Designation: ~~D6210 – 10~~ D6210 – 17

Standard Specification for Fully-Formulated Glycol Base Engine Coolant for Heavy-Duty Engines[1,2]

This standard is issued under the fixed designation D6210; 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 fully-formulated glycol base coolants for cooling systems of heavy-duty engines. When concentrates are used at 40 to 60 % glycol concentration by volume in water of suitable quality, (see Appendix X1), or when prediluted glycol base engine coolants (50 volume % minimum) are used without further dilution, they 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 or propylene glycol.

NOTE 1—Committee D15 has not substantially studied the impact of using recycled glycols from sources such as:

- glycol bottoms
- polyester manufacturing waste
- aircraft and runway deicers
- medical waste

to prepare engine coolants. However, several serious cases of very poor performance have been reported and substantiated in heavy duty fleets when recycled glycols from sources such as above have been used to prepare engine coolants. Efforts are underway to more clearly define the purity requirements for glycols used to prepare engine coolants meeting this specification, whether from recycled engine coolants or other sources.

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

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

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

1.6 *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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D1126 Test Method for Hardness in Water

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[1] This specification is under the jurisdiction of ASTM Committee D15 on Engine Coolants and Related Fluids and is the direct responsibility of Subcommittee D15.07 on Specifications.

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[2] A research report is available from ASTM International Headquarters. Request RR:D15-1023.

[3] 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**

D1293 Test Methods for pH of Water
D3306 Specification for Glycol Base Engine Coolant for Automobile and Light-Duty Service
D4327 Test Method for Anions in Water by Suppressed Ion Chromatography
D5828 Test Method for Compatibility of Supplemental Coolant Additives (SCAs) and Engine Coolant Concentrates
D7583 Test Method for John Deere Coolant Cavitation Test

2.2 *Other ~~Standards:~~ Standard:*[4]
Federal Method 2540B Total Dissolved Solids Dried at 103–105°C

3. General Requirements

3.1 Concentrated and prediluted coolants shall meet all of the general, physical, chemical, and performance requirements of Specification D3306~~.~~, Tables 1, 2, 3, and ~~3.~~4.

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 two years (see Appendix X1).

4. Additional Requirements

4.1 The coolant concentrate or prediluted coolant 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 spacer, upper cylinder liner, or liquid cooled exhaust manifold. ~~ASTM~~Annex A1 ~~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~~ details requirements that ~~Annex A1~~shall ~~apply.~~be met.

4.2 Lack of compatibility between the coolant and SCA product's chemistry may cause the solute to precipitate out of solution, with potential adverse effects in the vehicle or engine cooling system. A test procedure for compatibility (Test Method D5828) has been developed and approved. The compatibility of SCA and coolant concentrate solutions meeting this specification shall be determined using Test Method D5828 and the results reported. ASTM Committee D15 has not determined a pass/fail limit for this test. Limits are to be agreed upon between the customer and the supplier.

4.3 Both the concentrated and prediluted coolants shall contain less than 50 µg/g sulfate ion.

5. Keywords

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

ANNEX

(Mandatory Information)

A1. 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. See Table A1.1.

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]

A1.1.2 Coolants that have completed the Test Method D7583 (laboratory test method to demonstrate coolant cavitation performance) test with a maximum pit count of 200 are regarded as passing the requirements of A1.1.

A1.1.3 Several chemical compositions have been tested extensively by producers and users and satisfactorily minimize cylinder liner cavitation in actual test engines. Coolants meeting either of the following compositions are regarded as passing the requirements of A1.1:

[4] ~~Standard Method for the Examination of Water and Wastewater, American Public Health Association, et al, 1015 15th Street, N.W. Washington, DC 20005~~ *Standard Method for the Examination of Water and Wastewater*, American Public Health Association (APHA), et al, 800 I Street, NW, Washington, DC 20001.

[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.~~15096.

TABLE A1.1 Cavitation Protection Options Meeting the Requirements of A1.1

Utilize one of the Following	Predilute or Concentrate	Acceptance Criteria
~~Utilize one of the Following~~	~~Predilute or Concentrate~~	~~Acceptance Criteria~~
~~In-service test~~	~~per agreement~~	~~agreement between engine manufacturer and coolant supplier for test criteria~~
In-service test	per agreement	agreement between engine manufacturer and coolant supplier for test criteria
~~Laboratory test (D7583)~~	~~per tested formulation~~	~~maximum 200 pit count measured per Test Method D7583~~
Laboratory test (D7583) (for all formulations that do not meet the chemical composition requirements below)	per tested formulation	maximum 200 pit count measured per Test Method D7583
Chemical Composition		
~~Nitrite formulation~~	~~predilute~~	~~nitrite (as NO_2^-) of 1200 µg/g (ppm) minimum~~
Nitrite formulation	predilute	nitrite (as NO_2^-) of 1200 µg/g (ppm) minimum
~~Nitrite formulation~~	~~concentrate~~	~~nitrite (as NO_2^-) of 2400 µg/g (ppm) minimum~~
Nitrite formulation	concentrate	nitrite (as NO_2^-) of 2400 µg/g (ppm) minimum
~~Combined nitrite and molybdate formulation~~	~~predilute~~	~~combined concentration of nitrite (as NO_2^-) plus molybdate as (MoO_4^{-2}) of 780 µg/g (ppm) minimum. At least 300 µg/g (ppm) each of NO_2^- and MoO_4^{-2} must be present~~
Combined nitrite and molybdate formulation	predilute	combined concentration of nitrite (as NO_2^-) plus molybdate as (MoO_4^{-2}) of 780 µg/g (ppm) minimum. At least 300 µg/g (ppm) each of NO_2^- and MoO_4^{-2} must be present
~~Combined nitrite and molybdate formulation~~	~~concentrate~~	~~combined concentration of nitrite (as NO_2^-) plus molybdate (as MoO_4^{-2}) of 1560 µg/g (ppm) minimum. At least 600 µg/g (ppm) each of NO_2^- and MoO_4^{-2} must be present~~
Combined nitrite and molybdate formulation	concentrate	combined concentration of nitrite (as NO_2^-) plus molybdate (as MoO_4^{-2}) of 1560 µg/g (ppm) minimum. At least 600 µg/g (ppm) each of NO_2^- and MoO_4^{-2} must be present

A1.1.3.1 A minimum concentration of nitrite (as NO_2^-) of 1200 µg/g (ppm) in the 50 volume % predilute coolant, or

A1.1.3.2 A minimum combined concentration of nitrite (as NO_2^-) plus molybdate (as MoO_4^{-2}) in the 50 volume % predilute coolant of 780 µg/g (ppm). At least 300 µg/g (ppm) each of NO_2^- and MoO_4^{-2} must be present.

A1.1.3.3 The above concentrations are doubled for coolant concentrates.

A1.2 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.~~