



Designation: D6210 – 17

# Standard Specification for Fully-Formulated Glycol Base Engine Coolant for Heavy-Duty Engines<sup>1,2</sup>

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 ( $\epsilon$ ) 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

<sup>1</sup> 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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<sup>2</sup> A research report is available from ASTM International Headquarters. Request RR:D15-1023.

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, health, and 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:<sup>3</sup>

- D1126 Test Method for Hardness in Water
  - 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 Standard:<sup>4</sup>
- Federal Method 2540B Total Dissolved Solids Dried at 103–105°C

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>4</sup> *Standard Method for the Examination of Water and Wastewater*, American Public Health Association (APHA), et al, 800 I Street, NW, Washington, DC 20001.

\*A Summary of Changes section appears at the end of this standard

### 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 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. **Annex A1** details requirements that shall 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.<sup>5</sup>

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**:

A1.1.3.1 A minimum concentration of nitrite (as NO<sub>2</sub><sup>-</sup>) of 1200 µg/g (ppm) in the 50 volume % predilute coolant, or

A1.1.3.2 A minimum combined concentration of nitrite (as NO<sub>2</sub><sup>-</sup>) plus molybdate (as MoO<sub>4</sub><sup>-2</sup>) in the 50 volume % predilute coolant of 780 µg/g (ppm). At least 300 µg/g (ppm) each of NO<sub>2</sub><sup>-</sup> and MoO<sub>4</sub><sup>-2</sup> 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

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

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
Laboratory test ( <b>D7583</b> ) (for all formulations that do not meet the chemical composition requirements below)	per tested formulation	maximum 200 pit count measured per Test Method <b>D7583</b>
Chemical Composition	Nitrite formulation	nitrite (as NO <sub>2</sub> <sup>-</sup> ) of 1200 µg/g (ppm) minimum
	Nitrite formulation	nitrite (as NO <sub>2</sub> <sup>-</sup> ) of 2400 µg/g (ppm) minimum
Combined nitrite and molybdate formulation	predilute	combined concentration of nitrite (as NO <sub>2</sub> <sup>-</sup> ) plus molybdate as (MoO <sub>4</sub> <sup>-2</sup> ) of 780 µg/g (ppm) minimum. At least 300 µg/g (ppm) each of NO <sub>2</sub> <sup>-</sup> and MoO <sub>4</sub> <sup>-2</sup> must be present
		combined concentration of nitrite (as NO <sub>2</sub> <sup>-</sup> ) plus molybdate (as MoO <sub>4</sub> <sup>-2</sup> ) of 1560 µg/g (ppm) minimum. At least 600 µg/g (ppm) each of NO <sub>2</sub> <sup>-</sup> and MoO <sub>4</sub> <sup>-2</sup> must be present
Combined nitrite and molybdate formulation	concentrate	combined concentration of nitrite (as NO <sub>2</sub> <sup>-</sup> ) plus molybdate (as MoO <sub>4</sub> <sup>-2</sup> ) of 1560 µg/g (ppm) minimum. At least 600 µg/g (ppm) each of NO <sub>2</sub> <sup>-</sup> and MoO <sub>4</sub> <sup>-2</sup> must be present

<sup>5</sup> "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.