Manual of Petroleum Measurement Standards Chapter 11.3.3

Miscellaneous Hydrocarbon Product Properties—Denatured Ethanol Density and Volume Correction Factors

THIRD EDITION, MAY 2019

REAFFIRMED, OCTOBER 2024

American Petroleum Institute

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Contents

Page

1 Scope . . . 1
1.1 General . . . 1
1.2 Limits of Application . . . 1

2 Normative References . . . 1

3 Terms and Definitions . . . 1

4 Implementation Procedures . . . 3
4.1 Denatured 99+ % Fuel Ethanol . . . 3
4.2 Denatured 95 % to 99 % Fuel Ethanol . . . 5

5 Rounding . . . 6
5.1 Data Level . . . 6
5.2 Rounding of Numbers . . . 7

Annex A (informative) **Ethanol VCF Table Historical Information** . . . 8

Annex B (informative) **U.S. Regulation of Alcohol for Fuel Use** . . . 11

Annex C (Informative) **Denatured Ethanol Density Study** . . . 12

Annex D (informative) **Ethanol/Water Mixtures** . . . 16

Annex E (normative) **Ethanol Compressibility** . . . 17

Bibliography . . . 21

Figures
A.1 U.S. Customs and Border Protection Directive on 99+ % Ethanol VCF . . . 9
A.2 Data and the Applet Output Results . . . 10
C.1 Denatured Ethanol Feedstock Densities (0 psig) . . . 13
C.2 FS4 Data and the Applet Output Results . . . 14

Tables
1 Significant Digits for Bulk Quantities . . . 7
C.1 Denatured Ethanol Feedstock Densities . . . 13
C.2 Table 6C VCF values . . . 14
D.1 API Applet Regression of Portions of OIML Table II . . . 16

Introduction

Volume Correction Factors (VCFs) are used to correct observed liquid volumes at specific operating conditions to equivalent volumes at a standard temperature condition. The American Petroleum Institute provides procedures for calculating VCFs for Generalized Crude oils, Refined Products, Lubricating Oils, and Special Applications. These procedures are presented in API *MPMS* Ch. 11.1–2004/Adjunct to ASTM D1250-08/IP 200/08. The API has not previously addressed ethanol, considered a Special Application, in *MPMS* Ch. 11.1, so industry has used a variety of privately developed tables for both denatured 99+ % and denatured 95 % to 99 % fuel ethanol VCFs. (Denaturant requirements vary by country and if this standard is being used outside the United States, refer to the local jurisdiction for denaturant requirements.) The most commonly used table has been that of a large ethanol supplier, and it appears that U.S. Customs and Border Protection (CBP) and the Environmental Protection Agency (EPA) have adopted a variant of this table. The API, through a consortium of its member companies and in cooperation with the Renewable Fuels Association (RFA), commissioned an independent laboratory to take density measurements at various temperatures of pure (99.038 % by volume) ethanol and representative denatured fuel ethanols. The density data were obtained utilizing the best available commercial instrumentation and was then used to develop the VCFs provided in this standard.

Miscellaneous Hydrocarbon Product Properties—Denatured Ethanol Density and Volume Correction Factors

1 Scope

1.1 General

This standard covers density and volume correction factors for denatured fuel ethanol. The actual standard consists of the explicit implementation procedures set forth in this document. Sample tables and other examples created from a computerized version of this implementation procedure are presented as examples only and do not represent the standard.

1.2 Limits of Application

This standard is applicable at any operating temperature to bulk (e.g. tank trucks, tank cargos, barges) denatured 95 % to 99 % fuel ethanol containing D4806 allowed denaturants (natural gasoline, gasoline blend stocks, and unleaded gasoline) and denatured, 99+ % fuel ethanol containing less than 1 % denaturant. This standard does not apply to undenatured ethanol of any purity. Annex E extends the range of application to –40 to 60 °C (–40 to 140 °F) over the pressure range of 0 to 15 MPa (0 to 2200 psi).

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API *MPMS* Ch. 11.1–2004, *Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils* (includes Addendum dated September 2007).

API *MPMS* Ch. 12.1.1–2012, *Calculation of Static Petroleum Quantities—Upright Cylindrical Tanks and Marine Vessels*.

3 Terms and Definitions

For the purposes of this document, the following definitions apply.

3.1
absolute density
RHO
The mass of a substance per unit of volume at a specified temperature and pressure.

3.2
alpha α
A product-specific thermal coefficient of expansion used in the API *MPMS* Ch. 11.1 equations for VCFs (Annex A).

3.3
correction for the effect of pressure on liquid
CPL
Compensates for the effect of pressure on a liquid.

3.4
correction for the effect of temperature on liquid
CTL
Compensates for the effect of temperature on a liquid.