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~~Standard Specification for Fuel Ethanol (Ed70-Ed85) for Automotive Spark-Ignition Engines~~ Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines¹

This standard is issued under the fixed designation D5798; 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 Department of Defense.

1. Scope*

1.1 ~~This specification covers a fuel blend, nominally 70 to 85 volume % denatured fuel ethanol and 30 to 15 additional volume % hydrocarbons for use in ground vehicles with automotive spark-ignition engines. This specification covers the requirements for automotive fuel blends of ethanol and gasoline for use in ground vehicles equipped with flexible-fuel spark-ignition engines. Fuel produced to this specification contains 51 to 83 volume % ethanol. This fuel is for use in flexible-fuel vehicles and is sometimes referred to at retail as “Ethanol Flex-Fuel.” Appendix X1 discusses the significance of the properties specified.~~

~~1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.~~

1.2 The vapor pressure of ethanol fuel blends is varied for seasonal climatic changes. Vapor pressure is increased at lower temperatures to ensure adequate flexible-fuel vehicle operability. Ethanol content and selection of hydrocarbon blendstock are adjusted by the blender to meet these vapor pressure requirements. Hydrocarbon blendstocks for meeting ethanol fuel blends performance requirements are unleaded gasoline, gasoline blendstocks for oxygenate blending (BOBs), natural gasoline or other hydrocarbons in the gasoline boiling range.

1.3 This specification formerly covered Fuel Ethanol (Ed70-Ed85) for Automotive Spark-Ignition Engines, also known commercially as E85. The nomenclature “fuel ethanol” has been changed to “ethanol fuel blends” to distinguish this product from denatured fuel ethanol Specification D4806. To facilitate blending of ethanol fuel blends that meet seasonal vapor pressure requirements, a new lower minimum ethanol content has been established.

1.4 The United States government has established various programs for alternative fuels. Many of the definitions of alternative fuel used by these programs may be more restrictive than the requirements of this specification. See 4.1.2.1 for additional information on alternative fuels containing ethanol.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 The following safety hazard caveat pertains only to the test method portion, 8.1.8, of this specification. *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.*

2. Referenced Documents

2.1 ASTM Standards:²

D86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure

D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

D381 Test Method for Gum Content in Fuels by Jet Evaporation ~~D512 Test Methods for Chloride Ion in Water~~

D525 Test Method for Oxidation Stability of Gasoline (Induction Period Method) ~~D1266 Test Method for Sulfur in Petroleum Products (Lamp Method)~~

D1613 Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products

D1688 Test Methods for Copper in Water ~~D2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry~~

~~D3120 Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry~~

¹ This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is under the direct responsibility of Subcommittee D02.A0.02 on Oxygenated Fuels and Components.

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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.

*A Summary of Changes section appears at the end of this standard.

- D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
- D4175 Terminology Relating to Petroleum, Petroleum Products, and Lubricants
- D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
- D4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination
- 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 C₁ to C₄ Alcohols in Gasoline by Gas Chromatography~~
- D4953 Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)
- D5190 Test Method for Vapor Pressure of Petroleum Products (Automatic Method)
- D5191 Test Method for Vapor Pressure of Petroleum Products (Mini Method)
- D5453 Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
- D5501 Test Method for Determination of Ethanol Content of Denatured Fuel Ethanol by Gas Chromatography
- D5854 Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products
- D6423 Test Method for Determination of pH_e of Ethanol, Denatured Fuel Ethanol, and Fuel Ethanol (Ed75-Ed85)
- D7319 Test Method for Determination of Total and Potential Sulfate and Inorganic Chloride in Fuel Ethanol by Direct Injection Suppressed Ion Chromatography
- D7328 Test Method for Determination of Total and Potential Inorganic Sulfate and Total Inorganic Chloride in Fuel Ethanol by Ion Chromatography Using Aqueous Sample Injection
- E203 Test Method for Water Using Volumetric Karl Fischer Titration
- E1064 Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration

2.2 Government Standards:³

40 CFR Part 80 Code of Federal Regulations—United States Code of Federal Regulations, Title 40, Part 80

2.3 SAE Papers:⁴

SAE 2007-01-4006 A Model for Estimating Vapor Pressures of Commingled Ethanol Fuels

3. Terminology

3.1 Terminology

3.1 For general terminology, refer to Terminology D4175.

3.2 Definitions:

3.1.1

3.2.1 *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.

3.2.1.1 *Discussion*—Denaturants are only those materials added by the denaturer to comply with the approved formula; any materials absorbed later are not denaturants. **D4806**

3.2.2 *denatured fuel ethanol*—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**

3.2.3 *ethanol, n*—ethyl alcohol, the chemical compound C₂H₅OH.

3.1.2

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

3.2.5 *methanol, n*—methyl alcohol, the chemical compound CH₃OH.

3.2

3.3 Definitions of Terms Specific to This Standard:

3.2.1 *aliphatic ether*—an oxygen-containing, ashless, organic compound in which the oxygen atom is interposed between two carbon atoms (organic groups), has the general formula C_nH_{2n+2}O with *n* being 5 to 8, and in which the carbon atoms are connected in open chains and not closed rings.

3.2.1.1 *Discussion*—Aliphatic compounds can be straight or branched chains and saturated or unsaturated. The term aliphatic ether, as used in this specification, refers only to the saturated compounds.

3.2.2 *denaturants*—natural gasoline, gasoline components, unleaded gasoline, or toxic or noxious materials added to fuel ethanol to make it unsuitable for beverage use but not unsuitable for automotive use.

³ Available from the U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

³ A printed copy of the Code of Federal Regulations may be purchased from the U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol Street, N.W., Mail Stop: SDE, Washington, DC 20401 or the online store at <http://bookstore.gpo.gov/>. The Code of Federal Regulations may be browsed online at <http://www.gpoaccess.gov/cfr/index.html>.

⁴ American Automobile Manufacturers Association, *Fuel Methanol Compatibility Standards and Dispensing Equipment List for M85 Fueled Vehicles*, October 1994.

⁴ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

3.2.3 denatured fuel ethanol—fuel ethanol made unfit for beverage use by the addition of denaturants.

3.2.4 fuel ethanol—ethanol with impurities common to its production (including water but excluding denaturants):

3.2.5 fuel ethanol (Ed70-Ed85)—blend of ethanol and hydrocarbon of which the ethanol portion is nominally 70 to 85 volume % denatured fuel ethanol.

3.2.6 higher alcohols—aliphatic alcohols of general formula $C_nH_{2n+1}OH$ with n being 3 to 8.

3.2.7 hydrocarbon—those components in an ethanol-hydrocarbon blend containing only hydrogen and carbon.

3.2.8

3.3.1 flexible-fuel vehicle, n —a vehicle designed to operate on either unleaded gasoline or ethanol fuel blends or mixtures of both.

3.3.1.1 Discussion—In the United States, these vehicles have U.S. EPA emissions certifications using gasoline complying with U.S. EPA requirements and ethanol fuel blends that meet the requirements of Specification D5798.

3.3.2 hydrocarbon, n —a compound composed solely of hydrogen and carbon.

3.3.2.1 Discussion—The hydrocarbons used in ethanol fuel blends will be unleaded gasoline, gasoline blendstock for oxygenate blending (BOB), natural gasoline or other hydrocarbons in the gasoline boiling range. The hydrocarbon blend components will also contain trace quantities of other elements.

3.3.3 pH_e —a measure of the acid strength of alcohol fuels.

4. Fuel Ethanol (Ed70-Ed85) Performance Requirements

4.1 Fuel ethanol (Ed70-Ed85) shall conform to the requirements of Ordering Information

4.1 The purchasing agency shall:

4.1.1 Indicate the season and locality in which the fuel is to be used,

4.1.2 If requested, ensure that the ethanol concentration meets the requirements for an alternative fuel for federal fleets.

4.1.2.1 The composition of alternative fuels in the United States is regulated by various government agencies and regulations including the U.S. Department of Energy (DOE) and U.S. Environmental Protection Agency (EPA). With regard to fuel properties including volatility, this specification can be more or less restrictive than DOE or EPA rules, regulations and waivers. To qualify as an alternative fuel for federal fleet use in the United States, the ethanol blend is required to meet the U.S. Department of Energy's definition of alternative fuels, enacted under the Energy Policy Act of 1992 (Title III, Sec. 301). For ethanol, the Act defines "alternative fuel" as a mixture containing denatured ethanol at a volume of "85 percent or more (or such other percentage, but not less than 70 percent, as determined by the Secretary, by rule...)." Correcting for denaturant content, a blend of 70 to 85 volume % denatured fuel ethanol contains 68 to 83 volume % ethanol as measured by Test Method D5501. The U.S. government has other programs and definitions for alternative fuels. Users of this specification are advised to check with the applicable regulatory agency for specific alternative fuel requirements.

5. Ethanol Fuel Blends Performance Requirements

5.1 Ethanol fuel blends shall conform to the requirements of Table 1. Ethanol content requirements for ethanol alternative fuel blends can be found in 4.1.2.1.

NOTE 1—Most of the requirements cited are based on the best technical information currently available. Requirements for sulfur, phosphorus, and lead are based on the use of gasoline defined in Specification D4814 and the understanding that control of these elements will affect catalyst lifetime. The lead maximum is limited for Class 1 and Class 2 fuels to the lower limit of the test method. As greater experience is gained from field use of Ed70-Ed85 vehicles and further vehicle hardware developments for the use of ethanol content fuels occurs, it is expected that many of these requirements will change.

4.1.1 Vapor pressure is varied for seasonal and climatic changes by providing three vapor pressure classes for fuel ethanol (Ed70-Ed85). The seasonal and geographical distribution for three vapor pressure classes is shown in 1—Most of the requirements cited are based on the best technical information currently available. Requirements for sulfur, phosphorus, and lead are based on the use of gasoline defined in Specification D4814 and the understanding that control of these elements will affect catalyst lifetime.

5.1.1 Vapor pressure is varied for seasonal and climatic changes by providing four vapor pressure classes for ethanol fuel blends. The seasonal and geographical distribution for four vapor pressure classes is shown in Table 2. Class 1 encompasses geographical areas with 6-h tenth percentile minimum ambient temperature of greater than 5°C (41°F). Class 2 encompasses geographical areas with 6-h tenth percentile minimum ambient temperature of greater than -5°C (23°F) but less than +5°C (41°F). Class 3 encompasses geographical areas with 6-h tenth percentile minimum ambient temperature greater than -13°C (9°F) but less than or equal to -5°C (23°F). Class 4 encompasses geographical areas with 6-h tenth percentile minimum ambient temperature less than or equal to -13°C (9°F).

4.1.2 The 5.1.2 The hydrocarbons blended with the denatured fuel ethanol shall have a maximum boiling point of 225°C (437°F) by Test Method D86, oxidation stability of 240-min minimum by Test Method D525, and No. 1 maximum copper strip corrosion by Test Method D130. The hydrocarbons may contain aliphatic ethers as blending components as are customarily used for automotive spark-ignition engine fuel.

4.1.3 The denaturant for the denatured fuel ethanol used in making fuel ethanol (Ed70-Ed85) shall meet the requirements of Specification D4806 (see Section 6):

4.1.4 Fuel ethanol (Ed70-Ed85) of any volatility class shall meet the same limits for lead and phosphorus as required by U.S.

TABLE 1 Requirements for Fuel Ethanol (E Fuel Blend70-Ed85)s^A

Properties	Class 1 ^{A,B}	Class 2	Class 3 Ethanol volume %	Class 4	Test Methods
68–83	68–83				
Vapor pressure, kPa (psi)	38–59	48–65	66–83 (psi)	(5.5–8.5)	(7.0–9.5) (9.5–12.0)
Vapor pressure, kPa ⁵⁹ (5.5–8.5)	38–59	48–65 (7.0–9.5)	59–83 (8.5–12.0)	66–103 (9.5–15.0)	D495) (9.3, D5190)
All Classes Methanol, volume %, max					
All Classes ^C					
Ethanol Content, volume %		5			
Ethanol Content, volume %		51–83			D5501
Higher alcohols (C ₃ –C ₈), max, volume %	Methanol Content, max, volume %		2		
Higher alcohols (C ₃ –C ₈), max, volume %	Methanol Content, max, volume %		0.5		
Sulfur, max, mg/kg					
Sulfur, max, mg/kg	D5501				
Sulfur Content, max, mg/kg		80 ^B			
Sulfur Content, max, mg/kg		80			
	D5453				
Acidity, (as acetic acid CH ₃ COOH), mass % (mg/L), max				0.005 (40)	
Acidity, (as acetic acid CH ₃ COOH), mass % (mg/L), max				0.005 (40)	D16
Solvent-washed gum content, max, mg/100 mL				5	
Solvent-washed gum content, max, mg/100 mL				5	D3
pH _e		6.5 to 9.0			D6423
Unwashed gum content, max, mg/100 mL				20	
Unwashed gum content, max, mg/100 mL				20	D3
Inorganic chloride, max, mg/kg	Inorganic chloride content, max, mg/kg	1			
Inorganic chloride, max, mg/kg	Inorganic chloride content, max, mg/kg	1			D7319 o
Copper, max, mg/L	Copper content, max, mg/L	0.07			
Copper, max, mg/L	Copper content, max, mg/L	0.07			D16
Water, max, mass %	Water content, max, mass %	1.0			Appearance This-pr
Water, max, mass %	Water content, max, mass %	1.0			Appearance This-pr

^A For information on alternative fuels, see 4.1.2.1.

^B See 45.1.1 for volatility class criteria.

^C QuEthanolifi content and smael-refctioneries of have-varying maximum sulfudr-limits for gcastrbolin ble-upndsto 0.0450 mass%, whichk are-b adjusted-on by their 1997–1998 su blfuender-l to mevel bt vapor pressure^l requirements. See X1.43.2 f-gor additional inefrom-qualitifeon and-ref guidanceries is used-t for blend-Ed70–Ed85, the maximum-sulfur-level shall be 134 mg/kg.

Environmental Protection Agency (EPA) regulations for unleaded gasoline.

4.1.4.1 The intentional addition of lead or phosphorus compounds to fuel ethanol (Ed70–Ed85) is not permitted. EPA regulations limit their maximum concentrations in unleaded gasoline to 0.05 g lead/US gal (0.013 g/L) and 0.005 g phosphorus/US gal (0.0013 g/L), respectively. Details of the EPA regulations and test methods are available in 40 CFR Part 80, Part 80 of Title 40 of the Code of Federal Regulations.

4.1.5 Use of unprotected aluminum in fuel ethanol (Ed70-Ed85) distribution and dispensing equipment will introduce insoluble aluminum compounds into the fuel, causing plugged vehicle fuel filters. Furthermore, this effect can be exaggerated even with protected aluminum by elevated fuel conductivity caused by contact with nitrile rubber dispensing hose. Therefore, unprotected

TABLE 2 Seasonal and Geographical Volatility Specifications for Fuel Ethanol (E Fuel Blend70-Ed85)s

NOTE 1—This schedule, subject to agreement between the purchaser and the seller, denotes the vapor pressure class of the fuel at the time and place of bulk delivery to fuel-dispensing facilities for the end user. Shipments should anticipate this schedule.

NOTE 2—Where alternative classes are listed, either class is acceptable; the option shall be exercised by the seller.

State	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Alabama	2	2	2	2	2/1	1	1	1	1	1/2	2	2
Alaska												
—Southern Region	3	3	3	3	3/2	2/1	1	1/2	2/3	3	3	3
—Southern Region	4	4	4	4/3	3/2	2/1	1	1/2	2/3	3/4	4	4
—South Mainland	3	3	3	3	3/2	2/1	1/2	2	2/3	3	3	3
—South Mainland	4	4	4	4	4/2	2/1	1/2	2	2/4	4	4	4
Arizona												
—N of 34° Latitude	3	3	3	3/2	2	2/1	1	1	1/2	2/3	3	3
—S of 34° Latitude	2	2	2	2/1	1	1	1	1	1	1/2	2	2
Arkansas	3	3	3/2	2/1	1	1	1	1	1/2	2	2/3	3
California ^A												
—North Coast	2	2	2	2	2	2/1	1	1	1	1/2	2	2
—North Coast	2	2	2	2	2/1	1	1	1	1	1/2	2	2
—South Coast	3/2	2	2	2	2/1	1	1	1	1	1/2	1/2	2/3
—South Coast	3/2	2	2	2	2/1	1	1	1	1	1	1/2	2
—Southeast	3	3/2	2	2	2/1	1	1	1	1/2	2	2/3	3
—Southeast	2	2	2/1	1	1	1	1	1	1	1	1/2	2
—Interior	2	2	2	2	2	2/1	1	1	1	1/2	2	2
—Interior	2	2	2	2/1	1	1	1	1	1	1/2	2	2
Colorado												
—E of 105° Longitude	3	3	3	3/2	2	2/1	1	1	1/2	2/3	3	3
—E of 105° Longitude	4	4/3	3	3/2	2	2/1	1	1	1/2	2/3	3	3/4
—W of 105° Longitude	3	3	3	3	3/2	2	2/1	1/2	2/3	3	3	3
—W of 105° Longitude	4	4	4/3	3	3/2	2	2/1	1/2	2/3	3/4	4	4
Connecticut	3	3	3	3/2	2	2/1	1	1	1/2	2	2/3	3
Connecticut	4	4	4/3	3/2	2	2/1	1	1	1/2	2	2/3	3/4
Delaware	3	3	3/2	2	2/1	1	1	1	1/2	2	2/3	3
Delaware	3	3	3/2	2	2/1	1	1	1	1/2	2	2/3	4
District of Columbia	3	3	3/2	2	2/1	1	1	1	1/2	2	2/3	3
Florida												
—N of 29° Latitude	2	2	2	2/1	1	1	1	1	1	1/2	2	2
—S of 29° Latitude	2	2/1	1	1	1	1	1	1	1	1	1/2	2
Georgia	3	3/2	2	2/1	1	1	1	1	1	1/2	2	2/3
Hawaii	1	1	1	1	1	1	1	1	1	1	1	1
Idaho	3	3	3	3/2	2	2	2/1	1/2	2	2/3	3	3
Idaho	4	4	4/3	3/2	2	2	2/1	1/2	2	2/3	3/4	4
Illinois												
—N of 40° Latitude	3	3	3	3/2	2	2/1	1	1	1/2	2/3	3	3
—N of 40° Latitude	4	4	4/3	3/2	2	2/1	1	1	1/2	2/3	3/4	4
—S of 40° Latitude	3	3	3	3/2	2/1	1	1	1	1/2	2/3	3	3
—S of 40° Latitude	4	4/3	3	3/2	2/1	1	1	1	1/2	2/3	3/4	4
Indiana	3	3	3	3/2	2/1	1	1	1	1/2	2/3	3	3
Indiana	4	4	4/3	3/2	2/1	1	1	1	1/2	2/3	3/4	4
Iowa	3	3	3	3/2	2	2/1	1	1	1/2	2/3	3	3
Iowa	4	4	4	4/2	2	2/1	1	1	1/2	2/3	3/4	4
Kansas	3	3	3	3/2	2	2/1	1	1	1/2	2/3	3	3
Kansas	4	4/3	3	3/2	2	2/1	1	1	1/2	2/3	3/4	4
Kentucky	3	3	3/2	2	2/1	1	1	1	1/2	2	2/3	3
Louisiana	2	2	2	2/1	1	1	1	1	1	1/2	2	2
Maine	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
Maine	4	4	4	4/2	2	2/1	1	1/2	2	2/3	3/4	4
Maryland	3	3	3/2	2	2/1	1	1	1	1/2	2	2/3	3
Massachusetts	3	3	3	3/2	2	2/1	1	1	1/2	2	2/3	3
Massachusetts	4	4	4/3	3/2	2	2/1	1	1	1/2	2	2/4	4
Michigan												
—Lower Michigan	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
—Lower Michigan	4	4	4/3	3/2	2	2/1	1	1/2	2	2/3	3/4	4
—Upper Michigan	3	3	3	3	3/2	2/1	1	1/2	2	2/3	3	3
—Upper Michigan	4	4	4	4/3	3/2	2/1	1	1/2	2	2/3	3/4	4
Minnesota	3	3	3	3	3/2	2/1	1	1/2	2	2/3	3	3
Minnesota	4	4	4	4/3	3/2	2/1	1	1/2	2	2/4	4	4
Mississippi	2	2	2	2/1	1	1	1	1	1	1/2	2	2
Missouri	3	3	3	3/2	2/1	1	1	1	1/2	2/3	3	3
Missouri	4	4/3	3	3/2	2/1	1	1	1	1/2	2/3	3	3
Montana	3	3	3	3	3/2	2	2/1	1/2	2/3	3	3	3
Montana	4	4	4	4/3	3/2	2	2/1	1/2	2/3	3/4	4	4
Nebraska	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
Nebraska	4	4	4/3	3/2	2	2/1	1	1/2	2	2/3	3/4	4
Nevada												
—N of 38° Latitude	3	3	3	3/2	2	2	2/1	1/2	2	2/3	3	3

TABLE 2 *Continued*

State	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
N of 38° Latitude	4	4	4/3	3/2	2	2	2/1	1/2	2	2/3	3/4	4
S of 38° Latitude	3	3	3/2	2	2/1	1	1	1/2	1/2	2	2/3	3
New Hampshire	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
New Hampshire	4	4	4/3	3/2	2	2/1	1	1/2	2	2/3	3/4	4
New Jersey	3	3	3/2	2	2/1	1	1	1	1/2	2	2/3	3
New Mexico												
—N of 34° Latitude	3	3	3	3/2	2	2/1	1	1	1/2	2/3	3	3
N of 34° Latitude	4	4/3	3	3/2	2	2/1	1	1	1/2	2/3	3	3/4
S of 34° Latitude	3	3	3/2	2/1	1	1	1	1	1	1/2	2/3	3
New York												
—N of 42° Latitude	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
N of 42° Latitude	4	4	4	4/2	2	2/1	1	1/2	2	2/3	3/4	4
—S of 42° Latitude	3	3	3	3/2	2/1	1	1	1	1/2	2	2/3	3
S of 42° Latitude	4	4	4/3	3/2	2/1	1	1	1	1/2	2	2/3	3/4
North Carolina	3	3	3/2	2	2/1	1	1	1	1/2	2/3	3	3
North Dakota	3	3	3	3	3/2	2/1	1	1/2	2	2/3	3	3
North Dakota	4	4	4	4/3	3/2	2/1	1	1/2	2	2/4	4	4
Ohio	3	3	3	3/2	2/1	1	1	1	1/2	2/3	3	3
Ohio	4	4	4/3	3/2	2/1	1	1	1	1/2	2/3	3/4	4
Oklahoma	3	3	3	3/2	2/1	1	1	1	1/2	2	2/3	3
Oregon												
—E of 122° Longitude	3	3	3	3/2	2	2	2/1	1/2	2	2/3	3	3
E of 122° Longitude	4	4/3	3	3/2	2	2	2/1	1/2	2	2/3	3	3/4
W of 122° Longitude	3	3/2	2	2	2	2/1	1	1	1/2	2	2	2/3
Pennsylvania												
—N of 41° Latitude	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
N of 41° Latitude	4	4	4	4/2	2	2/1	1	1/2	2	2/3	3/4	4
—S of 41° Latitude	3	3	3	3/2	2	2/1	1	1	1/2	2	2/3	3
S of 41° Latitude	4	4	4/3	3/2	2	2/1	1	1	1/2	2	2/3	3/4
Rhode Island	3	3	3	3/2	2/1	1	1	1	1/2	2	2/3	3
South Carolina	2	2	2	2/1	1	1	1	1	1	1/2	2	2
South Dakota	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
South Dakota	4	4	4	4/2	2	2/1	1	1/2	2	2/3	3/4	4
Tennessee	3	3	3/2	2	2/1	1	1	1	1/2	2	2/3	3
Texas												
N of 31° Latitude	3	3	3/2	2	2/1	1	1	1	1/2	2	2/3	3
S of 31° Latitude	2	2	2	2/1	1	1	1	1	1	1/2	2	2
Utah	3	3	3	3/2	2	2/1	1	1/2	2/3	3	3	3
Utah	4	4/3	3	3/2	2	2/1	1	1	1/2	2/3	3	3/4
Vermont	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
Vermont	4	4	4/3	3/2	2	2/1	1	1/2	2	2/3	3/4	4
Virginia	3	3	3/2	2	2/1	1	1	1	1/2	2	2/3	3
Washington												
—E of 122° Longitude	3	3	3/2	2	2	2/1	1	1/2	2/3	3	3	3
E of 122° Longitude	4	4/3	3/2	2	2	2/1	1	1	1/2	2/3	3	3/4
W of 122° Longitude	3	3/2	2	2	2	2/1	1	1	1/2	2	2	2/3
West Virginia	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
West Virginia	4	4/3	3	3/2	2	2/1	1	1/2	2	2/3	3	3/4
Wisconsin	3	3	3	3/2	2	2/1	1	1/2	2	2/3	3	3
Wisconsin	4	4	4	4/2	2	2/1	1	1/2	2	2/3	3/4	4
Wyoming	3	3	3	3	3/2	2	2/1	1/2	2	2/3	3	3
Wyoming	4	4	4	4/3	3/2	2	2/1	1/2	2	2/4	4	4

^A Details of State Climatological Division by county as indicated:

California, North Coast—Alameda, Contra Costa, Del Norte, Humboldt, Lake, Marin, Mendocino, Monterey, Napa, San Benito, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma, Trinity

California, Interior—Lassen, Modoc, Plumas, Sierra, Siskiyou, Alpine, Amador, Butte, Calaveras, Colusa, El Dorado, Fresno, Glenn, Kern (except that portion lying east of Los Angeles County Aqueduct), Kings, Madera, Mariposa, Merced, Placer, Sacramento, San Joaquin, Shasta, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, Yolo, Yuba, Nevada

California, South Coast—Orange, San Diego, San Luis Obispo, Santa Barbara, Ventura, Los Angeles (except that portion north of the San Gabriel Mountain range and east of the Los Angeles County Aqueduct)

California, Southeast—Imperial, Riverside, San Bernardino, Los Angeles (that portion north of the San Gabriel Mountain range and east of the Los Angeles County Aqueduct), Mono, Inyo, Kern (that portion lying east of the Los Angeles County Aqueduct)

aluminum and unlined nitrile rubber dispensing hose should be avoided in fuel ethanol (Ed70–Ed85) fuel distribution and dispensing systems.

5. Workmanship

5.1 Fuel ethanol (Ed70–Ed85) shall be visually free of sediment and suspended matter. It shall be clear and bright at the ambient temperature or 21°C (70°F), whichever is higher.

5.2 The specification defines only a basic purity for fuel ethanol (Ed70–Ed85). The product shall be free of any adulterant or contaminant that can render the material unacceptable for its commonly used applications.