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An American National Standard

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Method for Rust-Preventing Characteristics of Steam Turbine Oil in the Presence of Water (Horizontal Disk Method)[1]

This standard is issued under the fixed designation D 3603; 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 the ability of steam-turbine oils to prevent the rusting of horizontal and vertical ferrous surfaces when water becomes mixed with the oil.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*

A 108 Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality[2]

A 240/A 240M Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels[3]

D 91 Test Method for Precipitation Number of Lubricating Oils[4]

D 665 Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water[4]

D 1193 Specification for Reagent Water[5]

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products[6]

E 1 Specification for ASTM Thermometers[7]

2.2 *Other Documents:*

IP 60/80 Specification for Petroleum Spirit[8]

Annex II, Reference Materials and Blending Accessories, Motor Section[9]

3. Summary of Test Method

3.1 The test method involves completely immersing a horizontal steel disk and vertical steel cylinder in a stirred mixture of 275 mL of the oil under test and 25 mL of distilled water (water conforming to Specification D 1193, Type II) at a temperature at 60°C (140°F).

3.2 The horizontal specimen allows water to puddle on the surface, and the vertical specimen is continually washed with the oil-water mixture during the test.

3.3 The test is run for 6 h and the specimens are evaluated.

4. Significance and Use

4.1 Horizontal metal surfaces, on which water droplets tend to be retained, are more prone to rusting and corrosion than vertical or sloping surfaces. This test method is therefore more discriminating than Test Method D 665 (Procedure A), since it gives a separate evaluation of the oil on a horizontal and a vertical surface. The test method indicates the ability of oils to prevent rusting and corrosion of all ferrous surfaces in steam turbines under full flow and quasi-static conditions. It is used for specification of new oils.

5. Apparatus

5.1 *Oil Bath*—A thermostatically controlled liquid bath capable of maintaining a temperature in the oil sample of 60 ± 1°C (140 ± 2°F). The bath shall have a cover with holes to accommodate the test beakers.

NOTE 1—The bath used for Test Method D 665 may be used with slight modification, that is, the centers of the beaker holes are moved from 6.4 mm to 18.3 mm (¼to 23⁄32 in.) from the axes of the stirrers.

NOTE 2—To indicate the temperature, a thermometer conforming to the requirements of ASTM Thermometer 9C or 9F, or IP Thermometer 21C, as prescribed in Specification E 1 should be used.

5.2 *Beaker*—A 400-mL, Berzelius-type, tall-form heat-resistant glass[10] beaker without pourout, as shown in Fig. 1 , approximately 127 mm (5 in.) in height measured from the inside bottom center and approximately 70 mm (2¾ in.) in inside diameter measured at the middle.

[1] This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of D02.C0.02 on Corrosion and Water/Air Separability.

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[2] *Annual Book of ASTM Standards,* Vol 01.05.

[3] *Annual Book of ASTM Standards,* Vol 01.03.

[4] *Annual Book of ASTM Standards,* Vol 05.01.

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

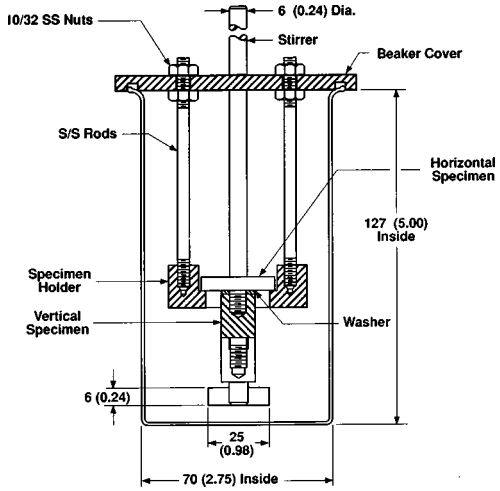
[6] *Annual Book of ASTM Standards,*Vol 05.02.

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

[8] Available from Applied Science Publishers, Ltd., Ripple Road, Barking, Essex, England.

[9] *Annual Book of ASTM Standards,* Vol 05.04.

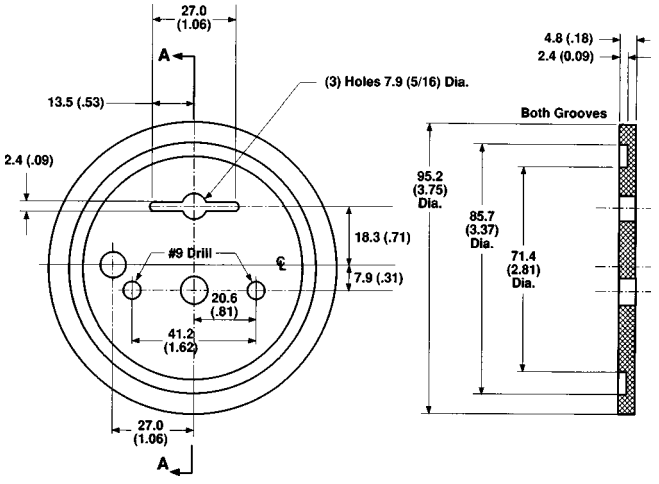
[10] Borosilicate glass is satisfactory for this purpose.



NOTE 1—All dimensions are in millimeters (inches).

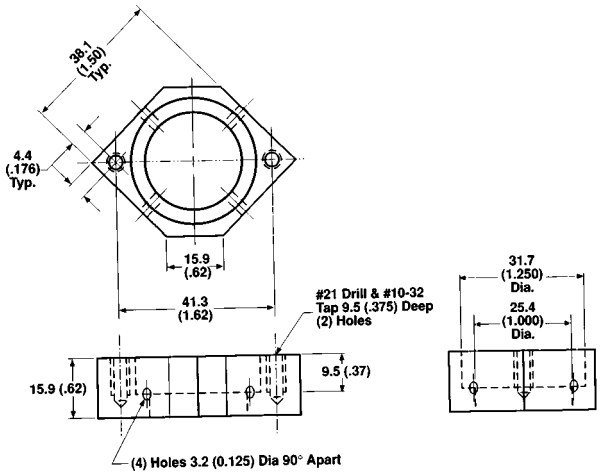
FIG. 1 Rusting Test Apparatus

5.3 *Beaker Cover and Specimen Holder*—A flat beaker cover (Fig. 2) of methyl methacrylate resin or other fluid resistant material is kept in position by a suitable groove. Three holes are provided. Two are located on any diameter of the cover, one for a stirrer, and the other for attachment of a disk specimen to the underside of the cover for optional vapor phase testing. The third hole is for a thermometer, located on a diameter perpendicular to that of the other two holes. The outside of the polytetrafluoroethylene (PTFE) specimen holder (Fig. 3) is a square, but from the ends of one diagonal, two equal pieces of PTFE are cut off over the height of the holder. Two vertical threaded holes are made on the other diagonal of the square. The inside of the holder consists of two cylindrical holes, one on top of the other. Four horizontal holes are drilled 90° apart on the circumference where the two cylindrical holes meet. The PTFE specimen holder is connected to the beaker cover by two stainless steel holding rods (Fig. 4). Both ends of each holding rod are threaded. The surfaces between the threads are polished with No. 180 grit emery. The 12.7-mm



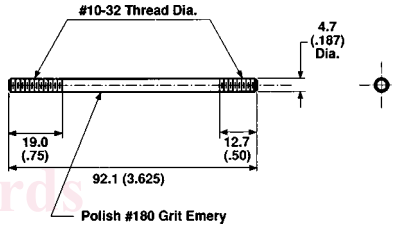
NOTE 1—All dimensions are in millimeters (inches).

FIG. 2 Beaker Cover



NOTE 1—All dimensions are in millimeters (inches).

FIG. 3 Specimen Holder



NOTE 1—All dimensions are in millimeters (inches).

FIG. 4 Holding Rod

threaded ends of the holding rods are screwed into the two vertical threaded holes of the specimen holder. The 19.0-mm threaded ends of the holding rods are connected to the beaker cover by putting them through two holes on a line perpendicular to the connection line of the centers of the earlier mentioned first and second hole of the beaker cover. Each holding rod is fastened by two 10-32 stainless steel nuts.

NOTE 3—An alternative design for the specimen holder assembly has also been used successfully. See Test Method D 3603–82.

5.4 *Stirrer*—A stirrer constructed entirely from stainless steel in the form of an inverted T (Fig. 5). A flat blade 25.4 by 6.1 by 0.6 mm (1 by 0.24 by 0.024 in.) shall be attached to a 6.1-mm (0.24-in.) rod in such a way that the blade is symmetrical with the rod and has its flat surface in the vertical plane.

NOTE 4—A suitable material is an 18 % chromium, 8 % nickel alloy steel conforming to Type 304 of ASTM Specification A 240 or SAE No. 30304[11], or BS 970: Part I:1983:302531.[12]

NOTE 5—If stainless steel is not obtainable, stirrers made of heat-resistant glass[10] and having approximately the same dimensions as the stainless steel stirrers may be used.

5.5 *Stirring Apparatus*—Any convenient form of stirring apparatus capable of maintaining a speed of 1000 ± 50 r/min.

5.6 *Grinding and Polishing Equipment*—A 150 and 240-grit metalworking aluminum oxide abrasive cloth, closed coat on a

[11] 1988 SAE Handbook.

[12] British Standard 2, 1965 Section 5, or equivalent, may be used.