



Designation: D 3306 – 05

# Standard Specification for Glycol Base Engine Coolant for Automobile and Light-Duty Service<sup>1</sup>

This standard is issued under the fixed designation D 3306; 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 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. Separate specifications exist for engine coolants prepared from recycled or reprocessed used coolant or reprocessed industrial-source glycols.

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:<sup>2</sup>

D 512 Test Methods for Chloride Ion in Water

<sup>1</sup> 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 Oct. 1, 2005. Published November 2005. Originally approved in 1974. Last previous edition approved in 2003 as D 3306 – 03.

<sup>2</sup> 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

- D 516 Test Methods for Sulfate Ion in Water
- D 1119 Test Method for Percent Ash Content of Engine Coolants and Antirusts
- 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 and 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
- D 1888 Test Methods for Particulate and Dissolved Matter, Solids, or Residue in Water
- 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

**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, <sup>A</sup> °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 <sup>B</sup>
Water, mass %	5 max	5 max	not applicable	not applicable	D 1123
Reserve alkalinity, mL	report <sup>C</sup>	report <sup>C</sup>	report <sup>C</sup>	report <sup>C</sup>	D 1121
Effect on automotive finish (use clear coat thermostat urethane or acrylic urethane finish)	no effect	no effect	no effect	no effect	D 1882 <sup>D</sup>

<sup>A</sup> Some precipitate may be observed at the end of the test. This should not be cause for rejection.

<sup>B</sup> In case of dispute, D 3634 shall be the preferred test method.

<sup>C</sup> Value as agreed upon between the supplier and the customer.

<sup>D</sup> 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.

**TABLE 3 Performance Requirements<sup>A</sup>**

Property	Specific Values	ASTM Test Method	Test Solution Concentration, vol % Glycol
Corrosion in glassware		D 1384 <sup>B</sup>	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 <sup>C</sup>	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 <sup>2</sup> /week	1.0 max	D 4340 <sup>D</sup>	25
Foaming		D 1881 <sup>E</sup>	33
Volume, mL	150 max		
Break time, s	5 max		
Cavitation-Erosion	8 min	D 2809 <sup>F</sup>	17
Rating for pitting, cavitation, and erosion of the water pump			

<sup>A</sup> 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.

<sup>B</sup> 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.

<sup>C</sup> 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.

<sup>D</sup> 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.

<sup>E</sup> 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.

<sup>F</sup> 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.