Designation: D 4985 – 03

Standard Specification for Low Silicate Ethylene Glycol Base Engine Coolant for Heavy Duty Engines Requiring a Pre-Charge of Supplemental Coolant Additive (SCA)[1]

This standard is issued under the fixed designation D 4985; 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 the requirements for low silicate ethylene glycol base engine coolants for cooling systems of heavy-duty engines. When concentrates are used at 40 to 60 % 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 corrosion, freezing to at least −37°C (−34°F), and boiling to at least 108°C (226°F).

NOTE 1—This specification is based on the knowledge of the performance of engine coolants prepared from new or virgin ingredients. A separate specification exists (D 6210) for heavy-duty engine coolants which may be prepared from recycled or reprocessed used coolant or reprocessed industrial-source ethylene glycol.

1.2 Coolants meeting this specification require an initial charge of a supplemental coolant additive (SCA) and require regular maintenance doses of an SCA to continue the protection in certain operating heavy-duty engine cooling systems, particularly those of the wet cylinder liner-in-block design. The SCA additions are defined by and are the primary responsibility of the engine manufacturer or vehicle manufacturer. If they provide no instructions, follow the SCA supplier's recommended instructions.

1.3 The values stated in SI units are to be regarded as the standard. The values given 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.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 512 Test Methods for Chloride Ion in Water[2]
D 516 Test Method for Sulfate Ion in Water[2]
D 1119 Test Method for Percent Ash Content of Engine Coolants and Antirusts[3]
D 1120 Test Method for Boiling Point of Engine Coolants[3]
D 1121 Test Method for Reserve Alkalinity of Engine Coolants and Antirusts[3]
D 1122 Test Method for Density and Relative Density of Engine Coolant Concentrates and Engine Coolants by the Hydrometer[3]
D 1123 Test Methods for Water in Engine Coolant Concentrate by the Karl Fischer Reagent Method[3]
D 1126 Test Method for Hardness in Water[2]
D 1177 Test Method for Freezing Point of Aqueous Engine Coolants[3]
D 1193 Specification for Reagent Water[2]
D 1287 Test Method for pH of Engine Coolants and Antirusts[3]
D 1293 Test Methods for pH of Water[2]
D 1384 Test Method for Corrosion Test for Engine Coolants in Glassware[3]
D 1881 Test Method for Foaming Tendencies of Engine Coolants in Glassware[3]
D 1882 Test Method for Effect of Cooling System Chemical Solutions on Organic Finishes for Automotive Vehicles[3]
D 1888 Test Methods for Particulate and Dissolved Matter, Solids, or Residue in Water[4]
D 2570 Test Method for Simulated Service Corrosion Testing of Engine Coolants[3]
D 2809 Test Method for Cavitation Corrosion and Erosion-Corrosion Characteristics of Aluminum Pumps With Engine Coolants[3]

[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.
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[2] *Annual Book of ASTM Standards*, Vol 11.01.
[3] *Annual Book of ASTM Standards*, Vol 15.05.
[4] Discontinued—See 1990 *Annual Book of ASTM Standards*, Vol 11.01.

D 3306 Specification for Glycol Base Engine Coolant for Automobile and Light-Duty Service[3]

D 3634 Test Method for Trace Chloride Ion in Engine Coolants[3]

D 4327 Test Method for Anions in Water by Chemically Suppressed Ion Chromatography[2]

D 5827 Test Method for Determination of Chloride in Engine Coolant by Ion Chromatography[3]

D 5931 Test Method for Density and Relative Density of Engine Coolant Concentrates and Aqueous Engine Coolants by Digital Density Meter[3]

D 6129 Test Method for Silicon in Engine Coolant Concentrates by Atomic Absorption Spectroscopy[3]

D 6130 Test Method for the Determination of Silicon and Other Elements in Engine Coolant by Inductively Coupled Plasma-Atomic Emission Spectroscopy[3]

D 6210 Specification for Fully Formulated Glycol Base Engine Coolant for Heavy Duty Engines[3]

D 6660 Test Method for Freezing Point of Aqueous Ethylene Glycol Base Engine Coolants by Automatic Phase Transition Method[3]

E 394 Test Method for Iron in Trace Quantities Using the 1,10-Phenanthroline Method[3]

E 1177 Specification for Engine Coolant Grade Glycol[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *heavy duty engine*—a diesel, gasoline, or similarly fueled internal combustion engine, having operating characteristics of a long duty cycle at or near maximum rated conditions. Such engines are typically used in off-highway machinery for agriculture, mining, earth-moving, and construction; Class 5 to 8 over the road trucks and buses; high output stationary engine installations; and locomotive and marine installations. (See Specification D 3306 for coolant requirements for automobiles, vans, and pickup class trucks.)

3.1.2 *supplemental coolant additive (SCA)*—a material added to the cooling system of a heavy-duty engine to provide additional cavitation protection and corrosion inhibition and to minimize deposits on heat transfer surfaces.

4. General Requirements

4.1 Ethylene glycol base engine coolant concentrates or prediluted ethylene glycol base engine coolants shall be formulated with ethylene glycol meeting Specification D 1177, water, and shall contain suitable corrosion inhibitors, dye, and a foam suppressor. Other glycols, such as propylene and diethylene, may be included in concentrates up to a maximum of 15 % (7.5 % for prediluted coolants) if the physical and chemical properties in Table 1 are met.

4.2 All ethylene glycol base engine coolants shall conform to the general requirements in Table 2.

TABLE 1 Physical and Chemical Requirements

Property	Specific Values		ASTM Test Method
	Concentrate	Predilute	
Relative density, 15.5/15.5°C (60/60°F)	1.110 to 1.145	1.065 min	D 1122, D 5931
Freezing point, °C (°F):			D 1177, D 6660
50 vol % in DI water	–37 (–34) max		
Undiluted		–37 (–34) max	
Boiling point,[A] °C (°F):			D 1120
Undiluted	163 (325) min	108 (226) min	
50 vol % in DI water	108 (226) min		
Ash content, mass %	5 max	2.5 max	D 1119
pH:			D 1287
50 vol % in DI water	7.5 to 11		
Undiluted		7.5 to 11	
Reserve alkalinity, mL	report[B]	report[B]	D 1121
Water, mass %	5 max	not applicable	D 1123
Chloride ion, ppm	25 max	25 max	D 3634, D 5827
Silicon, ppm	250 max	125 max	D 6129, D 6130
Effect on engine or vehicle finish	no effect	no effect	D 1882[C]

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

[B] Value as agreed upon between the supplier and the customer.

[C] Currently, many heavy-duty engine manufacturers and vehicle manufacturers that use these engines prepare test panels using the specific paint finishes employed on their actual products. Coolant suppliers and equipment builders should agree on the exact test procedures and acceptance criteria on an individual case basis.

TABLE 2 General Requirements

Property	Specific Values	ASTM Test Method
Color	distinctive	. . .
Effect on nonmetals	no adverse effect	under consideration

4.3 Prediluted coolants shall be prepared using deionized 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 2—Prediluted coolants are intended for direct addition to an engine cooling system with no further dilution.

This practice minimizes the formation of hard water scale and avoids the introduction of mineral components, such as chlorides and sulfates, which can increase the corrosion rate of aluminum and iron. The use of Type IV reagent water also minimizes interferences that may cause coolant instability or SCA compatibility problems.

4.4 When diluting engine coolant concentrates for actual service, municipal (treated) or a low-mineral content well water should be used (see Appendix X1, Table X1.1).