Designation: D7717 – 11 (Reapproved 2017)

Standard Practice for Preparing Volumetric Blends of Denatured Fuel Ethanol and Gasoline Blendstocks for Laboratory Analysis[1]

This standard is issued under the fixed designation D7717; 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.

1. Scope

1.1 This practice covers and provides instructions on making a volumetric blend of denatured fuel ethanol with gasoline blendstocks, such as a reformulated gasoline blendstock for oxygenate blending (RBOB) or a conventional gasoline blendstock for oxygenate blending (CBOB).

1.2 This practice does not preclude the use of automated volumetric blending systems.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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

1.5 *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 *ASTM Standards:*[2]

D4806 Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel

D4814 Specification for Automotive Spark-Ignition Engine Fuel

D4815 Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C_1 to C_4 Alcohols in Gasoline by Gas Chromatography

D5501 Test Method for Determination of Ethanol and Methanol Content in Fuels Containing Greater than 20% Ethanol by Gas Chromatography

D5599 Test Method for Determination of Oxygenates in Gasoline by Gas Chromatography and Oxygen Selective Flame Ionization Detection

2.2 *Federal Standard:*[3]

CFR 40.80 Title 40 —Protection of Environment, Chapter 1—Environmental Protection Agency (continued), Part 80—Regulation of Fuels and Fuel Additives, Subpart D—Reformulated Gasoline

3. Terminology

3.1 *Definitions:*

3.1.1 *denaturants, n*—materials added to ethanol to make it unsuitable for beverage use under a formula approved by a regulatory agency to prevent the imposition of beverage alcohol tax. **D4806**

3.1.2 *denatured fuel ethanol, n*—fuel ethanol made unfit for beverage use by the addition of denaturants under formula(s) approved by the applicable regulatory agency to prevent the imposition of beverage alcohol tax. **D4806**

3.1.3 *gasoline, n*—volatile mixture of liquid hydrocarbons, generally containing small amounts of additives, suitable for use as a fuel in spark-ignition, internal combustion engines. **D4814**

3.1.4 *gasoline-alcohol blend, n*—fuel consisting primarily of gasoline along with a substantial amount (more than 0.35 % by mass oxygen or more than 0.15 % by mass oxygen if methanol is the only oxygenate) of one or more alcohols. **D4814**

3.2 *Abbreviations:*

3.2.1 *CBOB*—conventional gasoline blendstock for oxygenate blending.

3.2.2 *RBOB*—reformulated gasoline blendstock for oxygenate blending.

[1] This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.04.0A on Preparation of Standard Hydrocarbon Blends.

Current edition approved May 1, 2017. Published July 2017. Originally approved in 2011. Last previous edition approved in 2011 as D7717 – 11. DOI: 10.1520/D7717-11R17.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov.

4. Summary of Practice

4.1 A specific measured volume of denatured fuel ethanol is blended with a gasoline blendstock to achieve a final blend of a predetermined percentage of denatured fuel ethanol. The blend shall be prepared with all components and apparatus chilled. The total volume of the blend prepared is dependent upon the volume needed to complete required testing.

5. Significance and Use

5.1 Typically, denatured fuel ethanol is added to gasoline blendstocks after production. For laboratories to test a sample that is similar to the finished fuel available in the market, it is important to provide a laboratory practice that standardizes the preparation of a blend of denatured fuel ethanol and gasoline blendstock.

5.2 The laboratory blend shall be prepared volumetrically to yield a fuel similar to that produced for consumer use.

5.3 When applicable, blends shall meet requirements of CFR 40.80, Subpart D—Reformulated Gasoline.

6. Apparatus

6.1 Class A glassware is recommended.

6.2 Container used to mix blend shall have an appropriate closure so as to prevent loss of light ends.

7. Procedure

7.1 Chill apparatus (see Note 1), samples, denatured fuel ethanol, to be used in blending to 0 °C to 4 °C.

NOTE 1—Glassware should be sealed to reduce condensation from forming when chilled.

NOTE 2—Sample or denatured fuel ethanol temperature may be verified by direct temperature measurement of a similar liquid in a similar container placed in the cooling bath or refrigerator at the same time. Alternatively, a laboratory may conduct a temperature-monitoring study to determine the minimum length of time needed to achieve the temperature requirements stated in 7.1, based upon the laboratory's specific operation for cooling.

7.2 Denatured fuel ethanol used shall meet the requirements of Specification D4806. When available, the denatured fuel ethanol to be used in the blend should be the same as that to be used in production.

7.3 Determine the ethanol percentage required for the final blend that is needed to meet specification or other requirements, for example, a blend containing 10% by volume of denatured fuel ethanol.

7.4 Determine the total volume of the final blend needed to complete all necessary testing.

7.5 Use Eq 1 to calculate the volume of the denatured fuel ethanol to be used in the blend.

7.6 When not using a volumetric flask, use Eq 2 to calculate the volume of the gasoline blendstock to be used in the blend.

7.7 Perform the following actions as efficiently as possible to minimize vapor loss and temperature increase.

7.8 Depending on the volume of denatured ethanol needed as determined by Eq 1, measure the volume using the appropriate pipet, graduated cylinder, or other suitable volumetric measuring device.

7.9 When using a volumetric flask, add measured denatured ethanol to the volumetric flask and bring up to volume with gasoline blendstock.

7.10 When not using a volumetric flask and depending on the volume of the gasoline blendstock needed as determined by Eq 2, measure the volume using the appropriate pipet, graduated cylinder, or other suitable volumetric measuring device.

7.10.1 Pour a measured volume of denatured ethanol and a measured volume of gasoline blendstock into a container of suitable size to accommodate the total volume determined in 7.4. Funnels may be used to limit sample loss during transfer to the final container.

7.11 Thoroughly mix the blend. Do not shake vigorously as to do so can negatively impact vapor pressure.

7.11.1 The blend may be split into smaller aliquots, if necessary.

7.11.2 The volume percentage of ethanol in the final blend may be verified if desired by Test Method D5599 or by Test Method D4815.

8. Calculations

8.1 To make blends at specific levels, it is necessary to calculate the volume of each component needed to achieve these levels. See Appendix X1 for a calculation which accounts for the purity of the ethanol in the denatured ethanol. Calculate the ethanol volume as follows:

$$V_{de} = [\%E/100]*V_b \quad (1)$$

where:

V_{de} = volume of denatured ethanol needed for blend, mL,
$\%E$ = final percentage of denatured ethanol needed in blend, for example, 10 %, and
V_b = target volume of final blend, mL.

8.2 Calculate gasoline blendstock volume as follows:

$$V_g = V_b - V_{de} \quad (2)$$

V_g = volume of gasoline blendstock needed for blend, mL,
V_b = target volume of final blend, mL, and
V_{de} = volume of denatured ethanol needed for blend, mL.

9. Keywords

9.1 denatured fuel ethanol; gasoline blendstocks; volumetric blends

APPENDIX

(Nonmandatory Information)

X1. GUIDELINES TO CALCULATE ETHANOL VOLUME% WHEN CONSIDERING PURITY OF DENATURED ETHANOL

X1.1 Calculation

X1.1.1 If the purity of ethanol in the denatured ethanol is to be considered when targeting a specific volume % of ethanol in the final blend, use the following calculation to determine volume of denatured ethanol to be used.

$$V_{de} = [\%E * V_b]/P \quad \text{(X1.1)}$$

where:

V_{de} = volume of denatured ethanol needed for blend, mL,
$\%E$ = percentage of denatured ethanol targeted in blend, for example, 9.5 % by volume,
V_b = target volume of final blend, mL, and
P = Purity of denatured ethanol, as determined by Test Method D5501, percent by volume.