Designation: D 1881 – 97 (Reapproved 2002)ε1

Standard Test Method for Foaming Tendencies of Engine Coolants in Glassware[1]

This standard is issued under the fixed designation D 1881; 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.

This standard has been approved for use by agencies of the Department of Defense.

ε[1] NOTE—The address for Godax Laboratories in footnote 7 was updated editorially in June 2003.

1. Scope

1.1 This test method covers a simple glassware test for evaluating the tendency of engine coolants to foam under laboratory-controlled-conditions of aeration and temperature.

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.* For specific warning statements, see 7.2 and 7.4.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are approximate equivalents provided for information purposes only.

2. Referenced Documents

2.1 *ASTM Standards:*

D 1176 Test Method for Sampling and Preparing Aqueous Solutions of Engine Coolants or Antirusts for Testing Purposes[2]

D 1193 Specification for Reagent Water[3]

D 3585 Specification for ASTM Reference Fluid for Coolant Tests[2]

E 1 Specification for ASTM Thermometers[4]

E 128 Test Method for Maximum Pore Diameter and Permeability of Rigid Porous Filters for Laboratory Use[5]

3. Terminology

3.1 *Definitions:*

3.1.1 *break time*, *n*—the time required for the foam to collapse (after the air supply has been shut off) to the first appearance of an "eye" on the surface of the test solution.

3.1.2 *eye*, *n*—the appearance of foam free area on the surface of the test coolant surrounded by a ring of foam clinging to the cylinder walls.

4. Summary of Test Method

4.1 A solution of coolant and ASTM Type II water is blown with air at a constant rate for 5 min, while maintained at a constant temperature of 88 ± 1°C (190 ± 2°F) by means of a suitable temperature bath. The volume of foam, and the time for such foam to break, are measured.

5. Significance and Use

5.1 The test method generally will distinguish coolants that have a tendency to foam excessively from those that are suitable for further evaluation to determine performance in actual service.

NOTE 1—In use, the foaming tendency of a coolant solution may be increased by service aging or contamination. A properly functioning pressure cap will tend to suppress foaming in coolant solutions.

6. Apparatus

6.1 *Container*—A 500-mL graduated container of heat-resistant glass, having a diameter of 45 to 50 mm and a length of 380 mm.

6.2 *Temperature Bath*—A heat resistant glass container large enough to permit immersion of the graduated container at least to the 350 mL graduation mark. A 4000-mL beaker is satisfactory.

6.3 *Heat Source*—Any heating system capable of maintaining a uniform bath temperature ±1°C (±2°F). A750-watt electric hot-plate is satisfactory.

6.4 *Aerator Tube*—A 25.4-mm (1-in.) diameter spherical gas-diffuser stone[6] made of fused crystalline alumina grain which meets the following specifications when tested in accordance with the method given in Annex A1:

Maximum pore diameter, μm	Not greater than 80

[1] This test method is under the jurisdiction of ASTM Committee D15 on Engine Coolants and is the direct responsibility of Subcommittee D15.06 on Glassware Performance Tests.

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[2] *Annual Book of ASTM Standards*, Vol 15.05.

[3] *Annual Book of ASTM Standards*, Vol 11.01.

[4] *Annual Book of ASTM Standards*, Vol 14.03.

[5] *Annual Book of ASTM Standards*, Vol 14.02.

[6] For information on aerator supplier and specifications contact ASTM Subcommittee D15.06 through ASTM International Headquarters.

Permeability at a pressure of 2.45 kPa, mL of air/min	3000 to 6400

6.5 *Thermometer*—An ASTM Partial Immersion Thermometer having a range from −20 to +150°C (0 to 302°F) and conforming to the requirements for Thermometer 1F as prescribed in Specification E 1.

6.6 *Air Supply*—A clean and dry source, free from grease and other contaminants, capable of maintaining the prescribed flow rate through the diffuser stone.

6.7 *Timer*—A stop watch or suitable timing device, accurate to ±0.2 s.

6.8 *Vent*—A three-way stopcock inserted in the metered air supply line immediately ahead of the aerator tube.

6.9 *Typical Assembly Set-Up*—A typical apparatus using a hot-plate heat source is shown in Fig. 1.

7. Materials and Reagents

7.1 *Purity of Water*—Unless otherwise indicated, references to water means reagent water as defined by Type II of Specification D 1193.

7.2 *Acetone*, for flushing and drying the test equipment. (**Warning**—Acetone is extremely flammable.)

7.3 *Specification D 3585 Test Coolant*—Unless otherwise indicated, references to the reference test coolant means Specification D 3585 coolant prepared without antifoam (Pluronic L-61) as defined in Specification D 3585.

7.4 *Cleaning Bath*—Refers to an acid or base cleaning solution used to clean glassware between tests. The choice of cleaning baths depends on individual needs. For example, Nochromix and alcoholic sodium (potassium) hydroxide are common acid and base cleaning baths, respectively.[7] (**Warning**—The cleaning baths are strong oxidants and strong acid and base, respectively. Avoid contact with skin, eyes, and clothing. Do not breathe vapor. Handle in a fume hood.)

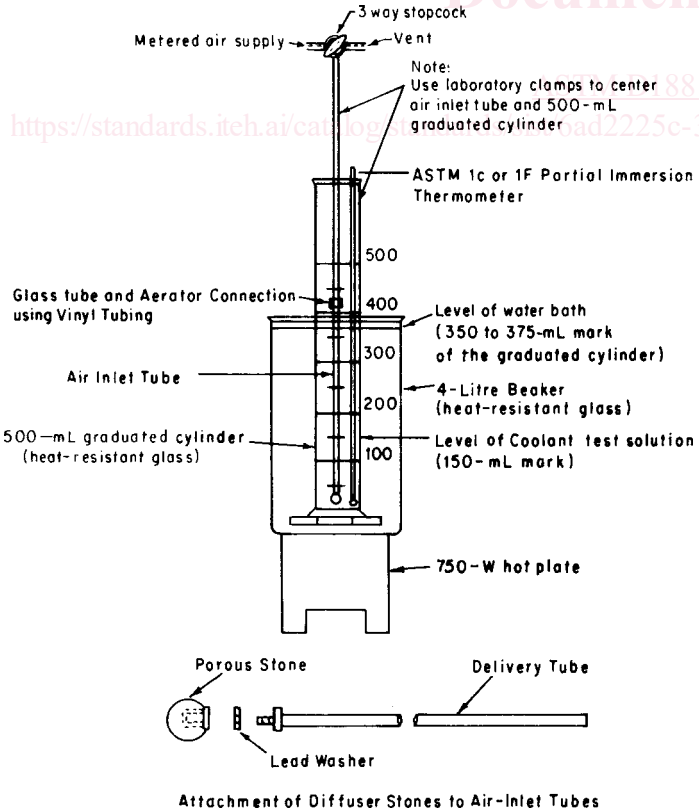

FIG. 1 Schematic Drawing of Apparatus for Glassware Foam Test

8. Test Solution

8.1 A 33 % by volume solution of reference coolant (Specification D 3585 test coolant without antifoam) shall be prepared with the proper quantity of Type II water.

8.2 Prepare a 33 % by volume solution of the coolant to be tested with Type II water. Use the same glassware used to prepare the reference coolant test solution. Rinse the glassware with Type II water between preparations. Additive concentrates shall be diluted with Type II water to recommended use concentration. Preparation of the sample shall be done in accordance with treatment of mixtures described in Test Method D 1176. Thus, any insoluble materials will be included in the representative sample.

9. Test Conditions

9.1 *Test Temperature*—The temperature bath shall be kept at a constant volume (350 to 375 mL mark of the graduated cylinder) throughout the test. The test solution shall be maintained at 88 ± 1°C (190 ± 2°F) throughout. This temperature is suitable for both high-boiling and low-boiling coolants.

9.2 *Aeration Rate*—The aeration rate shall be 1000 ± 25 mL/min.

9.3 *Number of Tests*—The reference coolant shall be tested to determine if the glassware and testing equipment is contaminated with residue defoamer. If the reference coolant gives a foam volume of greater than 250 mL and a break time of greater than 8 s, drain the reference coolant from the glassware, rinse with Type II water and use for the preparation of the test coolant.

9.3.1 Each test coolant shall be tested in triplicate, using a freshly prepared test solution (Section 8) for each test. The entire container and aerator tube (see 6.1 and 6.4) shall be cleaned scrupulously between each test. The container shall be cleaned in cleaning bath and the aerator tube shall be immersed first in acetone and flushed back and forth, and then in water and flushed back and forth, using vacuum and air pressure. The entire assembly shall be thoroughly rinsed with Type II water before each test.

NOTE 2—Scrupulously cleaning of the glassware, aerator tube and diffuser stone between tests will reduce the potential carry-over of antifoam from previous test or glassware detergents that can interfere with test reproducibility.

10. Procedure

10.1 Heat 145 mL of solution to 88°C (190°F) in the container positioned in the temperature bath. Immerse the

[7] Nochromix is an inorganic oxidizer that contains no metallic ions. The white powder is dissolved in water and mixed with concentrated sulfuric acid, giving a solution that reportedly is more strongly oxidizing than chromic acid. Available from Godax Laboratories Inc., 720–B Erie Ave., Takoma Park, MD 20912.