



Designation: D8566 – 24

Standard Specification for Glycol-Based Electric Vehicle Coolant with Low Electrical Conductivity¹

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1. Scope

1.1 This specification covers fully formulated glycol-based coolants with low electrical conductivity for use in electric vehicles (EV).

1.2 Coolants are formulated for cooling systems in battery electric vehicles (BEV), fuel cell electric vehicles (FCEV), plug-in hybrid electric vehicles (PHEV), or hybrid electric vehicles (HEV) where a low electrical conductivity coolant is required.

1.3 Coolants covered by this specification are not intended to circulate within a fuel cell stack in a fuel cell electric vehicle.

1.4 Coolant in this specification shall be used as supplied and need no further dilution by the user.

1.5 Coolants shall provide protection against corrosion, freezing, and overheating.

1.6 Coolants may circulate within the vehicle battery, or other vehicle components or may circulate through a cooling plate heat exchanger used to manage heat loads from batteries and other electrical components. Coolants shall not be used in direct immersion applications where there is a risk of contact with electrified components or circuits.

1.7 Coolants manage heat loads within the vehicle, prevent thermal runaway, and may serve to either cool or heat the batteries or electrical components.

1.8 Coolants shall be fully compatible with all system components in which they are in contact, including metals, polymers, and elastomers.

1.9 Coolants shall not be mixed or contaminated by a different coolant type.

1.10 Coolants may be used in non-vehicle applications. The requirements for non-vehicle applications are not addressed by this standard.

1.11 Coolants are not intended to be used in internal combustion engines.

1.12 *Units*—The values stated in SI units are to be regarded as standard.

1.13 *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.*

1.14 *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

- D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D1120 Test Method for Boiling Point of Engine Coolants
- D1123 Test Methods for Water in Engine Coolant Concentrate by the Karl Fischer Reagent Method
- D1125 Test Methods for Electrical Conductivity and Resistivity of Water
- D1177 Test Method for Freezing Point of Aqueous Engine Coolants
- D1287 Test Method for pH of Engine Coolants and Antirusts
- D1881 Test Method for Foaming Tendencies of Engine Coolants in Glassware
- 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

¹ This specification is under the jurisdiction of ASTM Committee D15 on Engine Coolants and Related Fluids and is the direct responsibility of Subcommittee D15.26 on Electric Vehicle Coolants.

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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.

- 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
- D7896** Test Method for Thermal Conductivity, Thermal Diffusivity, and Volumetric Heat Capacity of Engine Coolants and Related Fluids by Transient Hot Wire Liquid Thermal Conductivity Method
- D8485** Test Method for Corrosion Test for Electric Vehicle Coolants in Glassware
- E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

3. Terminology

3.1 For definitions of general terms used in Committee D15 on Engine Coolants and Related Fluids standards, refer to Terminology **D4725**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *battery electric vehicle (BEV)*, *n*—an electric vehicle where the source of electricity is external and stored in a battery.

3.2.2 *cooling plate*, *n*—a heat exchanger used to dissipate heat from batteries and other electrical components.

3.2.3 *electric vehicle (EV)*, *n*—a motor vehicle that uses an electric motor as a means of propulsion.

3.2.4 *fuel cell electric vehicle (FCEV)*, *n*—an electric vehicle where the primary source of electricity is produced from a fuel cell stack.

3.2.5 *hybrid electric vehicle (HEV)*, *n*—a vehicle with an electrical propulsion system in combination with an internal combustion engine.

3.2.6 *plug-in hybrid electric vehicle (PHEV)*, *n*—a vehicle with an electrical propulsion system with an extended-range battery that can be charged externally or in combination with an internal combustion engine.

4. General Requirements

4.1 Coolant may contain up to 50 % water and have an electrical conductivity that does not exceed 100 $\mu\text{S}/\text{cm}$ at 25 °C.

4.2 Coolant shall be formulated with either 1,2-ethanediol; 1,2, propanediol; or 1,3 propanediol, water, and shall contain suitable corrosion inhibitors, dye, and a foam suppressor.

5. Detailed Requirement

5.1 Coolants shall meet the physical and chemical requirements of **Table 1**.

5.2 Coolants shall meet the performance requirements of **Table 2** and **Table 3**.

5.3 The requirements prescribed are for the coolant used in vehicle cooling systems.

5.4 Coolants shall be used as supplied and need no further dilution by the user.

5.5 Additional requirements may be specified by the customer.

6. Labeling

6.1 It is recommended that all product packaging be labeled with “Do not add water.”

7. Keywords

7.1 battery electric vehicles (BEV); electric vehicle coolant; fuel cell electric vehicles (FCEV); hybrid electric vehicle (HEV); low electrical conductivity; plug-in hybrid electric vehicles (PHEV)

TABLE 1 Physical and Chemical Requirements^{A, B}

NOTE 1—Specific heat capacity is calculated from volumetric heat capacity and density.

Substance/ Property	Units	Limits	ASTM Test Methods
Water Content	Mass %	50 max	D1123
Electrical Conductivity, 25 °C	$\mu\text{S}/\text{cm}$	100 max	D1125
Freeze Point	°C	−30 max ^C	D1177,^D D6660
Boiling Point	°C	105 min ^E	D1120
Kinematic Viscosity at −20 °C	mm^2/s	report	D445
Density at 20 °C	kg/m^3	report	D5931
Specific Heat Capacity, 20 °C (Note 1)	$\text{kJ}/(\text{kg}\cdot\text{K})$	2.2 min	D7896
Thermal Conductivity, 20 °C	$\text{W}/\text{m}\cdot\text{K}$	0.15 min	D7896
Chloride	mg/kg	5 max	D5827
pH	pH	report	D1287

^A For values listed in this table, unless otherwise specified by the test method, products shall be tested as supplied.

^B For purposes of determining conformance with this specification, rounding shall be done in accordance with Practice **E29**.

^C Maximum Freeze point shall be −27.8 °C for 1,3-propanediol-based fluids.

^D In cases of dispute Test Method **D1177** shall be the preferred test method.

^E Minimum boiling point shall be 102 °C for 1,3-propanediol-based fluids.