Designation: D7713 – 12

Standard Specification for Aqueous Engine Coolant Grade Glycol (53% Nominal)[1]

This standard is issued under the fixed designation D7713; 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 specification covers both commercial products, engine coolant grade ethylene glycol and propylene glycol, including virgin glycols and those derived from the recycling of vehicle engine coolants and industrial source glycols.

1.2 Types EG-1 and PG-1 cover glycols with sufficiently low limits on components to allow a blended coolant to meet most OEM (Original Equipment Manufacturer) specifications. These types will probably be virgin materials, although redistillation could produce a sufficiently pure product. Types EG-2 and PG-2 cover glycol that will be suitable for many coolants. These types can be either redistilled or virgin.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1122 Test Method for Density or Relative Density of Engine Coolant Concentrates and Engine Coolants By The Hydrometer

D1123 Test Methods for Water in Engine Coolant Concentrate by the Karl Fischer Reagent Method

D1177 Test Method for Freezing Point of Aqueous Engine Coolants

D1209 Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)

D1287 Test Method for pH of Engine Coolants and Antirusts

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

D3634 Test Method for Trace Chloride Ion in Engine Coolants

D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter

D5827 Test Method for Analysis of Engine Coolant for Chloride and Other Anions by Ion Chromatography

D5931 Test Method for Density and Relative Density of Engine Coolant Concentrates and Aqueous Engine Coolants by Digital Density Meter

D6130 Test Method for Determination of Silicon and Other Elements in Engine Coolant by Inductively Coupled Plasma-Atomic Emission Spectroscopy

D6660 Test Method for Freezing Point of Aqueous Ethylene Glycol Base Engine Coolants by Automatic Phase Transition Method

D7638 Test Method for Determination of Fatty Acids and Esters in Glycerin

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E202 Test Methods for Analysis of Ethylene Glycols and Propylene Glycols

E300 Practice for Sampling Industrial Chemicals

E394 Test Method for Iron in Trace Quantities Using the 1,10-Phenanthroline Method

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E1177 Specification for Engine Coolant Grade Glycol

3. Requirements

3.1 Engine coolant grade 53 % (nominal) ethylene glycol or propylene glycol shall conform to the chemical and physical property requirements in Table 1.

4. Sampling

4.1 Sample ethylene or propylene glycol in accordance with the appropriate sections of Practice E300 for liquid samples.

5. Packaging, Package Markings, and Transportation

5.1 The packaging, labeling, and transportation of commercial quantities shall conform to applicable federal, state, and

[1] This specification is under the jurisdiction of ASTM Committee D15 on Engine Coolants and Related Fluids and is the direct responsibility of Subcommittee D15.15 on Recycled Engine Coolant.

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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.

TABLE 1

Requirement	Value for 53 % Ethylene Glycol, Type EG-1 53 %	Value for 53 % Propylene Glycol, Type PG-1 53 %	Value for 53 % Ethylene Glycol, Type EG-2 53 %	Value for 53 % Propylene-Glycol, PG-2 53 %	ASTM Test Method
Clarity	Clear, no suspended matter	Clear, no suspended matter	Clear, no suspended matter	Clear, no suspended matter	Visual
Color, Pt/Co scale	25 max	25 max	100 max	100 max	D1209
Relative density, 20/20°C	1.068 to 1.123	1.025 to 1.0331	1.068 to 1.123	1.025 to 1.0331	D1122, D4052, D5931
pH	6.5 to 9.0	6.5 to 9.0	6.5 to 9.0	6.5 to 9.0	D1287
Acidity as acetic acid, mass %	0.005 max	0.005 max	0.005 max	0.005 max	D1613
Freezing Point, °C (°F)	-40 (-40)	-38 (-36)	-40 (-40)	-38 (-36)	D1177[A], D6660
Glycol esters, mg/L	[B]	[B]	[B]	[B]	D7638
Nitrite, Nitrate, Phosphate (total, µg/g)	5 max	5 max	50 max	25 max	D5827
Silicon, µg/g	5 max	5 max	5 max	5 max	D6130
Chloride ion, mg/L	2.5 max	2.5 max	12.5 max	12.5 max	D3634, D5827[C]
Sulfate, mg/L	5 max	5 max	50 max	50 max	D5827
Boron, µg/g	5 max	5 max	25 max	25 max	D5827
Aluminum, Calcium, Copper, Iron, Magnesium, Lead, Zinc (total, µg/g)	5 max	5 max	5 max	5 max	D6130
Iron, µg/g	1.0 max	1.0 max	1.0 max	1.0 max	E394, D6130

[A] In case of dispute, Test Method D1177 shall be the preferred test method.
[B] A limit for glycol esters should be established by agreement between the supplier and the customer.
[C] In case of dispute, Test Method D3634 shall be the preferred test method.

local regulations. Conformance is the responsibility of the manufacturer and the shipper.

6. Precision and Bias

6.1 The precision of this test method is based on an interlaboratory study of WK25513 Standard Specification for Aqueous Engine Coolant Grade Glycol (53 % nominal), conducted in 2010. Each of eight laboratories tested three different materials. Every "test result" represents an individual determination. All laboratories were asked to report three test results from a single operator, for every material. Except for the inability of all participants to report all requested replicates, Practice E691 was followed for the design and analysis of the data; the details are given in ASTM Research Report No. D15-XXXX.[3]

6.1.1 *Repeatability limit (r)*—Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the "*r*" value for that material; "*r*" is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory.

6.1.1.1 Repeatability limits are listed in Table 2.

6.1.2 *Reproducibility limit (R)*—Two test results shall be judged not equivalent if they differ by more than the "*R*" value for that material; "*R*" is the interval representing the critical difference between two test results for the same material, obtained by different operators using different equipment in different laboratories.

6.1.2.1 Reproducibility limits are listed in Table 2.

TABLE 2 Glycol Concentration (%)

Material	Average[A]	Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit	Reproducibility Limit
	$\bar{x}$	s_r	s_R	r	R
Sample A	47.4	0.27	0.73	0.77	2.04
Sample B	52.1	0.47	0.89	1.32	2.50
Sample C	42.0	0.37	0.89	1.04	2.49

[A] The average of the laboratories' calculated averages.

6.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

6.1.4 Any judgment in accordance with statements 6.1.1 and 6.1.2 has an approximate 95 % probability of being correct.

6.2 *Bias*—At the time of the study, there was no accepted reference material tested to determine the bias for this test method, therefore no statement on bias is being made.

6.3 The precision statement was determined through statistical examination of 51 results, from eight laboratories, on three materials. These materials were described as:

Sample Aqueous Glycol nom 45–55 % "A"
Sample Aqueous Glycol nom 45–55 % "B"
Sample Aqueous Glycol nom 45–55 % "C"

6.4 To judge the equivalency of two test results, it is recommended to choose the material closest in characteristics to the test material.

7. Keywords

7.1 engine coolant; ethylene; glycol; polyester; propylene glycol, pre-diluted, recycled

[3] For a copy of the draft Research Report, please contact Caitlin Farrell at cfarrell@astm.org