	235	(949.)	5	360	(822.)	5
			115	(1050.)	2	240	(945.)	5	365	(816.)	5
-5	(1144.)	1	120	(1046.)	2	245	(940.)	5	370	(809.)	5
0	(1141.)	1	125	(1042.)	2	250	(936.)	5	375	(803.)	5
5	(1137.)	1	130	(1038.)	2	255	(931.)	5	380	(797.)	5
10	(1133.)	1	135	(1034.)	2	260	(926.)	5	385	(790.)	5
15	1129.	1	140	(1030.)	2	265	(922.)	5	390	(784.)	10
20	1125.	1	145	(1026.)	2	270	(917.)	5	395	(777.)	10
25	1121.	1	150	(1022.)	2	275	(912.)	5	400	(770.)	10
30	1117.	1	155	(1018.)	2	280	(907.)	5	405	(763.)	10
35	1113.	1	160	(1014.)	2	285	(902.)	5	410	(755.)	10
40	1109.	1	165	(1009.)	2	290	(897.)	5	415	(748.)	10
45	1106.	1	170	(1005.)	2	295	(892.)	5	420	(740.)	10
50	1102.	1	175	(1001.)	2	300	(887.)	5	425	(732.)	10
55	1098.	1	180	(997.)	2	305	(882.)	5	430	(724.)	10
60	1094.	1	185	(993.)	5	310	(877.)	5	435	(715.)	10
65	1090.	1	190	(988.)	5	315	(872.)	5	440	(706.)	10
70	1086.	2	195	(984.)	5	320	(867.)	5	445	(697.)	10
75	1082.	2	200	(980.)	5	325	(861.)	5	450	(688.)	10
80	1078.	2	205	(976.)	5	330	(856.)	5	455	(678.)	10
85	1074.	2	210	(971.)	5	335	(850.)	5	460	(667.)	10
90	1070.	2	215	(967.)	5	340	(845.)	5	465	(657.)	10
95	1066.	2	220	(963.)	5	345	(839.)	5	470	(645.)	10

Issued January 1995

Orthobaric Liquid Molar Volume of Triethylene glycol

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
			375	(141.6)	0.2	500	(157.)	0.5	625	(181.)	2
			380	(142.1)	0.2	505	(158.)	1	630	(182.)	2
			385	(142.7)	0.2	510	(158.)	1	635	(183.)	2
			390	(143.2)	0.2	515	(159.)	1	640	(185.)	2
270	(131.4)	0.1	395	(143.7)	0.2	520	(160.)	1	645	(186.)	2
275	(131.8)	0.1	400	(144.3)	0.2	525	(161.)	1	650	(188.)	2
280	(132.3)	0.1	405	(144.9)	0.2	530	(162.)	1	655	(189.)	2
285	(132.7)	0.1	410	(145.)	0.5	535	(162.)	1	660	(191.)	2
290	133.2	0.1	415	(146.)	0.5	540	(163.)	1	665	(192.)	2
295	133.7	0.1	420	(147.)	0.5	545	(164.)	1	670	(194.)	2
300	134.1	0.1	425	(147.)	0.5	550	(165.)	1	675	(196.)	2
305	134.6	0.1	430	(148.)	0.5	555	(166.)	1	680	(198.)	2
310	135.1	0.1	435	(148.)	0.5	560	(167.)	1	685	(200.)	2
315	135.5	0.1	440	(149.)	0.5	565	(168.)	1	690	(202.)	2
320	136.0	0.2	445	(150.)	0.5	570	(169.)	1	695	(204.)	2
325	136.5	0.2	450	(150.)	0.5	575	(170.)	1	700	(206.)	2
330	137.0	0.2	455	(151.)	0.5	580	(171.)	1	705	(208.)	2
335	137.5	0.2	460	(152.)	0.5	585	(172.)	1	710	(211.)	2
340	138.0	0.2	465	(152.)	0.5	590	(173.)	1	715	(214.)	2
345	138.5	0.2	470	(153.)	0.5	595	(174.)	1	720	(216.)	2
350	139.0	0.2	475	(153.)	0.5	600	(175.)	1	725	(220.)	2
355	139.5	0.2	480	(154.)	0.5	605	(176.)	1	730	(223.)	2
360	140.0	0.2	485	(155.)	0.5	610	(177.)	1	735	(226.)	2
365	140.5	0.2	490	(156.)	0.5	615	(178.)	1	740	(230.)	2
370	141.0	0.2	495	(156.)	0.5	620	(179.)	1	745	(234.)	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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|----|-------------------------------------|---|---|
| 1 | MOUREU, H., DODE, M., | Bull. Soc. Chim. France, 5, Vol. 4, p. 637, 1937. | |
| 2 | ISHIGURO, I., KATO, S., et al., | Yakugaku Zasshi, Vol. 63, p. 283, 1943. | |
| 3 | CARBIDE & CARBON CHEM. CO., | 'Glycols', Am. Chem. Soc. Monograph Series, 1952.* | |
| 4 | CURME, G. O., JOHNSTON, F., | Glycols, Reinhold Pub. Corp., New York, USA, 1952.* | |
| 5 | ISHIGURO, I., KATO, S., et al., | Yakugaku Zasshi, Vol. 73, p. 1167, 1953. | A |
| 6 | CHIAO, T.-T., THOMPSON, A. R., | Anal. Chem., Vol. 29, p. 1678, 1957. | A |
| 7 | LUTSKII, A. E., OBUKOVA, E. M., | J. Gen. Chem. USSR, Vol. 31, p. 2522, 1961. | |
| 8 | UNION CARBIDE CORP., | Chemicals and Plastics Physical Properties, 1968.* | |
| 9 | ADAMCOVA, Z., | Coll. Czech. Chem. Comm., Vol. 34, p. 3149, 1969. | |
| 10 | RASTORGUEV, Yu. L., GAZDIEV, M. A., | Russ. J. Phys. Chem., Vol. 44, p. 1758, 1970. | |
| 11 | BRUNNER, E., | J. Chem. Thermodynamics, Vol. 12, p. 993, 1980. | M |
| 12 | DETHLEFSEN, C., HVIDT, A., | J. Chem. Thermodynamics, Vol. 17, p. 193, 1985. | A |

C₃H₈O₂

Sheet 3.1a

Propane-1,2-diol; 1,2-Dihydroxypropane; Propylene glycol

CAS Reg. No. 57-55-6

Mol. Wt. 76.10

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	$T_c =$	670 K	($t_c =$	396.85 °C)
Critical Pressure	$p_c =$	5000 kPa	($p_c =$	49.35 atm)
Critical Density	$d_c =$	312 kg/m ³	($V_c =$	243.91 cm ³ /mol)
Critical Compression Factor	$Z_c =$	0.219		
$N_1 = 1.82244$	$N_2 = 0.00000$	$N_3 = -0.94220$	$N_4 = 0.48731$	
Density at 298.15 K (25 °C)	$d_{25} =$	1032.79 kg/m ³	($V_{25} =$	73.68 cm ³ /mol)
Normal Boiling Point	$T_b =$	459.15 K	($t_b =$	186.00 °C)
Normal Melting Point	$T_m =$	213 K	($t_m =$	-60 °C)

Data at Specified Temperatures

$t/^\circ\text{C}$	-60	0	25	100	186	300	396.85
T/K	213.15	273.15	298.15	373.15	459.15	573.15	670.00
$d/(\text{kg/m}^3)$	(1093.42)	1051.36	1032.79	(972.13)	(889.28)	(735.26)	(312.00)
$(d(d)/dT)/(\text{kg/m}^3 \text{ K})$	(-0.68)	-0.73	-0.76	(-0.87)	(-1.08)	(-1.76)	$-\infty$
$V/(\text{cm}^3/\text{mol})$	(69.60)	72.38	73.68	(78.28)	(85.57)	(103.50)	(243.91)
$(dV/dT)/(\text{cm}^3/\text{mol K})$	(0.04)	0.05	0.05	(0.07)	(0.10)	(0.25)	∞
Data Quality	(B)	B	B	(B)	(B)	(B)	(C)
Uncertainty in d (kg/m ³)	(2)	1	1	(2)	(5)	(5)	(10)
Uncertainty in V (cm ³ /mol)	(0.2)	0.05	0.05	(0.2)	(0.5)	(1)	(10)

Orthobaric Liquid Density of Propane-1,2-diol

Units: kg/m³ v. °C

t	d	Uncert.	t	d	Uncert.	t	d	Uncert.	t	d	Uncert.
°C	kg/m ³	in d	°C	kg/m ³	in d	°C	kg/m ³	in d	°C	kg/m ³	in d
		kg/m ³		kg/m ³	kg/m ³		kg/m ³	kg/m ³		kg/m ³	kg/m ³
			50 (1013.)	1		175 (901.)	5		300 (735.)	5	
			55 (1010.)	1		180 (896.)	5		305 (726.)	5	
			60 (1006.)	1		185 (890.)	5		310 (717.)	5	
-60 (1093.)	2		65 (1001.)	1		190 (885.)	5		315 (707.)	5	
-55 (1090.)	2		70 (997.)	2		195 (879.)	5		320 (698.)	10	
-50 (1087.)	2		75 (993.)	2		200 (874.)	5		325 (687.)	10	
-45 (1083.)	2		80 (989.)	2		205 (868.)	5		330 (676.)	10	
-40 (1080.)	2		85 (985.)	2		210 (862.)	5		335 (665.)	10	
-35 (1076.)	2		90 (981.)	2		215 (857.)	5		340 (653.)	10	
-30 (1073.)	2		95 (976.)	2		220 (851.)	5		345 (641.)	10	
-25 (1069.)	2		100 (972.)	2		225 (844.)	5		350 (628.)	10	
-20 (1066.)	1		105 (968.)	2		230 (838.)	5		355 (614.)	10	
-15 (1062.)	1		110 (963.)	2		235 (832.)	5		360 (599.)	10	
-10 (1059.)	1		115 (959.)	2		240 (825.)	5		365 (582.)	10	
-5 (1055.)	1		120 (954.)	2		245 (819.)	5		370 (564.)	10	
0 1051.	1		125 (950.)	2		250 (812.)	5		375 (544.)	10	
5 1048.	1		130 (945.)	2		255 (805.)	5		380 (522.)	10	
10 1044.	1		135 (941.)	2		260 (798.)	5		385 (494.)	10	
15 1040.	1		140 (936.)	2		265 (791.)	5		390 (459.)	10	
20 1037.	1		145 (931.)	2		270 (784.)	5		395 (402.)	10	
25 1033.	1		150 (926.)	2		275 (776.)	5				
30 1029.	1		155 (921.)	2		280 (768.)	5				
35 1025.	1		160 (916.)	2		285 (761.)	5				
40 1021.	1		165 (911.)	2		290 (752.)	5				
45 1017.	1		170 (906.)	5		295 (744.)	5				

Issued January 1995