



Designation: D8116 – 18

Standard Specification for Fully-Formulated Non-Aqueous Engine Coolant for Heavy-Duty Engines¹

This standard is issued under the fixed designation D8116; 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 A non-aqueous engine coolant is a glycol, diol, triol, or mixtures thereof, based heat transfer fluid containing less than 1.0 % water when formulated and intended for final use without dilution with water. (Definition from Terminology [D4725](#).)

1.2 This specification covers the requirements for fully formulated non-aqueous glycol base coolants for cooling systems of heavy-duty engines. These coolants will function effectively during both winter and summer to provide protection against corrosion, cavitation, freezing, boiling, and excessive viscosity.

1.3 This specification is intended to cover the requirements for non-aqueous engine coolants prepared from virgin glycols, diols, or triols, or mixtures thereof.

1.4 Coolants meeting this specification exhibit very low vapor pressures under all operating conditions, thereby avoiding the creation and collapse of coolant vapor, the primary cause of pump and cylinder liner cavitation erosion. They may additionally contain additives that provide traditional anti-cavitation erosion coatings but there is no requirement that they must. Non-aqueous engine coolants usually contain one or more carboxylates and do not normally contain nitrites. It is suggested that coolant testing be undertaken at normal manufacturer's recommended intervals to monitor degradation products. The low vapor pressures inherent in coolants that meet this specification also provide protection from hot surface scaling, as liquid coolant is in contact with all hot metal surfaces of the engine cooling system at all times.

1.5 Water is a contaminant to non-aqueous engine coolants and it is suggested that water content be tested periodically with test strips to ideally keep water content of the coolant at 3 % or less. Increases in water cause an undesirable drop in the boiling point. It is instructive that the glassware corrosion testing per this specification is conducted at 6 % corrosive water.

¹ This specification is under the jurisdiction of ASTM Committee [D15](#) on Engine Coolants and Related Fluids and is the direct responsibility of Subcommittee [D15.22](#) on Non-Aqueous Coolants.

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1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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

1.8 *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

- [D4725](#) Terminology for Engine Coolants and Related Fluids
- [D5827](#) Test Method for Analysis of Engine Coolant for Chloride and Other Anions by Ion Chromatography
- [D6210](#) Specification for Fully-Formulated Glycol Base Engine Coolant for Heavy-Duty Engines
- [D7583](#) Test Method for John Deere Coolant Cavitation Test
- [D8085](#) Specification for Non-Aqueous Engine Coolant for Automobile and Light-Duty Service

3. Requirements

3.1 The non-aqueous coolant shall meet all the physical, chemical, and performance requirements of Specification [D8085](#), Tables 1, 2, and 3.

3.2 The non-aqueous coolant shall be suitable for use in a property maintained cooling system in normal service for a minimum of two years (see [Appendix X1](#)).

3.3 The non-aqueous coolant shall not contain more than 50 $\mu\text{g/g}$ sulfate ion (Test Method [D5827](#)).

3.4 The non-aqueous coolant shall conform to the requirements of [Annex A1](#).

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.

4. Keywords

4.1 cavitation; heavy-duty engine coolant; non-aqueous coolant

ANNEX

(Mandatory Information)

A1. REQUIREMENTS FOR NON-AQUEOUS 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.³

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 in [A1.1](#).

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

Use Either of These Methods	Acceptable Criteria
In-service test	Agreement between engine manufacturer and coolant supplier for test criteria
Laboratory test (Test Method D7583)	200 pit count measured per Test Method D7583 , max

³ “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.

APPENDIXES

(Nonmandatory Information)

X1. INSTALLATION AND MAINTENANCE OF NON-AQUEOUS COOLANT FOR HEAVY DUTY ENGINES

X1.1 It is assumed that the cooling system for the engine includes a pressurized expansion tank that is located high in the system, the tank having a fill tube at its base that connects to the inlet side of the coolant pump, and vent lines to the expansion tank from locations that could otherwise trap air. There is a pressure cap on the expansion tank. The coolant level in the expansion tank responds to the temperature of the coolant. There is an air space between the top of the coolant in the expansion tank and the top of the expansion tank.

X1.1.1 If all components of the engine cooling system are new and empty of all water or previous coolants, or both, the non-aqueous coolant may be directly installed into the cooling system.

X1.1.1.1 Introduce the coolant into the expansion tank until it is ½ full.

X1.1.1.2 Operate the engine until the thermostat opens, adding coolant as necessary to the expansion tank. Look for evidence that the vent lines are functioning.

X1.1.2 If the engine cooling system contains water or an aqueous coolant, these fluids must be drained from the system. Generally, the radiator and the block are drained and the thermostat housing is opened and drained. Air is blown through heater lines, etc. It is possible to remove enough of the old

coolant by these means to achieve a good installation, meaning, ending up, after re-filling the system with non-aqueous coolant, with a water content of 3 % or less. Always run the engine enough to assure that the thermostat has opened and full flow through the radiator is achieved.

X1.1.2.1 A glycol-based preparation fluid for absorbing water may be employed to save time and labor in the process of removing the previous coolant.

X1.1.2.2 Use test strips, available from the coolant manufacturer, to check that the water content is 3 % or less.

X1.1.3 Place a warning label at or near the expansion tank: “USE WATERLESS COOLANT ONLY.”

X1.1.4 Unless the expansion tank is overfilled, there will not be any loss of coolant by operating the engine, only by leaks. That is because the vapor pressure of non-aqueous engine coolant is so low that the pressure cap (assumed at 100 kPa) will almost never open.

X1.1.5 Water is a contaminant of non-aqueous engine coolants. As water is added, the vapor pressure increases and the boiling point drops, thereby degrading a desired feature of the coolant. It is therefore important to test the water content from time to time and more often if others could be a water source.