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StandardSpecification for ASTM Reference Fluid for Coolant Tests[1]

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1. Scope

1.1 This specification covers a reference ethylene glycol-base test fluid to be used in providing base line data for ASTM coolant test procedures.

1.2 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D501 Test Methods of Sampling and Chemical Analysis of Alkaline Detergents
D538 Specification for Trisodium Phosphate (Discontinued 2001) (Withdrawn 2001)[3]
D891 Test Methods for Specific Gravity, Apparent, of Liquid Industrial Chemicals
D1078 Test Method for Distillation Range of Volatile Organic Liquids
D1119 Test Method for Percent Ash Content of Engine Coolants
D1120 Test Method for Boiling Point of Engine Coolants
D1121 Test Method for Reserve Alkalinity of Engine Coolants and Antirusts
D1122 Test Method for Density or 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
D1176 Practice for Sampling and Preparing Aqueous Solutions of Engine Coolants or Antirusts for Testing Purposes
D1177 Test Method for Freezing Point of Aqueous Engine Coolants
D1287 Test Method for pH of Engine Coolants and Antirusts
D1384 Test Method for Corrosion Test for Engine Coolants in Glassware
D1613 Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products
D1881 Test Method for Foaming Tendencies of Engine Coolants in Glassware
D3634 Test Method for Trace Chloride Ion in Engine Coolants
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
E202 Test Methods for Analysis of Ethylene Glycols and Propylene Glycols

3. Chemical Composition Requirements

3.1 The reference test fluid concentrate shall be prepared to conform to the requirements as to chemical composition prescribed in Table 1.

4. Ingredient Requirements

4.1 The materials used to prepare the reference test fluid shall meet the requirements given in Annex A1-Annex A5.

5. Significance and Use

5.1 The data obtained for the reference test fluid are intended to be used by laboratory personnel to determine their capability to perform tests properly. If a particular determination does not fall within the prescribed limits, it has to be assumed that an error occurred in the application of the test procedure.

5.2 The coolant composition given in this specification is not intended to be a commercial product.

6. Chemical and Physical Requirements

6.1 The formulated reference test fluid concentrate shall conform to the requirements for physical and chemical properties prescribed in Table 2

[1] This specification is under the jurisdiction of ASTM Committee D15 on Engine Coolants and Related Fluids and is the direct responsibility of Subcommittee D15.01 on Reference Test Materials.

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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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 Chemical Composition Requirements

NOTE 1—The reference coolant shall be colored blue-green using Alizarine Cyanine Green G Extra 100 % added in the proportion of 0.3 g of dye/gal of coolant.

Ingredient	Mass %	lb/100 gal[A]	kg/m^3
Ethylene glycol	89.86	847.9	1016.0
Diethylene glycol	5.00	47.2	56.5
Sodium tetraborate, pentahydrate	3.06	28.9	34.6
Trisodium phosphate, dodecahydrate	0.30	2.8	3.4
Sodium mercaptobenzothiazole solution (50 mass % aqueous)	0.40	3.8	4.5
Pluronic L-61[B]			
Water[C]	0.02	0.2	0.2
	1.36	12.8	15.4

[A]Based on a test fluid relative density of 1.133 at 60/60°F (15.5/15.5°C).
[B]A nonionic polyol manufactured by BASF Corporation, 100 Cherry Hill Rd., Parsippany, NJ 07054.
[C]Calculated value; the total water content (water originally present in the base materials, added water, water of hydration, and water of reaction and quantitative interference by the reaction of the reagent used (in Test Method D1123) with the ingredients) should be adjusted to 4.0 ± 0.2 mass % as the final step in the preparation.

TABLE 2 Physical and Chemical Requirements

Property	Requirements		ASTM Test Method
	min	max	
pH, concentrate	6.1	6.3	D1287
33 volume % solution	7.7	8.0	
50 volume % solution	7.5	7.8	
Reserve alkalinity, mL	26.5	27.5	D1121
Water content, weight %	3.8	4.2	D1123
Freezing protection:			D1177
Concentrate	−23°C (−9°F)	−25°C (−13°F)	
33 volume % solution	−18°C (0°F)	−19°C (−2°F)	
50 volume % solution	−36°C (−33°F)	−38°C (−36°F)	
Relative Density at 15.6°C	1.131	1.134	D1122, D5931
at 20°C	1.129	1.132	D891
Boiling point, °C (°F)	330 (166)	340 (171)	D1120
Ash, weight %	1.4	1.6	D1119
Chloride, ppm	–	25	D3634, D5827

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7. Performance Requirements

7.1 The formulated reference test fluid concentrate shall conform to the requirements for laboratory test performance prescribed in Table 3.

8. Sampling

8.1 To obtain a sample of the concentrated reference test fluid from the storage container, allow the material to come to room temperature (not below 68°F (20°C)) and shake well before withdrawing the sample.

8.2 All aqueous solutions to be used for test purposes shall be prepared in accordance with Section 5 of Test Method D1176.

9. Mixing Procedure

9.1 Weigh the ingredients according to the batch size required.

9.2 Mix the ethylene and diethylene glycols.

9.3 Dissolve the sodium tetraborate in the glycol mixture using continuous agitation.

9.4 Dissolve the trisodium phosphate in the above solution.

9.5 Add the sodium mercaptobenzothiazole solution and continue agitating the mixture until it is homogeneous.

9.6 Slurry the dye into a convenient portion of the solution; then add the dye slurry solution back into the formulation.

9.7 Add the Pluronic L-61 antifoam and mix thoroughly.

9.8 Determine the water content of the formula in accordance with Test Method D1123 and adjust to 4.0 ± 0.2 mass % by the addition of distilled water.

10. Precision and Bias

10.1 For statements on the precision and bias of the various test methods for physical and chemical properties used in this specification, refer to the appropriate ASTM standards.

10.2 For statements on the precision and bias of the performance tests used in this specification, see the footnotes to Table 3.