



Designation: D8039 – 16 (Reapproved 2023)

Standard Specification for Heat Transfer Fluids (HTF) for Heating and Air Conditioning (HVAC) Systems¹

This standard is issued under the fixed designation D8039; 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 ethylene glycol, propylene glycol, 1,3 propanediol as well as glycerin base heat transfer fluids (HTF) used in heating and air conditioning (HVAC) systems. When concentrates are used at up to 65 % concentration by weight in water, or when prediluted heat transfer fluids (30 % by weight minimum) are used without further dilution, they will function effectively to provide protection against freezing, and corrosion.

1.2 The fluids described in this specification are not appropriate for use in systems where internal combustion engines (gasoline, diesel, or CNG/LPG) are used.

1.3 The heat transfer fluids governed by this specification are categorized as follows by the primary base of freeze depressant used:

Heat Transfer Fluid Type	Description
I	Ethylene glycol
II	Propylene glycol
III	1,3-Propanediol
IV	Glycerin

1.4 Heat transfer fluids meeting this specification shall be tested and fully comply with requirements listed in **Table 1**.

NOTE 1—This specification is based on the knowledge of the performance of heat transfer fluids prepared from new or virgin ingredients. This specification shall also apply to heat transfer fluids prepared using materials generated from recycled or reprocessed ingredients, provided that these ingredients meet the requirements of Specifications **E1177** and **D7388** for Glycols and Specification **D7640** for Glycerin.

NOTE 2—This specification addresses concentrated inhibited glycols and glycerol that will be mixed with water for use in various climates and prediluted heat transfer fluids (HTF) that are factory-blended with purified water. A table of estimated freeze protection temperatures at appropriate dilutions is provided in **Appendix X1**.

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

¹ This specification is under the jurisdiction of ASTM Committee **D15** on Engine Coolants and Related Fluids and is the direct responsibility of Subcommittee **D15.30** on Industrial Heat Transfer Fluids.

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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:²

- D512** Test Methods for Chloride Ion in Water
- D516** Test Method for Sulfate Ion in Water
- D1121** Test Method for Reserve Alkalinity of Engine Coolants and Antirusts
- D1122** Test Method for Relative Density of Engine Coolant Concentrates and Engine Coolants By The Hydrometer
- D1123** Test Methods for Water in Engine Coolant Concentrate by the Karl Fischer Reagent Method
- D1126** Test Method for Hardness in Water
- D1177** Test Method for Freezing Point of Aqueous Engine Coolants
- D1287** Test Method for pH of Engine Coolants and Antirusts
- D1293** Test Methods for pH of Water
- D1881** Test Method for Foaming Tendencies of Engine Coolants in Glassware
- 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
- D5931** Test Method for Density and Relative Density of Engine Coolant Concentrates and Aqueous Engine Coolants by Digital Density Meter

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.

TABLE 1 Physical and Chemical Requirements for Heat Transfer Fluids^A

Property	Type I Ethylene Glycol	Type II Propylene Glycol	Type III 1,3-Propanediol	Type IV Glycerin	ASTM Test Method
Relative density 15.5/15.5 °C (60/60 °F)	report ^B	report ^B	report ^B	report ^B	D1122, D5931 ^C
Freezing point, ^{D, E} °C (°F), undiluted	-16 °C (+4 °F) min	-13 °C (+9 °F) min	-13 °C (+9 °F) min	-10 °C (+15 °F) min	D1177, D6660 ^E
pH, undiluted	7.5 to 11	7.5 to 11	7.5 to 11	7.5 to 11	D1287
Chloride, µg/g	30 max	30 max	30 max	30 max	D5827
Water, mass % ^B	70 max	70 max	70 max	70 max	D1123
Reserve alkalinity, mL	report ^B	report ^B	report ^B	report ^B	D1121

^A For purposes of determining conformance with this specification, an observed value shall be rounded "to the nearest unit" in the last right-hand digit used in expressing the specification limit, in accordance with the rounding method of Practice E29.

^B Value as agreed upon between the supplier and the customer.

^C In case of dispute, Test Method D1122 is the preferred test method.

^D Test Methods D1177 and D6660 work with glycol/glycerin mixtures.

^E In case of dispute, Test Method D1177 is the preferred test method.

D6130 Test Method for Determination of Silicon and Other Elements in Engine Coolant by Inductively Coupled Plasma-Atomic Emission Spectroscopy

D6660 Test Method for Freezing Point of Aqueous Ethylene Glycol Base Engine Coolants by Automatic Phase Transition Method

D7388 Specification for Engine Coolant Grade 1,3-Propanediol (PDO)

D7640 Specification for Engine Coolant Grade Glycerin

D8040 Test Method for Corrosion Test for Heat Transfer Fluids in Glassware

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E394 Test Method for Iron in Trace Quantities Using the 1,10-Phenanthroline Method

E1177 Specification for Engine Coolant Grade Glycol

2.2 Other Document:³

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

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *glycerin*, *n*—Specification D7640 grade glycerin for engine coolant.

3.1.2 *heat transfer fluid concentrate*, *n*—a formulated liquid product intended to be diluted with water for use in heating and air conditioning systems.

3.1.3 *other glycols*, *n*—in ethylene glycol base heat transfer fluid, diethylene glycol, triethylene glycol, tetraethylene glycol, propylene glycol, dipropylene glycol, tripropylene glycol, and 1,3-propanediol.

3.1.4 *other glycols*, *n*—in propylene glycol base heat transfer fluids, ethylene glycol, triethylene glycol, tetraethylene glycol, dipropylene glycol, tripropylene glycol, and 1,3-propanediol.

3.1.5 *prediluted heat transfer fluid*, *n*—a commercially prepared uniform solution (30 % by weight minimum) of ethylene

glycol, propylene glycol, 1,3-propanediol or glycerin based heat transfer fluid concentrate and deionized water (demineralized).

3.1.6 *ready-to-use heat transfer fluid*, *n*—a formulated liquid product (30 % by weight minimum) of ethylene glycol, propylene glycol, 1,3-propanediol or glycerin base intended to be used in heating and air conditioning system without any further dilution.

3.2 For definitions of other terms used in this specification, refer to Terminology D4725.

4. General Requirements

4.1 Heat transfer fluid concentrates or prediluted heat transfer fluids shall be formulated with glycols or glycerols (meeting the requirements of Specifications E1177 and D7388 for glycols and Specification D7640 for glycerin), water, suitable corrosion inhibitors, dye, and a foam suppressor.

4.2 Ethylene glycol base heat transfer fluid concentrate (Type I) may contain a maximum of 15 % other glycols, as long as the physical, chemical, and performance requirements of this specification can be met. Similarly, prediluted ethylene glycol base heat transfer fluids (30 % by weight minimum) may contain a maximum 4.5 % other glycols as long as all of the requirements of this specification can be met.

4.3 Propylene glycol and 1,3-propanediol base heat transfer fluid concentrates (Types II and III) may contain a combined maximum of 1 % other glycols (less than 0.3 % for prediluted base heat transfer fluids) as long as the physical, chemical, and performance requirements of this specification can be met.

4.4 Glycerin base heat transfer fluid (Type IV) may contain a combined maximum of 99.5 % glycerin but not less than less than 30 % for prediluted base heat transfer fluids as long as the physical, chemical, and performance requirements of this specification can be met.

4.5 All heat transfer fluids concentrates or prediluted base heat transfer fluids shall conform to the general requirements given in Table 1 and performance specifications given in Table 2.

³ Method from *Standard Methods for the Examination of Water and Wastewater*, latest edition. Available from The Standard Methods Organization, <http://www.standardmethods.org>.