



# Standard Test Method for Determining the Accelerated Iron Corrosion Rating of Denatured Fuel Ethanol and Ethanol Fuel Blends<sup>1</sup>

This standard is issued under the fixed designation D7577; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method measures the ability of inhibited and uninhibited Ethanol Fuel Blends defined by Specification [D5798](#) and Denatured Fuel Ethanol defined by Specification [D4806](#) to resist corrosion of iron should water become mixed with the fuel, using an accelerated laboratory test method. Corrosion ratings are reported based on a visual, numbered rating scale.

1.2 The values stated in SI units are to be regarded as standard. The values 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 hazard statements are given in Sections [7](#) and [8](#).

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- [A29/A29M](#) Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
- [A108](#) Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- [D665](#) Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water
- [D1193](#) Specification for Reagent Water
- [D2699](#) Test Method for Research Octane Number of Spark-Ignition Engine Fuel
- [D4175](#) Terminology Relating to Petroleum, Petroleum Products, and Lubricants
- [D4806](#) Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee [D02](#) on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee [D02.14](#) on Stability and Cleanliness of Liquid Fuels.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- [D5798](#) Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines
- [E177](#) Practice for Use of the Terms Precision and Bias in ASTM Test Methods
- [E2251](#) Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids

## 3. Terminology

### 3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology [D4175](#).

3.1.2 *Fuel C, n*—a volumetric mixture of 50 volume percent reference fuel grade toluene and 50 volume percent reference fuel grade isooctane.

3.1.2.1 *Discussion*—Specifications for reference fuel grade toluene and reference fuel grade isooctane can be found in Test Method [D2699](#).

### 3.2 Abbreviations:

- 3.2.1 *HDPE, n*—high density polyethylene
- 3.2.2 *PTFE, n*—Polytetrafluoroethylene

## 4. Summary of Test Method

4.1 A polished steel test rod is immersed in a mixture of the test sample and water at a ratio of 10 parts fuel sample to 1 part water and held at a temperature of 37 to 39°C (98 to 102°F) for 1 h.

4.2 At the end of 1 h, the test rod is removed, rinsed and rated according to a numeric corrosion rating scale.

## 5. Significance and Use

5.1 This test is designed to be used as a rapid measure of the overall relative corrosivity of Ethanol Fuel Blends (Specification [D5798](#)) and Denatured Fuel Ethanol (Specification [D4806](#)) to iron (steel).

5.2 The test can be used to compare corrosion inhibitor dosage levels and effectiveness of various corrosion inhibitors as they pertain to protecting iron (steel) materials from corrosion.

## 6. Apparatus

6.1 *General*—Two test apparatus have been evaluated and found to give comparable results.

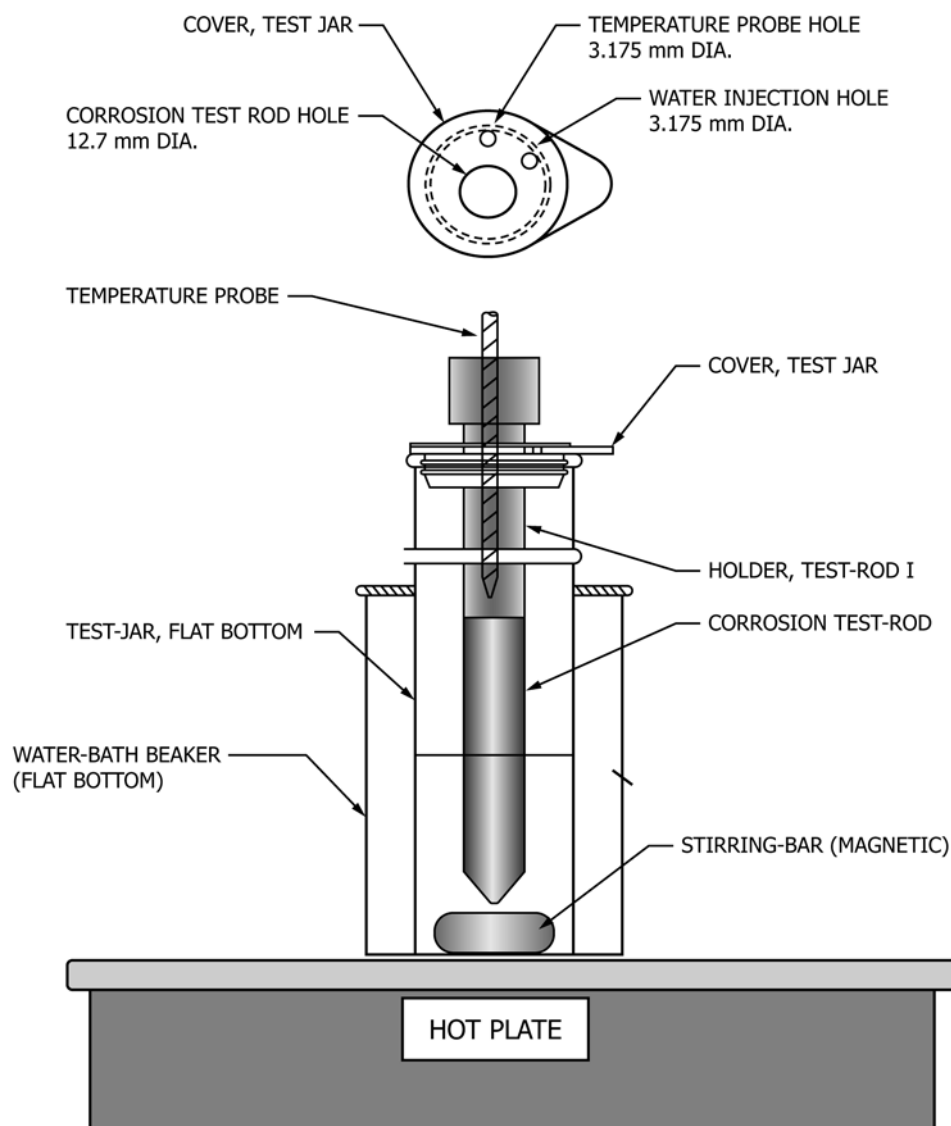


FIG. 1 Recommended Small Volume Test Apparatus

6.1.1 Large sample volume (300 mL) apparatus specified in Test Method **D665**.

6.1.2 Small sample volume (30 – 75 mL) apparatus specified in **6.2**.

#### 6.2 Small Volume Test Apparatus (Fig. 1).

6.2.1 Compared to Test Method **D665**, the small volume test apparatus is lower in cost and allows for use of smaller volumes of samples to improve the safety of the measurement. Different apparatus and components that achieve the same results may be used.

6.2.2 Hot plate/stir plate or water bath capable of maintaining a temperature of 37 to 39°C (98 to 102°F) and stirring at a rate of  $900 \pm 100$  r/min.

6.2.3 150 - 200 mL borosilicate glass beakers to hold water to serve as a water bath.

6.2.4 50 - 150 mL borosilicate, flat bottom, glass test jar to hold test sample.

6.2.5 Jar covers made of HDPE or other material compatible with ethanol, water and gasoline with three holes:

6.2.5.1 A hole to suspend the steel test rod into the test sample,

6.2.5.2 A hole for the thermometer,

6.2.5.3 A hole for inserting a syringe needle to add water to the test sample.

6.2.6 PTFE (polytetrafluoroethylene) coated magnetic stir bar.

6.2.7 The small volume test apparatus shall be designed so that at least 50% of the test rod surface is below the surface of the test material.

6.3 *Grinding and sanding apparatus*, capable of rotating the steel test rod at 1700 to 1800 r/min for manual sanding.

6.4 *Timing device*, capable of taking readings with a discrimination of 1 min or better.

6.5 *Analytical balance*, at least 100 g capacity, capable of weighing accurately to at least 0.001 g.

6.6 *Temperature measuring device*, Any thermometer with a temperature range that includes 37 to 39°C (98 to 102°F) with