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Standard Specification for Glycol Base Engine Coolant for Automobile and Light-Duty Service¹

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1. Scope

1.1 This specification covers the requirements for ethylene glycol or propylene glycol base engine coolants used in automobiles or other light duty service cooling systems. When concentrates are used at 40 to 70 % concentration by volume in water, or when prediluted glycol base engine coolants (50 volume % minimum) are used without further dilution, they will function effectively to provide protection against freezing, boiling, and corrosion.

1.2 The coolants governed by this specification are categorized as follows:

Coolant Type	Description
I	Ethylene glycol base concentrate
II	Propylene glycol base concentrate
III	Ethylene glycol predilute (50 vol %)
IV	Propylene glycol predilute (50 vol %)

NOTE 1—This specification is based on the knowledge of the performance of engine coolants prepared from new or virgin ingredients. This specification shall also apply to engine coolants prepared using glycol generated from recycled or reprocessed used coolant or reprocessed industrial-source glycol, provided that said glycol meets the requirements of Specification E 1177. Separate specifications (D 6471 and D 6472) exist for engine coolants prepared from recycled or reprocessed used coolant or reprocessed industrial-source glycol that does not meet the requirements established in Specification E 1177.

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

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.*

NOTE 2—This specification applies to automobiles and light duty service. Specifications D 4985 and D 6210 exist for heavy duty engine service.

2. Referenced Documents

2.1 ASTM Standards:²

- D 512 Test Methods for Chloride Ion In Water
- D 516 Test Method for Sulfate Ion in Water
- D 1119 Test Method for Percent Ash Content of Engine Coolants
- D 1120 Test Method for Boiling Point of Engine Coolants
- D 1121 Test Method for Reserve Alkalinity of Engine Coolants and Antirusts
- D 1122 Test Method for Density or Relative Density of Engine Coolant Concentrates and Engine Coolants By The Hydrometer
- D 1123 Test Methods for Water in Engine Coolant Concentrate by the Karl Fischer Reagent Method
- D 1126 Test Method for Hardness in Water
- D 1177 Test Method for Freezing Point of Aqueous Engine Coolants
- D 1287 Test Method for pH of Engine Coolants and Antirusts
- D 1293 Test Methods for pH of Water
- D 1384 Test Method for Corrosion Test for Engine Coolants in Glassware
- D 1881 Test Method for Foaming Tendencies of Engine Coolants in Glassware
- D 1882 Test Method for Effect of Cooling System Chemical Solutions on Organic Finishes for Automotive Vehicles

¹ This specification is under the jurisdiction of ASTM Committee D15 on Engine Coolants and is the direct responsibility of Subcommittee D15.07 on Specifications. Current edition approved Jan-May 15, 2008. Published February-June 2008. Originally approved in 1974. Last previous edition approved in 2005 as D 3306 – 058.

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 General Requirements

Property	Specified Values	ASTM Test Method
Color	Distinctive	...
Effect on nonmetals	No adverse effect	under consideration

TABLE 2 Physical and Chemical Requirements

Property	Type I	Type II	Type III	Type IV	ASTM Test Method
Relative density 15.5/15.5°C (60/60°F)	1.110 to 1.145	1.030 to 1.065	1.065 min	1.025 min	D 1122, D 5931
Freezing point, °C (°F): 50 vol % in DI water Undiluted	-37 (-34) max	-32 (-26) max	-37 (-34) max	-32 (-26) max	D 1177, D 6660
Boiling point, ^A °C (°F): 50 vol % in DI water Undiluted	108 (226) min 163 (325) min	104 (219) min 152 (305) min	108 (226) min	104 (219) min	D 1120
Ash content, mass %	5 max	5 max	2.5 max	2.5 max	D 1119
pH: 50 vol % in DI water Undiluted	7.5 to 11	7.5 to 11	7.5 to 11	7.5 to 11	D 1287
Chloride, ppm	25 max	25 max	25 max	25 max	D 3634, D 5827 ^B
Water, mass %	5 max	5 max	not applicable	not applicable	D 1123
Reserve alkalinity, mL	report ^C	report ^C	report ^C	report ^C	D 1121
Effect on automotive finish (use clear coat thermoset urethane or acrylic urethane finish)	no effect	no effect	no effect	no effect	D 1882 ^D

^A Some precipitate may be observed at the end of the test. This should not be cause for rejection.

^B In case of dispute, D 3634 shall be the preferred test method.

^C Value as agreed upon between the supplier and the customer.

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

D 1888 Methods of Test for Particulate and Dissolved Matter in Water³

D 2570 Test Method for Simulated Service Corrosion Testing of Engine Coolants

D 2809 Test Method for Cavitation Corrosion and Erosion-Corrosion Characteristics of Aluminum Pumps With Engine Coolants

D 3321 Test Method for Use of the Refractometer for Field Test Determination of the Freezing Point of Aqueous Engine Coolants

D 3634 Test Method for Trace Chloride Ion in Engine Coolants

D 4327 Test Method for Anions in Water by Chemically Suppressed Ion Chromatography

D 4340 Test Method for Corrosion of Cast Aluminum Alloys in Engine Coolants Under Heat-Rejecting Conditions

D 4985 Specification for Low Silicate Ethylene Glycol Base Engine Coolant for Heavy Duty Engines Requiring a Pre-Charge of Supplemental Coolant Additive (SCA)

D 5827 Test Method for Analysis of Engine Coolant for Chloride and Other Anions by Ion Chromatography

D 5931 Test Method for Density and Relative Density of Engine Coolant Concentrates and Aqueous Engine Coolants by Digital Density Meter

D 6210 Specification for Fully-Formulated Glycol Base Engine Coolant for Heavy-Duty Engines

D 6471 Specification for Recycled Prediluted Aqueous Glycol Base Engine Coolant (50 Volume % Minimum) for Automobile and Light-Duty Service

D 6472 Specification for Recycled Glycol Base Engine Coolant Concentrate for Automobile and Light-Duty Service

D 6660 Test Method for Freezing Point of Aqueous Ethylene Glycol Base Engine Coolants by Automatic Phase Transition Method

E 394 Test Method for Iron in Trace Quantities Using the 1,10-Phenanthroline Method

E 1177 Specification for Engine Coolant Grade Glycol

3. General Requirements

3.1 Engine coolant concentrates or prediluted glycol base engine coolants shall be formulated with either ethylene glycol or

³ Withdrawn.

TABLE 3 Performance Requirements^A

Property	Specific Values	ASTM Test Method	Test Solution Concentration, vol % Glycol
Corrosion in glassware		D 1384 ^B	33
Weight loss, mg/specimen			
copper	10 max		
solder	30 max		
brass	10 max		
steel	10 max		
cast iron	10 max		
aluminum	30 max		
Simulated service test		D 2570 ^C	44
Weight loss, mg/specimen			
copper	20 max		
solder	60 max		
brass	20 max		
steel	20 max		
cast iron	20 max		
aluminum	60 max		
Corrosion of Cast Aluminum Alloys at Heat-Rejecting Surfaces, mg/cm ² /week	1.0 max	D 4340 ^D	25
Foaming		D 1881 ^E	33
Volume, mL	150 max		
Break time, s	5 max		
Cavitation-Erosion	8 min	D 2809 ^F	17
Rating for pitting, cavitation, and erosion of the water pump			

^A For engine coolant concentrates, test solutions shall be prepared in accordance with the directions provided in the individual ASTM test methods noted. For prediluted engine coolants, prepare test solutions using the directions provided in Footnotes B through F.

^B For prediluted coolants, prepare the test solution by mixing 67 volume % of the adjusted (see 4.6) prediluted product with 33 volume % ASTM Type IV reagent water. Add 99 mg of sodium sulfate, 110 mg of sodium chloride, and 92 mg of sodium bicarbonate per litre of test solution.

^C For prediluted coolants, prepare the test solution by mixing 88 volume % of the adjusted (see 4.6) prediluted product with 12 volume % ASTM Type IV reagent water. Add 83 mg of sodium sulfate, 92 mg of sodium chloride, and 77 mg of sodium bicarbonate per litre of test solution.

^D For prediluted coolants, prepare the test solution by mixing 50 volume % of the adjusted (see 4.6) prediluted product with 50 volume % ASTM Type IV reagent water. Add 165 mg of sodium chloride per litre of test solution.

^E For prediluted coolants, prepare the test solution by mixing 67 volume % of the adjusted (see 4.6) prediluted product with 33 volume % ASTM Type II reagent water.

^F For prediluted coolants, prepare the test solution by mixing 33 volume % of the adjusted (see 4.6) prediluted product with 67 volume % ASTM Type IV reagent water. Add 123 mg of sodium sulfate, 137 mg of sodium chloride, and 115 mg of sodium bicarbonate per litre of test solution.

propylene glycol meeting Specification E 1177, water, and shall contain suitable corrosion inhibitors, dye, and a foam suppressor.

3.2 Ethylene glycol base engine coolant concentrates (Type I) may contain a maximum of 15 % other glycols, as long as the physical, chemical, and performance requirements of this specification can be met. Similarly, prediluted ethylene glycol base coolants (Type III) may contain a maximum of 7.5 % other glycols as long as all of the requirements of this specification can be met.

3.3 Propylene glycol base engine coolant concentrates (Type II) may contain a combined maximum of 1 % other glycols (less than 0.5 % for prediluted propylene glycol base coolants, Type IV) and all of the physical, chemical, and performance requirements of this specification must be met.

3.4 All engine coolant concentrates or prediluted glycol base engine coolants shall conform to the general requirements given in Table 1.

3.5 Prediluted glycol base engine coolants shall be formulated using water that meets the following requirements:

Property	Specific Values	ASTM Test Method
Chlorides, ppm (grains/gal)	25 (1.5) max	D 512, D 4327
Sulfate, ppm (grains/gal)	50 (3.0) max	D 516, D 4327
Hardness, as CaCO ₃ , ppm (grains/gal)	20 (1.2) max	D 1126
pH	5.5 to 8.5	D 1293
Iron, ppm (grains/gal)	1.0 (0.06) max	E 394

NOTE 3—Prediluted coolants are intended for direct addition to an engine cooling system with no further dilution. However, if circumstances require addition and prediluted aqueous engine coolant is not available, use the appropriate engine coolant concentrate (Type I or II) diluted to 50 volume % with water of at least the quality outlined in Table X1.1.

3.6 When diluting engine coolant concentrates for actual service, use a municipal (treated) water, or a low-mineral content well water (see Appendix X1, Table X1.1). If such water is not available, use deionized (demineralized) or distilled water. This procedure will minimize the formation of hard water scale and avoid the introduction of mineral components, such as chlorides and sulfates, which can increase the corrosion rate of aluminum and iron.

3.7 When installed in accordance with the vehicle manufacturer's recommendations and those on the product label, engine coolant concentrates or prediluted glycol base engine coolants shall be suitable for use in a properly maintained cooling system (Appendix X1) in normal light-duty service for a minimum of one year without adversely affecting fluid flow and heat transfer.