Designation: D8485 – 23

Standard Test Method for Corrosion Test for Electric Vehicle Coolants in Glassware[1]

This standard is issued under the fixed designation D8485; 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 test method covers a simple beaker-type procedure for evaluating the effects of glycol-based electric vehicle coolants on metal specimens under controlled laboratory conditions.

1.2 This test method evaluates the corrosion on test specimens of stainless steel and aluminum, with an option for a copper test specimen.

1.3 This test method evaluates coolants without the addition of any corrosive elements.

1.4 Additional types of metal test specimens may be evaluated.

1.5 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

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:*

D1125 Test Methods for Electrical Conductivity and Resistivity of Water

D1193 Specification for Reagent Water

D1384 Test Method for Corrosion Test for Engine Coolants in Glassware

D4725 Terminology for Engine Coolants and Related Fluids

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

E178 Practice for Dealing With Outlying Observations

E2470 Specification for Polyester Grade Ethylene Glycol

3. Terminology

3.1 *Definitions:* For definitions of general terms used in D15 standards, refer to Terminology D4725.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *electric vehicle, n*—a motor vehicle that uses an electric motor as a means of propulsion.

3.2.1.1 *Discussion*—An electric vehicle may be either a fuel cell vehicle, battery electric vehicle or a plug-in hybrid electric vehicle.

4. Summary of Test Method

4.1 In this test method, specimens of metals typical of those present in electric vehicle cooling systems are totally immersed in aerated coolant solutions for 336 h at 88 °C. The corrosion-inhibitive properties of the test solution are evaluated on the change in weight incurred by the specimens. Each test is run in triplicate, and the average weight change is determined for each metal.

5. Significance and Use

5.1 This test method provides a method to distinguish between coolants that are deleterious from the corrosion standpoint and those suitable for further evaluation.

6. Apparatus

6.1 *Container*—1000 mL 3-Neck Glass Cylinder Reactor, Flat Bottom Reaction Flask with a PTFE O-Ring and clamp. See Fig. 1.

6.2 *Water Condenser,* joint size to match middle neck of container in 6.1.

6.3 Two inlet adapters to accommodate an aerator tube and temperature probe. Joint size to match side necks of container in 6.1.

6.4 Optionally a 1000 mL, tall-form, spoutless beaker, made of heat-resistant glass, for containing the engine coolant solution and test specimens. The beaker shall be tightly closed

[1] This test method 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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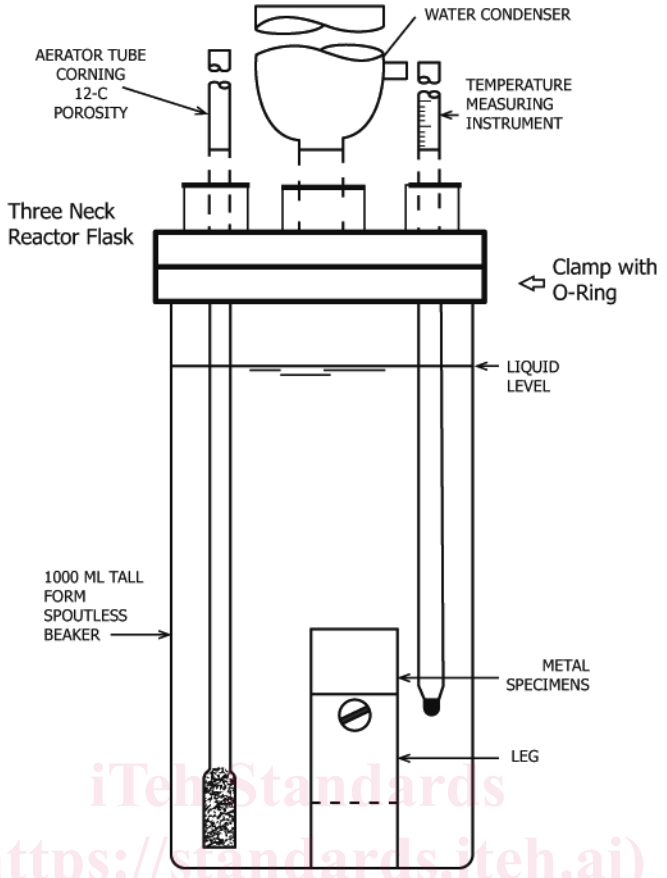

FIG. 1 Metal Specimens and Equipment for the 336 h Corrosion Test

with a No. 15 rubber stopper, having drill holes to accommodate a water condenser, an aerator tube, and a thermometer as shown in Fig. 2.

6.5 *Temperature Measuring Device.*

6.6 *Aerator Tube*—A gas dispersion tube with a 12 mm-diameter fritted cylinder with a coarse porosity (40 µm to 60 µm) to ensure continuous aeration without plugging. Optionally, a capillary tip bleed tube with 7 mm bore and 280 mm length may be used.

6.7 *Temperature Measuring Instrument*—An electronic temperature measuring and recording device with a minimum accuracy of ±2 °C within the specified test temperature range.

6.8 *Heater*—An electric hot plate or a constant-temperature bath containing a high boiling liquid that is capable of maintaining the specified temperature. The size of the bath will be determined by the number of corrosion tests that are to be run concurrently.

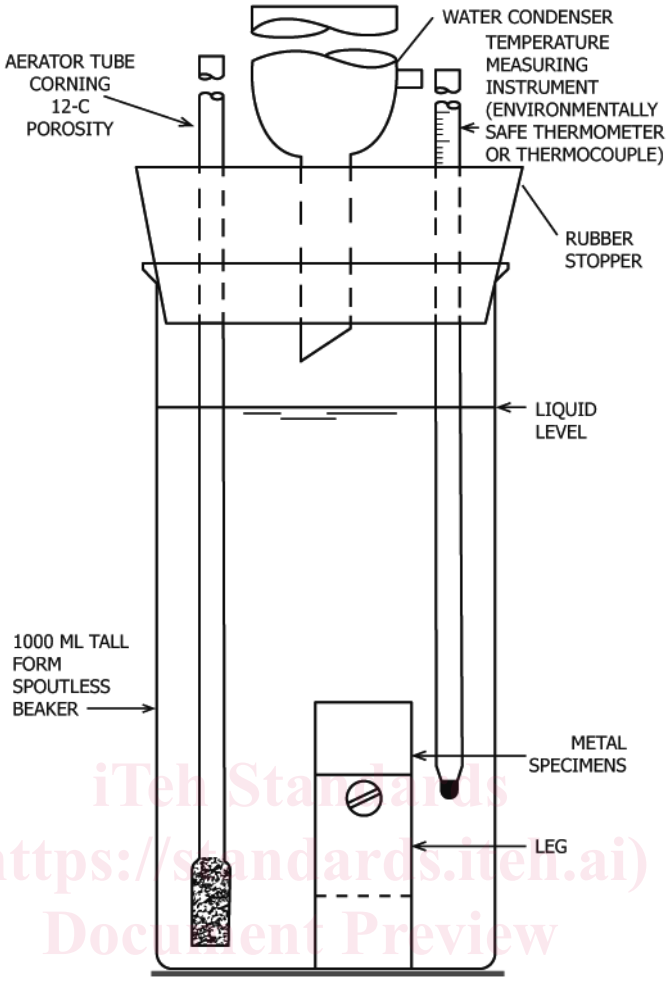

FIG. 2 Tall Form Beaker Specimens and Equipment for the 336 h Corrosion Test

6.9 *Metal Test Specimens*:[2,3]

6.9.1 Stainless Steel S30400, cut from 1.59 mm (1⁄16 in.) sheet stock to size 51 mm by 25 mm (2 in. by 1 in.).

6.9.2 Aluminum A93003, cut from 1.59 mm (1⁄16 in.) sheet stock to size 51 mm by 25 mm (2 in. by 1 in.).

6.9.3 Copper C11000, cut from 1.59 mm (1⁄16 in.) sheet stock to size 51 mm by 25 mm (2 in. by 1 in.).

6.10 *Metal Specimen Assembly*—The metal test specimens shall be drilled through the center with a 6.75 mm drill to accommodate a 51 mm 10–24 Tetrafluoroethylene polymer screw covered with a thin-walled insulating sleeve. Tetrafluoroethylene polymer tubing with a 6.35 mm outside diameter 1.59 mm wide and a wall thickness of 0.4 mm is satisfactory. The legs shall be Tetrafluoroethylene polymer. A 6.35 mm diameter hole shall be drilled in each leg with the center 6.35 mm from the top and 12.7 mm from each side. The test "bundle" shall be made up on the insulated screw with the specimens separated by insulating spacers made from tetrafluoroethylene polymer and shall be used between the legs and the specimens. The nut shall be tightened firmly to ensure test specimens do not come loose in bundle. (See Fig. 2 or Fig. 3).

NOTE 1—None of the hardware used in metal specimen arrangement (metal specimen, screws, washers, spacers, insulating sleeves, insulating spacers, and nuts) can be reused for a test.

7. Preparation of Test Specimens

7.1 Remove any burrs from coupon edges and hole. Scrub all specimens vigorously, using a moistened bristle brush and ground pumice powder or fine silicon carbide grit until the entire metal area is bright, shiny, and free from any visible oxide film or tarnish.

7.2 Rinse the specimens thoroughly with tap water; then rinse with acetone, dry, and weigh to the nearest 1 mg.

NOTE 2—If the test specimens are not to be used immediately, keep them in a desiccator until required.

8. Test Solutions

8.1 Prediluted coolant shall be tested as supplied. Concentrated coolant shall be diluted as to a volume fraction of 50 %

[2] When assembling the test bundle, sizes are stated in SI units, adjustment to these unit may be made to accommodate US customary units, for example, 51 mm or 2 in.

[3] Test specimens are available from suppliers of test specimens for Test Method D1384.

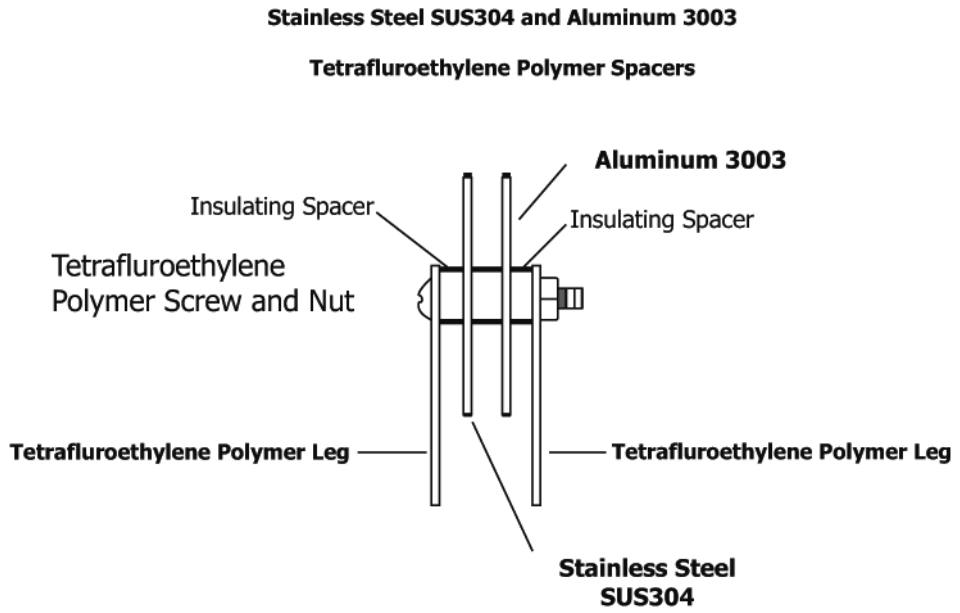

FIG. 3 Stainless Steel SUS304 and Aluminum 3003 Tetrafluroethylene Polymer Spacers

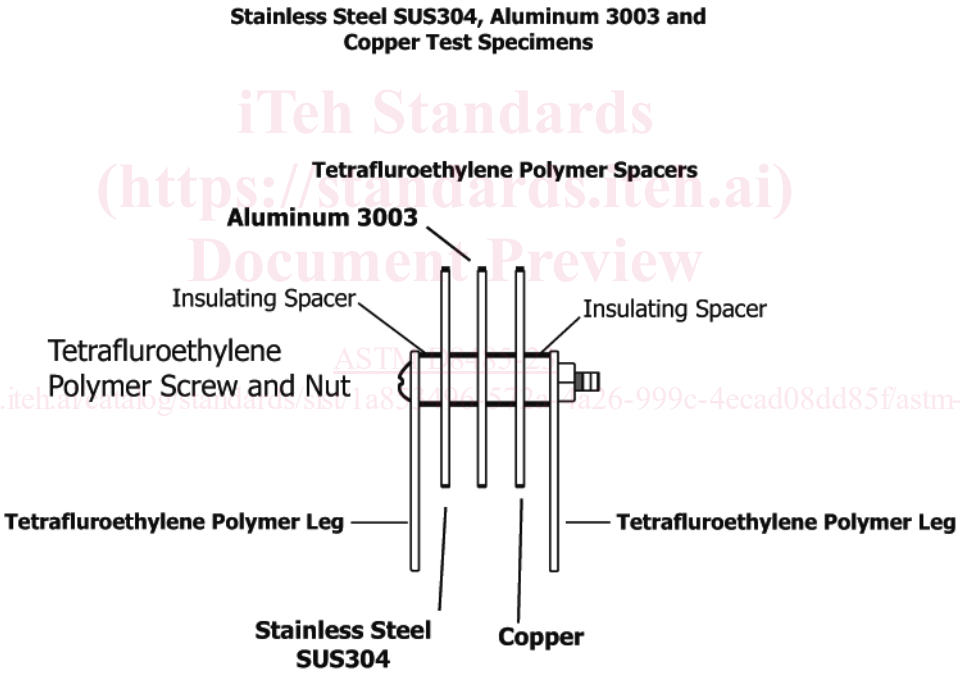

FIG. 4 Stainless Steel SUS304, Aluminum 3003 and Copper Test Specimens

with Specification D1193 Type II or better water (<1 µS/cm). An aliquot of test solution shall be collected for conductivity and metals testing as described in 10.8.1.

9. Test Conditions

9.1 *Test Container Assembly*—The arrangement of the assembled metal specimens with relation to the aerator tube and other components is shown in Fig. 1 or Fig. 2.

9.2 *Test Temperature*—The test solution shall be maintained at a temperature of 88 °C ± 2 °C.

9.3 *Aeration Rate*—The aeration rate shall be 100 mL/min ± 10 mL/min. The aerator tube should be located at least 13 mm away from the test "bundle" to avoid direct contact with the metal specimens.

9.4 *Test Duration*—The test shall be run continuously for 336 h (2 weeks).

10. Procedure

10.1 Make triplicate tests concurrently on each coolant solution in accordance with the following procedure: