Designation: ~~D3147 – 06 (Reapproved 2013)~~ D3147 – 21

Standard Test Method for Testing Stop-Leak Additives for Engine Coolants[1]

This standard is issued under the fixed designation D3147; 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 U.S. Department of Defense.

1. Scope

1.1 This test method covers screening procedures for the preliminary evaluation of leak-stopping materials intended for use in engine cooling systems. (Heavy-duty users are referred to X1.2.21 in Specification D4485 for additional information.)

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

1.3 *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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.* Specific warning statements are given in 10.1.

1.4 *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]

D1176 Practice for Sampling and Preparing Aqueous Solutions of Engine Coolants or Antirusts for Testing Purposes

D4485 Specification for Performance of Active API Service Category Engine Oils

D4725 Terminology for Engine Coolants and Related Fluids

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *leaking*—frequent drops forming (more than 5 drops/min).

3.1.2 *sealed*—completely plugged with no leaking or seeping.

3.1.3 *seeping*—occasional drops forming (fewer than ~~5~~ 5 drops ~~drops/min).~~ /min).

[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 D15.09 on Simulated Service Tests.

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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~~standard's Document Summary page on the ASTM website.

3.2 For definitions of terms used in this test method, refer to Terminology D4725.

4. Summary of Test Method

4.1 A heated test solution is circulated through a pressurized cubical metal reservoir which contains a slit and holes to simulate leaks in an engine cooling system. The effectiveness of the stop-leak material is measured by its ability to seal the leaks under the prescribed conditions of flow rate, temperature, pressure, and time.

4.2 The presence of particles in the test material that are larger than 0.84 mm (0.033 in.) or the presence of gumming or gelling in stop-leak additives is determined by screening a test solution through a ~~850-µm~~850 µm (U.S. No. 20) standard sieve. The screening is done both before and after the circulating test. Particles that remain on the sieve may be too large to pass through some passages of the cooling system.

5. Significance and Use

5.1 The screening procedures simulate the conditions of temperature, pressure, and circulation encountered in service. This test method will indicate whether a product is suitable for further evaluation in vehicles.

6. Apparatus (See Fig. 1)

6.1 *Reservoir:*

6.1.1 The reservoir shall be constructed of stainless steel, aluminum, or brass, ~~260~~260 mm by ~~175~~175 mm by ~~260-mm (10~~260 mm (10 in. by ~~7~~7 in. by 10 in.) high, and the total capacity of the assembled unit shall be between ~~1~~2 L and 13.5 L ~~(3.2~~(3.2 gal to 3.6 gal). The reservoir shall have a ~~20-mm~~20 mm (¾~~-in.)~~ in.) flange at the top, to which a cover plate is fitted.

6.1.2 The reservoir and cover shall have a minimum thickness of 1.6 mm (0.06 in.) in order to withstand a pressure of 140 kPa (20 psi).

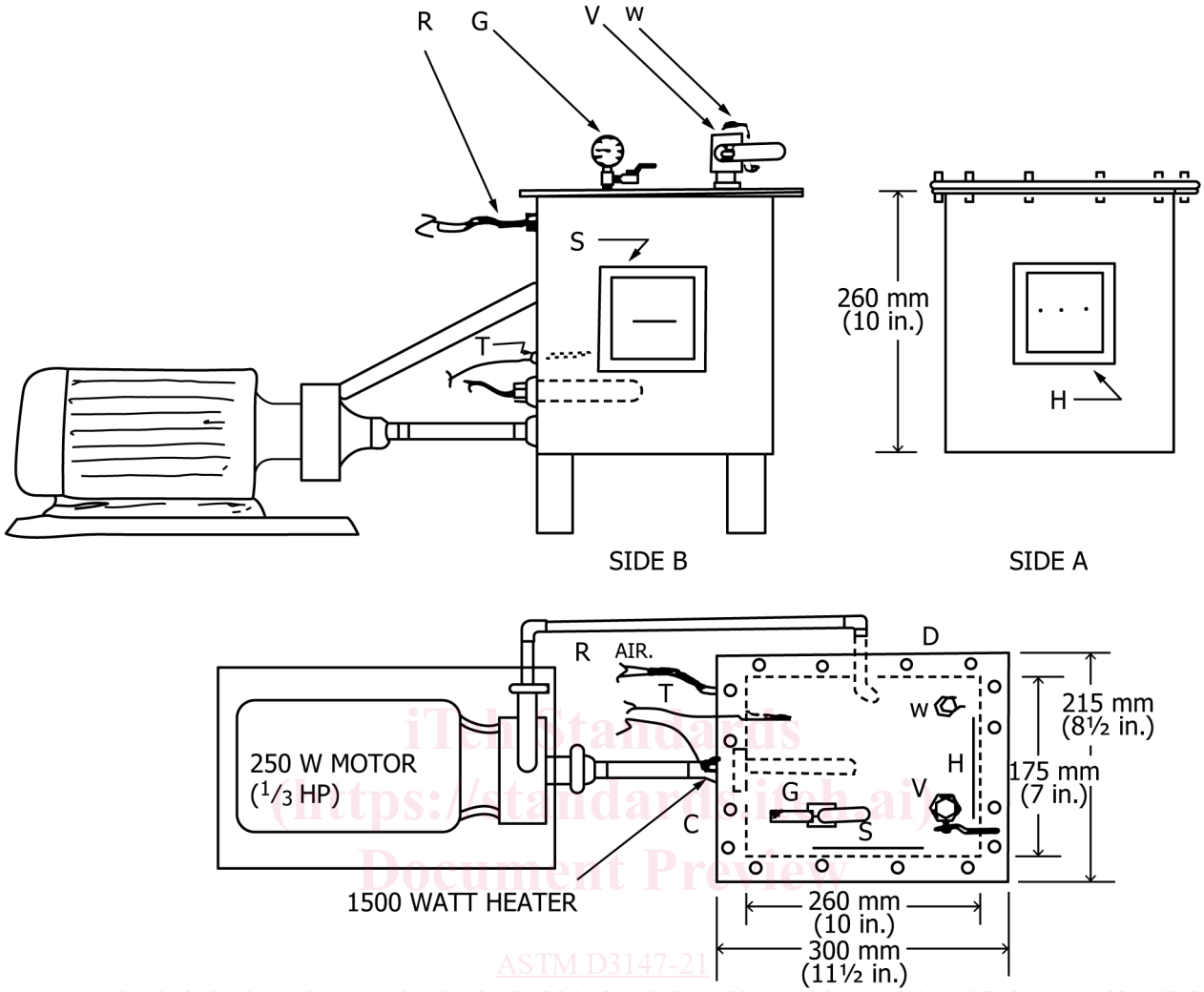
6.1.3 A drain shall be located either on one side or the bottom of the reservoir to facilitate drainage of the test solution. The reservoir outlet to the circulating pump (suction side) shall be located near the bottom of Side C. The reservoir inlet from the circulating pump (discharge side) shall be located near the top of Side D. ~~A13-mm~~ A 13 mm (½~~-in.)~~ in.) elbow shall be welded to the reservoir inlet opening (inner surface of Side D) so that the liquid flow is directed towards Side A.

6.1.4 The cover plate of the reservoir shall be attached with bolts and sealed with neoprene gasket material. Openings accommodate a pressure ~~gage (0~~gauge (0 kPa to 10 kPa ~~(0~~(0 psi to 30 psi) minimum)/vent valve assembly.

6.1.5 Openings, ~~64~~64 mm by 64 mm (2½ in. by 2½~~-in.),~~ in.), centered on Side A and Side B accommodate test plates (as described in Section 7~~7).~~). An inlet for regulated air at ~~103~~103 kPa ± 14 kPa ~~(15~~(15 psi ± 2 psi) and a thermocouple probe are shown in Side C.

6.1.6 A liquid collection pan or pans shall be placed under the reservoir in a position that will allow collection of coolant that has leaked from test openings during operation of the apparatus. A transparent safety shield shall enclose the reservoir fully. This shield will be arranged to deflect any spray into the collection pans. The safety shield *must* be in place any time the reservoir is hot or pressurized, or both.

6.2 *Circulation Pump,* capable of circulating a minimum of 30 L (8 gal) of water per minute against zero head pressure, shall be used. The packing seal of the pump shall be capable of withstanding 140 kPa (20 psi) and ~~104°C (220°F).~~104 °C (220 °F). Inlet and outlet connections shall be not less than ½ in. (12 mm) standard water pipe.



A,B,C,D—Sides of reservoir
~~G—Pressure gage, 0-210 kPa, (0-30 psi) vent valve~~
G—Pressure gauge, 0–210 kPa, (0–30 psi) vent valve
H—Brass test section, holes
S—Brass test section, slit
R—Regulated air, 103 kPa (15 psi)
~~T—Thermocouple foil, temperature controller, and well~~
T—Thermocouple foil, temperature controller, and well
V—Fill opening (ball valve)
W—Pressure relief valve, 137 kPa (20 psi)

FIG. 1 Leak Test Apparatus

6.3 *Heating Element,* shall be of the immersion cartridge type and shall have a power rating of approximately 1500 W. It shall be installed above the suction pipe of the circulation pump and shall be capable of heating the filled system to ~~88°C (190°F).~~88 °C (190 °F). A temperature controller shall be used with the thermocouple to control power to the heating element and coolant temperature. An electrical pressure switch should also be used to interrupt power to the heater, in the event that excess pressure is generated.

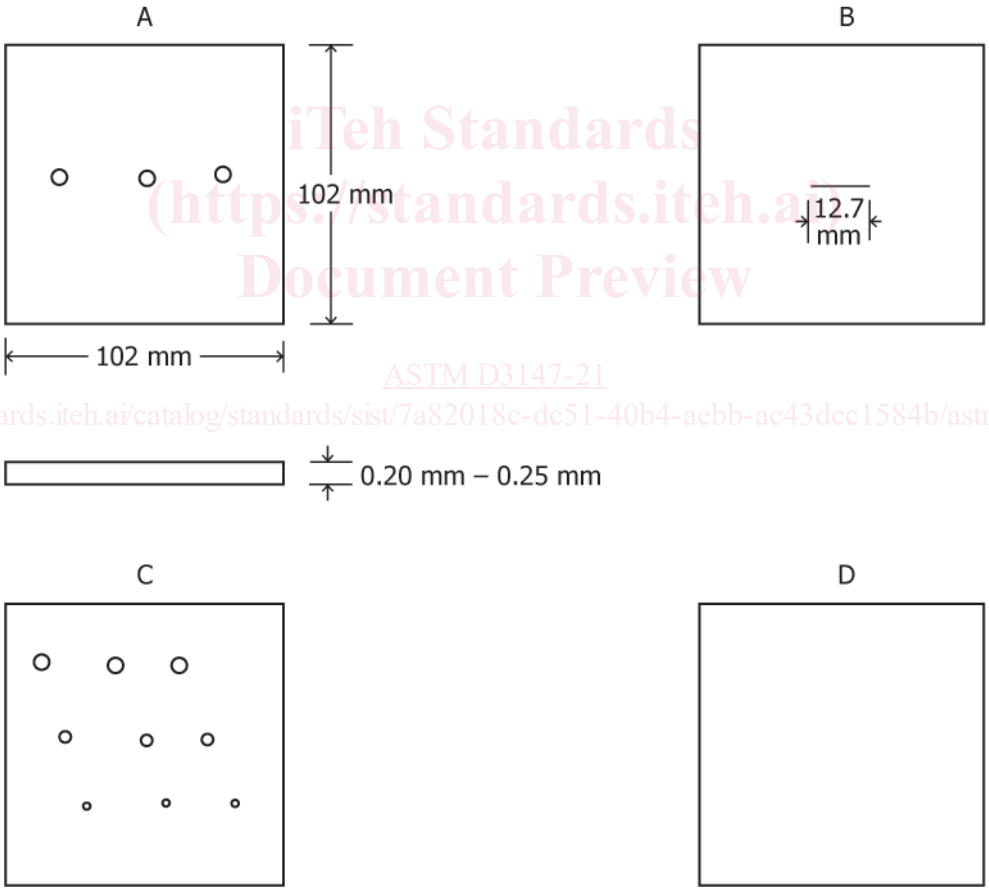
6.4 The reservoir should be equipped with a suitable pressure relief valve to prevent an over-pressure in the event of a problem with the regulated air source.

6.5 A means of interrupting power to the heater in the event of excessive fluid loss or overheating is necessary.

6.6 *U.S.A. Standard Testing Sieve,* ~~per~~ in accordance with Specification E11–95, 850 µm in an 8 in. (203 mm) or 10 in. (254 mm) FH frame.

7. Test Plates (See Fig. 2)

7.1 The test plates shall be constructed of solid brass plates, ~~102~~102 mm by ~~102~~102 mm by ~~0.200~~.20 mm to 0.25 mm ~~(4~~(4 in. by ~~44~~ in. by ~~0.008~~0.008 in. to 0.010 in.), with bolt holes for attachment to the reservoir. Neoprene gasket material shall be used to seal the plates. A complete set shall consist of fifteen plates: two plates without test holes or slits, six plates with one slit each ~~[12.7 mm~~ [12.7 mm long by ~~0.127, 0.254, 0.381, 0.508, 0.635~~0.127 mm, 0.254 mm, 0.381 mm, 0.508 mm, 0.635 mm and 0.762 mm wide, respectively (0.5 in. long by ~~0.005, 0.010, 0.015, 0.020, 0.025 and 0.030 in.)~~ 0.005 in., 0.010 in., 0.015 in., 0.020 in., 0.025 in. and 0.030 in.) (Note 1)], six plates with three holes each of the same size ~~[0.127, 0.254, 0.381, 0.508, 0.635~~[0.127 mm, 0.254 mm, 0.381 mm, 0.508 mm, 0.635 mm, and 0.762 mm ~~(0.005, 0.010, 0.015, 0.020, 0.025~~(0.005 in., 0.010 in., 0.015 in., 0.020 in., 0.025 in., and 0.030 in.) in diameter], and one plate with nine holes [three holes ~~0.254-mm (0.010-in.)~~0.254 mm (0.010 in.) diameter, three holes ~~0.508-mm (0.020-in.)~~0.508 mm (0.020 in.) diameter, and three holes ~~0.762-mm (0.030-in.)~~0.762 mm (0.030 in.) diameter], bored on a diagonal across the plate so that drainage from one hole will not flow across another hole.



A—3 holes of appropriate diameter
~~B—One 12.7-mm (⅛-in.) slit of appropriate width~~
B—One 12.7 mm (⅛ in.) slit of appropriate width
~~C—9 holes—3 each 0.254, 0.508, and 0.762 mm (0.010, 0.020, and 0.030 in.) in diameter (bored on a diagonal) so that drainage from one hole will not flow across another hole~~
C—9 holes—3 each 0.254 mm, 0.508 mm, and 0.762 mm (0.010 in., 0.020 in., and 0.030 in.) in diameter (bored on a diagonal) so that drainage from one hole will not flow across another hole
D—Solid

FIG. 2 Brass Test Panels