

Addendum to Chapter 11.1— Volume Correction Factors

Volume III

**TABLE 6C—Volume Correction Factors for
Individual and Special Applications,
Volume Correction for MTBE to 60°F**

Volume IX

**TABLE 54C—Volume Correction Factors for
Individual and Special Applications,
Volume Correction for MTBE to 15°C**

ADDENDUM TO API CHAPTER 11.1,
VOLUME III AND VOLUME IX
AUGUST 1980 (REAFFIRMED, OCTOBER 1993)
JANUARY 1995

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**TABLE 54C—Volume Correction Factors for
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Volume Correction for MTBE to 15°C**

Measurement Coordination

**ADDENDUM TO API CHAPTER 11.1,
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FOREWORD

The Chapter 11.1, "Volume Correction Factors," tables are jointly developed and published by the American Petroleum Institute (API), the American Society for Testing and Materials (ASTM), and the Institute of Petroleum (IP) as *API Manual of Petroleum Measurement Standards* (MPMS) Chapter 11.1 (API Standard 2540), ASTM D1250, and IP 200, respectively. This standard is also designated as an American National Standard (American National Standard Institute) under the designation of ANSI/ASTM D1250, and has been adopted by the International Standards Organization as ISO/91-1:1992.

With the 1990 amendments to the Clean Air Act and the resulting regulations requiring greater use of reformulated gasolines, there has been an increasing demand for methyl *tert*-butyl ether (MTBE) as a blending agent for those gasolines. The accurate transfer of MTBE requires that the volume being transferred be temperature compensated back to customary reference conditions. Within the United States those conditions are 60°F and the maximum of saturation pressure or atmospheric pressure. Most other countries have reference conditions of 15°C and the maximum of saturation pressure or atmospheric pressure.

This addendum has been approved through the API and IP standardization process, and has been submitted to ASTM Committee D02 on Petroleum Products and Lubricants, and ISO/TC 28, Petroleum Products and Lubricants, Subcommittee 3, Static Petroleum Measurement, for concurrent review as a draft addendum to D1250 and ISO/91-1:1992.

Due to the high priority API member companies have assigned to these revised volume correction factor tables for MTBE, this addendum is being published as approved through the API and IP standardization process while awaiting completion of the ASTM and ISO review procedures. At the conclusion of the ASTM and ISO review, this document will be published as an addendum to D1250 and ISO 91-1.

The API Committee on Static Petroleum Measurement currently has a project underway to address volume correction of MTBE gasoline blends and commercial grades of MTBE and other oxygenates. The results of this study will be available from the Measurement Coordinator upon completion of the project.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any federal, state, or municipal regulation with which this publication may conflict.

Suggested revisions are invited and should be submitted to the Measurement Coordinator, Exploration and Production Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

CONTENTS

	Page
1—SCOPE	1
1.1 Introduction	1
1.2 Purpose	1
1.3 Safety Considerations	1
2—REFERENCED PUBLICATIONS	1
3—SIGNIFICANCE AND USE	2
3.1 General	2
3.2 Recommended Use of Volume Correction Factors for MTBE	2
4—BASIC DATA	2
4.1 Use of Data Obtained	2
4.2 Comparison to Previous Data	2
5—REFERENCES FOR MTBE DENSITY	2
 Tables	
Table 6C—Volume Correction Factors for MTBE	3
Table 54C—Volume Correction Factors for MTBE	4

Addendum to Chapter 11.1—Volume Correction Factors

Volume III (Table 6C), Individual and Specialized Applications, Volume Correction for MTBE to 60°F Volume IX (Table 54C), Individual and Specialized Applications, Volume Correction for MTBE to 15°C

1 Scope

1.1 INTRODUCTION

With the recent emphasis on reformulated gasolines, there is an increasing demand to use methyl *tert*-butyl ether (MTBE) as a blending agent for reformulated gasolines. The accurate transfer of MTBE requires that the volume being transferred be temperature compensated back to customary reference conditions. Within the United States, those conditions are 60°F and the maximum of saturation pressure or atmospheric pressure. Most other countries have reference conditions of 15°C and the maximum of saturation pressure or atmospheric pressure.

1.2 PURPOSE

The purpose of this addendum is to provide the users of the API *Manual of Petroleum Measurement Standards* Chapter 11.1, "Volume Correction Factors," Volume III (Table 6C) and Volume IX (Table 54C), "Individual and Specialized Applications," with revised volume correction factor tables for methyl *tert*-butyl ether (MTBE). These tables are used for calculating the volume of mixtures composed predominantly of MTBE at standard conditions from volumes at other conditions. These tables apply to commercially available mixtures containing at least 85 weight percent MTBE.

1.3 SAFETY CONSIDERATIONS

This standard does not purport to address the safety problems, if any, associated with the use of this publication. It is the responsibility of the user of this standard to establish the appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use.

2 Referenced Publications

The most recent editions of the following standards are cited in this addendum:

API

Manual of Petroleum Measurement Standards
Chapter 11.1, "Volume Correction Factors"

Volume III, Table 6C, "Individual and Special

Applications, Volume Correction to 60°F
Against Thermal Expansion Coefficients at 60°F"

Volume IX, Table 54C, "Individual and Special Applications, Volume Correction to 15°C Against Thermal Expansion Coefficients at 15°C"

ASTM¹

D1250 *Petroleum Measurement Tables*
Volume III, Table 6C, "Volume Correction Factors for Individual and Special Applications, Volume Correction to 60°F Against Thermal Expansion Coefficients at 60°F"
Volume IX, Table 54C, "Volume Correction Factors for Individual and Special Applications, Volume Correction to 15°C Against Thermal Expansion Coefficients at 15°C"

IP²

200 *Petroleum Measurement Tables*
Volume III, Table 6C, "Individual and Special Applications, Volume Correction to 60°F Against Thermal Expansion Coefficients at 60°F"
Volume IX, Table 54C, "Individual and Special Applications, Volume Correction to 15°C Against Thermal Expansion Coefficients at 15°C"

ISO³

91/1 *Petroleum Measurement Tables*
"Part 1: Tables Based on Reference Temperatures of 15°C and 60°F"

Section 5 contains a list of references for MTBE density.

¹American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103-1187

²Institute of Petroleum, 61 New Cavendish Street, London W1M8AR, United Kingdom

³International Organization for Standardization, ISO publications are available from ANSI (American National Standards Institute, 11 West 42nd Street, New York, New York 10036).

3 Significance and Use

3.1 GENERAL

These tables are suitable for use in calculating volumes of MTBE mixtures as outlined in 1.2. The information gained from this method can be used to determine quantities of MTBE in tanks, shipping containers, and other storage containers typically used in the petroleum industry.

3.2 RECOMMENDED USE OF VOLUME CORRECTION FACTORS FOR MTBE

It is recommended for pure MTBE that either Volume III, Table 6C—with a mean coefficient of thermal expansion, α_{60} , of $789.0 \times 10^{-6} \text{ }^{\circ}\text{F}^{-1}$ —or Volume IX, Table 54C—with a mean coefficient of thermal expansion, α_{15} , of $1420.2 \times 10^{-6} \text{ }^{\circ}\text{C}^{-1}$ —be used from API Chapter 11.1 of the *Manual of Petroleum Measurement Standards*. The use of these tables for commercial grades of MTBE is expected to introduce an additional uncertainty of less than 0.1 percent. The attached Tables 6C and 54C are an abridged version of the results available from the computer subroutines for Tables 6C and 54C. Interpolation of the printed tables will provide answers that differ no more than 1 in the last significant figure from the computer subroutines.

4 Basic Data

4.1 USE OF DATA OBTAINED

Density data obtained from the open literature for pure methyl *tert*-butyl ether (MTBE) were used for comparison against several tables proposed for correcting MTBE volumes. The data of Jangkamolkachai, et. al [1] were fit using a 60°F density of 745.3 kg/m^3 (261.23 lb/bbl). This gave an overall fit over the range of 0°C to 60°C (32°F to 140°F) of ± 0.1 percent. An equivalent fit of the data was obtained using a 15°C density of 745.9 kg/m^3 and a mean coefficient of thermal expansion of $1420.2 \times 10^{-6} \text{ }^{\circ}\text{C}^{-1}$. This data was compared to API Tables 6A, 6B, and a special fit of Table 6C. The best fit of the data was obtained using Table 6C. An equivalent fit was obtained using Table 54C.

4.2 COMPARISON TO PREVIOUS DATA

A review of the density data available for MTBE indicated that there were only two sources of experimental data for MTBE at temperatures other than 20°C or 25°C , Jangkamolkachai, et. al [1] and Obama, et. al [2]. Only 20°C or 25°C data were reported by Aim and Ciprian [3], Fen-

wick, et. al [4], Timmermans [5], and the Thermodynamics Research Center [6]. Although the *API Monograph Series* [7] reports data at other temperatures, it was found that the reported data was generated by fitting a correlation to the selected 20°C density. Obama, et. al [2] reported a coefficient of thermal expansion for MTBE at 25°C of $1.423 \times 10^{-3} \text{ }^{\circ}\text{C}^{-1}$ ($791 \times 10^{-6} \text{ }^{\circ}\text{F}^{-1}$) for data in the range of 15°C to 35°C (59°F to 95°F). The data of Obama, et. al [2] and Jangkamolkachai, et. al [1] were fit to the following equations:

$$VCF = \frac{\rho}{\rho_{60}} = \exp(-\alpha_{60}\Delta t(1 + 0.8\alpha_{60}\Delta t)) \quad (1)$$

and

$$VCF = \frac{\rho}{\rho_{15}} = \exp(-\alpha_{15}\Delta t(1 + 0.8\alpha_{15}\Delta t)) \quad (2)$$

Equation 1 was fit to the experimental data according to the procedures outlined in Chapter 11.1, Volume III, with both α_{60} and ρ_{60} as adjustable parameters.

Equation 2 was fit according to the procedures outlined in Chapter 11.1, Volume IX, with both α_{15} and ρ_{15} as adjustable parameters.

5 References for MTBE Density

1. A. Jangkamolkachai, G. C. Allred, and W. R. Parrish, "Densities and Excess Molar Volumes of Methyl *tert*-Butyl Ether with Hydrocarbons from 255.4 to 333.2 K," *Journal of Chemical Engineering Data*, 1991, pp. 481–484.
2. M. Obama, Y. Oodera, N. Kohama, T. Yanase, Y. Saito, and K. Kusano, "Densities, Molar Volumes, and Cubic Expansion Coefficients of 78 Aliphatic Ethers," *Journal of Chemical Engineering Data*, 1985, pp. 1–5.
3. K. Aim and M. Ciprian, "Vapor Pressures, Refractive Index at 20°C and Vapor-Liquid Equilibria at 101.325 kPa in the Methyl *tert*-Butyl Ether—Methanol System," *Journal of Chemical Engineering Data*, 1989, pp. 100–103.
4. J. O. Fenwick, D. Harrop, and A. J. Head, "Thermodynamic Properties of Organic Oxygen Compounds 41. Enthalpies of Formation of Eight Ethers," *Journal of Chemical Thermodynamics* 7, 1975, p. 943.
5. J. Timmermans, *Physicochemical Constants of Pure Organic Substances*, 2nd edition, Elsevier, New, York, 1965.
6. "Selected Values of Properties of Chemical Compounds," Thermodynamics Research Center, Data Project, Texas A&M University, College Station, Texas, extant 1980.
7. *API Monograph Series "tert-Butyl Methyl Ether,"* API Publication 723, University Microfilms International, Ann Arbor, MI, 1984.

Table 6C—Volume Correction Factors for MTBE

Factors for Correction of Volume to 60°F

Temp (°F)	VCF	Temp (°F)	VCF	Temp (°F)	VCF	Temp (°F)	VCF	Temp (°F)	VCF
0.0	1.0466	25.0	1.0274	50.0	1.0079	75.0	0.98812	100.0	0.96816
0.5	1.0462	25.5	1.0270	50.5	1.0075	75.5	0.98773	100.5	0.96776
1.0	1.0458	26.0	1.0266	51.0	1.0071	76.0	0.98733	101.0	0.96736
1.5	1.0455	26.5	1.0262	51.5	1.0067	76.5	0.98693	101.5	0.96696
2.0	1.0451	27.0	1.0258	52.0	1.0063	77.0	0.98653	102.0	0.96656
2.5	1.0447	27.5	1.0254	52.5	1.0059	77.5	0.98614	102.5	0.96615
3.0	1.0443	28.0	1.0250	53.0	1.0055	78.0	0.98574	103.0	0.96575
3.5	1.0439	28.5	1.0247	53.5	1.0051	78.5	0.98534	103.5	0.96535
4.0	1.0435	29.0	1.0243	54.0	1.0047	79.0	0.98494	104.0	0.96495
4.5	1.0432	29.5	1.0239	54.5	1.0043	79.5	0.98455	104.5	0.96455
5.0	1.0428	30.0	1.0235	55.0	1.0039	80.0	0.98415	105.0	0.96415
5.5	1.0424	30.5	1.0231	55.5	1.0035	80.5	0.98375	105.5	0.96374
6.0	1.0420	31.0	1.0227	56.0	1.0032	81.0	0.98335	106.0	0.96334
6.5	1.0416	31.5	1.0223	56.5	1.0028	81.5	0.98295	106.5	0.96294
7.0	1.0412	32.0	1.0219	57.0	1.0024	82.0	0.98255	107.0	0.96254
7.5	1.0409	32.5	1.0215	57.5	1.0020	82.5	0.98216	107.5	0.96213
8.0	1.0405	33.0	1.0212	58.0	1.0016	83.0	0.98176	108.0	0.96173
8.5	1.0401	33.5	1.0208	58.5	1.0012	83.5	0.98136	108.5	0.96133
9.0	1.0397	34.0	1.0204	59.0	1.0008	84.0	0.98096	109.0	0.96093
9.5	1.0393	34.5	1.0200	59.5	1.0004	84.5	0.98056	109.5	0.96052
10.0	1.0389	35.0	1.0196	60.0	1.0000	85.0	0.98016	110.0	0.96012
10.5	1.0386	35.5	1.0192	60.5	0.99961	85.5	0.97976	110.5	0.95972
11.0	1.0382	36.0	1.0188	61.0	0.99921	86.0	0.97937	111.0	0.95932
11.5	1.0378	36.5	1.0184	61.5	0.99882	86.5	0.97897	111.5	0.95891
12.0	1.0374	37.0	1.0180	62.0	0.99842	87.0	0.97857	112.0	0.95851
12.5	1.0370	37.5	1.0177	62.5	0.99803	87.5	0.97817	112.5	0.95811
13.0	1.0366	38.0	1.0173	63.0	0.99763	88.0	0.97777	113.0	0.95770
13.5	1.0363	38.5	1.0169	63.5	0.99724	88.5	0.97737	113.5	0.95730
14.0	1.0359	39.0	1.0165	64.0	0.99684	89.0	0.97697	114.0	0.95690
14.5	1.0355	39.5	1.0161	64.5	0.99645	89.5	0.97657	114.5	0.95649
15.0	1.0351	40.0	1.0157	65.0	0.99605	90.0	0.97617	115.0	0.95609
15.5	1.0347	40.5	1.0153	65.5	0.99565	90.5	0.97577	115.5	0.95569
16.0	1.0343	41.0	1.0149	66.0	0.99526	91.0	0.97537	116.0	0.95528
16.5	1.0339	41.5	1.0145	66.5	0.99486	91.5	0.97497	116.5	0.95488
17.0	1.0336	42.0	1.0141	67.0	0.99447	92.0	0.97457	117.0	0.95448
17.5	1.0332	42.5	1.0137	67.5	0.99407	92.5	0.97417	117.5	0.95407
18.0	1.0328	43.0	1.0134	68.0	0.99368	93.0	0.97377	118.0	0.95367
18.5	1.0324	43.5	1.0130	68.5	0.99328	93.5	0.97337	118.5	0.95327
19.0	1.0320	44.0	1.0126	69.0	0.99288	94.0	0.97297	119.0	0.95286
19.5	1.0316	44.5	1.0122	69.5	0.99249	94.5	0.97257	119.5	0.95246
20.0	1.0312	45.0	1.0118	70.0	0.99209	95.0	0.97217	120.0	0.95205
20.5	1.0309	45.5	1.0114	70.5	0.99170	95.5	0.97177	120.5	0.95165
21.0	1.0305	46.0	1.0110	71.0	0.99130	96.0	0.97137	121.0	0.95125
21.5	1.0301	46.5	1.0106	71.5	0.99090	96.5	0.97097	121.5	0.95084
22.0	1.0297	47.0	1.0102	72.0	0.99051	97.0	0.97057	122.0	0.95044
22.5	1.0293	47.5	1.0098	72.5	0.99011	97.5	0.97017	122.5	0.95003
23.0	1.0289	48.0	1.0094	73.0	0.98971	98.0	0.96977	123.0	0.94963
23.5	1.0285	48.5	1.0090	73.5	0.98932	98.5	0.96936	123.5	0.94922
24.0	1.0281	49.0	1.0087	74.0	0.98892	99.0	0.96896	124.0	0.94882
24.5	1.0278	49.5	1.0083	74.5	0.98852	99.5	0.96856	124.5	0.94842
25.0	1.0274	50.0	1.0079	75.0	0.98812	100.0	0.96816	125.0	0.94801

Note: This table is generated using $\alpha_{60} = 789.0 \times 10^{-6} \text{ }^{\circ}\text{F}^{-1}$ 

Table 54C—Volume Correction Factors for MTBE

Factors for Correction of Volume to 15°C

Temp (°C)	VCF	Temp (°C)	VCF	Temp (°C)	VCF	Temp (°C)	VCF	Temp (°C)	VCF
-20.00	1.0489	-6.00	1.0295	8.00	1.0099	22.00	0.99003	36.00	0.96993
-19.75	1.0485	-5.75	1.0292	8.25	1.0096	22.25	0.98967	36.25	0.96956
-19.50	1.0482	-5.50	1.0288	8.50	1.0092	22.50	0.98932	36.50	0.96920
-19.25	1.0479	-5.25	1.0285	8.75	1.0089	22.75	0.98896	36.75	0.96884
-19.00	1.0475	-5.00	1.0281	9.00	1.0085	23.00	0.98860	37.00	0.96848
-18.75	1.0472	-4.75	1.0278	9.25	1.0081	23.25	0.98824	37.25	0.96812
-18.50	1.0468	-4.50	1.0275	9.50	1.0078	23.50	0.98789	37.50	0.96776
-18.25	1.0465	-4.25	1.0271	9.75	1.0074	23.75	0.98753	37.75	0.96740
-18.00	1.0461	-4.00	1.0268	10.00	1.0071	24.00	0.98717	38.00	0.96704
-17.75	1.0458	-3.75	1.0264	10.25	1.0067	24.25	0.98681	38.25	0.96668
-17.50	1.0455	-3.50	1.0261	10.50	1.0064	24.50	0.98646	38.50	0.96631
-17.25	1.0451	-3.25	1.0257	10.75	1.0060	24.75	0.98610	38.75	0.96595
-17.00	1.0448	-3.00	1.0254	11.00	1.0057	25.00	0.98574	39.00	0.96559
-16.75	1.0444	-2.75	1.0250	11.25	1.0053	25.25	0.98538	39.25	0.96523
-16.50	1.0441	-2.50	1.0247	11.50	1.0050	25.50	0.98502	39.50	0.96487
-16.25	1.0437	-2.25	1.0243	11.75	1.0046	25.75	0.98467	39.75	0.96451
-16.00	1.0434	-2.00	1.0240	12.00	1.0043	26.00	0.98431	40.00	0.96415
-15.75	1.0430	-1.75	1.0236	12.25	1.0039	26.25	0.98395	40.25	0.96378
-15.50	1.0427	-1.50	1.0233	12.50	1.0035	26.50	0.98359	40.50	0.96342
-15.25	1.0424	-1.25	1.0229	12.75	1.0032	26.75	0.98323	40.75	0.96306
-15.00	1.0420	-1.00	1.0226	13.00	1.0028	27.00	0.98287	41.00	0.96270
-14.75	1.0417	-0.75	1.0222	13.25	1.0025	27.25	0.98252	41.25	0.96234
-14.50	1.0413	-0.50	1.0219	13.50	1.0021	27.50	0.98216	41.50	0.96197
-14.25	1.0410	-0.25	1.0215	13.75	1.0018	27.75	0.98180	41.75	0.96161
-14.00	1.0406	0.00	1.0212	14.00	1.0014	28.00	0.98144	42.00	0.96125
-13.75	1.0403	0.25	1.0208	14.25	1.0011	28.25	0.98108	42.25	0.96089
-13.50	1.0399	0.50	1.0205	14.50	1.0007	28.50	0.98072	42.50	0.96052
-13.25	1.0396	0.75	1.0201	14.75	1.0004	28.75	0.98036	42.75	0.96016
-13.00	1.0393	1.00	1.0198	15.00	1.0000	29.00	0.98000	43.00	0.95980
-12.75	1.0389	1.25	1.0194	15.25	0.99964	29.25	0.97964	43.25	0.95944
-12.50	1.0386	1.50	1.0191	15.50	0.99929	29.50	0.97929	43.50	0.95907
-12.25	1.0382	1.75	1.0187	15.75	0.99893	29.75	0.97893	43.75	0.95871
-12.00	1.0379	2.00	1.0184	16.00	0.99858	30.00	0.97857	44.00	0.95835
-11.75	1.0375	2.25	1.0180	16.25	0.99822	30.25	0.97821	44.25	0.95799
-11.50	1.0372	2.50	1.0177	16.50	0.99787	30.50	0.97785	44.50	0.95762
-11.25	1.0368	2.75	1.0173	16.75	0.99751	30.75	0.97749	44.75	0.95726
-11.00	1.0365	3.00	1.0170	17.00	0.99716	31.00	0.97713	45.00	0.95690
-10.75	1.0361	3.25	1.0166	17.25	0.99680	31.25	0.97677	45.25	0.95654
-10.50	1.0358	3.50	1.0162	17.50	0.99645	31.50	0.97641	45.50	0.95617
-10.25	1.0354	3.75	1.0159	17.75	0.99609	31.75	0.97605	45.75	0.95581
-10.00	1.0351	4.00	1.0155	18.00	0.99573	32.00	0.97569	46.00	0.95545
-9.75	1.0348	4.25	1.0152	18.25	0.99538	32.25	0.97533	46.25	0.95508
-9.50	1.0344	4.50	1.0148	18.50	0.99502	32.50	0.97497	46.50	0.95472
-9.25	1.0341	4.75	1.0145	18.75	0.99467	32.75	0.97461	46.75	0.95436
-9.00	1.0337	5.00	1.0141	19.00	0.99431	33.00	0.97425	47.00	0.95399
-8.75	1.0334	5.25	1.0138	19.25	0.99395	33.25	0.97389	47.25	0.95363
-8.50	1.0330	5.50	1.0134	19.50	0.99360	33.50	0.97353	47.50	0.95327
-8.25	1.0327	5.75	1.0131	19.75	0.99324	33.75	0.97317	47.75	0.95290
-8.00	1.0323	6.00	1.0127	20.00	0.99288	34.00	0.97281	48.00	0.95254
-7.75	1.0320	6.25	1.0124	20.25	0.99253	34.25	0.97245	48.25	0.95218
-7.50	1.0316	6.50	1.0120	20.50	0.99217	34.50	0.97209	48.50	0.95181
-7.25	1.0313	6.75	1.0117	20.75	0.99181	34.75	0.97173	48.75	0.95145
-7.00	1.0309	7.00	1.0113	21.00	0.99146	35.00	0.97137	49.00	0.95108
-6.75	1.0306	7.25	1.0110	21.25	0.99110	35.25	0.97101	49.25	0.95072
-6.50	1.0302	7.50	1.0106	21.50	0.99074	35.50	0.97065	49.50	0.95036
-6.25	1.0299	7.75	1.0103	21.75	0.99039	35.75	0.97029	49.75	0.94999
-6.00	1.0295	8.00	1.0099	22.00	0.99003	36.00	0.96993	50.00	0.94963

Note: This table is generated using $\alpha_{15} = 1420.2 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$

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Manual of Petroleum Measurement Standards Chapter 11.1—Volume Correction Factors

Volume IX

TABLE 54C—Volume Correction Factors for Individual and Special Applications Volume Correction to 15°C Against Thermal Expansion Coefficients at 15°C

API STANDARD 2540
FIRST EDITION, AUGUST 1980
REAFFIRMED, AUGUST 1987

	Institute of Petroleum	IP 200
	American Society for Testing & Materials	ASTM D1250
	American National Standards Institute	ANSI/ASTM D1250

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Volume IX TABLE 54C—Volume Correction Factors for Individual and Special Applications Volume Correction to 15°C Against Thermal Expansion Coefficients at 15°C

Measurement Coordination/Industry Affairs

API STANDARD 2540
FIRST EDITION, AUGUST 1980

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The tables included in this volume and the subroutines from which they were generated are voluntary standards and were developed under the auspices of the joint API/ASTM Committee on Static Petroleum Measurement in part from data generated by a project funded by the American Petroleum Institute at the U.S. National Bureau of Standards, Gaithersburg, Maryland.

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Library of Congress Catalog Card Number: 80-68070

ISBN 0-89364-032-8 (Volume IX)
ISBN 0-89364-021-2 (10 Volume Set)

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CONTENTS

	PAGE
Introductory Information	
Foreword	v
Preface	vii
Officers of the Committee on Petroleum Measurement and the Joint API/ASTM Committee on Static Petroleum Measurement	ix
API Measurement Coordinators	x
Members of the COSM Physical Properties Working Group	x
Members of the Institute of Petroleum Measurement and Sampling Committee and the Calculation and Tables Subcommittee	xi

Manual of Petroleum Measurement Standards

Chapter 11—Physical Properties Data Section 1—Volume Correction Factors

Volume IX

11.1.54	TABLES 54A, 54B, and 54C—Correction of Volume to 15°C Against Density at 15°C and Thermal Expansion Coefficients	IX-1
11.1.54.7	TABLE 54C—Volume Correction Factors for Individual and Special Applications, Volume Correction to 15°C Against Thermal Expansion Coefficients at 15°C	IX-2
TABLE 54C	(see Note)	IX-5
11.1.54.7.1	Appendix to TABLE 54C	IX-7
11.1.54.7.1.1	Equations and Constants for TABLES 53 and 54	IX-7
11.1.54.7.1.2	Densities and Coefficients of Thermal Expansion for Each Individual NBS Sample	IX-7

Note to User: TABLE 54C is internally numbered beginning with page 1. The actual table begins after the page noted in the contents.

FOREWORD

The Objectives

The complete collection of the jointly issued API/ASTM-IP tables of which this volume is a part is the result of close cooperation between the American Petroleum Institute (API), the Institute of Petroleum (London) (IP), and the American Society for Testing and Materials (ASTM). The overall objective of this effort was to meet the worldwide need for a uniform and authoritative publication, based on the most accurate information available. This publication serves as a basis for standardized calculations of measured quantities of petroleum fluids regardless of point of origin, destination, or units of measure used by custom or statute. To meet the objective of worldwide standardized measurement practices, the American National Standards Institute (ANSI) and the British Standards Institute (BSI) have also been closely involved nationally, resulting in the acceptance of the revised tables as an American National Standard and as a British Standard. In addition, in their respective capacities as Secretariat of the International Organization for Standardization TC/28 and of TC/28 SC3, ANSI and BSI have been instrumental in progressing the revised tables towards their adoption as an international standard by the International Organization for Standardization.

Historical Notes

The present collection supersedes all previous editions of the petroleum measurement Tables ANSI/ASTM D1250, IP200, and API Standard 2540. Action is being taken in ISO/TC 28 for the corresponding tables listed in ISO R91 and the tables in the addendum to R91 to be superseded by the present revised collection.

In view of the progress of metrication in countries formerly using the British system of weights and measures, demand for the revision of the British edition does not justify the considerable work involved. The present edition will therefore be withdrawn on the same date as the corresponding metric and American editions are published and will not be replaced.

For the metric edition the new standard covers products with densities in the range 610.0 to 1076.0 kg/m³ (0.610 to 1.076 g/mL). The tables for densities below this range, covering liquefied petroleum gases, have not been revised.

The original tables, which were developed in the late 1940s, were based on the 1916 data of Bearce and Pepper (1916) and represent thirty years of evolution. The history of this evolution is summarized by Hall et al. (1975).

Present Development

Downer and Inkley (1972) demonstrated that the original tables were not satisfactory representations of many petroleum fluids of current importance. In 1974 the American Petroleum Institute (API) and the United States National Bureau of Standards (NBS) initiated a research program funded by the API which intended to provide the solid scientific base for the development of more accurate, consequently more equitable, measurement tables. The result of this program was precise density data on 349 different fluids representing a wide variety of refined products and 66.8 percent of the world crude production in 1974. The completion of this five-year, \$500,000 project in March 1979 opened the way for modernizing the tables. Using the NBS density data and taking advantage of publications of outstanding technical authorities, a Joint API-ASTM Physical Properties Working

Group produced this present collection of the Petroleum Measurement Tables. The development and results of the work are described by Hankinson et al. (1979).

Conceptual Departure

A major conceptual departure from previous versions is inherent in the recognition of the present and future position of computers in the petroleum industry. The actual Standard represented by this volume and the companion volumes is neither the hardcopy printed tables nor the set of equations used to represent the density data but is an explicit implementation procedure used to develop computer subroutines. The standardization of an implementation procedure implies the standardization of the set of mathematical expressions, including calculational sequence and round-off procedures, used within the computer code. Absolute adherence to the outlined procedures will ensure that all computers and computer codes of the future, meeting the stated specifications and restrictions, will be able to produce identical results. Hence, the published implementation procedures are the primary Standard, the distributed subroutines are the secondary standard, and the published tables are produced for convenience.

Acknowledgments

The task of completing this project could not have been accomplished without many substantial contributions by a considerable number of individuals and companies. It is impossible to single out any specific individuals for special mention. However, included in the introductory material are lists of the officers of the API's Committee on Petroleum Measurement (COPM), the officers of the Joint API/ASTM Committee on Static Petroleum Measurement (COSM), the major contributors from the Institute of Petroleum, and the members of the COSM Physical Properties Working Group.

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- Bearce, H. W., and E. L. Peffer, "Technology Papers of National Bureau of Standards—Density and Thermal Expansion of American Petroleum Oils," GPO, pp. 125-154, Washington, DC, 1916.
- Downer, L., and F. A. Inkley, *Oil and Gas Journal*, Vol. 70, No. 25, p. 52-55, June 19, 1972.
- Hall, A. H., J. A. Simpson, and J. R. Whetstone, "Investigation of Densities and Thermal Expansion Coefficients Applicable to Petroleum Measurement," SP 7, World Petroleum Congress, Tokyo, 1975.
- Hankinson, R. W., R. G. Segers, T. Krolkowski Buck, and F. P. Gielzecki, *Oil and Gas Journal*, Vol. 77, No. 52, p. 66-70, December 24, 1979.

PREFACE

The Petroleum Measurement Tables, Volume Correction Factors (Volumes I through X), are, with this edition, incorporated into API's *Manual of Petroleum Measurement Standards*. These tables form Section 1 of Chapter 11, "Physical Properties Data." To simplify the transition from the American Society for Testing and Materials' (ASTM) publication of the original tables to API's publication in 1980, the original ASTM numerical designations have been retained for the individual tables.

The numbering system used throughout Volumes I through X corresponds to the numbering system of the *Manual of Petroleum Measurement Standards*. The system consists of a series of fields separated by decimal points. The first two fields (11.1) indicate chapter and section of the manual; the third field gives the ASTM table number. Therefore, although not serial, 11.1.5, 11.1.6, 11.1.23, 11.1.24, 11.1.53, and 11.1.54 are the major headings used. All other headings are subordinate to the three field headings.

Volumes I through IX, which are designed for field use, are arranged on a functional basis rather than on a topical basis.

First Series—Volumes I, II, and III

These three volumes contain TABLES 5 and 6, the tables for the °API, °F, 60°F base series, plus examples to guide the user. Each volume contains specific data as follows:

- Volume I —Generalized Crude Oils (TABLES 5A and 6A)
- Volume II —Generalized Products (TABLES 5B and 6B)
- Volume III —Individual and Special Applications (TABLE 6C) and an appendix describing the equations and constants used and the densities and coefficients of thermal expansion of each NBS sample.

Second Series—Volumes IV, V, and VI

These three volumes contain TABLES 23 and 24, the tables for the relative density, °F, 60°F base series, plus examples to guide the user. Each volume contains specific data as follows:

- Volume IV —Generalized Crude Oils (TABLES 23A and 24A)
- Volume V —Generalized Products (TABLES 23B and 24B)
- Volume VI —Individual and Special Applications (TABLE 24C) and an appendix describing the equations and constants used and the densities and coefficients of thermal expansion of each NBS sample.

Third Series—Volumes VII, VIII, and IX

These three volumes contain TABLES 53 and 54, the tables for the kilogram per cubic metre, °C, 15°C base series, plus examples to guide the user. Each volume contains specific data as follows:

- Volume VII —Generalized Crude Oils (TABLES 53A and 54A)
- Volume VIII—Generalized Products (TABLES 53B and 54B)
- Volume IX —Individual and Special Applications (TABLE 54C) and an appendix describing the equations and constants used and the densities and coefficients of thermal expansion for each NBS sample.

Volume X provides a complete breakdown of the Petroleum Measurement Tables, Volume Correction Factors, and references appropriate volumes for the location of specific tables. Volume X is the key volume of the entire set and contains the actual Standard, the implementation procedures, and the instructions for the

use of the computer subroutines. The history and development of the project are also included in Volume X under 11.1.6.

Inquiries concerning the application of the tables or the computer subroutines should be addressed to—

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O.W. Molony		British Standards Institution
P.D. O'Connell		Institute of Petroleum

COPM—API Committee on Petroleum Measurement

COSM—Joint API/ASTM Subcommittee on Static Petroleum Measurement

NBS—U.S. National Bureau of Standards

ISO—International Organization for Standardization

Chapter 11—Physical Properties Data

SECTION 1—VOLUME CORRECTION FACTORS

11.1.54 TABLES 54A, 54B, and 54C— Correction of Volume to 15°C Against Density at 15°C and Thermal Expansion Coefficients

TABLES 54A, 54B, and 54C give the factors for converting liquid petroleum volumes measured at observed temperatures to the corresponding volumes at 15°C.

The data are presented in three tables to maximize accuracy while maintaining convenience of use:

TABLE 54A Generalized Crude Oils
(see Volume VII)

TABLE 54B Generalized Products
(see Volume VIII)

TABLE 54C Volume Correction Factors for Individual and Special Applications

TABLES 54A and 54B use density at 15°C to obtain volume correction factors. TABLE 54C uses experimentally determined thermal expansion coefficients to obtain volume correction factors.

The development and intended use of these tables is described in 11.1.6 in Volume X. The parameters K_0 and K_1 may be found in 11.1.54.7.1.

The limits of these tables are illustrated in Figure IX-1, IX-2, and IX-3.

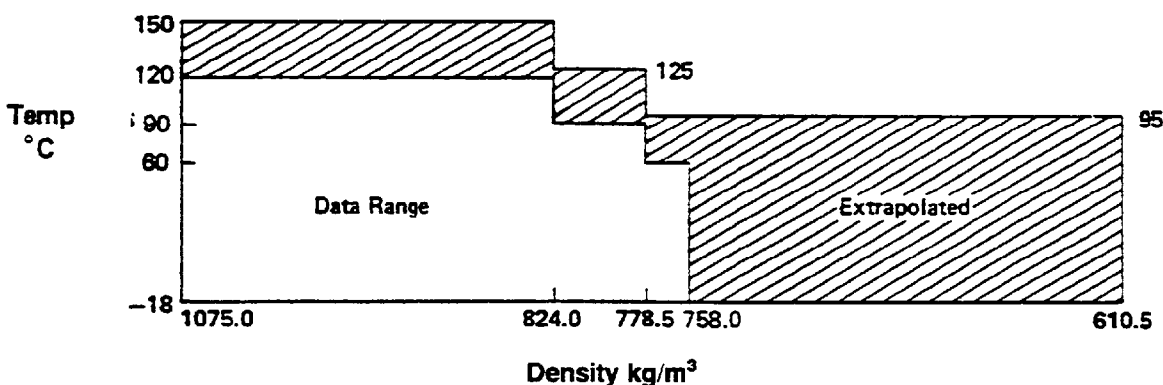


Figure IX-1 — Data Limits for TABLE 54A, Generalized Crude Oils

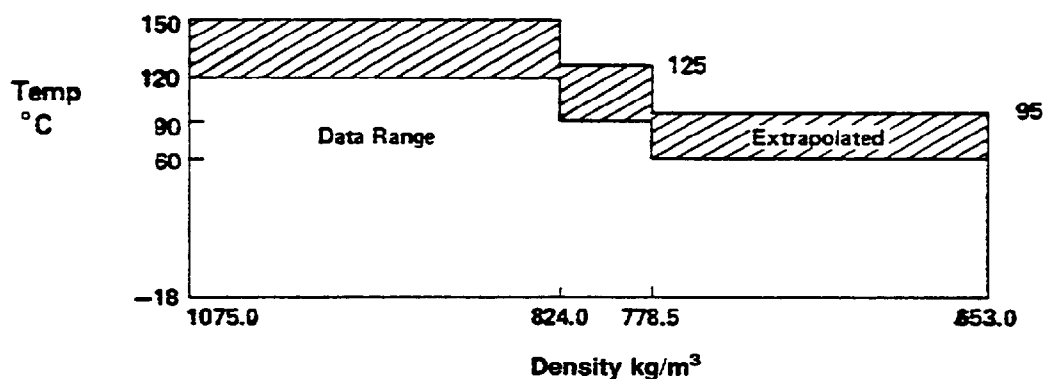


Figure IX-2 — Data Limits for TABLE 54B, Generalized Products

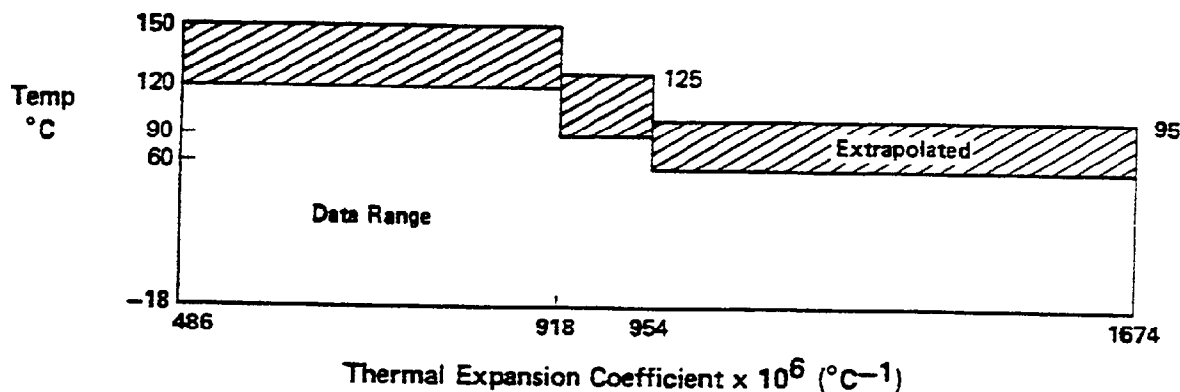


Figure IX-3 — Data Limits for TABLE 54C, Volume Correction Factors for Individual and Special Applications

11.1.54.7 TABLE 54C—Volume Correction Factors for Individual and Special Applications, Volume Correction to 15°C Against Thermal Expansion Coefficients at 15°C

TABLE 54C gives volume correction factors to convert petroleum liquid volumes to the corresponding volume at 15°C. The table presents tabular entries of volume correction factors against thermal expansion coefficients and temperature. The values were computed from the basic equation used to represent volume correction factors.

$$\text{VCF} = \text{EXP} [-\alpha_T \Delta t (1 + 0.8 \alpha_T \Delta t)] \quad (1)$$

$\alpha_T = \alpha$ at the base temperature

$\Delta t = t - T$

$t =$ any temperature

$T =$ base temperature

In this form the equation is independent of the group or substance. It can be used with any valid method of obtaining the thermal expansion coefficient for a given fluid as long as a statistically significant number of points are obtained. A minimum of ten such points is recommended. The appendix (11.1.54.7.1) to Table 54C presents values of the thermal expansion coefficient along with the base density for each of the NBS samples. In addition, values of the constants K_0 and K_1 are given for each major group. These constants relate the thermal expansion coefficient to base density by

$$\alpha_T = \frac{K_0 + K_1 \rho_T}{\rho_T^2} \quad (2)$$

This table and its primary subroutine allow the use of measured data for previously unstudied fluids to supplement those data included in the initial data base. High precision density data obtained from the laboratory for a fluid of interest may be reduced by Equation 1 to obtain ρ_T and α_T . TABLE 54C may then be entered with the α_T so determined.

TABLE 54C, when used with a minimum of ten data points, allows one to extract the highest degree of accuracy from the base data. It is suggested that TABLE 54C be used when:

1. TABLES 54A and 54B do not adequately represent the thermal expansion properties of the fluids of interest;
2. Precise thermal expansion coefficients may be obtained directly or indirectly by experiment (As an example, high precision density data may be used to compute the coefficients.); and
3. Buyers and sellers agree that, for their use, a greater degree of equity can be obtained.

The temperature ranges of this table are:

$\alpha \times 10^6$	°C
486 to 918	-18 to 150
918 to 954	-18 to 125
954 to 1674	-18 to 95

The volume correction factors given in this table are based on data from the U.S. National Bureau of Standards (NBS) and from other published data. The appendix to this table presents values of the thermal expansion coefficients at 15°C for each of the samples included in the NBS data set. Portions of the temperature ranges represent areas beyond these data. Thus, mathematical techniques were employed to extrapolate beyond temperature ranges of the given data to determine the volume correction factors for these areas. These factors are denoted by an asterisk (*). Extension of this table beyond the ranges shown is not intended.

Increments used in this table for determining the volume correction factors are 0.25°C and 4 units for α . Interpolation between either temperature or thermal expansion coefficient is not intended since there is no practical method of interpolation that will produce the accuracy obtainable from the Standard.

This table must be entered with a known thermal expansion coefficient at 15°C and with an observed temperature.

Example 1

What is the volume at 15°C of 786 470 cubic metres at 20°C of a lubricating oil with coefficient of thermal expansion 701.6×10^{-6} per °C?

1. Enter the table with the column headed "Coefficient of Thermal Expansion" at 702.0. Note that against observed "Temperature" of 20°C the volume correction factor is 0.9965. Hence one m³ of oil measured at 20°C occupies a volume of 0.9965 m³.

2. Then 786 470 m³ measured at 20°C occupies a volume at 15°C of

$$786\,470 \times 0.9965 = 783\,717.36 \text{ m}^3.$$

or

$$783\,717 \text{ net cubic metres.}$$

3. Note that interpolation is not used.

Example 2

The laboratory reports the following experimental data for a specific petroleum fluid:

°C	kg/m ³
14.927	868.211
15.918	868.0219
20.212	864.5136
24.955	861.187
29.621	857.908
32.878	855.615
35.427	853.818
40.162	850.475
42.017	849.163
44.865	847.148

From these data thermal expansion coefficient at 15°C is 805.468×10^{-6} reciprocal °C. (Note: A minimum of the ten data pairs is suggested if this type of procedure is used.)

What is the net volume at 15°C of 270 000 barrels of this petroleum fluid at 25°C?

Enter the table in the column "Coefficient of Thermal Expansion," headed 804.0 and note that against observed "Temperature at 25°C the volume correction factor is 0.9919. Therefore the net volume at 15°C is

$$270\,000 \times 0.9919 = 267\,813.0$$

or

$$267\,813 \text{ net barrels.}$$

Note that interpolation is not used.

(Text continues on page IX-7 following TABLE 54C.)

API/ASTM-IP PETROLEUM MEASUREMENT TABLE

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 DEGREES C

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TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0	TEMP. C
-20.00	-	-	-	-	-	-	-	-	-	-	-	-20.00
-19.75	-	-	-	-	-	-	-	-	-	-	-	-19.75
-19.50	-	-	-	-	-	-	-	-	-	-	-	-19.50
-19.25	-	-	-	-	-	-	-	-	-	-	-	-19.25
-19.00	-	-	-	-	-	-	-	-	-	-	-	-19.00
-18.75	-	-	-	-	-	-	-	-	-	-	-	-18.75
-18.50	-	-	-	-	-	-	-	-	-	-	-	-18.50
-18.25	-	-	-	-	-	-	-	-	-	-	-	-18.25
-18.00	-	-	-	-	-	-	-	-	-	-	-	-18.00
-17.75	-	-	-	-	-	-	-	-	-	-	-	-17.75
-17.50	-	-	-	-	-	-	-	-	-	-	-	-17.50
-17.25	-	-	-	-	-	-	-	-	-	-	-	-17.25
-17.00	-	-	-	-	-	-	-	-	-	-	-	-17.00
-16.75	-	-	-	-	-	-	-	-	-	-	-	-16.75
-16.50	-	-	-	-	-	-	-	-	-	-	-	-16.50
-16.25	-	-	-	-	-	-	-	-	-	-	-	-16.25
-16.00	-	-	-	-	-	-	-	-	-	-	-	-16.00
-15.75	-	-	-	-	-	-	-	-	-	-	-	-15.75
-15.50	-	-	-	-	-	-	-	-	-	-	-	-15.50
-15.25	-	-	-	-	-	-	-	-	-	-	-	-15.25
-15.00	-	-	-	-	-	-	-	-	-	-	-	-15.00
-14.75	-	-	-	-	-	-	-	-	-	-	-	-14.75
-14.50	-	-	-	-	-	-	-	-	-	-	-	-14.50
-14.25	-	-	-	-	-	-	-	-	-	-	-	-14.25
-14.00	-	-	-	-	-	-	-	-	-	-	-	-14.00
-13.75	-	-	-	-	-	-	-	-	-	-	-	-13.75
-13.50	-	-	-	-	-	-	-	-	-	-	-	-13.50
-13.25	-	-	-	-	-	-	-	-	-	-	-	-13.25
-13.00	-	-	-	-	-	-	-	-	-	-	-	-13.00
-12.75	-	-	-	-	-	-	-	-	-	-	-	-12.75
-12.50	-	-	-	-	-	-	-	-	-	-	-	-12.50

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C. VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 °C

TEMP. C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C	
	480.0	484.0	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0		520.0
-12.50	-	-	1.0134	1.0135	1.0136	1.0137	1.0138	1.0139	1.0140	1.0141	1.0142	-12.50
-12.25	-	-	1.0132	1.0134	1.0135	1.0136	1.0137	1.0138	1.0139	1.0140	1.0141	-12.25
-12.00	-	-	1.0131	1.0132	1.0133	1.0134	1.0136	1.0137	1.0138	1.0139	1.0140	-12.00
-11.75	-	-	1.0130	1.0131	1.0132	1.0133	1.0134	1.0135	1.0136	1.0137	1.0139	-11.75
-11.50	-	-	1.0129	1.0130	1.0131	1.0132	1.0133	1.0134	1.0135	1.0136	1.0137	-11.50
-11.25	-	-	1.0128	1.0129	1.0130	1.0131	1.0132	1.0133	1.0134	1.0135	1.0136	-11.25
-11.00	-	-	1.0126	1.0127	1.0128	1.0129	1.0131	1.0132	1.0133	1.0134	1.0135	-11.00
-10.75	-	-	1.0125	1.0126	1.0127	1.0128	1.0129	1.0130	1.0131	1.0132	1.0133	-10.75
-10.50	-	-	1.0124	1.0125	1.0126	1.0127	1.0128	1.0129	1.0130	1.0131	1.0132	-10.50
-10.25	-	-	1.0123	1.0124	1.0125	1.0126	1.0127	1.0128	1.0129	1.0130	1.0131	-10.25
-10.00	-	-	1.0122	1.0123	1.0124	1.0125	1.0126	1.0127	1.0128	1.0129	1.0131	-10.00
-9.75	-	-	1.0120	1.0121	1.0122	1.0123	1.0124	1.0125	1.0126	1.0127	1.0128	-9.75
-9.50	-	-	1.0119	1.0120	1.0121	1.0122	1.0123	1.0124	1.0125	1.0126	1.0127	-9.50
-9.25	-	-	1.0118	1.0119	1.0120	1.0121	1.0122	1.0123	1.0124	1.0125	1.0126	-9.25
-9.00	-	-	1.0117	1.0118	1.0119	1.0120	1.0121	1.0121	1.0122	1.0123	1.0124	-9.00
-8.75	-	-	1.0115	1.0116	1.0117	1.0118	1.0119	1.0120	1.0121	1.0122	1.0123	-8.75
-8.50	-	-	1.0114	1.0115	1.0116	1.0117	1.0118	1.0119	1.0120	1.0121	1.0123	-8.50
-8.25	-	-	1.0113	1.0114	1.0115	1.0116	1.0117	1.0118	1.0119	1.0120	1.0122	-8.25
-8.00	-	-	1.0112	1.0113	1.0114	1.0115	1.0116	1.0116	1.0117	1.0118	1.0119	-8.00
-7.75	-	-	1.0111	1.0112	1.0112	1.0113	1.0114	1.0115	1.0115	1.0117	1.0118	-7.75
-7.50	-	-	1.0109	1.0110	1.0111	1.0112	1.0113	1.0114	1.0115	1.0116	1.0117	-7.50
-7.25	-	-	1.0108	1.0109	1.0110	1.0111	1.0112	1.0113	1.0114	1.0116	1.0117	-7.25
-7.00	-	-	1.0107	1.0108	1.0109	1.0110	1.0111	1.0111	1.0112	1.0114	1.0115	-7.00
-6.75	-	-	1.0106	1.0107	1.0108	1.0108	1.0109	1.0110	1.0111	1.0112	1.0113	-6.75
-6.50	-	-	1.0105	1.0105	1.0106	1.0107	1.0108	1.0109	1.0110	1.0111	1.0111	-6.50
-6.25	-	-	1.0103	1.0104	1.0105	1.0106	1.0107	1.0108	1.0108	1.0109	1.0110	-6.25
-6.00	-	-	1.0102	1.0103	1.0104	1.0105	1.0105	1.0106	1.0107	1.0108	1.0110	-6.00
-5.75	-	-	1.0101	1.0102	1.0103	1.0103	1.0104	1.0105	1.0106	1.0107	1.0109	-5.75
-5.50	-	-	1.0100	1.0101	1.0101	1.0102	1.0103	1.0104	1.0105	1.0105	1.0108	-5.50
-5.25	-	-	1.0099	1.0099	1.0100	1.0101	1.0102	1.0103	1.0103	1.0105	1.0106	-5.25
-5.00	-	-	1.0097	1.0098	1.0099	1.0100	1.0100	1.0101	1.0102	1.0103	1.0105	-5.00
* DENOTES EXTRAPOLATED VALUE												
ALPHA = 480.0 TO 520.0												

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C	
	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0			
-5.00	1.0097	1.0098	1.0099	1.0100	1.0100	1.0101	1.0102	1.0103	1.0104			-5.00
-4.75	1.0096	1.0097	1.0098	1.0098	1.0099	1.0100	1.0101	1.0102	1.0102			-4.75
-4.50	1.0095	1.0096	1.0096	1.0097	1.0098	1.0099	1.0100	1.0100	1.0101			-4.50
-4.25	1.0094	1.0094	1.0095	1.0096	1.0097	1.0097	1.0098	1.0099	1.0100			-4.25
-4.00	1.0092	1.0093	1.0094	1.0095	1.0095	1.0096	1.0097	1.0098	1.0099			-4.00
-3.75	1.0091	1.0092	1.0093	1.0093	1.0094	1.0095	1.0096	1.0096	1.0097			-3.75
-3.50	1.0090	1.0091	1.0092	1.0092	1.0093	1.0094	1.0094	1.0095	1.0096			-3.50
-3.25	1.0089	1.0090	1.0090	1.0091	1.0092	1.0092	1.0093	1.0094	1.0095			-3.25
-3.00	1.0088	1.0088	1.0089	1.0090	1.0090	1.0091	1.0092	1.0093	1.0093			-3.00
-2.75	1.0086	1.0087	1.0088	1.0089	1.0089	1.0090	1.0091	1.0091	1.0092			-2.75
-2.50	1.0085	1.0086	1.0087	1.0087	1.0088	1.0089	1.0089	1.0090	1.0091			-2.50
-2.25	1.0084	1.0085	1.0085	1.0086	1.0087	1.0087	1.0088	1.0089	1.0089			-2.25
-2.00	1.0083	1.0083	1.0084	1.0085	1.0085	1.0086	1.0087	1.0087	1.0088			-2.00
-1.75	1.0082	1.0082	1.0083	1.0084	1.0084	1.0085	1.0086	1.0086	1.0087			-1.75
-1.50	1.0080	1.0081	1.0082	1.0082	1.0083	1.0084	1.0084	1.0085	1.0086			-1.50
-1.25	1.0079	1.0080	1.0080	1.0081	1.0082	1.0082	1.0083	1.0084	1.0084			-1.25
-1.00	1.0078	1.0079	1.0079	1.0080	1.0080	1.0081	1.0082	1.0082	1.0083			-1.00
-0.75	1.0077	1.0077	1.0078	1.0079	1.0079	1.0080	1.0080	1.0081	1.0082			-0.75
-0.50	1.0075	1.0076	1.0077	1.0077	1.0078	1.0079	1.0079	1.0080	1.0080			-0.50
-0.25	1.0074	1.0075	1.0075	1.0076	1.0077	1.0077	1.0078	1.0079	1.0079			-0.25
0.0	1.0073	1.0074	1.0074	1.0075	1.0075	1.0076	1.0077	1.0077	1.0078			0.0
0.25	1.0072	1.0072	1.0073	1.0074	1.0074	1.0075	1.0075	1.0076	1.0077			0.25
0.50	1.0071	1.0071	1.0072	1.0072	1.0073	1.0073	1.0074	1.0075	1.0075			0.50
0.75	1.0069	1.0070	1.0071	1.0071	1.0072	1.0072	1.0073	1.0073	1.0074			0.75
1.00	1.0068	1.0069	1.0069	1.0070	1.0070	1.0071	1.0072	1.0072	1.0073			1.00
1.25	1.0067	1.0068	1.0068	1.0069	1.0069	1.0070	1.0070	1.0071	1.0071			1.25
1.50	1.0066	1.0066	1.0067	1.0067	1.0068	1.0068	1.0069	1.0070	1.0070			1.50
1.75	1.0065	1.0065	1.0066	1.0066	1.0067	1.0067	1.0068	1.0068	1.0069			1.75
2.00	1.0063	1.0064	1.0064	1.0065	1.0065	1.0066	1.0066	1.0067	1.0067			2.00
2.25	1.0062	1.0063	1.0063	1.0064	1.0064	1.0065	1.0065	1.0066	1.0066			2.25
2.50	1.0061	1.0061	1.0062	1.0062	1.0063	1.0063	1.0064	1.0064	1.0065			2.50

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0	TEMP. C
2.50	-	-	1.0061	1.0061	1.0062	1.0062	1.0063	1.0063	1.0064	1.0064	1.0065	2.50
2.75	-	-	1.0060	1.0060	1.0061	1.0061	1.0062	1.0062	1.0063	1.0063	1.0064	2.75
3.00	-	-	1.0058	1.0059	1.0059	1.0060	1.0060	1.0061	1.0061	1.0062	1.0062	3.00
3.25	-	-	1.0057	1.0058	1.0058	1.0059	1.0059	1.0060	1.0060	1.0061	1.0061	3.25
3.50	-	-	1.0056	1.0056	1.0057	1.0057	1.0058	1.0058	1.0059	1.0059	1.0060	3.50
3.75	-	-	1.0055	1.0055	1.0056	1.0056	1.0057	1.0057	1.0057	1.0058	1.0058	3.75
4.00	-	-	1.0054	1.0054	1.0054	1.0055	1.0055	1.0056	1.0056	1.0057	1.0057	4.00
4.25	-	-	1.0052	1.0053	1.0053	1.0054	1.0054	1.0055	1.0055	1.0055	1.0056	4.25
4.50	-	-	1.0051	1.0052	1.0052	1.0052	1.0053	1.0053	1.0054	1.0054	1.0055	4.50
4.75	-	-	1.0050	1.0050	1.0051	1.0051	1.0052	1.0052	1.0052	1.0053	1.0053	4.75
5.00	-	-	1.0049	1.0049	1.0050	1.0050	1.0050	1.0051	1.0051	1.0052	1.0052	5.00
5.25	-	-	1.0048	1.0048	1.0048	1.0049	1.0049	1.0049	1.0050	1.0050	1.0051	5.25
5.50	-	-	1.0046	1.0047	1.0047	1.0047	1.0048	1.0048	1.0049	1.0049	1.0050	5.50
5.75	-	-	1.0045	1.0045	1.0046	1.0046	1.0047	1.0047	1.0047	1.0048	1.0048	5.75
6.00	-	-	1.0044	1.0044	1.0045	1.0045	1.0045	1.0046	1.0046	1.0046	1.0047	6.00
6.25	-	-	1.0043	1.0043	1.0043	1.0044	1.0044	1.0044	1.0045	1.0045	1.0045	6.25
6.50	-	-	1.0041	1.0042	1.0042	1.0042	1.0043	1.0043	1.0043	1.0044	1.0044	6.50
6.75	-	-	1.0040	1.0041	1.0041	1.0041	1.0042	1.0042	1.0042	1.0043	1.0043	6.75
7.00	-	-	1.0039	1.0039	1.0040	1.0040	1.0040	1.0041	1.0041	1.0041	1.0042	7.00
7.25	-	-	1.0038	1.0038	1.0039	1.0039	1.0039	1.0039	1.0040	1.0040	1.0040	7.25
7.50	-	-	1.0037	1.0037	1.0037	1.0038	1.0038	1.0038	1.0038	1.0039	1.0039	7.50
7.75	-	-	1.0035	1.0036	1.0036	1.0036	1.0037	1.0037	1.0037	1.0037	1.0038	7.75
8.00	-	-	1.0034	1.0034	1.0035	1.0035	1.0035	1.0036	1.0036	1.0036	1.0036	8.00
8.25	-	-	1.0033	1.0033	1.0033	1.0034	1.0034	1.0034	1.0035	1.0035	1.0035	8.25
8.50	-	-	1.0032	1.0032	1.0032	1.0032	1.0033	1.0033	1.0033	1.0034	1.0034	8.50
8.75	-	-	1.0030	1.0031	1.0031	1.0031	1.0032	1.0032	1.0032	1.0032	1.0032	8.75
9.00	-	-	1.0029	1.0029	1.0030	1.0030	1.0030	1.0030	1.0031	1.0031	1.0031	9.00
9.25	-	-	1.0028	1.0028	1.0028	1.0029	1.0029	1.0029	1.0029	1.0030	1.0030	9.25
9.50	-	-	1.0027	1.0027	1.0027	1.0027	1.0028	1.0028	1.0028	1.0028	1.0029	9.50
9.75	-	-	1.0026	1.0026	1.0026	1.0026	1.0026	1.0027	1.0027	1.0027	1.0027	9.75
10.00	-	-	1.0024	1.0025	1.0025	1.0025	1.0025	1.0025	1.0026	1.0026	1.0026	10.00

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0



TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 °C

TEMP. C	480.0	484.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C
			488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0		
-	-	-	1.0024	1.0025	1.0025	1.0025	1.0025	1.0025	1.0026	1.0026	1.0026	10.00	
-	-	-	1.0023	1.0023	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0025	10.25	
-	-	-	1.0022	1.0022	1.0022	1.0022	1.0023	1.0023	1.0023	1.0023	1.0023	10.50	
-	-	-	1.0021	1.0021	1.0021	1.0021	1.0021	1.0022	1.0022	1.0022	1.0022	10.75	
-	-	-	1.0020	1.0020	1.0020	1.0020	1.0020	1.0020	1.0020	1.0021	1.0021	11.00	
-	-	-	1.0018	1.0018	1.0019	1.0019	1.0019	1.0019	1.0019	1.0019	1.0019	11.25	
-	-	-	1.0017	1.0017	1.0017	1.0017	1.0018	1.0018	1.0018	1.0018	1.0018	11.50	
-	-	-	1.0016	1.0016	1.0016	1.0016	1.0016	1.0017	1.0017	1.0017	1.0017	11.75	
-	-	-	1.0015	1.0015	1.0015	1.0015	1.0015	1.0015	1.0015	1.0015	1.0016	12.00	
-	-	-	1.0013	1.0014	1.0014	1.0014	1.0014	1.0014	1.0014	1.0014	1.0014	12.25	
-	-	-	1.0012	1.0012	1.0012	1.0013	1.0013	1.0013	1.0013	1.0013	1.0013	12.50	
-	-	-	1.0011	1.0011	1.0011	1.0011	1.0011	1.0011	1.0012	1.0012	1.0012	12.75	
-	-	-	1.0010	1.0010	1.0010	1.0010	1.0010	1.0010	1.0010	1.0010	1.0010	13.00	
-	-	-	1.0009	1.0009	1.0009	1.0009	1.0009	1.0009	1.0009	1.0009	1.0009	13.25	
-	-	-	1.0007	1.0007	1.0007	1.0008	1.0008	1.0008	1.0008	1.0008	1.0008	13.50	
-	-	-	1.0006	1.0006	1.0006	1.0006	1.0006	1.0006	1.0006	1.0006	1.0006	13.75	
-	-	-	1.0005	1.0005	1.0005	1.0005	1.0005	1.0005	1.0005	1.0005	1.0005	14.00	
-	-	-	1.0004	1.0004	1.0004	1.0004	1.0004	1.0004	1.0004	1.0004	1.0004	14.25	
-	-	-	1.0002	1.0002	1.0002	1.0002	1.0003	1.0003	1.0003	1.0003	1.0003	14.50	
-	-	-	1.0001	1.0001	1.0001	1.0001	1.0001	1.0001	1.0001	1.0001	1.0001	14.75	
-	-	-	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	15.00	
-	-	-	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	15.25	
-	-	-	0.9998	0.9998	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	15.50	
-	-	-	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	15.75	
-	-	-	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	16.00	
-	-	-	0.9994	0.9994	0.9994	0.9994	0.9994	0.9994	0.9994	0.9994	0.9993	16.25	
-	-	-	0.9993	0.9993	0.9993	0.9992	0.9992	0.9992	0.9992	0.9992	0.9992	16.50	
-	-	-	0.9991	0.9991	0.9991	0.9991	0.9991	0.9991	0.9991	0.9991	0.9991	16.75	
-	-	-	0.9990	0.9990	0.9990	0.9990	0.9990	0.9990	0.9990	0.9990	0.9990	17.00	
-	-	-	0.9989	0.9989	0.9989	0.9989	0.9989	0.9989	0.9988	0.9988	0.9988	17.25	
-	-	-	0.9988	0.9988	0.9988	0.9987	0.9987	0.9987	0.9987	0.9987	0.9987	17.50	

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C)					FACTOR FOR CORRECTING VOLUME TO 15 C					TEMP. C				
	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0		516.0	520.0			
17.50	0.9988	0.9988	0.9988	0.9987	0.9987	0.9987	0.9987	0.9987	0.9987		0.9987	0.9987		17.50	
17.75	0.9987	0.9986	0.9986	0.9986	0.9986	0.9986	0.9986	0.9986	0.9986		0.9986	0.9986		17.75	
18.00	0.9985	0.9985	0.9985	0.9985	0.9985	0.9985	0.9985	0.9985	0.9985		0.9985	0.9985		18.00	
18.25	0.9984	0.9984	0.9984	0.9984	0.9984	0.9984	0.9983	0.9983	0.9983		0.9983	0.9983		18.25	
18.50	0.9983	0.9983	0.9983	0.9982	0.9982	0.9982	0.9982	0.9982	0.9982		0.9982	0.9982		18.50	
18.75	0.9982	0.9982	0.9981	0.9981	0.9981	0.9981	0.9981	0.9981	0.9981		0.9981	0.9981		18.75	
19.00	0.9980	0.9980	0.9980	0.9980	0.9980	0.9980	0.9980	0.9980	0.9980		0.9979	0.9979		19.00	
19.25	0.9979	0.9979	0.9979	0.9979	0.9979	0.9978	0.9978	0.9978	0.9978		0.9978	0.9978		19.25	
19.50	0.9978	0.9978	0.9978	0.9977	0.9977	0.9977	0.9977	0.9977	0.9977		0.9977	0.9977		19.50	
19.75	0.9977	0.9977	0.9976	0.9976	0.9976	0.9976	0.9976	0.9976	0.9976		0.9975	0.9975		19.75	
20.00	0.9976	0.9975	0.9975	0.9975	0.9975	0.9975	0.9975	0.9975	0.9975		0.9974	0.9974		20.00	
20.25	0.9974	0.9974	0.9974	0.9974	0.9974	0.9973	0.9973	0.9973	0.9973		0.9973	0.9973		20.25	
20.50	0.9973	0.9973	0.9973	0.9972	0.9972	0.9972	0.9972	0.9972	0.9972		0.9972	0.9972		20.50	
20.75	0.9972	0.9972	0.9972	0.9971	0.9971	0.9971	0.9971	0.9971	0.9971		0.9970	0.9970		20.75	
21.00	0.9971	0.9970	0.9970	0.9970	0.9970	0.9969	0.9969	0.9969	0.9969		0.9969	0.9969		21.00	
21.25	0.9969	0.9969	0.9969	0.9969	0.9968	0.9968	0.9968	0.9968	0.9968		0.9968	0.9968		21.25	
21.50	0.9968	0.9968	0.9968	0.9967	0.9967	0.9967	0.9967	0.9967	0.9967		0.9966	0.9966		21.50	
21.75	0.9967	0.9967	0.9966	0.9966	0.9966	0.9966	0.9966	0.9966	0.9966		0.9965	0.9965		21.75	
22.00	0.9966	0.9966	0.9966	0.9965	0.9965	0.9965	0.9965	0.9965	0.9965		0.9964	0.9964		22.00	
22.25	0.9965	0.9964	0.9964	0.9964	0.9963	0.9963	0.9963	0.9963	0.9963		0.9963	0.9963		22.25	
22.50	0.9963	0.9963	0.9963	0.9962	0.9962	0.9962	0.9962	0.9962	0.9962		0.9961	0.9961		22.50	
22.75	0.9962	0.9962	0.9962	0.9961	0.9961	0.9961	0.9961	0.9961	0.9961		0.9960	0.9960		22.75	
23.00	0.9961	0.9961	0.9961	0.9960	0.9960	0.9960	0.9959	0.9959	0.9959		0.9959	0.9959		23.00	
23.25	0.9960	0.9959	0.9959	0.9959	0.9958	0.9958	0.9958	0.9958	0.9958		0.9957	0.9957		23.25	
23.50	0.9958	0.9958	0.9958	0.9957	0.9957	0.9957	0.9956	0.9956	0.9956		0.9956	0.9956		23.50	
23.75	0.9957	0.9957	0.9957	0.9956	0.9956	0.9956	0.9955	0.9955	0.9955		0.9955	0.9955		23.75	
24.00	0.9956	0.9956	0.9956	0.9955	0.9955	0.9955	0.9954	0.9954	0.9954		0.9954	0.9954		24.00	
24.25	0.9955	0.9955	0.9955	0.9954	0.9954	0.9954	0.9953	0.9953	0.9953		0.9953	0.9953		24.25	
24.50	0.9954	0.9954	0.9954	0.9953	0.9953	0.9953	0.9952	0.9952	0.9952		0.9952	0.9952		24.50	
24.75	0.9952	0.9952	0.9952	0.9952	0.9951	0.9951	0.9951	0.9951	0.9951		0.9950	0.9950		24.75	
25.00	0.9951	0.9951	0.9951	0.9950	0.9950	0.9950	0.9949	0.9949	0.9949		0.9949	0.9949		25.00	

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C. VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										516.0	520.0	TEMP. C
			488.0	492.0	496.0	500.0	504.0	508.0	512.0						
25.00	-	-	0.9951	0.9951	0.9950	0.9950	0.9950	0.9949	0.9949	0.9948	0.9948	0.9948	0.9948	25.00	
25.25	-	-	0.9950	0.9949	0.9949	0.9949	0.9948	0.9948	0.9947	0.9947	0.9947	0.9947	0.9947	25.25	
25.50	-	-	0.9949	0.9948	0.9948	0.9947	0.9947	0.9947	0.9946	0.9946	0.9946	0.9946	0.9945	25.50	
25.75	-	-	0.9947	0.9947	0.9947	0.9946	0.9946	0.9945	0.9945	0.9945	0.9944	0.9944	0.9944	25.75	
26.00	-	-	0.9946	0.9946	0.9945	0.9945	0.9944	0.9944	0.9944	0.9943	0.9943	0.9943	0.9943	26.00	
26.25	-	-	0.9945	0.9945	0.9944	0.9944	0.9943	0.9943	0.9942	0.9942	0.9942	0.9941	0.9941	26.25	
26.50	-	-	0.9944	0.9943	0.9943	0.9942	0.9942	0.9941	0.9941	0.9941	0.9940	0.9940	0.9940	26.50	
26.75	-	-	0.9943	0.9942	0.9942	0.9941	0.9941	0.9940	0.9940	0.9939	0.9939	0.9939	0.9939	26.75	
27.00	-	-	0.9941	0.9941	0.9940	0.9940	0.9939	0.9939	0.9938	0.9938	0.9937	0.9937	0.9937	27.00	
27.25	-	-	0.9940	0.9940	0.9939	0.9939	0.9938	0.9938	0.9937	0.9937	0.9936	0.9936	0.9936	27.25	
27.50	-	-	0.9939	0.9938	0.9938	0.9937	0.9937	0.9936	0.9936	0.9935	0.9935	0.9935	0.9935	27.50	
27.75	-	-	0.9938	0.9937	0.9937	0.9936	0.9936	0.9935	0.9935	0.9934	0.9934	0.9934	0.9934	27.75	
28.00	-	-	0.9936	0.9936	0.9935	0.9935	0.9934	0.9934	0.9933	0.9933	0.9933	0.9932	0.9932	28.00	
28.25	-	-	0.9935	0.9935	0.9934	0.9934	0.9933	0.9933	0.9933	0.9932	0.9931	0.9931	0.9931	28.25	
28.50	-	-	0.9934	0.9933	0.9933	0.9932	0.9932	0.9931	0.9931	0.9930	0.9930	0.9930	0.9930	28.50	
28.75	-	-	0.9933	0.9932	0.9932	0.9931	0.9931	0.9930	0.9929	0.9929	0.9929	0.9928	0.9928	28.75	
29.00	-	-	0.9932	0.9931	0.9930	0.9930	0.9929	0.9929	0.9928	0.9928	0.9928	0.9927	0.9927	29.00	
29.25	-	-	0.9930	0.9930	0.9929	0.9929	0.9928	0.9927	0.9927	0.9926	0.9926	0.9926	0.9926	29.25	
29.50	-	-	0.9929	0.9929	0.9928	0.9927	0.9927	0.9926	0.9926	0.9925	0.9925	0.9924	0.9924	29.50	
29.75	-	-	0.9928	0.9927	0.9927	0.9926	0.9925	0.9925	0.9924	0.9924	0.9923	0.9923	0.9923	29.75	
30.00	-	-	0.9927	0.9926	0.9925	0.9925	0.9924	0.9924	0.9923	0.9923	0.9922	0.9922	0.9922	30.00	
30.25	-	-	0.9925	0.9925	0.9924	0.9924	0.9923	0.9922	0.9922	0.9922	0.9921	0.9921	0.9921	30.25	
30.50	-	-	0.9924	0.9924	0.9923	0.9922	0.9922	0.9921	0.9920	0.9920	0.9919	0.9919	0.9919	30.50	
30.75	-	-	0.9923	0.9922	0.9922	0.9921	0.9920	0.9920	0.9919	0.9919	0.9919	0.9918	0.9918	30.75	
31.00	-	-	0.9922	0.9921	0.9920	0.9920	0.9919	0.9919	0.9918	0.9917	0.9917	0.9917	0.9917	31.00	
31.25	-	-	0.9921	0.9920	0.9919	0.9919	0.9918	0.9917	0.9917	0.9916	0.9916	0.9915	0.9915	31.25	
31.50	-	-	0.9919	0.9919	0.9918	0.9917	0.9917	0.9916	0.9915	0.9915	0.9914	0.9914	0.9914	31.50	
31.75	-	-	0.9918	0.9917	0.9917	0.9916	0.9915	0.9915	0.9914	0.9913	0.9913	0.9912	0.9913	31.75	
32.00	-	-	0.9917	0.9916	0.9915	0.9915	0.9914	0.9913	0.9913	0.9912	0.9911	0.9911	0.9911	32.00	
32.25	-	-	0.9916	0.9915	0.9914	0.9914	0.9913	0.9912	0.9912	0.9911	0.9910	0.9910	0.9910	32.25	
32.50	-	-	0.9914	0.9914	0.9913	0.9912	0.9912	0.9911	0.9910	0.9909	0.9909	0.9909	0.9909	32.50	

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 °C

TEMP. °C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 °C										TEMP. °C
	488.0	484.0	480.0	476.0	472.0	468.0	464.0	460.0	456.0	452.0	
32.50	0.9914	0.9914	0.9913	0.9912	0.9912	0.9911	0.9910	0.9909	0.9909	0.9909	32.50
32.75	0.9913	0.9912	0.9912	0.9911	0.9910	0.9910	0.9909	0.9908	0.9907	0.9907	32.75
33.00	0.9912	0.9911	0.9910	0.9910	0.9909	0.9908	0.9908	0.9907	0.9906	0.9906	33.00
33.25	0.9911	0.9910	0.9909	0.9909	0.9908	0.9907	0.9906	0.9906	0.9905	0.9905	33.25
33.50	0.9909	0.9909	0.9908	0.9907	0.9907	0.9906	0.9905	0.9904	0.9904	0.9904	33.50
33.75	0.9908	0.9907	0.9907	0.9906	0.9905	0.9904	0.9904	0.9903	0.9902	0.9902	33.75
34.00	0.9907	0.9906	0.9905	0.9905	0.9904	0.9903	0.9902	0.9902	0.9901	0.9901	34.00
34.25	0.9906	0.9905	0.9904	0.9903	0.9903	0.9902	0.9901	0.9900	0.9900	0.9900	34.25
34.50	0.9905	0.9904	0.9903	0.9902	0.9901	0.9901	0.9900	0.9899	0.9898	0.9898	34.50
34.75	0.9903	0.9903	0.9902	0.9901	0.9900	0.9899	0.9899	0.9898	0.9897	0.9897	34.75
35.00	0.9902	0.9901	0.9901	0.9900	0.9899	0.9898	0.9897	0.9896	0.9896	0.9896	35.00
35.25	0.9901	0.9900	0.9899	0.9898	0.9898	0.9897	0.9896	0.9895	0.9894	0.9894	35.25
35.50	0.9900	0.9899	0.9898	0.9897	0.9896	0.9896	0.9895	0.9894	0.9893	0.9893	35.50
35.75	0.9898	0.9898	0.9897	0.9896	0.9895	0.9894	0.9893	0.9892	0.9892	0.9892	35.75
36.00	0.9897	0.9896	0.9896	0.9895	0.9894	0.9893	0.9892	0.9891	0.9890	0.9890	36.00
36.25	0.9896	0.9895	0.9894	0.9893	0.9893	0.9892	0.9891	0.9890	0.9889	0.9889	36.25
36.50	0.9895	0.9894	0.9893	0.9892	0.9891	0.9890	0.9889	0.9888	0.9887	0.9887	36.50
36.75	0.9894	0.9893	0.9892	0.9891	0.9890	0.9889	0.9888	0.9887	0.9886	0.9885	36.75
37.00	0.9892	0.9891	0.9891	0.9890	0.9889	0.9888	0.9887	0.9886	0.9885	0.9884	37.00
37.25	0.9891	0.9890	0.9889	0.9888	0.9887	0.9886	0.9885	0.9884	0.9883	0.9882	37.25
37.50	0.9890	0.9889	0.9888	0.9887	0.9886	0.9885	0.9884	0.9883	0.9882	0.9881	37.50
37.75	0.9889	0.9888	0.9887	0.9886	0.9885	0.9884	0.9883	0.9882	0.9881	0.9880	37.75
38.00	0.9887	0.9886	0.9885	0.9884	0.9883	0.9882	0.9881	0.9880	0.9879	0.9878	38.00
38.25	0.9886	0.9885	0.9884	0.9883	0.9882	0.9881	0.9880	0.9879	0.9878	0.9877	38.25
38.50	0.9885	0.9884	0.9883	0.9882	0.9881	0.9880	0.9879	0.9878	0.9877	0.9876	38.50
38.75	0.9884	0.9883	0.9882	0.9881	0.9880	0.9879	0.9878	0.9877	0.9876	0.9875	38.75
39.00	0.9882	0.9882	0.9881	0.9880	0.9879	0.9878	0.9877	0.9876	0.9875	0.9874	39.00
39.25	0.9881	0.9880	0.9879	0.9878	0.9877	0.9876	0.9875	0.9874	0.9873	0.9872	39.25
39.50	0.9880	0.9879	0.9878	0.9877	0.9876	0.9875	0.9874	0.9873	0.9872	0.9871	39.50
39.75	0.9879	0.9878	0.9877	0.9876	0.9875	0.9874	0.9873	0.9872	0.9871	0.9870	39.75
40.00	0.9878	0.9877	0.9876	0.9875	0.9874	0.9873	0.9872	0.9871	0.9870	0.9869	40.00

8
DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0



TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	488.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C
				492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0			
-	-	-	0.9878	0.9877	0.9876	0.9875	0.9874	0.9873	0.9872	0.9871	0.9870	40.00		
-	-	-	0.9876	0.9875	0.9874	0.9873	0.9872	0.9871	0.9870	0.9869	0.9868	40.25		
-	-	-	0.9875	0.9874	0.9873	0.9872	0.9871	0.9870	0.9869	0.9868	0.9867	40.50		
-	-	-	0.9874	0.9873	0.9872	0.9871	0.9870	0.9869	0.9868	0.9867	0.9866	40.75		
-	-	-	0.9873	0.9872	0.9871	0.9870	0.9868	0.9867	0.9866	0.9865	0.9864	41.00		
-	-	-	0.9871	0.9870	0.9869	0.9868	0.9867	0.9866	0.9865	0.9864	0.9863	41.25		
-	-	-	0.9870	0.9869	0.9868	0.9867	0.9866	0.9865	0.9864	0.9863	0.9862	41.50		
-	-	-	0.9869	0.9868	0.9867	0.9866	0.9865	0.9864	0.9862	0.9861	0.9860	41.75		
-	-	-	0.9868	0.9867	0.9866	0.9864	0.9863	0.9862	0.9861	0.9860	0.9859	42.00		
-	-	-	0.9867	0.9865	0.9864	0.9863	0.9862	0.9861	0.9860	0.9859	0.9858	42.25		
-	-	-	0.9865	0.9864	0.9863	0.9862	0.9861	0.9860	0.9859	0.9858	0.9856	42.50		
-	-	-	0.9864	0.9863	0.9862	0.9861	0.9860	0.9858	0.9857	0.9856	0.9855	42.75		
-	-	-	0.9863	0.9862	0.9861	0.9859	0.9858	0.9857	0.9856	0.9855	0.9854	43.00		
-	-	-	0.9862	0.9860	0.9859	0.9858	0.9857	0.9856	0.9855	0.9854	0.9852	43.25		
-	-	-	0.9860	0.9859	0.9858	0.9857	0.9856	0.9855	0.9853	0.9852	0.9851	43.50		
-	-	-	0.9859	0.9858	0.9857	0.9856	0.9854	0.9853	0.9852	0.9851	0.9850	43.75		
-	-	-	0.9858	0.9857	0.9856	0.9854	0.9853	0.9852	0.9851	0.9850	0.9849	44.00		
-	-	-	0.9857	0.9855	0.9854	0.9853	0.9852	0.9851	0.9850	0.9848	0.9847	44.25		
-	-	-	0.9855	0.9854	0.9853	0.9852	0.9851	0.9849	0.9848	0.9847	0.9846	44.50		
-	-	-	0.9854	0.9853	0.9852	0.9851	0.9849	0.9848	0.9847	0.9846	0.9845	44.75		
-	-	-	0.9853	0.9852	0.9851	0.9849	0.9848	0.9847	0.9846	0.9845	0.9843	45.00		
-	-	-	0.9852	0.9851	0.9849	0.9848	0.9847	0.9846	0.9844	0.9843	0.9842	45.25		
-	-	-	0.9851	0.9849	0.9848	0.9847	0.9846	0.9844	0.9843	0.9842	0.9841	45.50		
-	-	-	0.9849	0.9848	0.9847	0.9846	0.9844	0.9843	0.9842	0.9841	0.9839	45.75		
-	-	-	0.9848	0.9847	0.9846	0.9844	0.9843	0.9842	0.9841	0.9839	0.9838	46.00		
-	-	-	0.9847	0.9846	0.9844	0.9843	0.9842	0.9841	0.9839	0.9838	0.9837	46.25		
-	-	-	0.9846	0.9844	0.9843	0.9842	0.9841	0.9839	0.9838	0.9837	0.9835	46.50		
-	-	-	0.9844	0.9843	0.9842	0.9841	0.9839	0.9838	0.9837	0.9835	0.9834	46.75		
-	-	-	0.9843	0.9842	0.9841	0.9839	0.9838	0.9837	0.9835	0.9834	0.9833	47.00		
-	-	-	0.9842	0.9841	0.9839	0.9838	0.9837	0.9835	0.9834	0.9833	0.9831	47.25		
-	-	-	0.9841	0.9839	0.9838	0.9837	0.9835	0.9834	0.9833	0.9831	0.9830	47.50		

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0	TEMP. C
	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C											
47.50	-	-	0.9841	0.9839	0.9838	0.9837	0.9835	0.9834	0.9833	0.9831	0.9830	47.50
47.75	-	-	0.9839	0.9838	0.9837	0.9835	0.9834	0.9833	0.9832	0.9830	0.9829	47.75
48.00	-	-	0.9838	0.9837	0.9836	0.9834	0.9833	0.9832	0.9830	0.9829	0.9828	48.00
48.25	-	-	0.9837	0.9836	0.9834	0.9833	0.9832	0.9830	0.9829	0.9828	0.9826	48.25
48.50	-	-	0.9836	0.9834	0.9833	0.9832	0.9830	0.9829	0.9828	0.9826	0.9825	48.50
48.75	-	-	0.9835	0.9833	0.9832	0.9830	0.9829	0.9828	0.9826	0.9825	0.9824	48.75
49.00	-	-	0.9833	0.9832	0.9831	0.9829	0.9828	0.9826	0.9825	0.9824	0.9822	49.00
49.25	-	-	0.9832	0.9831	0.9829	0.9828	0.9827	0.9825	0.9824	0.9822	0.9821	49.25
49.50	-	-	0.9831	0.9829	0.9828	0.9827	0.9825	0.9824	0.9822	0.9821	0.9820	49.50
49.75	-	-	0.9830	0.9828	0.9827	0.9825	0.9824	0.9823	0.9821	0.9820	0.9818	49.75
50.00	-	-	0.9828	0.9827	0.9826	0.9824	0.9823	0.9821	0.9820	0.9818	0.9817	50.00
50.25	-	-	0.9827	0.9826	0.9824	0.9823	0.9821	0.9820	0.9819	0.9817	0.9816	50.25
50.50	-	-	0.9826	0.9824	0.9823	0.9822	0.9820	0.9819	0.9817	0.9816	0.9814	50.50
50.75	-	-	0.9825	0.9823	0.9822	0.9820	0.9819	0.9817	0.9816	0.9815	0.9813	50.75
51.00	-	-	0.9823	0.9822	0.9821	0.9819	0.9818	0.9816	0.9815	0.9813	0.9812	51.00
51.25	-	-	0.9822	0.9821	0.9819	0.9818	0.9816	0.9815	0.9813	0.9812	0.9810	51.25
51.50	-	-	0.9821	0.9819	0.9818	0.9817	0.9815	0.9814	0.9812	0.9811	0.9809	51.50
51.75	-	-	0.9820	0.9818	0.9817	0.9815	0.9814	0.9812	0.9811	0.9809	0.9808	51.75
52.00	-	-	0.9818	0.9817	0.9816	0.9814	0.9813	0.9811	0.9810	0.9808	0.9807	52.00
52.25	-	-	0.9817	0.9816	0.9814	0.9813	0.9811	0.9810	0.9808	0.9807	0.9805	52.25
52.50	-	-	0.9816	0.9815	0.9813	0.9811	0.9810	0.9808	0.9807	0.9805	0.9804	52.50
52.75	-	-	0.9815	0.9813	0.9812	0.9810	0.9809	0.9807	0.9806	0.9804	0.9803	52.75
53.00	-	-	0.9814	0.9812	0.9810	0.9809	0.9807	0.9806	0.9804	0.9803	0.9801	53.00
53.25	-	-	0.9812	0.9811	0.9809	0.9808	0.9806	0.9805	0.9803	0.9802	0.9800	53.25
53.50	-	-	0.9811	0.9810	0.9808	0.9806	0.9805	0.9803	0.9802	0.9800	0.9799	53.50
53.75	-	-	0.9810	0.9808	0.9807	0.9805	0.9804	0.9802	0.9800	0.9799	0.9797	53.75
54.00	-	-	0.9809	0.9807	0.9805	0.9804	0.9802	0.9801	0.9799	0.9798	0.9796	54.00
54.25	-	-	0.9807	0.9806	0.9804	0.9803	0.9801	0.9799	0.9798	0.9796	0.9795	54.25
54.50	-	-	0.9806	0.9805	0.9803	0.9801	0.9800	0.9798	0.9797	0.9795	0.9793	54.50
54.75	-	-	0.9805	0.9803	0.9802	0.9800	0.9799	0.9797	0.9795	0.9794	0.9792	54.75
55.00	-	-	0.9804	0.9802	0.9800	0.9799	0.9797	0.9796	0.9794	0.9792	0.9791	55.00

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 °C

TEMP. C	480.0	484.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										516.0	520.0	TEMP. C
			488.0	492.0	496.0	500.0	504.0	508.0	512.0						
55.00	-	-	0.9804	0.9802	0.9800	0.9799	0.9799	0.9797	0.9796	0.9794	0.9792	0.9791	55.00		
55.25	-	-	0.9802	0.9801	0.9799	0.9798	0.9798	0.9796	0.9794	0.9793	0.9791	0.9789	55.25		
55.50	-	-	0.9801	0.9800	0.9798	0.9796	0.9795	0.9793	0.9792	0.9790	0.9788	0.9787	55.50		
55.75	-	-	0.9800	0.9798	0.9797	0.9795	0.9793	0.9792	0.9790	0.9789	0.9787	0.9785	55.75		
56.00	-	-	0.9799	0.9797	0.9795	0.9794	0.9792	0.9790	0.9789	0.9789	0.9787	0.9785	56.00		
56.25	-	-	0.9798	0.9796	0.9794	0.9793	0.9791	0.9789	0.9788	0.9788	0.9786	0.9784	56.25		
56.50	-	-	0.9796	0.9795	0.9793	0.9791	0.9790	0.9788	0.9786	0.9785	0.9783	0.9781	56.50		
56.75	-	-	0.9795	0.9793	0.9792	0.9790	0.9788	0.9787	0.9785	0.9783	0.9782	0.9780	56.75		
57.00	-	-	0.9794	0.9792	0.9790	0.9789	0.9787	0.9785	0.9784	0.9782	0.9781	0.9779	57.00		
57.25	-	-	0.9793	0.9791	0.9789	0.9787	0.9786	0.9784	0.9782	0.9781	0.9779	0.9777	57.25		
57.50	-	-	0.9791	0.9790	0.9788	0.9786	0.9784	0.9783	0.9781	0.9779	0.9778	0.9776	57.50		
57.75	-	-	0.9790	0.9788	0.9787	0.9785	0.9783	0.9781	0.9780	0.9778	0.9777	0.9775	57.75		
58.00	-	-	0.9789	0.9787	0.9785	0.9784	0.9782	0.9780	0.9778	0.9777	0.9775	0.9774	58.00		
58.25	-	-	0.9788	0.9786	0.9784	0.9782	0.9781	0.9779	0.9777	0.9775	0.9774	0.9772	58.25		
58.50	-	-	0.9786	0.9785	0.9783	0.9781	0.9779	0.9778	0.9776	0.9774	0.9772	0.9771	58.50		
58.75	-	-	0.9785	0.9783	0.9782	0.9780	0.9778	0.9776	0.9775	0.9773	0.9771	0.9769	58.75		
59.00	-	-	0.9784	0.9782	0.9780	0.9779	0.9777	0.9775	0.9773	0.9771	0.9769	0.9767	59.00		
59.25	-	-	0.9783	0.9781	0.9779	0.9777	0.9776	0.9774	0.9772	0.9771	0.9769	0.9767	59.25		
59.50	-	-	0.9781	0.9780	0.9778	0.9776	0.9774	0.9772	0.9771	0.9769	0.9767	0.9766	59.50		
59.75	-	-	0.9780	0.9778	0.9777	0.9775	0.9773	0.9771	0.9769	0.9768	0.9766	0.9765	59.75		
60.00	-	-	0.9779	0.9777	0.9775	0.9774	0.9772	0.9770	0.9768	0.9766	0.9764	0.9763	60.00		
60.25	-	-	0.9778	0.9776	0.9774	0.9772	0.9770	0.9769	0.9767	0.9765	0.9763	0.9762	60.25		
60.50	-	-	0.9777	0.9775	0.9773	0.9771	0.9769	0.9767	0.9765	0.9763	0.9761	0.9759	60.50		
60.75	-	-	0.9775	0.9773	0.9772	0.9770	0.9768	0.9766	0.9764	0.9762	0.9760	0.9758	60.75		
61.00	-	-	0.9774	0.9772	0.9770	0.9768	0.9767	0.9765	0.9763	0.9761	0.9759	0.9757	61.00		
61.25	-	-	0.9773	0.9771	0.9769	0.9767	0.9765	0.9763	0.9762	0.9760	0.9758	0.9756	61.25		
61.50	-	-	0.9772	0.9770	0.9768	0.9766	0.9764	0.9762	0.9760	0.9758	0.9756	0.9754	61.50		
61.75	-	-	0.9770	0.9768	0.9767	0.9765	0.9763	0.9761	0.9759	0.9757	0.9755	0.9753	61.75		
62.00	-	-	0.9769	0.9767	0.9765	0.9763	0.9762	0.9760	0.9758	0.9756	0.9754	0.9753	62.00		
62.25	-	-	0.9768	0.9766	0.9764	0.9762	0.9760	0.9758	0.9756	0.9754	0.9753	0.9751	62.25		
62.50	-	-	0.9767	0.9765	0.9763	0.9761	0.9759	0.9757	0.9755	0.9753	0.9751	0.9750	62.50		

ALPHA = 480.0 TO 520.0

11

Denotes Extrapolated Value

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	488.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C
				492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0			
62.50	-	-	0.9767	0.9765	0.9763	0.9761	0.9759	0.9757	0.9755	0.9753	0.9751	62.50		
62.75	-	-	0.9765	0.9763	0.9762	0.9760	0.9758	0.9756	0.9754	0.9752	0.9750	62.75		
63.00	-	-	0.9764	0.9762	0.9760	0.9758	0.9756	0.9754	0.9753	0.9751	0.9749	63.00		
63.25	-	-	0.9763	0.9761	0.9759	0.9757	0.9755	0.9753	0.9751	0.9749	0.9747	63.25		
63.50	-	-	0.9762	0.9760	0.9758	0.9756	0.9754	0.9752	0.9750	0.9748	0.9746	63.50		
63.75	-	-	0.9760	0.9759	0.9757	0.9755	0.9753	0.9751	0.9749	0.9747	0.9745	63.75		
64.00	-	-	0.9759	0.9757	0.9755	0.9753	0.9751	0.9749	0.9747	0.9745	0.9743	64.00		
64.25	-	-	0.9758	0.9756	0.9754	0.9752	0.9750	0.9748	0.9746	0.9744	0.9742	64.25		
64.50	-	-	0.9757	0.9755	0.9753	0.9751	0.9749	0.9747	0.9745	0.9743	0.9741	64.50		
64.75	-	-	0.9756	0.9754	0.9752	0.9749	0.9747	0.9745	0.9743	0.9741	0.9739	64.75		
65.00	-	-	0.9754	0.9752	0.9750	0.9748	0.9746	0.9744	0.9742	0.9740	0.9738	65.00		
65.25	-	-	0.9753	0.9751	0.9749	0.9747	0.9745	0.9743	0.9741	0.9739	0.9737	65.25		
65.50	-	-	0.9752	0.9750	0.9748	0.9746	0.9744	0.9742	0.9740	0.9738	0.9735	65.50		
65.75	-	-	0.9751	0.9749	0.9746	0.9744	0.9742	0.9740	0.9738	0.9736	0.9734	65.75		
66.00	-	-	0.9749	0.9747	0.9745	0.9743	0.9741	0.9739	0.9737	0.9735	0.9733	66.00		
66.25	-	-	0.9748	0.9746	0.9744	0.9742	0.9740	0.9738	0.9736	0.9734	0.9731	66.25		
66.50	-	-	0.9747	0.9745	0.9743	0.9741	0.9739	0.9736	0.9734	0.9732	0.9730	66.50		
66.75	-	-	0.9746	0.9744	0.9741	0.9739	0.9737	0.9735	0.9733	0.9731	0.9729	66.75		
67.00	-	-	0.9744	0.9742	0.9740	0.9738	0.9736	0.9734	0.9732	0.9730	0.9728	67.00		
67.25	-	-	0.9743	0.9741	0.9739	0.9737	0.9735	0.9733	0.9730	0.9728	0.9726	67.25		
67.50	-	-	0.9742	0.9740	0.9738	0.9736	0.9733	0.9731	0.9729	0.9727	0.9725	67.50		
67.75	-	-	0.9741	0.9739	0.9736	0.9734	0.9732	0.9730	0.9728	0.9726	0.9724	67.75		
68.00	-	-	0.9739	0.9737	0.9735	0.9733	0.9731	0.9729	0.9727	0.9724	0.9722	68.00		
68.25	-	-	0.9738	0.9736	0.9734	0.9732	0.9730	0.9727	0.9725	0.9723	0.9721	68.25		
68.50	-	-	0.9737	0.9735	0.9733	0.9730	0.9728	0.9726	0.9724	0.9722	0.9720	68.50		
68.75	-	-	0.9736	0.9734	0.9731	0.9729	0.9727	0.9725	0.9723	0.9720	0.9718	68.75		
69.00	-	-	0.9735	0.9732	0.9730	0.9728	0.9726	0.9724	0.9721	0.9719	0.9717	69.00		
69.25	-	-	0.9733	0.9731	0.9729	0.9727	0.9724	0.9722	0.9720	0.9718	0.9716	69.25		
69.50	-	-	0.9732	0.9730	0.9728	0.9725	0.9723	0.9721	0.9719	0.9717	0.9714	69.50		
69.75	-	-	0.9731	0.9729	0.9726	0.9724	0.9722	0.9720	0.9717	0.9715	0.9713	69.75		
70.00	-	-	0.9730	0.9727	0.9725	0.9723	0.9721	0.9718	0.9716	0.9714	0.9712	70.00		
ALPHA = 480.0 TO 520.0														
DENOTES EXTRAPOLATED VALUE														

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C
			488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0		
70.00	-	-	0.9730	0.9727	0.9725	0.9723	0.9721	0.9718	0.9716	0.9714	0.9712	70.00	
70.25	-	-	0.9728	0.9726	0.9724	0.9722	0.9719	0.9717	0.9715	0.9713	0.9710	70.25	
70.50	-	-	0.9727	0.9725	0.9723	0.9720	0.9718	0.9716	0.9714	0.9711	0.9709	70.50	
70.75	-	-	0.9726	0.9724	0.9721	0.9719	0.9717	0.9715	0.9712	0.9710	0.9708	70.75	
71.00	-	-	0.9725	0.9722	0.9720	0.9718	0.9716	0.9713	0.9711	0.9709	0.9706	71.00	
71.25	-	-	0.9723	0.9721	0.9719	0.9717	0.9714	0.9712	0.9710	0.9707	0.9705	71.25	
71.50	-	-	0.9722	0.9720	0.9718	0.9715	0.9713	0.9711	0.9708	0.9706	0.9704	71.50	
71.75	-	-	0.9721	0.9719	0.9716	0.9714	0.9712	0.9709	0.9707	0.9705	0.9702	71.75	
72.00	-	-	0.9720	0.9717	0.9715	0.9713	0.9710	0.9708	0.9706	0.9703	0.9701	72.00	
72.25	-	-	0.9718	0.9716	0.9714	0.9711	0.9709	0.9707	0.9704	0.9702	0.9700	72.25	
72.50	-	-	0.9717	0.9715	0.9713	0.9710	0.9708	0.9705	0.9703	0.9701	0.9698	72.50	
72.75	-	-	0.9716	0.9714	0.9711	0.9709	0.9707	0.9704	0.9702	0.9700	0.9697	72.75	
73.00	-	-	0.9715	0.9712	0.9710	0.9708	0.9705	0.9703	0.9701	0.9698	0.9696	73.00	
73.25	-	-	0.9713	0.9711	0.9709	0.9706	0.9704	0.9702	0.9699	0.9697	0.9695	73.25	
73.50	-	-	0.9712	0.9710	0.9707	0.9705	0.9703	0.9700	0.9698	0.9696	0.9693	73.50	
73.75	-	-	0.9711	0.9709	0.9706	0.9704	0.9701	0.9699	0.9697	0.9694	0.9692	73.75	
74.00	-	-	0.9710	0.9707	0.9705	0.9703	0.9700	0.9698	0.9695	0.9693	0.9691	74.00	
74.25	-	-	0.9709	0.9706	0.9704	0.9701	0.9699	0.9696	0.9694	0.9692	0.9689	74.25	
74.50	-	-	0.9707	0.9705	0.9702	0.9700	0.9698	0.9695	0.9693	0.9690	0.9688	74.50	
74.75	-	-	0.9706	0.9704	0.9701	0.9699	0.9696	0.9694	0.9691	0.9689	0.9687	74.75	
75.00	-	-	0.9705	0.9702	0.9700	0.9697	0.9695	0.9693	0.9690	0.9688	0.9685	75.00	
75.25	-	-	0.9704	0.9701	0.9699	0.9696	0.9694	0.9691	0.9689	0.9686	0.9684	75.25	
75.50	-	-	0.9702	0.9700	0.9697	0.9695	0.9692	0.9690	0.9688	0.9685	0.9683	75.50	
75.75	-	-	0.9701	0.9699	0.9696	0.9694	0.9691	0.9689	0.9686	0.9684	0.9681	75.75	
76.00	-	-	0.9700	0.9697	0.9695	0.9692	0.9690	0.9687	0.9685	0.9682	0.9680	76.00	
76.25	-	-	0.9699	0.9696	0.9694	0.9691	0.9689	0.9686	0.9684	0.9681	0.9679	76.25	
76.50	-	-	0.9697	0.9695	0.9692	0.9690	0.9687	0.9685	0.9682	0.9680	0.9677	76.50	
76.75	-	-	0.9696	0.9694	0.9691	0.9689	0.9686	0.9684	0.9681	0.9679	0.9676	76.75	
77.00	-	-	0.9695	0.9692	0.9690	0.9687	0.9685	0.9682	0.9680	0.9677	0.9675	77.00	
77.25	-	-	0.9694	0.9691	0.9689	0.9686	0.9684	0.9681	0.9678	0.9676	0.9673	77.25	
77.50	-	-	0.9692	0.9690	0.9687	0.9685	0.9682	0.9680	0.9677	0.9675	0.9672	77.50	

DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C. VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 °C

TEMP. °C	480.0	484.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 °C										TEMP. °C
			488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0		
77.50	-	-	0.9692	0.9690	0.9687	0.9685	0.9682	0.9680	0.9677	0.9675	0.9672	77.50	
77.75	-	-	0.9691	0.9689	0.9686	0.9683	0.9681	0.9678	0.9676	0.9673	0.9671	77.75	
78.00	-	-	0.9690	0.9687	0.9685	0.9682	0.9680	0.9677	0.9675	0.9672	0.9669	78.00	
78.25	-	-	0.9689	0.9686	0.9684	0.9681	0.9678	0.9676	0.9673	0.9671	0.9668	78.25	
78.50	-	-	0.9687	0.9685	0.9682	0.9680	0.9677	0.9675	0.9672	0.9669	0.9667	78.50	
78.75	-	-	0.9686	0.9684	0.9681	0.9678	0.9676	0.9673	0.9671	0.9668	0.9665	78.75	
79.00	-	-	0.9685	0.9682	0.9680	0.9677	0.9675	0.9672	0.9669	0.9667	0.9664	79.00	
79.25	-	-	0.9684	0.9681	0.9678	0.9676	0.9673	0.9671	0.9668	0.9665	0.9663	79.25	
79.50	-	-	0.9682	0.9680	0.9677	0.9675	0.9672	0.9669	0.9667	0.9664	0.9661	79.50	
79.75	-	-	0.9681	0.9679	0.9676	0.9673	0.9671	0.9668	0.9665	0.9663	0.9660	79.75	
80.00	-	-	0.9680	0.9677	0.9675	0.9672	0.9669	0.9667	0.9664	0.9661	0.9659	80.00	
80.25	-	-	0.9679	0.9676	0.9673	0.9671	0.9668	0.9665	0.9663	0.9660	0.9657	80.25	
80.50	-	-	0.9678	0.9675	0.9672	0.9670	0.9667	0.9664	0.9662	0.9659	0.9656	80.50	
80.75	-	-	0.9676	0.9674	0.9671	0.9668	0.9666	0.9663	0.9660	0.9658	0.9655	80.75	
81.00	-	-	0.9675	0.9672	0.9670	0.9667	0.9664	0.9662	0.9659	0.9656	0.9654	81.00	
81.25	-	-	0.9674	0.9671	0.9668	0.9666	0.9663	0.9660	0.9658	0.9655	0.9652	81.25	
81.50	-	-	0.9673	0.9670	0.9667	0.9664	0.9662	0.9659	0.9656	0.9654	0.9651	81.50	
81.75	-	-	0.9671	0.9669	0.9666	0.9663	0.9660	0.9658	0.9655	0.9652	0.9650	81.75	
82.00	-	-	0.9670	0.9667	0.9665	0.9662	0.9659	0.9656	0.9654	0.9651	0.9648	82.00	
82.25	-	-	0.9669	0.9666	0.9663	0.9661	0.9658	0.9655	0.9652	0.9650	0.9647	82.25	
82.50	-	-	0.9668	0.9665	0.9662	0.9659	0.9657	0.9654	0.9651	0.9648	0.9646	82.50	
82.75	-	-	0.9666	0.9664	0.9661	0.9658	0.9655	0.9653	0.9650	0.9647	0.9644	82.75	
83.00	-	-	0.9665	0.9662	0.9660	0.9657	0.9654	0.9651	0.9648	0.9646	0.9643	83.00	
83.25	-	-	0.9664	0.9661	0.9658	0.9656	0.9653	0.9650	0.9647	0.9644	0.9642	83.25	
83.50	-	-	0.9663	0.9660	0.9657	0.9654	0.9651	0.9649	0.9646	0.9643	0.9640	83.50	
83.75	-	-	0.9661	0.9659	0.9656	0.9653	0.9650	0.9647	0.9645	0.9642	0.9639	83.75	
84.00	-	-	0.9660	0.9657	0.9654	0.9652	0.9649	0.9646	0.9643	0.9640	0.9638	84.00	
84.25	-	-	0.9659	0.9656	0.9653	0.9650	0.9648	0.9645	0.9642	0.9639	0.9636	84.25	
84.50	-	-	0.9658	0.9655	0.9652	0.9649	0.9646	0.9643	0.9641	0.9638	0.9635	84.50	
84.75	-	-	0.9656	0.9654	0.9651	0.9648	0.9645	0.9642	0.9639	0.9636	0.9634	84.75	
85.00	-	-	0.9655	0.9652	0.9649	0.9647	0.9644	0.9641	0.9638	0.9635	0.9632	85.00	

ALPHA = 480.0 TO 520.0

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* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 °C

TEMP. C	480.0	484.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C
			488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0		
85.00	-	-	0.9655	0.9652	0.9649	0.9647	0.9644	0.9641	0.9638	0.9635	0.9632	85.00	
85.25	-	-	0.9654	0.9651	0.9648	0.9645	0.9642	0.9640	0.9637	0.9634	0.9631	85.25	
85.50	-	-	0.9653	0.9650	0.9647	0.9644	0.9641	0.9638	0.9635	0.9633	0.9630	85.50	
85.75	-	-	0.9651	0.9649	0.9646	0.9643	0.9640	0.9637	0.9634	0.9631	0.9628	85.75	
86.00	-	-	0.9650	0.9647	0.9644	0.9642	0.9639	0.9636	0.9633	0.9630	0.9627	86.00	
86.25	-	-	0.9649	0.9646	0.9643	0.9640	0.9637	0.9634	0.9632	0.9629	0.9626	86.25	
86.50	-	-	0.9648	0.9645	0.9642	0.9639	0.9636	0.9633	0.9630	0.9627	0.9624	86.50	
86.75	-	-	0.9646	0.9644	0.9641	0.9638	0.9635	0.9632	0.9629	0.9626	0.9623	86.75	
87.00	-	-	0.9645	0.9642	0.9639	0.9636	0.9633	0.9631	0.9628	0.9625	0.9622	87.00	
87.25	-	-	0.9644	0.9641	0.9638	0.9635	0.9632	0.9629	0.9626	0.9623	0.9620	87.25	
87.50	-	-	0.9643	0.9640	0.9637	0.9634	0.9631	0.9628	0.9625	0.9622	0.9619	87.50	
87.75	-	-	0.9641	0.9639	0.9636	0.9633	0.9630	0.9627	0.9624	0.9621	0.9618	87.75	
88.00	-	-	0.9640	0.9637	0.9634	0.9631	0.9628	0.9625	0.9622	0.9619	0.9616	88.00	
88.25	-	-	0.9639	0.9636	0.9633	0.9630	0.9627	0.9624	0.9621	0.9618	0.9615	88.25	
88.50	-	-	0.9638	0.9635	0.9632	0.9629	0.9626	0.9623	0.9620	0.9617	0.9614	88.50	
88.75	-	-	0.9637	0.9634	0.9630	0.9627	0.9624	0.9621	0.9618	0.9615	0.9612	88.75	
89.00	-	-	0.9635	0.9632	0.9629	0.9626	0.9623	0.9620	0.9617	0.9614	0.9611	89.00	
89.25	-	-	0.9634	0.9631	0.9628	0.9625	0.9622	0.9619	0.9616	0.9613	0.9610	89.25	
89.50	-	-	0.9633	0.9630	0.9627	0.9624	0.9621	0.9618	0.9615	0.9612	0.9608	89.50	
89.75	-	-	0.9632	0.9628	0.9625	0.9622	0.9619	0.9616	0.9613	0.9610	0.9607	89.75	
90.00	-	-	0.9630	0.9627	0.9624	0.9621	0.9618	0.9615	0.9612	0.9609	0.9606	90.00	
90.25	-	-	0.9629	0.9626	0.9623	0.9620	0.9617	0.9614	0.9611	0.9608	0.9604	90.25	
90.50	-	-	0.9628	0.9625	0.9622	0.9619	0.9615	0.9612	0.9609	0.9606	0.9603	90.50	
90.75	-	-	0.9627	0.9623	0.9620	0.9617	0.9614	0.9611	0.9608	0.9605	0.9602	90.75	
91.00	-	-	0.9625	0.9622	0.9619	0.9616	0.9613	0.9610	0.9607	0.9604	0.9601	91.00	
91.25	-	-	0.9624	0.9621	0.9618	0.9615	0.9612	0.9609	0.9605	0.9602	0.9599	91.25	
91.50	-	-	0.9623	0.9620	0.9617	0.9613	0.9610	0.9607	0.9604	0.9601	0.9598	91.50	
91.75	-	-	0.9622	0.9618	0.9615	0.9612	0.9609	0.9606	0.9603	0.9600	0.9597	91.75	
92.00	-	-	0.9620	0.9617	0.9614	0.9611	0.9608	0.9605	0.9601	0.9598	0.9595	92.00	
92.25	-	-	0.9619	0.9616	0.9613	0.9610	0.9606	0.9603	0.9600	0.9597	0.9594	92.25	
92.50	-	-	0.9618	0.9615	0.9612	0.9608	0.9605	0.9602	0.9599	0.9596	0.9593	92.50	

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C)					FACTOR FOR CORRECTING VOLUME TO 15 C					TEMP. C				
	488.0	484.0	480.0	476.0	472.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0	524.0	528.0	532.0
92.50	0.9618	0.9615	0.9612	0.9608	0.9605	0.9602	0.9599	0.9596	0.9593	0.9590	0.9587	0.9584	0.9581	0.9578	0.9575
92.75	0.9617	0.9613	0.9610	0.9607	0.9604	0.9601	0.9598	0.9594	0.9591	0.9588	0.9585	0.9582	0.9579	0.9576	0.9573
93.00	0.9615	0.9612	0.9609	0.9606	0.9603	0.9599	0.9596	0.9593	0.9590	0.9587	0.9584	0.9581	0.9578	0.9575	0.9572
93.25	0.9614	0.9611	0.9608	0.9605	0.9601	0.9598	0.9595	0.9592	0.9589	0.9586	0.9583	0.9580	0.9577	0.9574	0.9571
93.50	0.9613	0.9610	0.9606	0.9603	0.9600	0.9597	0.9594	0.9590	0.9587	0.9584	0.9581	0.9578	0.9575	0.9572	0.9569
93.75	0.9612	0.9608	0.9605	0.9602	0.9599	0.9596	0.9593	0.9590	0.9587	0.9584	0.9581	0.9578	0.9575	0.9572	0.9569
94.00	0.9610	0.9607	0.9604	0.9601	0.9597	0.9594	0.9591	0.9588	0.9585	0.9582	0.9579	0.9576	0.9573	0.9570	0.9567
94.25	0.9609	0.9606	0.9603	0.9599	0.9596	0.9593	0.9590	0.9586	0.9583	0.9580	0.9577	0.9574	0.9571	0.9568	0.9565
94.50	0.9608	0.9605	0.9601	0.9598	0.9595	0.9592	0.9589	0.9586	0.9583	0.9580	0.9577	0.9574	0.9571	0.9568	0.9565
94.75	0.9607	0.9603	0.9600	0.9597	0.9594	0.9590	0.9587	0.9584	0.9581	0.9578	0.9575	0.9572	0.9569	0.9566	0.9563
95.00	0.9605	0.9602	0.9599	0.9596	0.9592	0.9589	0.9586	0.9583	0.9580	0.9577	0.9574	0.9571	0.9568	0.9565	0.9562
95.25	0.9604	0.9601	0.9598	0.9594	0.9591	0.9588	0.9585	0.9582	0.9579	0.9576	0.9573	0.9570	0.9567	0.9564	0.9561
95.50	0.9603	0.9600	0.9596	0.9593	0.9590	0.9586	0.9583	0.9580	0.9577	0.9574	0.9571	0.9568	0.9565	0.9562	0.9559
95.75	0.9602	0.9598	0.9595	0.9592	0.9589	0.9586	0.9583	0.9580	0.9577	0.9574	0.9571	0.9568	0.9565	0.9562	0.9559
96.00	0.9600	0.9597	0.9594	0.9590	0.9587	0.9584	0.9581	0.9578	0.9575	0.9572	0.9569	0.9566	0.9563	0.9560	0.9557
96.25	0.9599	0.9596	0.9593	0.9589	0.9586	0.9583	0.9580	0.9577	0.9574	0.9571	0.9568	0.9565	0.9562	0.9559	0.9556
96.50	0.9598	0.9595	0.9591	0.9588	0.9585	0.9582	0.9579	0.9576	0.9573	0.9570	0.9567	0.9564	0.9561	0.9558	0.9555
96.75	0.9597	0.9593	0.9590	0.9587	0.9583	0.9580	0.9577	0.9574	0.9571	0.9568	0.9565	0.9562	0.9559	0.9556	0.9553
97.00	0.9595	0.9592	0.9589	0.9585	0.9582	0.9579	0.9576	0.9572	0.9569	0.9566	0.9563	0.9560	0.9557	0.9554	0.9551
97.25	0.9594	0.9591	0.9587	0.9584	0.9581	0.9577	0.9574	0.9571	0.9568	0.9565	0.9562	0.9559	0.9556	0.9553	0.9550
97.50	0.9593	0.9590	0.9586	0.9583	0.9579	0.9576	0.9573	0.9570	0.9567	0.9564	0.9561	0.9558	0.9555	0.9552	0.9549
97.75	0.9592	0.9588	0.9585	0.9582	0.9578	0.9575	0.9572	0.9569	0.9566	0.9563	0.9560	0.9557	0.9554	0.9551	0.9548
98.00	0.9590	0.9587	0.9584	0.9580	0.9577	0.9574	0.9571	0.9568	0.9565	0.9562	0.9559	0.9556	0.9553	0.9550	0.9547
98.25	0.9589	0.9586	0.9582	0.9579	0.9576	0.9572	0.9569	0.9566	0.9563	0.9560	0.9557	0.9554	0.9551	0.9548	0.9545
98.50	0.9588	0.9585	0.9581	0.9578	0.9574	0.9571	0.9568	0.9564	0.9561	0.9558	0.9555	0.9552	0.9549	0.9546	0.9543
98.75	0.9587	0.9583	0.9580	0.9576	0.9573	0.9570	0.9567	0.9563	0.9560	0.9557	0.9554	0.9551	0.9548	0.9545	0.9542
99.00	0.9585	0.9582	0.9579	0.9575	0.9572	0.9569	0.9566	0.9563	0.9560	0.9557	0.9554	0.9551	0.9548	0.9545	0.9542
99.25	0.9584	0.9581	0.9577	0.9574	0.9570	0.9567	0.9564	0.9561	0.9558	0.9555	0.9552	0.9549	0.9546	0.9543	0.9540
99.50	0.9583	0.9580	0.9576	0.9573	0.9569	0.9566	0.9563	0.9560	0.9557	0.9554	0.9551	0.9548	0.9545	0.9542	0.9539
99.75	0.9582	0.9578	0.9575	0.9571	0.9568	0.9564	0.9561	0.9558	0.9555	0.9552	0.9549	0.9546	0.9543	0.9540	0.9537
100.00	0.9580	0.9577	0.9574	0.9570	0.9567	0.9563	0.9560	0.9557	0.9554	0.9551	0.9548	0.9545	0.9542	0.9539	0.9536

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 °C

TEMP. C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C											TEMP. C
	480.0	484.0	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0	
100.00	-	-	0.9580	0.9577	0.9574	0.9570	0.9567	0.9563	0.9560	0.9556	0.9553	100.00
100.25	-	-	0.9579	0.9576	0.9572	0.9569	0.9565	0.9562	0.9558	0.9555	0.9551	100.25
100.50	-	-	0.9578	0.9575	0.9571	0.9568	0.9564	0.9561	0.9557	0.9554	0.9550	100.50
100.75	-	-	0.9577	0.9573	0.9570	0.9566	0.9563	0.9559	0.9556	0.9552	0.9549	100.75
101.00	-	-	0.9576	0.9572	0.9568	0.9565	0.9561	0.9558	0.9554	0.9551	0.9547	101.00
101.25	-	-	0.9574	0.9571	0.9567	0.9564	0.9560	0.9557	0.9553	0.9550	0.9546	101.25
101.50	-	-	0.9573	0.9569	0.9566	0.9562	0.9559	0.9555	0.9552	0.9548	0.9545	101.50
101.75	-	-	0.9572	0.9568	0.9565	0.9561	0.9558	0.9554	0.9550	0.9547	0.9543	101.75
102.00	-	-	0.9571	0.9567	0.9563	0.9560	0.9556	0.9553	0.9549	0.9546	0.9542	102.00
102.25	-	-	0.9569	0.9566	0.9562	0.9559	0.9555	0.9551	0.9548	0.9544	0.9541	102.25
102.50	-	-	0.9568	0.9564	0.9561	0.9557	0.9554	0.9550	0.9547	0.9543	0.9539	102.50
102.75	-	-	0.9567	0.9563	0.9560	0.9556	0.9552	0.9549	0.9545	0.9542	0.9538	102.75
103.00	-	-	0.9566	0.9562	0.9558	0.9555	0.9551	0.9548	0.9544	0.9540	0.9537	103.00
103.25	-	-	0.9564	0.9561	0.9557	0.9553	0.9550	0.9546	0.9543	0.9539	0.9535	103.25
103.50	-	-	0.9563	0.9559	0.9556	0.9552	0.9549	0.9545	0.9541	0.9538	0.9534	103.50
103.75	-	-	0.9562	0.9558	0.9555	0.9551	0.9547	0.9544	0.9540	0.9536	0.9533	103.75
104.00	-	-	0.9561	0.9557	0.9553	0.9550	0.9546	0.9542	0.9539	0.9535	0.9531	104.00
104.25	-	-	0.9559	0.9556	0.9552	0.9548	0.9545	0.9541	0.9537	0.9534	0.9530	104.25
104.50	-	-	0.9558	0.9554	0.9551	0.9547	0.9543	0.9540	0.9536	0.9532	0.9529	104.50
104.75	-	-	0.9557	0.9553	0.9549	0.9546	0.9542	0.9538	0.9535	0.9531	0.9527	104.75
105.00	-	-	0.9556	0.9552	0.9548	0.9545	0.9541	0.9537	0.9533	0.9530	0.9526	105.00
105.25	-	-	0.9554	0.9551	0.9547	0.9543	0.9540	0.9536	0.9532	0.9528	0.9525	105.25
105.50	-	-	0.9553	0.9549	0.9546	0.9542	0.9538	0.9535	0.9531	0.9527	0.9523	105.50
105.75	-	-	0.9552	0.9548	0.9544	0.9541	0.9537	0.9533	0.9530	0.9526	0.9522	105.75
106.00	-	-	0.9551	0.9547	0.9543	0.9539	0.9536	0.9532	0.9528	0.9524	0.9521	106.00
106.25	-	-	0.9549	0.9546	0.9542	0.9538	0.9534	0.9531	0.9527	0.9523	0.9519	106.25
106.50	-	-	0.9548	0.9544	0.9541	0.9537	0.9533	0.9529	0.9526	0.9522	0.9518	106.50
106.75	-	-	0.9547	0.9543	0.9539	0.9536	0.9532	0.9528	0.9524	0.9521	0.9517	106.75
107.00	-	-	0.9546	0.9542	0.9538	0.9534	0.9530	0.9527	0.9523	0.9519	0.9515	107.00
107.25	-	-	0.9544	0.9541	0.9537	0.9533	0.9529	0.9525	0.9522	0.9518	0.9514	107.25
107.50	-	-	0.9543	0.9539	0.9535	0.9532	0.9528	0.9524	0.9520	0.9517	0.9513	107.50

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										520.0	516.0	512.0	TEMP. C
			488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0					
107.50	-	-	0.9543	0.9539	0.9535	0.9532	0.9528	0.9524	0.9520	0.9517	0.9513	107.50				
107.75	-	-	0.9542	0.9538	0.9534	0.9530	0.9527	0.9523	0.9519	0.9515	0.9511	107.75				
108.00	-	-	0.9541	0.9537	0.9533	0.9529	0.9525	0.9522	0.9518	0.9514	0.9510	108.00				
108.25	-	-	0.9539	0.9536	0.9532	0.9528	0.9524	0.9520	0.9516	0.9513	0.9509	108.25				
108.50	-	-	0.9538	0.9534	0.9530	0.9527	0.9523	0.9519	0.9515	0.9511	0.9507	108.50				
108.75	-	-	0.9537	0.9533	0.9529	0.9525	0.9521	0.9518	0.9514	0.9510	0.9506	108.75				
109.00	-	-	0.9536	0.9532	0.9528	0.9524	0.9520	0.9516	0.9512	0.9509	0.9505	109.00				
109.25	-	-	0.9534	0.9530	0.9527	0.9523	0.9519	0.9515	0.9511	0.9507	0.9503	109.25				
109.50	-	-	0.9533	0.9529	0.9525	0.9521	0.9518	0.9514	0.9510	0.9506	0.9502	109.50				
109.75	-	-	0.9532	0.9528	0.9524	0.9520	0.9516	0.9512	0.9509	0.9505	0.9501	109.75				
110.00	-	-	0.9531	0.9527	0.9523	0.9519	0.9515	0.9511	0.9507	0.9503	0.9499	110.00				
110.25	-	-	0.9529	0.9525	0.9522	0.9518	0.9514	0.9510	0.9506	0.9502	0.9498	110.25				
110.50	-	-	0.9528	0.9524	0.9520	0.9516	0.9512	0.9509	0.9505	0.9501	0.9497	110.50				
110.75	-	-	0.9527	0.9523	0.9519	0.9515	0.9511	0.9507	0.9503	0.9499	0.9495	110.75				
111.00	-	-	0.9526	0.9522	0.9518	0.9514	0.9510	0.9506	0.9502	0.9498	0.9494	111.00				
111.25	-	-	0.9524	0.9520	0.9516	0.9513	0.9509	0.9505	0.9501	0.9497	0.9493	111.25				
111.50	-	-	0.9523	0.9519	0.9515	0.9511	0.9507	0.9503	0.9499	0.9495	0.9491	111.50				
111.75	-	-	0.9522	0.9518	0.9514	0.9510	0.9506	0.9502	0.9498	0.9494	0.9490	111.75				
112.00	-	-	0.9521	0.9517	0.9513	0.9509	0.9505	0.9501	0.9497	0.9493	0.9489	112.00				
112.25	-	-	0.9519	0.9515	0.9511	0.9507	0.9503	0.9499	0.9495	0.9491	0.9487	112.25				
112.50	-	-	0.9518	0.9514	0.9510	0.9506	0.9502	0.9498	0.9494	0.9490	0.9486	112.50				
112.75	-	-	0.9517	0.9513	0.9509	0.9505	0.9501	0.9497	0.9493	0.9489	0.9485	112.75				
113.00	-	-	0.9516	0.9512	0.9508	0.9504	0.9500	0.9496	0.9492	0.9488	0.9484	113.00				
113.25	-	-	0.9514	0.9510	0.9506	0.9502	0.9498	0.9494	0.9490	0.9486	0.9482	113.25				
113.50	-	-	0.9513	0.9509	0.9505	0.9501	0.9497	0.9493	0.9489	0.9485	0.9481	113.50				
113.75	-	-	0.9512	0.9508	0.9504	0.9500	0.9496	0.9492	0.9488	0.9484	0.9480	113.75				
114.00	-	-	0.9511	0.9507	0.9502	0.9498	0.9494	0.9490	0.9486	0.9482	0.9478	114.00				
114.25	-	-	0.9509	0.9505	0.9501	0.9497	0.9493	0.9489	0.9485	0.9481	0.9477	114.25				
114.50	-	-	0.9508	0.9504	0.9500	0.9496	0.9492	0.9488	0.9484	0.9480	0.9475	114.50				
114.75	-	-	0.9507	0.9503	0.9499	0.9495	0.9490	0.9486	0.9482	0.9478	0.9474	114.75				
115.00	-	-	0.9506	0.9501	0.9497	0.9493	0.9489	0.9485	0.9481	0.9477	0.9473	115.00				

18 DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C
			488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0		
115.00	-	-	0.9506	0.9501	0.9497	0.9493	0.9489	0.9485	0.9481	0.9477	0.9473	115.00	
115.25	-	-	0.9504	0.9500	0.9496	0.9492	0.9488	0.9484	0.9480	0.9476	0.9471	115.25	
115.50	-	-	0.9503	0.9499	0.9495	0.9491	0.9487	0.9482	0.9478	0.9474	0.9470	115.50	
115.75	-	-	0.9502	0.9498	0.9494	0.9489	0.9485	0.9481	0.9477	0.9473	0.9469	115.75	
116.00	-	-	0.9501	0.9496	0.9492	0.9488	0.9484	0.9480	0.9476	0.9472	0.9467	116.00	
116.25	-	-	0.9499	0.9495	0.9491	0.9487	0.9483	0.9479	0.9474	0.9470	0.9466	116.25	
116.50	-	-	0.9498	0.9494	0.9490	0.9486	0.9481	0.9477	0.9473	0.9469	0.9465	116.50	
116.75	-	-	0.9497	0.9493	0.9488	0.9484	0.9480	0.9476	0.9472	0.9468	0.9463	116.75	
117.00	-	-	0.9496	0.9491	0.9487	0.9483	0.9479	0.9475	0.9470	0.9466	0.9462	117.00	
117.25	-	-	0.9494	0.9490	0.9486	0.9482	0.9478	0.9473	0.9469	0.9465	0.9461	117.25	
117.50	-	-	0.9493	0.9489	0.9485	0.9480	0.9476	0.9472	0.9468	0.9464	0.9459	117.50	
117.75	-	-	0.9492	0.9488	0.9483	0.9479	0.9475	0.9471	0.9467	0.9462	0.9458	117.75	
118.00	-	-	0.9491	0.9486	0.9482	0.9478	0.9474	0.9469	0.9465	0.9461	0.9457	118.00	
118.25	-	-	0.9489	0.9485	0.9481	0.9477	0.9472	0.9468	0.9464	0.9460	0.9455	118.25	
118.50	-	-	0.9488	0.9484	0.9480	0.9475	0.9471	0.9467	0.9463	0.9458	0.9454	118.50	
118.75	-	-	0.9487	0.9483	0.9478	0.9474	0.9470	0.9466	0.9461	0.9457	0.9453	118.75	
119.00	-	-	0.9486	0.9481	0.9477	0.9473	0.9469	0.9464	0.9460	0.9456	0.9451	119.00	
119.25	-	-	0.9484	0.9480	0.9476	0.9471	0.9467	0.9463	0.9459	0.9454	0.9450	119.25	
119.50	-	-	0.9483	0.9479	0.9474	0.9470	0.9466	0.9462	0.9457	0.9453	0.9449	119.50	
119.75	-	-	0.9482	0.9478	0.9473	0.9469	0.9465	0.9460	0.9456	0.9452	0.9447	119.75	
120.00	-	-	0.9481	0.9476	0.9472	0.9468	0.9463	0.9459	0.9455	0.9450	0.9446	120.00	
120.25	-	-	0.9479*	0.9475*	0.9471*	0.9466*	0.9462*	0.9458*	0.9453*	0.9449*	0.9445*	120.25	
120.50	-	-	0.9478*	0.9474*	0.9469*	0.9465*	0.9461*	0.9456*	0.9452*	0.9448*	0.9443*	120.50	
120.75	-	-	0.9477*	0.9472*	0.9468*	0.9464*	0.9459*	0.9455*	0.9451*	0.9446*	0.9442*	120.75	
121.00	-	-	0.9476*	0.9471*	0.9467*	0.9463*	0.9458*	0.9454*	0.9449*	0.9445*	0.9441*	121.00	
121.25	-	-	0.9474*	0.9470*	0.9466*	0.9461*	0.9457*	0.9453*	0.9448*	0.9444*	0.9439*	121.25	
121.50	-	-	0.9473*	0.9469*	0.9464*	0.9460*	0.9456*	0.9451*	0.9447*	0.9442*	0.9438*	121.50	
121.75	-	-	0.9472*	0.9467*	0.9463*	0.9459*	0.9454*	0.9450*	0.9446*	0.9441*	0.9437*	121.75	
122.00	-	-	0.9471*	0.9466*	0.9462*	0.9457*	0.9453*	0.9449*	0.9444*	0.9440*	0.9435*	122.00	
122.25	-	-	0.9469*	0.9465*	0.9461*	0.9456*	0.9452*	0.9447*	0.9443*	0.9438*	0.9434*	122.25	
122.50	-	-	0.9468*	0.9464*	0.9459*	0.9455*	0.9450*	0.9446*	0.9442*	0.9437*	0.9433*	122.50	

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C. VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0	TEMP. C
COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C												
122.50	-	-	0.9468*	0.9464*	0.9459*	0.9455*	0.9450*	0.9446*	0.9442*	0.9437*	0.9433*	122.50
122.75	-	-	0.9467*	0.9462*	0.9458*	0.9454*	0.9449*	0.9445*	0.9440*	0.9436*	0.9431*	122.75
123.00	-	-	0.9466*	0.9461*	0.9457*	0.9452*	0.9448*	0.9443*	0.9439*	0.9434*	0.9430*	123.00
123.25	-	-	0.9464*	0.9460*	0.9455*	0.9451*	0.9447*	0.9442*	0.9438*	0.9433*	0.9429*	123.25
123.50	-	-	0.9463*	0.9459*	0.9454*	0.9450*	0.9445*	0.9441*	0.9436*	0.9432*	0.9427*	123.50
123.75	-	-	0.9462*	0.9457*	0.9453*	0.9448*	0.9444*	0.9439*	0.9435*	0.9431*	0.9426*	123.75
124.00	-	-	0.9461*	0.9456*	0.9452*	0.9447*	0.9443*	0.9438*	0.9434*	0.9429*	0.9425*	124.00
124.25	-	-	0.9459*	0.9455*	0.9450*	0.9446*	0.9441*	0.9437*	0.9432*	0.9428*	0.9423*	124.25
124.50	-	-	0.9458*	0.9454*	0.9449*	0.9445*	0.9440*	0.9436*	0.9431*	0.9427*	0.9422*	124.50
124.75	-	-	0.9457*	0.9452*	0.9448*	0.9443*	0.9439*	0.9434*	0.9430*	0.9425*	0.9421*	124.75
125.00	-	-	0.9456*	0.9451*	0.9446*	0.9442*	0.9437*	0.9433*	0.9428*	0.9424*	0.9419*	125.00
125.25	-	-	0.9454*	0.9450*	0.9445*	0.9441*	0.9436*	0.9432*	0.9427*	0.9423*	0.9418*	125.25
125.50	-	-	0.9453*	0.9448*	0.9444*	0.9439*	0.9435*	0.9430*	0.9426*	0.9421*	0.9417*	125.50
125.75	-	-	0.9452*	0.9447*	0.9443*	0.9438*	0.9434*	0.9429*	0.9424*	0.9420*	0.9415*	125.75
126.00	-	-	0.9451*	0.9446*	0.9441*	0.9437*	0.9432*	0.9428*	0.9423*	0.9419*	0.9414*	126.00
126.25	-	-	0.9449*	0.9445*	0.9440*	0.9436*	0.9431*	0.9426*	0.9422*	0.9417*	0.9413*	126.25
126.50	-	-	0.9448*	0.9443*	0.9439*	0.9434*	0.9430*	0.9425*	0.9421*	0.9416*	0.9411*	126.50
126.75	-	-	0.9447*	0.9442*	0.9438*	0.9433*	0.9428*	0.9424*	0.9419*	0.9415*	0.9410*	126.75
127.00	-	-	0.9446*	0.9441*	0.9436*	0.9432*	0.9427*	0.9422*	0.9418*	0.9413*	0.9409*	127.00
127.25	-	-	0.9444*	0.9440*	0.9435*	0.9430*	0.9426*	0.9421*	0.9417*	0.9412*	0.9407*	127.25
127.50	-	-	0.9443*	0.9438*	0.9434*	0.9429*	0.9425*	0.9420*	0.9415*	0.9411*	0.9406*	127.50
127.75	-	-	0.9442*	0.9437*	0.9432*	0.9428*	0.9423*	0.9419*	0.9414*	0.9409*	0.9405*	127.75
128.00	-	-	0.9440*	0.9436*	0.9431*	0.9427*	0.9422*	0.9417*	0.9413*	0.9408*	0.9403*	128.00
128.25	-	-	0.9439*	0.9435*	0.9430*	0.9425*	0.9421*	0.9416*	0.9411*	0.9407*	0.9402*	128.25
128.50	-	-	0.9438*	0.9433*	0.9429*	0.9424*	0.9419*	0.9415*	0.9410*	0.9405*	0.9401*	128.50
128.75	-	-	0.9437*	0.9432*	0.9427*	0.9423*	0.9418*	0.9413*	0.9409*	0.9404*	0.9399*	128.75
129.00	-	-	0.9435*	0.9431*	0.9426*	0.9421*	0.9417*	0.9412*	0.9407*	0.9403*	0.9398*	129.00
129.25	-	-	0.9434*	0.9430*	0.9425*	0.9420*	0.9415*	0.9411*	0.9406*	0.9401*	0.9397*	129.25
129.50	-	-	0.9433*	0.9428*	0.9424*	0.9419*	0.9414*	0.9409*	0.9405*	0.9400*	0.9395*	129.50
129.75	-	-	0.9432*	0.9427*	0.9422*	0.9418*	0.9413*	0.9408*	0.9403*	0.9399*	0.9394*	129.75
130.00	-	-	0.9430*	0.9426*	0.9421*	0.9416*	0.9412*	0.9407*	0.9402*	0.9397*	0.9393*	130.00

DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C	
	480.0	484.0	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0		520.0
-	-	-	0.9430*	0.9426*	0.9421*	0.9416*	0.9412*	0.9407*	0.9402*	0.9397*	0.9393*	130.00
-	-	-	0.9429*	0.9424*	0.9420*	0.9415*	0.9410*	0.9406*	0.9401*	0.9396*	0.9391*	130.25
-	-	-	0.9428*	0.9423*	0.9418*	0.9414*	0.9409*	0.9404*	0.9399*	0.9395*	0.9390*	130.50
-	-	-	0.9427*	0.9422*	0.9417*	0.9412*	0.9408*	0.9403*	0.9398*	0.9393*	0.9389*	130.75
-	-	-	0.9425*	0.9421*	0.9416*	0.9411*	0.9406*	0.9402*	0.9397*	0.9392*	0.9387*	131.00
-	-	-	0.9424*	0.9419*	0.9415*	0.9410*	0.9405*	0.9400*	0.9396*	0.9391*	0.9386*	131.25
-	-	-	0.9423*	0.9418*	0.9413*	0.9409*	0.9404*	0.9399*	0.9394*	0.9389*	0.9385*	131.50
-	-	-	0.9422*	0.9417*	0.9412*	0.9407*	0.9402*	0.9398*	0.9393*	0.9388*	0.9383*	131.75
-	-	-	0.9420*	0.9416*	0.9411*	0.9406*	0.9401*	0.9396*	0.9392*	0.9387*	0.9382*	132.00
-	-	-	0.9419*	0.9414*	0.9410*	0.9405*	0.9400*	0.9395*	0.9390*	0.9385*	0.9381*	132.25
-	-	-	0.9418*	0.9413*	0.9408*	0.9403*	0.9399*	0.9394*	0.9389*	0.9384*	0.9379*	132.50
-	-	-	0.9417*	0.9412*	0.9407*	0.9402*	0.9397*	0.9392*	0.9388*	0.9383*	0.9378*	132.75
-	-	-	0.9415*	0.9411*	0.9406*	0.9401*	0.9396*	0.9391*	0.9386*	0.9381*	0.9377*	133.00
-	-	-	0.9414*	0.9409*	0.9404*	0.9400*	0.9395*	0.9390*	0.9385*	0.9380*	0.9375*	133.25
-	-	-	0.9413*	0.9408*	0.9403*	0.9398*	0.9393*	0.9389*	0.9384*	0.9379*	0.9374*	133.50
-	-	-	0.9412*	0.9407*	0.9402*	0.9397*	0.9392*	0.9387*	0.9382*	0.9377*	0.9372*	133.75
-	-	-	0.9410*	0.9406*	0.9401*	0.9396*	0.9391*	0.9386*	0.9381*	0.9376*	0.9371*	134.00
-	-	-	0.9409*	0.9404*	0.9399*	0.9394*	0.9390*	0.9385*	0.9380*	0.9375*	0.9370*	134.25
-	-	-	0.9408*	0.9403*	0.9398*	0.9393*	0.9388*	0.9383*	0.9378*	0.9373*	0.9369*	134.50
-	-	-	0.9407*	0.9402*	0.9397*	0.9392*	0.9387*	0.9382*	0.9377*	0.9372*	0.9367*	134.75
-	-	-	0.9405*	0.9400*	0.9396*	0.9391*	0.9386*	0.9381*	0.9376*	0.9371*	0.9366*	135.00
-	-	-	0.9404*	0.9399*	0.9394*	0.9389*	0.9384*	0.9379*	0.9374*	0.9369*	0.9365*	135.25
-	-	-	0.9403*	0.9398*	0.9393*	0.9388*	0.9383*	0.9378*	0.9373*	0.9368*	0.9363*	135.50
-	-	-	0.9402*	0.9397*	0.9392*	0.9387*	0.9382*	0.9377*	0.9372*	0.9367*	0.9362*	135.75
-	-	-	0.9400*	0.9395*	0.9390*	0.9385*	0.9380*	0.9375*	0.9370*	0.9365*	0.9360*	136.00
-	-	-	0.9399*	0.9394*	0.9389*	0.9384*	0.9379*	0.9374*	0.9369*	0.9364*	0.9359*	136.25
-	-	-	0.9398*	0.9393*	0.9388*	0.9383*	0.9378*	0.9373*	0.9368*	0.9363*	0.9358*	136.50
-	-	-	0.9397*	0.9392*	0.9387*	0.9382*	0.9377*	0.9372*	0.9367*	0.9361*	0.9356*	136.75
-	-	-	0.9395*	0.9390*	0.9385*	0.9380*	0.9375*	0.9370*	0.9365*	0.9360*	0.9355*	137.00
-	-	-	0.9394*	0.9389*	0.9384*	0.9379*	0.9374*	0.9369*	0.9364*	0.9359*	0.9354*	137.25
-	-	-	0.9393*	0.9388*	0.9383*	0.9378*	0.9373*	0.9368*	0.9363*	0.9358*	0.9352*	137.50

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	480.0	484.0	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0	520.0	TEMP. C
	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C											
137.50	-	-	0.9393*	0.9388*	0.9383*	0.9378*	0.9373*	0.9368*	0.9363*	0.9358*	0.9352*	137.50
137.75	-	-	0.9392*	0.9387*	0.9381*	0.9376*	0.9371*	0.9366*	0.9361*	0.9356*	0.9351*	137.75
138.00	-	-	0.9390*	0.9385*	0.9380*	0.9375*	0.9370*	0.9365*	0.9360*	0.9355*	0.9350*	138.00
138.25	-	-	0.9389*	0.9384*	0.9379*	0.9374*	0.9369*	0.9364*	0.9359*	0.9354*	0.9349*	138.25
138.50	-	-	0.9388*	0.9383*	0.9378*	0.9373*	0.9368*	0.9363*	0.9358*	0.9353*	0.9348*	138.50
138.75	-	-	0.9387*	0.9382*	0.9377*	0.9372*	0.9367*	0.9362*	0.9357*	0.9352*	0.9347*	138.75
139.00	-	-	0.9385*	0.9380*	0.9375*	0.9370*	0.9365*	0.9360*	0.9355*	0.9350*	0.9345*	139.00
139.25	-	-	0.9384*	0.9379*	0.9374*	0.9369*	0.9364*	0.9359*	0.9354*	0.9349*	0.9344*	139.25
139.50	-	-	0.9383*	0.9378*	0.9373*	0.9368*	0.9363*	0.9358*	0.9353*	0.9348*	0.9343*	139.50
139.75	-	-	0.9382*	0.9377*	0.9372*	0.9367*	0.9362*	0.9357*	0.9352*	0.9347*	0.9342*	139.75
140.00	-	-	0.9380*	0.9375*	0.9370*	0.9365*	0.9360*	0.9355*	0.9350*	0.9345*	0.9340*	140.00
140.25	-	-	0.9379*	0.9374*	0.9369*	0.9364*	0.9359*	0.9354*	0.9349*	0.9344*	0.9339*	140.25
140.50	-	-	0.9378*	0.9373*	0.9368*	0.9363*	0.9358*	0.9353*	0.9348*	0.9343*	0.9338*	140.50
140.75	-	-	0.9376*	0.9371*	0.9366*	0.9361*	0.9356*	0.9351*	0.9346*	0.9341*	0.9336*	140.75
141.00	-	-	0.9375*	0.9370*	0.9365*	0.9360*	0.9355*	0.9350*	0.9345*	0.9340*	0.9335*	141.00
141.25	-	-	0.9374*	0.9369*	0.9364*	0.9359*	0.9354*	0.9349*	0.9344*	0.9339*	0.9334*	141.25
141.50	-	-	0.9373*	0.9368*	0.9363*	0.9358*	0.9353*	0.9348*	0.9343*	0.9338*	0.9333*	141.50
141.75	-	-	0.9371*	0.9366*	0.9361*	0.9356*	0.9351*	0.9346*	0.9341*	0.9336*	0.9331*	141.75
142.00	-	-	0.9370*	0.9365*	0.9360*	0.9355*	0.9350*	0.9345*	0.9340*	0.9335*	0.9330*	142.00
142.25	-	-	0.9369*	0.9364*	0.9359*	0.9354*	0.9349*	0.9344*	0.9339*	0.9334*	0.9329*	142.25
142.50	-	-	0.9368*	0.9363*	0.9358*	0.9353*	0.9348*	0.9343*	0.9338*	0.9333*	0.9328*	142.50
142.75	-	-	0.9366*	0.9361*	0.9356*	0.9351*	0.9346*	0.9341*	0.9336*	0.9331*	0.9326*	142.75
143.00	-	-	0.9365*	0.9360*	0.9355*	0.9350*	0.9345*	0.9340*	0.9335*	0.9330*	0.9325*	143.00
143.25	-	-	0.9364*	0.9359*	0.9354*	0.9349*	0.9344*	0.9339*	0.9334*	0.9329*	0.9324*	143.25
143.50	-	-	0.9363*	0.9358*	0.9353*	0.9348*	0.9343*	0.9338*	0.9333*	0.9328*	0.9323*	143.50
143.75	-	-	0.9361*	0.9356*	0.9351*	0.9346*	0.9341*	0.9336*	0.9331*	0.9326*	0.9321*	143.75
144.00	-	-	0.9360*	0.9355*	0.9350*	0.9345*	0.9340*	0.9335*	0.9330*	0.9325*	0.9320*	144.00
144.25	-	-	0.9359*	0.9354*	0.9349*	0.9344*	0.9339*	0.9334*	0.9329*	0.9324*	0.9319*	144.25
144.50	-	-	0.9358*	0.9353*	0.9348*	0.9343*	0.9338*	0.9333*	0.9328*	0.9323*	0.9318*	144.50
144.75	-	-	0.9356*	0.9351*	0.9346*	0.9341*	0.9336*	0.9331*	0.9326*	0.9321*	0.9316*	144.75
145.00	-	-	0.9355*	0.9350*	0.9345*	0.9340*	0.9335*	0.9330*	0.9325*	0.9320*	0.9315*	145.00

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C	
	480.0	484.0	488.0	492.0	496.0	500.0	504.0	508.0	512.0	516.0		520.0
-	-	-	0.9355*	0.9350*	0.9344*	0.9339*	0.9334*	0.9328*	0.9323*	0.9318*	0.9312*	145.00
-	-	-	0.9354*	0.9349*	0.9343*	0.9338*	0.9332*	0.9327*	0.9322*	0.9316*	0.9311*	145.25
-	-	-	0.9353*	0.9347*	0.9342*	0.9336*	0.9331*	0.9326*	0.9320*	0.9315*	0.9310*	145.50
-	-	-	0.9351*	0.9346*	0.9341*	0.9335*	0.9330*	0.9324*	0.9319*	0.9314*	0.9308*	145.75
-	-	-	0.9350*	0.9345*	0.9339*	0.9334*	0.9328*	0.9323*	0.9318*	0.9312*	0.9307*	146.00
-	-	-	0.9349*	0.9343*	0.9338*	0.9333*	0.9327*	0.9322*	0.9316*	0.9311*	0.9306*	146.25
-	-	-	0.9348*	0.9342*	0.9337*	0.9331*	0.9326*	0.9320*	0.9315*	0.9310*	0.9304*	146.50
-	-	-	0.9346*	0.9341*	0.9335*	0.9330*	0.9325*	0.9319*	0.9314*	0.9308*	0.9303*	146.75
-	-	-	0.9345*	0.9340*	0.9334*	0.9329*	0.9323*	0.9318*	0.9312*	0.9307*	0.9302*	147.00
-	-	-	0.9344*	0.9338*	0.9333*	0.9327*	0.9322*	0.9317*	0.9311*	0.9306*	0.9300*	147.25
-	-	-	0.9343*	0.9337*	0.9332*	0.9326*	0.9321*	0.9315*	0.9310*	0.9304*	0.9299*	147.50
-	-	-	0.9341*	0.9336*	0.9330*	0.9325*	0.9319*	0.9314*	0.9308*	0.9303*	0.9297*	147.75
-	-	-	0.9340*	0.9335*	0.9329*	0.9324*	0.9318*	0.9313*	0.9307*	0.9302*	0.9296*	148.00
-	-	-	0.9339*	0.9333*	0.9328*	0.9322*	0.9317*	0.9311*	0.9306*	0.9300*	0.9295*	148.25
-	-	-	0.9338*	0.9332*	0.9327*	0.9321*	0.9315*	0.9310*	0.9304*	0.9299*	0.9293*	148.50
-	-	-	0.9336*	0.9331*	0.9325*	0.9320*	0.9314*	0.9309*	0.9303*	0.9298*	0.9292*	148.75
-	-	-	0.9335*	0.9329*	0.9324*	0.9318*	0.9313*	0.9307*	0.9302*	0.9296*	0.9291*	149.00
-	-	-	0.9334*	0.9328*	0.9323*	0.9317*	0.9312*	0.9306*	0.9301*	0.9295*	0.9289*	149.25
-	-	-	0.9332*	0.9327*	0.9321*	0.9316*	0.9310*	0.9305*	0.9299*	0.9294*	0.9288*	149.50
-	-	-	0.9331*	0.9326*	0.9320*	0.9315*	0.9309*	0.9303*	0.9298*	0.9292*	0.9287*	149.75
-	-	-	0.9330*	0.9324*	0.9319*	0.9313*	0.9308*	0.9302*	0.9297*	0.9291*	0.9285*	150.00

* DENOTES EXTRAPOLATED VALUE

ALPHA = 480.0 TO 520.0

TABLE 54C, VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 C

TEMP. C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C
	520.0	524.0	528.0	532.0	536.0	540.0	544.0	548.0	552.0	556.0	
-20.00	-	-	-	-	-	-	-	-	-	-	-
-19.75	-	-	-	-	-	-	-	-	-	-	-
-19.50	-	-	-	-	-	-	-	-	-	-	-
-19.25	-	-	-	-	-	-	-	-	-	-	-
-19.00	-	-	-	-	-	-	-	-	-	-	-
-18.75	-	-	-	-	-	-	-	-	-	-	-
-18.50	-	-	-	-	-	-	-	-	-	-	-
-18.25	-	-	-	-	-	-	-	-	-	-	-
-18.00	1.0171	1.0172	1.0173	1.0175	1.0176	1.0177	1.0179	1.0180	1.0181	1.0182	1.0184
-17.75	1.0169	1.0171	1.0172	1.0173	1.0175	1.0176	1.0177	1.0178	1.0180	1.0181	1.0182
-17.50	1.0168	1.0169	1.0171	1.0172	1.0173	1.0175	1.0176	1.0177	1.0178	1.0180	1.0181
-17.25	1.0167	1.0168	1.0169	1.0171	1.0172	1.0173	1.0174	1.0176	1.0177	1.0178	1.0180
-17.00	1.0166	1.0167	1.0168	1.0169	1.0171	1.0172	1.0173	1.0174	1.0176	1.0177	1.0178
-16.75	1.0164	1.0166	1.0167	1.0168	1.0169	1.0171	1.0172	1.0173	1.0174	1.0176	1.0177
-16.50	1.0163	1.0164	1.0165	1.0167	1.0168	1.0169	1.0170	1.0172	1.0173	1.0174	1.0175
-16.25	1.0162	1.0163	1.0164	1.0165	1.0167	1.0168	1.0169	1.0170	1.0172	1.0173	1.0175
-16.00	1.0160	1.0162	1.0163	1.0164	1.0165	1.0167	1.0168	1.0169	1.0170	1.0172	1.0174
-15.75	1.0159	1.0160	1.0162	1.0163	1.0164	1.0165	1.0166	1.0168	1.0169	1.0170	1.0173
-15.50	1.0158	1.0159	1.0160	1.0161	1.0163	1.0164	1.0165	1.0166	1.0167	1.0169	1.0170
-15.25	1.0157	1.0158	1.0159	1.0160	1.0161	1.0163	1.0164	1.0165	1.0166	1.0167	1.0169
-15.00	1.0155	1.0156	1.0158	1.0159	1.0160	1.0161	1.0162	1.0164	1.0165	1.0166	1.0169
-14.75	1.0154	1.0155	1.0156	1.0157	1.0159	1.0160	1.0161	1.0162	1.0163	1.0165	1.0167
-14.50	1.0153	1.0154	1.0155	1.0156	1.0157	1.0159	1.0160	1.0161	1.0162	1.0163	1.0166
-14.25	1.0151	1.0153	1.0154	1.0155	1.0156	1.0157	1.0158	1.0159	1.0161	1.0162	1.0164
-14.00	1.0150	1.0151	1.0152	1.0154	1.0155	1.0156	1.0157	1.0158	1.0161	1.0162	1.0163
-13.75	1.0149	1.0150	1.0151	1.0152	1.0153	1.0155	1.0156	1.0157	1.0159	1.0160	1.0162
-13.50	1.0148	1.0149	1.0150	1.0151	1.0152	1.0153	1.0154	1.0155	1.0158	1.0159	1.0160
-13.25	1.0146	1.0147	1.0148	1.0150	1.0151	1.0152	1.0153	1.0154	1.0157	1.0158	1.0159
-13.00	1.0145	1.0146	1.0147	1.0148	1.0149	1.0150	1.0152	1.0153	1.0154	1.0155	1.0157
-12.75	1.0144	1.0145	1.0146	1.0147	1.0148	1.0149	1.0150	1.0151	1.0152	1.0154	1.0155
-12.50	1.0142	1.0143	1.0145	1.0146	1.0147	1.0148	1.0149	1.0150	1.0151	1.0152	1.0153
-12.25	1.0140	1.0141	1.0143	1.0144	1.0145	1.0146	1.0147	1.0148	1.0149	1.0150	1.0151
-12.00	1.0138	1.0139	1.0141	1.0142	1.0143	1.0144	1.0145	1.0146	1.0147	1.0148	1.0149
-11.75	1.0136	1.0137	1.0139	1.0140	1.0141	1.0142	1.0143	1.0144	1.0145	1.0146	1.0147
-11.50	1.0134	1.0135	1.0137	1.0138	1.0139	1.0140	1.0141	1.0142	1.0143	1.0144	1.0145
-11.25	1.0132	1.0133	1.0135	1.0136	1.0137	1.0138	1.0139	1.0140	1.0141	1.0142	1.0143
-11.00	1.0130	1.0131	1.0133	1.0134	1.0135	1.0136	1.0137	1.0138	1.0139	1.0140	1.0141
-10.75	1.0128	1.0129	1.0131	1.0132	1.0133	1.0134	1.0135	1.0136	1.0137	1.0138	1.0139
-10.50	1.0126	1.0127	1.0129	1.0130	1.0131	1.0132	1.0133	1.0134	1.0135	1.0136	1.0137
-10.25	1.0124	1.0125	1.0127	1.0128	1.0129	1.0130	1.0131	1.0132	1.0133	1.0134	1.0135
-10.00	1.0122	1.0123	1.0125	1.0126	1.0127	1.0128	1.0129	1.0130	1.0131	1.0132	1.0133
-9.75	1.0120	1.0121	1.0123	1.0124	1.0125	1.0126	1.0127	1.0128	1.0129	1.0130	1.0131
-9.50	1.0118	1.0119	1.0121	1.0122	1.0123	1.0124	1.0125	1.0126	1.0127	1.0128	1.0129
-9.25	1.0116	1.0117	1.0119	1.0120	1.0121	1.0122	1.0123	1.0124	1.0125	1.0126	1.0127
-9.00	1.0114	1.0115	1.0117	1.0118	1.0119	1.0120	1.0121	1.0122	1.0123	1.0124	1.0125
-8.75	1.0112	1.0113	1.0115	1.0116	1.0117	1.0118	1.0119	1.0120	1.0121	1.0122	1.0123
-8.50	1.0110	1.0111	1.0113	1.0114	1.0115	1.0116	1.0117	1.0118	1.0119	1.0120	1.0121
-8.25	1.0108	1.0109	1.0111	1.0112	1.0113	1.0114	1.0115	1.0116	1.0117	1.0118	1.0119
-8.00	1.0106	1.0107	1.0109	1.0110	1.0111	1.0112	1.0113	1.0114	1.0115	1.0116	1.0117
-7.75	1.0104	1.0105	1.0107	1.0108	1.0109	1.0110	1.0111	1.0112	1.0113	1.0114	1.0115
-7.50	1.0102	1.0103	1.0105	1.0106	1.0107	1.0108	1.0109	1.0110	1.0111	1.0112	1.0113
-7.25	1.0100	1.0101	1.0103	1.0104	1.0105	1.0106	1.0107	1.0108	1.0109	1.0110	1.0111
-7.00	1.0098	1.0099	1.0101	1.0102	1.0103	1.0104	1.0105	1.0106	1.0107	1.0108	1.0109
-6.75	1.0096	1.0097	1.0099	1.0100	1.0101	1.0102	1.0103	1.0104	1.0105	1.0106	1.0107
-6.50	1.0094	1.0095	1.0097	1.0098	1.0099	1.0100	1.0101	1.0102	1.0103	1.0104	1.0105
-6.25	1.0092	1.0093	1.0095	1.0096	1.0097	1.0098	1.0099	1.0100	1.0101	1.0102	1.0103
-6.00	1.0090	1.0091	1.0093	1.0094	1.0095	1.0096	1.0097	1.0098	1.0099	1.0100	1.0101
-5.75	1.0088	1.0089	1.0091	1.0092	1.0093	1.0094	1.0095	1.0096	1.0097	1.0098	1.0099
-5.50	1.0086	1.0087	1.0089	1.0090	1.0091	1.0092	1.0093	1.0094	1.0095	1.0096	1.0097
-5.25	1.0084	1.0085	1.0087	1.0088	1.0089	1.0090	1.0091	1.0092	1.0093	1.0094	1.0095
-5.00	1.0082	1.0083	1.0085	1.0086	1.0087	1.0088	1.0089	1.0090	1.0091	1.0092	1.0093
-4.75	1.0080	1.0081	1.0083	1.0084	1.0085	1.0086	1.0087	1.0088	1.0089	1.0090	1.0091
-4.50	1.0078	1.0079	1.0081	1.0082	1.0083	1.0084	1.0085	1.0086	1.0087	1.0088	1.0089
-4.25	1.0076	1.0077	1.0079	1.0080	1.0081	1.0082	1.0083	1.0084	1.0085	1.0086	1.0087
-4.00	1.0074	1.0075	1.0077	1.0078	1.0079	1.0080	1.0081	1.0082	1.0083	1.0084	1.0085
-3.75	1.0072	1.0073	1.0075	1.0076	1.0077	1.0078	1.0079	1.0080	1.0081	1.0082	1.0083
-3.50	1.0070	1.0071	1.0073	1.0074	1.0075	1.0076	1.0077	1.0078	1.0079	1.0080	1.0081
-3.25	1.0068	1.0069	1.0071	1.0072	1.0073	1.0074	1.0075	1.0076	1.0077	1.0078	1.0079
-3.00	1.0066	1.0067	1.0069	1.0070	1.0071	1.0072	1.0073	1.0074	1.0075	1.0076	1.0077
-2.75	1.0064	1.0065	1.0067	1.0068	1.0069	1.0070	1.0071	1.0072	1.0073	1.0074	1.0075
-2.50	1.0062	1.0063	1.0065	1.0066	1.0067	1.0068	1.0069	1.0070	1.0071	1.0072	1.0073
-2.25	1.0060	1.0061	1.0063	1.0064	1.0065	1.0066	1.0067	1.0068	1.0069	1.0070	1.0071
-2.00	1.0058	1.0059	1.0061	1.0062	1.0063	1.0064	1.0065	1.0066	1.0067	1.0068	1.0069
-1.75	1.0056	1.0057	1.0059	1.0060	1.0061	1.0062	1.0063	1.0064	1.0065	1.0066	1.0067
-1.50	1.0054	1.0055	1.0057	1.0058	1.0059	1.0060	1.0061	1.0062	1.0063	1.0064	1.0065
-1.25	1.0052	1.0053	1.0055	1.0056	1.0057	1.0058	1.0059	1.0060	1.0061	1.0062	1.0063
-1.00	1.0050	1.0051	1.0053	1.0054	1.0055	1.0056	1.0057	1.0058	1.0059	1.0060	1.0061
-0.75	1.0048	1.0049	1.0051	1.0052	1.0053	1.0054	1.0055	1.0056	1.0057	1.0058	1.0059
-0.50	1.0046	1.0047	1.0049	1.0050	1.0051	1.0052	1.0053	1.0054	1.0055	1.0056	1.0057
-0.25	1.0044	1.0045	1.0047	1.0048	1.0049	1.0050	1.0051	1.0052	1.0053	1.0054	1.0055
0.00	1.0042	1.0043	1.0045	1.0046	1.0047	1.0048	1.0049	1.0050	1.0051	1.0052	1.0053
0.25	1.0040	1.0041	1.0043	1.0044	1.0045	1.0046	1.0047	1.0048	1.0049	1.0050	1.0051
0.50	1.0038	1.0039	1.0041	1.0042	1.0043	1.0044	1.0045	1.0046	1.0047	1.0048	1.0049
0.75	1.0036	1.0037	1.0039	1.0040	1.0041	1.0042	1.0043	1.0044	1.0045	1.0046	1.0047
1.00	1.0034	1.0035	1.0037	1.0038	1.0039	1.0040	1.0041	1.0042	1.0043	1.0044	1.0045
1.25	1.0032	1.0033	1.0035	1.0036	1.0037	1.0038	1.0039	1.0040	1.0041	1.0042	1.0043
1.50	1.0030	1.0031	1.0033	1.0034	1.0035	1.0036	1.0037	1.0038	1.0039	1.0040	1.0041
1.75	1.0028	1.0029	1.0031	1.0032	1.0033	1.0034	1.0035	1.0036	1.0037	1.0038	1.0039
2.00	1.0026	1.0027	1.0029	1.0030	1.0031	1.0032	1.0033	1.0034	1.0035	1.0036	1.0037
2.25	1.0024	1.0025	1.0027	1.0028	1.0029	1.0030	1.0031	1.0032	1.0033	1.0034	1.0035
2.50	1.0022	1.0023	1.0025	1.0026	1.0027	1.0028	1.0029	1.0030	1.0031	1.0032	1.0033
2.75	1.0020	1.0021	1.0023	1.0024	1.0025	1.0026	1.0027	1.0028	1.0029	1.0030	1.0031
3.00	1.0018	1.0019	1.0021	1.0022	1.0023	1.0024	1.0025	1.0026	1.0027	1.0028	1.0029
3.25	1.0016	1.0017	1.0019	1.0020	1.0021	1.0022	1.0023	1.0024	1.0025	1.0026	1.0027
3.50	1.0014	1.0015	1.0017	1.0018	1.0019	1.0020					

* DENOTES EXTRAPOLATED VALUE

ALPHA = 520.0 TO 560.0

TABLE 54C. VCF FOR INDIVIDUAL AND SPECIAL APPLICATIONS
VOLUME CORRECTION TO 15 °C

TEMP. C	COEFFICIENT OF THERMAL EXPANSION * 1000000. (1/DEG C) FACTOR FOR CORRECTING VOLUME TO 15 C										TEMP. C	
	520.0	524.0	528.0	532.0	536.0	540.0	544.0	548.0	552.0	556.0		560.0
-12.50	1.0142	1.0143	1.0145	1.0146	1.0147	1.0148	1.0149	1.0150	1.0151	1.0152	1.0153	-12.50
-12.25	1.0141	1.0142	1.0143	1.0144	1.0145	1.0146	1.0148	1.0149	1.0150	1.0151	1.0152	-12.25
-12.00	1.0140	1.0141	1.0142	1.0143	1.0144	1.0145	1.0146	1.0147	1.0148	1.0149	1.0150	-12.00
-11.75	1.0139	1.0140	1.0141	1.0142	1.0143	1.0144	1.0145	1.0146	1.0147	1.0148	1.0149	-11.75
-11.50	1.0137	1.0138	1.0139	1.0140	1.0141	1.0142	1.0144	1.0145	1.0146	1.0147	1.0148	-11.50
-11.25	1.0136	1.0137	1.0138	1.0139	1.0140	1.0141	1.0142	1.0143	1.0144	1.0145	1.0146	-11.25
-11.00	1.0135	1.0136	1.0137	1.0138	1.0139	1.0140	1.0141	1.0142	1.0143	1.0144	1.0145	-11.00
-10.75	1.0133	1.0134	1.0135	1.0136	1.0137	1.0138	1.0139	1.0140	1.0142	1.0143	1.0144	-10.75
-10.50	1.0132	1.0133	1.0134	1.0135	1.0136	1.0137	1.0138	1.0139	1.0140	1.0141	1.0142	-10.50
-10.25	1.0131	1.0132	1.0133	1.0134	1.0135	1.0136	1.0137	1.0138	1.0139	1.0140	1.0141	-10.25
-10.00	1.0129	1.0130	1.0131	1.0132	1.0133	1.0134	1.0135	1.0136	1.0137	1.0138	1.0139	-10.00
-9.75	1.0128	1.0129	1.0130	1.0131	1.0132	1.0133	1.0134	1.0135	1.0136	1.0137	1.0138	-9.75
-9.50	1.0127	1.0128	1.0129	1.0130	1.0131	1.0132	1.0133	1.0134	1.0135	1.0136	1.0137	-9.50
-9.25	1.0126	1.0127	1.0128	1.0128	1.0129	1.0130	1.0131	1.0132	1.0133	1.0134	1.0135	-9.25
-9.00	1.0124	1.0125	1.0126	1.0127	1.0128	1.0129	1.0130	1.0131	1.0132	1.0133	1.0134	-9.00
-8.75	1.0123	1.0124	1.0125	1.0126	1.0127	1.0128	1.0129	1.0130	1.0131	1.0132	1.0132	-8.75
-8.50	1.0122	1.0123	1.0124	1.0125	1.0125	1.0126	1.0127	1.0128	1.0129	1.0130	1.0131	-8.50
-8.25	1.0120	1.0121	1.0122	1.0123	1.0124	1.0125	1.0126	1.0127	1.0128	1.0129	1.0130	-8.25
-8.00	1.0119	1.0120	1.0121	1.0122	1.0123	1.0124	1.0125	1.0126	1.0126	1.0127	1.0128	-8.00
-7.75	1.0118	1.0119	1.0120	1.0121	1.0121	1.0122	1.0123	1.0124	1.0125	1.0126	1.0127	-7.75
-7.50	1.0117	1.0117	1.0118	1.0119	1.0120	1.0121	1.0122	1.0123	1.0124	1.0125	1.0126	-7.50
-7.25	1.0115	1.0116	1.0117	1.0118	1.0119	1.0120	1.0121	1.0121	1.0122	1.0123	1.0124	-7.25
-7.00	1.0114	1.0115	1.0116	1.0117	1.0117	1.0118	1.0119	1.0120	1.0121	1.0122	1.0123	-7.00
-6.75	1.0113	1.0114	1.0114	1.0115	1.0116	1.0117	1.0118	1.0119	1.0120	1.0120	1.0121	-6.75
-6.50	1.0111	1.0112	1.0113	1.0114	1.0115	1.0116	1.0117	1.0117	1.0118	1.0119	1.0120	-6.50
-6.25	1.0110	1.0111	1.0112	1.0113	1.0114	1.0114	1.0115	1.0116	1.0117	1.0118	1.0119	-6.25
-6.00	1.0109	1.0110	1.0111	1.0111	1.0112	1.0113	1.0114	1.0115	1.0116	1.0116	1.0117	-6.00
-5.75	1.0108	1.0108	1.0109	1.0110	1.0111	1.0112	1.0112	1.0113	1.0114	1.0115	1.0116	-5.75
-5.50	1.0106	1.0107	1.0108	1.0109	1.0110	1.0110	1.0111	1.0112	1.0113	1.0114	1.0114	-5.50
-5.25	1.0105	1.0106	1.0107	1.0107	1.0108	1.0109	1.0110	1.0111	1.0111	1.0112	1.0113	-5.25
-5.00	1.0104	1.0104	1.0105	1.0106	1.0107	1.0108	1.0108	1.0109	1.0110	1.0111	1.0112	-5.00

* DENOTES EXTRAPOLATED VALUE

ALPHA = 520.0 TO 560.0