



Standard Test Method for Cavitation Corrosion and Erosion-Corrosion Characteristics of Aluminum Pumps With Engine Coolants¹

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1. Scope

1.1 This test method covers the evaluation of the cavitation corrosion and erosion-corrosion characteristics of aluminum automotive water pumps with coolants.

NOTE 1—During the development of this test method, it was found that results obtained when testing two-phase coolants did not correlate with results from field tests. Therefore, the test method cannot be recommended as being a significant test for determining cavitation effects of two-phase coolants.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 and health practices and determine the applicability of regulatory limitations prior to use.* Specific warning statements are given in 5.2.

2. Referenced Documents

2.1 ASTM Standards:²

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

3. Summary of Test Method

3.1 This test method consists of pumping an aqueous coolant solution at 113°C (235°F) through a pressurized 103-kPa (15-psig) simulated automotive coolant system (Note 2). An aluminum automotive water pump, driven at 4600 r/min by an electric motor, is used to pump the solution and to serve as the object specimen in evaluating the cavitation erosion-corrosion effect of the coolant under test. The pump is

TABLE 1 Rating System^{A,B}

Rating	Condition
10	No corrosion or erosion present; no metal loss. No change from original casting configuration. Staining permitted.
9	Minimal corrosion or erosion. Some rounding of sharp corners or light smoothing or both, or polishing of working surfaces.
8	Light corrosion or erosion may be generalized on working surfaces. Dimensional change not to exceed 0.4 mm ($\frac{1}{64}$ in.).
7	Corrosion or erosion with dimensional change not to exceed 0.8 mm ($\frac{1}{32}$ in.). Random pitting to 0.8 mm permitted.
6	Corrosion or erosion with dimensional change not to exceed 0.8 mm. Depressions, grooves, clusters of pits, or scalloping, or both, within 0.8 mm dimensional change limit permitted.
5	Corrosion or erosion with dimensional change not to exceed 1.6 mm ($\frac{1}{16}$ in.). Small localized areas of metal removal in high-impingement regions or random pits to 1.6 mm permitted.
4	Corrosion or erosion with dimensional change not to exceed 1.6 mm. Small localized areas of metal removal in high-impingement regions, clusters of pits within 1.6 mm dimensional change. Random pits to 2.4 mm ($\frac{3}{32}$ in.) permitted.
3	Corrosion or erosion with dimensional change not to exceed 2.4 mm. Depressions, grooves, clusters of pits or scalloping, or both, permitted.
2	Corrosion or erosion with any dimensional change over 2.4 mm, and short of pump case failure.
1	Pump case leaking due to corrosion or erosion.

^AIf placement in a rating group is uncertain or border-line, elevate the rating to the higher of the two groups in question.

^BRatings 1 to 3 are dependent on pump-wall thickness and are intended to be used as relative ratings for tests using a given pump.

examined to determine the extent of cavitation erosion-corrosion damage and is rated according to the system given in Table 1. Photographs of typical eroded pumps after testing appear in the Appendix.

NOTE 2—Tests run at other than 113°C (235°F) might show more or less cavitation depending upon the coolant formulation.

4. Significance and Use

4.1 This test method can be used to distinguish between coolants that contribute to cavitation corrosion and erosion-corrosion of aluminum automotive water pumps and those that do not. It is not intended that a particular rating number, as determined from this test, will be equivalent to a certain number of miles in a vehicle test; however, limited correlation between bench and field service tests has been observed with single-phase coolants. Field tests under severe operating conditions should be conducted as the final test if the actual effect

¹ This test method is under the jurisdiction of ASTM Committee D15 on Engine Coolants 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 Document Summary page on the ASTM website.