



Standard Specification for Recycled Prediluted Aqueous Glycol Base Engine Coolant (50 Volume % Minimum) for Automobile and Light-Duty Service¹

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1. Scope*

1.1 This specification covers the requirements for a recycled prediluted aqueous ethylene glycol (50 volume % minimum) base engine coolant and recycled prediluted aqueous propylene glycol (50 volume % minimum) base engine coolant for use in automobiles and light-duty vehicles. Committee D15 has developed this specification using experience, knowledge and research from recycling used aqueous base engine coolant and blends of used aqueous base engine coolant and virgin glycol. This standard does not apply to coolant produced from other glycol sources such as medical waste, distillation bottoms, airplane/airport deicers and polyester production waste. This specification provides a procedure for evaluating engine coolant recycling technologies through the recycling of a reference synthetic used engine coolant. It also specifies the chemical, physical, and performance requirements for the recycled prediluted aqueous glycol base engine coolant that is produced from that procedure. When used without further dilution, this product functions effectively during both winter and summer. This material is intended to provide protection against freezing, boiling, and corrosion in automobile or other light-duty service cooling systems.

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

1.3 *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 This specification is under the jurisdiction of ASTM Committee D15 on Engine Coolants and is the direct responsibility of Subcommittee D15.15 on Recycled Engine Coolant.

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2. Referenced Documents

2.1 ASTM Standards:²

- D512 Test Methods for Chloride Ion In Water
- D516 Test Method for Sulfate Ion in Water
- D1119 Test Method for Percent Ash Content of Engine Coolants
- D1120 Test Method for Boiling Point of Engine Coolants
- D1121 Test Method for Reserve Alkalinity of Engine Coolants and Antirusts
- D1122 Test Method for Density or Relative Density of Engine Coolant Concentrates and Engine Coolants By The Hydrometer
- D1126 Test Method for Hardness in Water
- D1176 Practice for Sampling and Preparing Aqueous Solutions of Engine Coolants or Antirusts for Testing Purposes
- D1177 Test Method for Freezing Point of Aqueous Engine Coolants
- D1193 Specification for Reagent Water
- D1287 Test Method for pH of Engine Coolants and Antirusts
- D1293 Test Methods for pH of Water
- D1384 Test Method for Corrosion Test for Engine Coolants in Glassware
- D1881 Test Method for Foaming Tendencies of Engine Coolants in Glassware
- D1882 Test Method for Effect of Cooling System Chemical Solutions on Organic Finishes for Automotive Vehicles
- D2570 Test Method for Simulated Service Corrosion Testing of Engine Coolants
- D2809 Test Method for Cavitation Corrosion and Erosion-Corrosion Characteristics of Aluminum Pumps With Engine Coolants
- D2847 Practice for Testing Engine Coolants in Car and Light Truck Service

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

- D3306 Specification for Glycol Base Engine Coolant for Automobile and Light-Duty Service
- D3634 Test Method for Trace Chloride Ion in Engine Coolants
- D4327 Test Method for Anions in Water by Suppressed Ion Chromatography
- D4340 Test Method for Corrosion of Cast Aluminum Alloys in Engine Coolants Under Heat-Rejecting Conditions
- 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
- D6129 Test Method for Silicon in Engine Coolant Concentrates by Atomic Absorption Spectroscopy
- D6130 Test Method for Determination of Silicon and Other Elements in Engine Coolant by Inductively Coupled Plasma-Atomic Emission Spectroscopy
- D6208 Test Method for Repassivation Potential of Aluminum and Its Alloys by Galvanostatic Measurement
- D6472 Specification for Recycled Glycol Base Engine Coolant Concentrate for Automobile and Light-Duty Service
- D6660 Test Method for Freezing Point of Aqueous Ethylene Glycol Base Engine Coolants by Automatic Phase Transition Method

2.2 Other Documents:

- Federal Method 2540B Total Dissolved Solids Dried at 103–105°C³
- GM 6043M—Automotive Engine Coolant Concentrate—Ethylene Glycol Type⁴
- GM 1825M—Automotive Engine Coolant Concentrate—Ethylene Glycol; §3.11 Storage Stability and Compatibility⁵

3. Reagents and Materials

3.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.⁶ Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

3.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type IV of Specification D1193.

4. Procedure

4.1 In order to properly evaluate a coolant recycling technology, a reference synthetic used coolant (Annex A1) is to

be used as the feed stock. The reference synthetic used coolant shall be prepared in accordance with Annex A1. An appropriately sized batch of reference synthetic used coolant is to be prepared and used to purge the recycling process components and yield enough consistent product to complete the testing specified within this specification.

4.2 Prepare the coolant recycling equipment or technology according to the manufacturer's directions and recommendations.

4.3 Vigorously stir or mix the reference synthetic used coolant using appropriate vessels and mixing equipment immediately prior to and during the processing through the coolant recycling process.

4.4 Recycle the reference synthetic used coolant according to the manufacturer's directions and recommendations.

4.5 Evaluate the recycled coolant per the requirements listed in this specification.

5. General Requirements

5.1 The recycled prediluted aqueous glycol base engine coolant shall consist essentially of water and ethylene glycol or propylene glycol obtained from the processing of light, medium or heavy duty engine coolant products. The recycled prediluted aqueous glycol base engine coolant can in part contain virgin glycol. It also shall contain suitable corrosion inhibitors and a foam suppressor.

5.1.1 Recycled prediluted aqueous ethylene glycol base engine coolant may contain glycols other than ethylene glycol up to 7.5 % provided the chemical and physical properties of Table 1 are met.

5.1.2 Recycled prediluted aqueous propylene glycol base engine coolant may contain glycols other than propylene glycol up to 0.5 % provided the chemical and physical properties of Table 1 are met.

5.2 The recycled prediluted aqueous glycol base engine coolant shall conform to the chemical and physical properties in Table 1. If the recycled prediluted aqueous glycol base engine coolant contains chloride or sulfate, or both, at levels greater than the requirements specified in Table 1, fleet testing requirements described in Section 6 shall be met. If the chloride and sulfate requirements in Table 1 are met, fleet testing is not required.

NOTE 1—The intention of conducting fleet testing is to verify that the effects of residual contaminants left in the recycled glycol base engine coolant are neutralized through real world application in a fleet test. Due to the fact that there are not enough industry field test data available to support setting hard specification limits, the fleet test requirements in Section 6 specify a protocol and limits based on comparing the recycled glycol base engine coolant to an industry standard reference engine coolant that is known to adequately protect modern day cooling systems from corrosion.

5.3 The recycled prediluted aqueous glycol base engine coolant shall conform to the general requirements in Table 2.

5.4 The recycled prediluted aqueous glycol base engine coolant shall be in accordance with the performance requirements in Table 3.

³ Standard Method for the Examination of Water and Wastewater. American Public Health Association, et al, 1015 15th Street, N.W. Washington, DC 20005.

⁴ Applicable rewrite available in Annex A2.

⁵ Applicable rewrite available in Annex A3.

⁶ *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the United States Pharmacopeia and National Formulary, U.S. Pharmacopeial Convention, Inc., (USPC), Rockville, MD.

TABLE 1 Physical and Chemical Requirements of the Recycled Prediluted Product

Property	Ethylene Glycol Base Specific Values	Propylene Glycol Base Specific Values	ASTM Test Method
Relative density, 15.5°C (60/60°F)	1.0650 min	1.0250 min	D1122, D5931
Freezing point, °C (°F)	-36.4 (-33.5) max or lower	-31 (-23.8) max or lower	D1177, D6660
Boiling point, °C (°F)	107.8 (226) min	104 (219) min	D1120
Effect on automotive finish (use clear coat thermoset urethane or acrylic urethane finish)	no effect	no effect	D1882 ^A
Ash content, mass %	2.5 max	2.5 max	D1119
pH, 50 volume % in distilled water	7.5 to 11.0	7.5 to 11.0	D1287
Chloride, ppm	33 max	33 max	D3634 ^B , D5827
Sulfate, ppm	140 max	140 max	D5827
Reserve alkalinity, mL	report ^C	report ^C	D1121

^ACurrently, many vehicle manufacturers prepare test panels using the specific paint finishes employed on their actual product. Coolant suppliers and vehicle manufacturers should agree on the exact test procedures and acceptance criteria on an individual basis.

^BIn case of dispute, D3634 shall be the preferred test method.

^CAgreed value between the supplier and the customer.

TABLE 2 General Requirements of the Recycled Prediluted Product

Property	Specified Values	ASTM Test Method
Color	distinctive ^A	—
Effect on nonmetals	no adverse affect	—

^ACommonly used color: green to blue-green.

5.5 This product, when installed in accordance with the recommendations of the manufacturer of the vehicle, or the coolant recycling process, and those on the product label, shall be suitable for use in a properly maintained cooling system (see [Appendix X1](#)) in normal light-duty or passenger car service for a minimum of one year without adversely affecting fluid flow and heat transfer.

6. Fleet Testing Requirements

6.1 *Engine Coolants*—Reference engine coolant concentrate ([Annex A2](#)) and recycled prediluted engine coolant shall be used to conduct the fleet testing.

6.2 *Vehicles*—A minimum of fourteen vehicles is recommended to start the test: seven containing reference engine coolant concentrate (control vehicles) and seven containing recycled prediluted engine coolant (test vehicles). A minimum of five control vehicles and five test vehicles shall finish the test. Starting with fourteen vehicles allows for vehicles to drop out of the test for various reasons, that is, mechanical failure, coolant contamination, etc.

6.2.1 *Vehicle Selection*—All vehicle cooling systems should be inspected prior to selection. Vehicles with corroded cooling systems should not be used for testing purposes. Vehicle selection shall be made as follows:

6.2.1.1 Control vehicles and test vehicles shall be matched pairs and be new or have similar low mileage accumulation.

6.2.1.2 Same year, make, and model.

6.2.1.3 Similar mileage and cooling system condition.

6.2.1.4 Same cooling system and power train configuration.

6.2.1.5 Aluminum head(s), aluminum radiator, aluminum heater core and aluminum water pump (housing).

6.2.1.6 Cast iron block (optional).

NOTE 2—Vehicles equipped with cast iron heads may be tested in addition to those specified above. A minimum of five control vehicles and

TABLE 3 Performance Requirements of the Recycled Prediluted Product

Property	Specific Values	ASTM Test Method
Corrosion in glassware; Weight loss, mg/specimen		D1384 ^A
Copper	10 max	
Solder	30 max	
Brass	10 max	
Steel	10 max	
Cast iron	10 max	
Cast aluminum	30 max	
Simulated service test; Weight loss, mg/specimen		D2570 ^B
Copper	20 max	
Solder	60 max	
Brass	20 max	
Steel	20 max	
Cast iron	20 max	
Cast aluminum	60 max	
Corrosion of cast aluminum alloys at heat-rejecting Surfaces; Weight loss, mg/cm ² /week	1.0 max	D4340 ^C
Foaming		D1881
Volume, mL	150 max	
Break time, s	5 max	
Cavitation-erosion rating for pitting, cavitation, or Erosion of the water pump		D2809 ^D
8 min	8 min	
Aluminum galvanostatic pitting potential, V v SHE	-0.40 min	D6208 ^E
Fleet test		see 6.8 and appropriate subsections

^AThe recycled product shall be mixed with the proper quantity of ASTM Type IV reagent water (Specification D1193) to result in a 33-1/3 volume % coolant test solution. To each liter of test solution add 99 mg of sodium sulfate, 110 mg of sodium chloride and 92 mg sodium bicarbonate.

^BThe recycled product shall be mixed with the proper quantity of ASTM Type IV reagent water (Specification D1193) to result in a 44 volume % coolant test solution. To each liter of test solution add 83 mg of sodium sulfate, 92 mg of sodium chloride and 77 mg of sodium bicarbonate.

^CThe adjusted recycled product shall be mixed with an equal volume of ASTM Type IV reagent water (Specification D1193). To each liter of test solution add 165 mg of sodium chloride.

^DOne volume of the recycled product shall be mixed with two volumes of ASTM Type IV reagent water (Specification D1193). To each liter of test solution add 123 mg of sodium sulfate, 137 mg of sodium chloride and 115 mg of sodium bicarbonate.

^EThe test solution is to be prepared as follows: 50 volume % of the prediluted coolant to be tested, 25 volume % of the corrosive water specified in Test Method D6208, and the remainder deionized or distilled water.

five test vehicles, equipped with aluminum heads, shall complete the test and be included in the conclusive analysis report.

6.2.2 *Vehicle Setup*—All vehicles shall be set up in accordance with Practice D2847 unless otherwise specified within this specification.