



Designation: D7517 – 19

Standard Specification for Fully-Formulated 1,3 Propanediol (PDO) Base Engine Coolant for Heavy-Duty Engines¹

This standard is issued under the fixed designation D7517; 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 % PDO concentration by volume in water of suitable quality, (see [Appendix X1](#)), or when prediluted PDO 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 The coolants governed by this specification are categorized as follows:

Coolant Type	Description
I-FF	1,3 Propanediol base concentrate
II-FF	1,3 Propanediol predilute (50 vol %)

1.3 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.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.5 *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 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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1.6 *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:²

- D512 Test Methods for Chloride Ion in Water
- D516 Test Method for Sulfate Ion in Water
- D1126 Test Method for Hardness in Water
- D1287 Test Method for pH of Engine Coolants and Antirusts
- D1293 Test Methods for pH of Water
- D4327 Test Method for Anions in Water by Suppressed Ion Chromatography
- D4725 Terminology for Engine Coolants and Related Fluids
- D5827 Test Method for Analysis of Engine Coolant for Chloride and Other Anions by Ion Chromatography
- D5828 Test Method for Compatibility of Supplemental Coolant Additives (SCAs) and Engine Coolant Concentrates
- D6130 Test Method for Determination of Silicon and Other Elements in Engine Coolant by Inductively Coupled Plasma-Atomic Emission Spectroscopy
- D7518 Specification for 1,3 Propanediol (PDO) Base Engine Coolant for Automobile and Light-Duty Service
- D7583 Test Method for John Deere Coolant Cavitation Test
- E394 Test Method for Iron in Trace Quantities Using the 1,10-Phenanthroline Method

2.2 Other Document:³

- Federal Method 2540B Total Dissolved Solids Dried at 103-105°C

² 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.

³ *Standard Methods for the Examination of Water and Wastewater*. American Public Health Association, et al, 800 I Street, NW, Washington, DC 20001, <http://www.apha.org>.

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

3. Terminology

3.1 Definitions:

3.1.1 *supplemental coolant additive (SCA), n*—an additive used in conventionally inhibited heavy-duty engine coolants required to maintain protection against general corrosion, cylinder liner pitting, and scaling in heavy-duty engines.

3.1.2 For other definitions used in this specification, refer to Terminology **D4725**.

4. General Requirements

4.1 Concentrated and prediluted coolants shall meet all of the respective requirements of Specification **D7518**.

4.2 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**).

5. Additional Requirements

5.1 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.

5.2 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 customer and supplier.

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

6. Keywords

6.1 1,3-propanediol; cavitation; fully-formulated heavy-duty engine coolant; maintenance dose; PDO; supplemental coolant additive

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 (that is, engines modified to induce liner cavitation)"

or in engines fully integrated into an application, such as a vehicle, a powerboat, or a stationary power source. One such test has been developed.⁴

⁴ "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.

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	In accordance with agreement	Agreement between engine manufacturer and coolant supplier for test criteria
Laboratory test (Test Method D7583) (for all formulations that do not meet the Chemical Composition requirements below)	In accordance with tested formulation	Maximum 200 pit count measured in accordance with Test Method D7583)
Chemical Composition		
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
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.