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Standard Guide for the Use of the Joint API and ASTM Adjunct for Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils: API MPMS Chapter 11.1¹

This standard is issued under the fixed designation D1250; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

INTRODUCTION

This guide, ASTM D1250, provides information related to the algorithm and implementation procedure for the correction of temperature and pressure effects on density and volume of liquid hydrocarbons as outlined in API *MPMS* Chapter 11.1, Physical Properties Data—Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils. The algorithms and implementation procedure are published in an adjunct (supplementary) product called the Adjunct for Volume Correction Factors (VCF).

ASTM D1250 is not the API standard and all instructions, procedures, and examples for calculating volume correction factors for generalized crude oils, refined products, and lubrication oils are found in the standard, API *MPMS* Chapter 11.1-2004, Addendum 1-2007, and Addendum 2-2019.

The volume correction factors, in their basic form, are the output of a set of equations derived from, and based on, empirical data relating to the volumetric change of hydrocarbons over a range of temperatures and pressures. Prior to 2004, the factors were listed in tabular format called ASTM D1250, Petroleum Measurement Tables and published as an API Standard Chapter 11.1/Adjunct to IP 200/Adjunct to ASTM D1250. However, the current standard, API *MPMS* Chapter 11.1-2004, Addendum 1-2007, and Addendum 2-2019 replaced the previous printed tables.

This current Adjunct for VCF establishes a set of implementation procedures for crude oils, liquid refined products, and lubricating oils, by which volume measurements taken at any temperature and pressure (within the range of the standard) can be corrected to an equivalent volume at base/standard conditions, normally 15 °C, 60 °F, or 20 °C, by use of a volume correction factor (VCF). The Adjunct for VCF also provides methods for making conversions to alternate conditions from base condition and to alternate base temperatures. Densities can be corrected by using the inverse of the VCF.

USAGE GUIDELINES

The current Adjunct for VCF is effective upon the date of publication and supersedes the previous edition of the standard/adjunct(s). Once the current year version of the standard(s) and adjunct are implemented in a particular application, the previous versions should no longer be used in that application. However, the use of the standard(s) and adjunct remains voluntary, and the decision on when to utilize a standard is an issue that is subject to the negotiations between the parties involved in the transaction.

2019 UPDATE

Some minor modifications to the API *MPMS* Chapter 11.1-2004/Adjunct to IP 200/04/Adjunct to ASTM D1250–04 (ADJD1250-E-PDF) Addendum 1-2007 have been issued as Addendum 2-2019. These modifications to the adjunct necessitated a realignment with ASTM Standard Guide D1250, hence a –19 version has been approved and published.

¹ This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and the API Committee on Petroleum Measurement, and is the direct responsibility of Subcommittee D02.02 /COMQ the joint ASTM-API Committee on Hydrocarbon Measurement for Custody Transfer (Joint ASTM-API). This guide has been approved by the sponsoring committees and was accepted by the Cooperating Societies in accordance with established procedures.

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1. Scope

1.1 This guide provides information related to the algorithm and implementation procedure but does not contain the full set of algorithms. The algorithms, instructions, procedures, and examples are located in the associated supplementary adjuncts. The Adjunct for Volume Correction Factors (VCF) for temperature and pressure volume correction factors for generalized crude oils, refined products, and lubricating oils provides the algorithm and implementation procedure for the correction of temperature and pressure effects on density and volume of liquid hydrocarbons. Natural gas liquids (NGLs) and liquefied petroleum gases (LPGs) are excluded from consideration in this standard but may be found in API *MPMS* Chapter 11.2.4/GPA 8217 Temperature Correction for NGL and LPG. As this Adjunct for VCF will be applied to a variety of applications, the output parameters of CTL, F_p , CPL, and CTPL may be used as specified in other standards.

1.2 Including the pressure correction in the Adjunct for VCF represents an important change from the “temperature only” correction factors given in the 1980 Petroleum Measurement Tables. However, if the pressure is one atmosphere (the standard pressure), then there is no pressure correction and the standard/adjunct(s) will give CTL values consistent with the 1980 Petroleum Measurement Tables.

1.3 The Adjunct for VCF covers general procedures for the conversion of input data to generate CTL, F_p , CPL, and CTPL values at the user-specified base temperature and pressure (T_b , P_b). Two sets of procedures are included for computing volume correction factor: one set for data expressed in customary units (temperature in °F, pressure in psig); the other for the metric system of units (temperature in °C, pressure in kPa or bar).

NOTE 1—In contrast to the 1980 Petroleum Measurement Tables, the metric procedures require the procedure for customary units be used first to compute density at 60 °F. This value is then further corrected to give the metric output. The metric procedures now incorporate the base temperature of 20 °C in addition to 15 °C.

1.4 The procedures in the Adjunct for VCF recognize three distinct commodity groups: crude oil, refined products, and lubricating oils. A procedure is also provided for determining volume correction for special applications where the generalized commodity groups’ parameters may not adequately represent the thermal expansion properties of the liquid and a precise thermal expansion coefficient has been determined by experiment. Procedures for determining Volume Correction Factors (VCF) for Denatured Ethanol can be found in API

MPMS Chapter 11.3.3, Miscellaneous Hydrocarbon Properties—Denatured Ethanol Density and Volume Correction Factors, 3rd edition. Procedures for determining Volume Correction Factors (VCF) for Gasoline and Denatured Ethanol Blends can be found in API *MPMS* Chapter 11.3.4, Miscellaneous Hydrocarbon Properties—Denatured Ethanol and Gasoline Component Blend Densities and Volume Correction Factors, 1st edition.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 API Standards:²

- API Manual of Petroleum Measurement Standards(MPMS):
 - Chapter 9 Density Determination (all sections)
 - Chapter 11.1-2004 Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils (including Addendum 1-2007 and Addendum 2-2019)
 - Chapter 11.2.1 Compressibility Factors for Hydrocarbons: 0–90° API Gravity Range
 - Chapter 11.2.1M Compressibility Factors for Hydrocarbons: 638–1074 Kilograms per Cubic Meter Range
 - Chapter 11.2.4 Temperature Correction for NGL and LPG
 - Chapter 11.3.3 Miscellaneous Hydrocarbon Properties—Denatured Ethanol Density and Volume Correction Factors
 - Chapter 11.3.4 Miscellaneous Hydrocarbon Properties—Denatured Ethanol and Gasoline Component Blend Densities and Volume Correction Factors
 - Chapter 11.5 Density/Weight/Volume Intraconversion
 - Part 1—Conversions of API Gravity at 60 °F

² Available from American Petroleum Institute (API), 200 Massachusetts Ave. NW, Washington, DC 20001, <http://www.api.org>.