



Designation: D 6210 – 98a

Standard Specification for Fully-Formulated Ethylene-Glycol-Base Engine Coolant for Heavy-Duty Engines¹

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1. Scope

1.1 This specification covers the requirements for a fully-formulated ethylene-glycol-base coolant for cooling systems of heavy-duty engines. When concentrates are used at 40 to 60 % ethylene-glycol concentration by volume in water of suitable quality, (see Appendix X1), or when prediluted ethylene-glycol base engine coolants (50 % volume, % minimum) are used without further dilution, it will function effectively during both winter and summer to provide protection against corrosion, cavitation, freezing, and boiling.

1.2 This specification is intended to cover the requirements for engine coolants prepared from virgin or recycled ethylene glycol.

1.3 Both concentrated and prediluted products are covered by this specification.

1.4 Coolant concentrates meeting this specification do not require any addition of Supplemental Coolant Additive (SCA) until the first maintenance interval when a maintenance does of SCA is required to continue protection in certain 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 instructions.

1.5 This specification does not cover extended service interval coolants.

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

1.7 *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 1126 Test Method for Hardness in Water²

D 1293 Test Method for pH of Water²

D 3306 Specification for Ethylene Glycol Base Engine Coolant for Automobile and Light Duty Service³

D 4327 Test Method for Anions in Water by Chemically-Suppressed Ion Chromatography²

D 4656 Specification for Prediluted Ethylene Glycol-Based Engine Coolant (50 Volume % Minimum) for Automobiles and Light Duty Service³

D 5828 Test Method for Compatibility of Supplemental Additives (SCA) and Engine Coolant Concentrates³

3. General Requirements

3.1 Concentrated coolant shall meet all of the requirements of Specification D 3306. Prediluted coolant shall meet all the requirements of Specification D 4656.

3.2 The coolant concentrate mixed with water or the prediluted coolant, when maintained with maintenance doses of SCA in accordance with the engine manufacturer's recommendations, and those on the product label, shall be suitable for use in a properly maintained cooling system in normal service for a minimum of one year (see Appendix X1).

4. Additional Requirements

4.1 The coolant concentrate additionally shall provide, protection in operating engines against cavitation corrosion, also termed liner pitting, and against scaling of internal engine hot surfaces. Hot surfaces typically are within the engine head, head space, or liquid cooled exhaust manifold. ASTM has test methods under development for both cavitation corrosion and hot surface scaling. Until these procedures are approved as ASTM standards, the mandatory requirements of Annex A1 shall apply.

4.2 Both the concentrated and prediluted coolants shall contain less than 50 ppm sulfate ion.

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.



4.3 Concentrated coolant must contain less than 4 % total dissolved solids as measured using Modified Federal Method 2540C.⁴ Prediluted coolant must contain less than 2 % total dissolved solids using the same method.

⁴ Federal Method 2540C, "Total Dissolved Solids Dried at 180°C," Standard Method for the Examination of Water and Wastewater, American Public Health Association, et al, 1015 15th Street, N.W., Washington, DC 20005.

5. Keywords

5.1 cavitation; fully-formulated heavy-duty engine coolant; supplemental coolant additive maintenance dose

ANNEX

(Mandatory Information)

A1. CHEMICAL REQUIREMENTS FOR FULLY FORMULATED HEAVY DUTY ENGINE COOLANT

A1.1 Laboratory data or in-service experience demonstrating a positive influence on reducing cavitation corrosion in an operating engine is required.

A1.1.1 In-service qualification tests may consist of single- or multiple-cylinder engine tests. At the option of the engine or vehicle manufacturer, such testing may be conducted in "loose engines" or in engines fully integrated into an application, such as a vehicle, a power boat, or a stationary power source. One such test has been developed.⁵

A1.2 Several chemical compositions have been tested extensively by producers and users and satisfactorily minimize cylinder liner cavitation in actual test engines. Coolants meeting these compositions are regarded as passing the requirements of A1.1.

A1.2.1 A minimum concentration of nitrite as NO₂ of 1200 ppm in the coolant.

⁵ "A Comparison of Engine Coolant in an Accelerated Heavy-Duty Engine Cavitation Test," SAE Technical Paper 960883, SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

A1.2.2 A minimum combined concentration of nitrite as NO₂ plus molybdate as MoO₄ in the coolant of 780 ppm. At least 300 ppm each of NO₂ and MoO₄ must be present.

A1.3 Chemical composition requirements for cavitation corrosion protection will be removed from this specification and replaced with an ASTM test method when a test method is developed and adopted.

A1.4 Both concentrated and prediluted coolants under this specification must contain additives to minimize hot surface scaling deposits. Certain additives (polyacrylate and other types) minimize the deposition of calcium and magnesium compounds on heat rejecting surfaces. No specific chemical requirements for hot surface scaling and deposits resistance have been established at this time. A test procedure is under development and will be incorporated into the specification when a procedure is approved by ASTM.

A1.5 Lack of compatibility between the coolant and SCA products' chemistry results in chemical ingredient dropout from solution, with potential adverse effects in the vehicle or engine cooling system. A test procedure for compatibility (Test Method D 5828) has been approved and will be incorporated into the specification when limits are determined.

APPENDIX

(Nonmandatory Information)

X1. COOLANT MAINTENANCE FOR HEAVY DUTY ENGINES

X1.1 *Engine Coolant*—Cooling system fill for a heavy duty engine consists of water and fully formulated heavy duty coolant or water, low-silicate coolant concentrate and supplemental coolant additive.

X1.1.1 *Water:*

X1.1.1.1 Water quality affects the efficiency of coolant additives. When untreated, all water is corrosive. Water having a high mineral content or corrosive materials is unfit for cooling system use.

X1.1.1.2 When preparing solutions, the water should be of such quality that it does not contain excessive solids, hardness salts, sulfates, or chlorides. In the absence of specific recommendations from the engine or vehicle manufacture, see Table X1.1. Contact your local water department, the responsible government agency, or submit a water sample for analysis if there is a question on water quality

X1.1.2 *Coolant Concentrates:*