



Designation: D7715 – 11

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

This standard is issued under the fixed designation D7715; 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 glycerin base coolants for cooling systems of heavy-duty engines. When concentrates are used at 40 to 60 % glycerin concentration by volume in water of suitable quality (see [Appendix X1](#)), or when prediluted glycerin base engine coolants (50 volume % min) 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 glycerin.

NOTE 1—This specification is based on the knowledge of the performance of engine coolants prepared from new or virgin ingredients that comply with Specification [D7640](#).

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

Coolant Type	Description
V-FF	Glycerin base concentrate
VI-FF	Glycerin predilute (50 vol %)

1.4 Coolant concentrates meeting this specification do not require 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 and health practices and determine the applicability of regulatory limitations prior to use.*

<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 [D15.93](#) on Research and Long Range Planning.

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## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</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

[D3321](#) Test Method for Use of the Refractometer for Field Test Determination of the Freezing Point of Aqueous Engine Coolants

[D4327](#) Test Method for Anions in Water by Suppressed Ion Chromatography

[D4725](#) Terminology for Engine Coolants

[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

[D7583](#) Test Method for John Deere Coolant Cavitation Test

[D7640](#) Specification for Engine Coolant Grade Glycerin

[E29](#) Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

### 2.2 Other Standards:<sup>3</sup>

[Federal Method 2540B](#) Total Dissolved Solids Dried at 103 - 105°C

## 3. Terminology

### 3.1 Definitions:

3.1.1 *supplemental coolant additive (SCA), n*—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 *glycerin base engine coolant, n*—engine coolant in which the freeze point depressant is 1,2,3 propane triol, with inhibitors to minimize foaming and corrosion.

3.1.3 For other definitions and terms used in this specification, refer to Terminology [D4725](#).

<sup>2</sup> 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.

<sup>3</sup> Standard Method for the Examination of Water and Wastewater, American Public Health Association, et al, 1015 15th Street, N.W. Washington, DC 20005.

#### 4. General Requirements

4.1 Concentrated and prediluted coolants shall meet all of the physical, chemical and performance requirements of Specification **D7640**, Tables 1, 2, and 3.

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. Test methods for cavitation corrosion and hot surface scaling are under development by ASTM Committee D15. Until these procedures are approved, the mandatory requirements of **Annex A1** shall apply.

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.

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

#### 6. Keywords

6.1 cavitation; fully-formulated heavy-duty engine coolant; glycerin; 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>4</sup>

A1.1.2 Coolants that have completed Test Method **D7583** with a maximum pit count of 200 are regarded as passing the requirements of **Annex A1**.

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 **Annex A1**:

A1.1.3.1 A minimum concentration of nitrite (as  $\text{NO}_2^-$ ) of 1200 µg/g (ppm) in the 50 volume % predilute coolant, or

A1.1.3.2 A minimum combined concentration of nitrite (as  $\text{NO}_2^-$ ) plus molybdate (as  $\text{MoO}_4^{2-}$ ) in the 50 volume % predilute coolant of 780 µg/g (ppm). At least 300 µg/g (ppm) each of  $\text{NO}_2^-$  and  $\text{MoO}_4^{2-}$  must be present.

<sup>4</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 15096-0001.

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

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 (Test Method <b>D7583</b> )	Per tested formulation	200 pit count measured per Test Method <b>D7583</b> , max
Chemical composition nitrite formulation	Predilute	Nitrite (as $\text{NO}_2^-$ ) of 1200 µg/g (ppm), min
Nitrite formulation	Concentrate	Nitrite (as $\text{NO}_2^-$ ) of 2400 µg/g (ppm) , min
Combined nitrite and molybdate formulation	Predilute	Combined concentration of nitrite (as $\text{NO}_2^-$ ) plus molybdate (as $\text{MoO}_4^{2-}$ ) of 780 µg/g (ppm), min (at least 300 µg/g (ppm) each of $\text{NO}_2^-$ and $\text{MoO}_4^{2-}$ must be present)
Combined nitrite and molybdate formulation	Concentrate	Combined concentration of nitrite (as $\text{NO}_2^-$ ) plus molybdate (as $\text{MoO}_4^{2-}$ ) of 1560 µg/g (ppm), min (at least 600 µg/g (ppm) each of $\text{NO}_2^-$ and $\text{MoO}_4^{2-}$ must be present)