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.

Designation: D5968 – 19a$^{\varepsilon 1}$

Standard Test Method for Evaluation of Corrosiveness of Diesel Engine Oil at 121 °C[1]

This standard is issued under the fixed designation D5968; 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.

ε[1] NOTE—Editorially updated TMC governance information in June 2022.

INTRODUCTION

The method described in this test method is based on the gas turbine lubricant corrosion and oxidation test described in Federal Test Method Standard 791, Method 5308. Because this test method relates to corrosion in diesel engines rather than in gas turbines, temperatures, metal coupons, and certain parts of the test procedure were modified to be more appropriate for heavy duty diesel engines.

The method described in this test method can be used by any properly equipped laboratory, without outside assistance. However, the ASTM Test Monitoring Center (TMC)[2] provides reference oils and an assessment of the test results obtained on those oils by the laboratory (see Annex A1). By these means, the laboratory will know whether their use of the test method gives results statistically similar to those obtained by other laboratories. Furthermore, various agencies require that a laboratory utilize the TMC services in seeking qualification of oils against specifications. For example, the U.S. Army imposes such a requirement in connection with several Army engine lubricating oil specifications.

Accordingly, this test method is written for use by laboratories that utilize the TMC services. Laboratories that choose not to use those services may simply ignore those portions of the test method that refer to the TMC.

This test method may be modified by means of Information Letters issued by the TMC. In addition, the TMC may issue supplementary memoranda related to the method (see Annex A1). For other information, refer to the research report on the Cummins Bench Corrosion Test.[3]

1. Scope*

1.1 This test method is used to test diesel engine lubricants to determine their tendency to corrode various metals, specifically alloys of lead and copper commonly used in cam followers and bearings. Correlation with field experience has been established.[4]

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific hazard statements are given in 5.3.1, 6.5, 6.6, 6.7, 6.8, 6.9, 7.1.1, 7.1.2, and 7.1.5.

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.*

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricantsand is the direct responsibility of Subcommittee D02.B0.02 on Heavy Duty Engine Oils.

Current edition approved Dec. 1, 2019. Published December 2019. Originally approved in 1998. Last previous edition approved in 2019 as D5968 – 19. DOI: 10.1520/D5968-19AE01.

[2] ASTM Test Monitoring Center, 203 Armstrong Drive, Freeport, PA 16229. (http://www.astmtmc.org)

[3] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D02-1322. The research report and this test method are supplemented by Information Letters and Memoranda issued by the ASTM Test Monitoring Center. This edition incorporates revisions contained in all information letters through No. 19-1. Users of this test method shall contact the ASTM Test Monitoring Center to obtain the most recent of these.

[4] Wang, J. C., and Cusano, C. M., "Development of A Bench Test to Detect Oils Corrosive to Engine Components," SAE Technical Paper No. 940790, 1994.

*A Summary of Changes section appears at the end of this standard

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

2. Referenced Documents

2.1 *ASTM Standards:*[5]

D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

D5185 Test Method for Multielement Determination of Used and Unused Lubricating Oils and Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 *U.S. Federal Test Method Standards:*[6]

Federal Test Method Standard 791, Method 5308.7 Corrosiveness and Oxidation Stability of Light Oils (Metal Squares)

3. Summary of Test Method

3.1 Four metal coupons of copper, lead, tin, and phosphor bronze are immersed in a measured amount of engine oil. The oil, at an elevated temperature, is blown with air for a period of time. When the test is completed, the coupons and the stressed oil are examined to detect corrosion.

3.2 An industrial reference oil is tested with each group of tests to verify test acceptability.

4. Significance and Use

4.1 This test method is intended to simulate the corrosion process of non-ferrous metals in diesel lubricants. The corrosion process under investigation is that believed to be induced primarily by inappropriate lubricant chemistry rather than lubricant degradation or contamination. This test method has been found to correlate with an extensive fleet database containing corrosion-induced cam and bearing failures.

5. Apparatus

5.1 The main apparatus consists of the following items of standard wall borosilicate glassware as shown in Figs. 1-6.

5.1.1 *Main Sample Tube,* Fig. 1.

5.1.2 *Sample Tube Head,* Fig. 2.

5.1.3 *Air Tube,* Fig. 3.

5.1.4 *Thermocouple Tube,* Fig. 4.

5.1.5 *Condenser, Allihn Type,* Fig. 5.

5.1.6 *Assembled Apparatus,* Fig. 6.

5.2 Additional glassware items and assembly accessories needed are:

5.2.1 *Hanger (for metal specimens),* of stainless steel, having the dimensions listed in Fig. 7.

5.2.2 *Oil Sampling Tube, Borosilicate Glass,* 4 mm outside diameter, with sampling end approximately 600 mm to reach into main sample tube. Tube is bent U-shape with exit end fitted by a one-hole stopper to a 25 mL filtering flask. Exit end may be any convenient length.

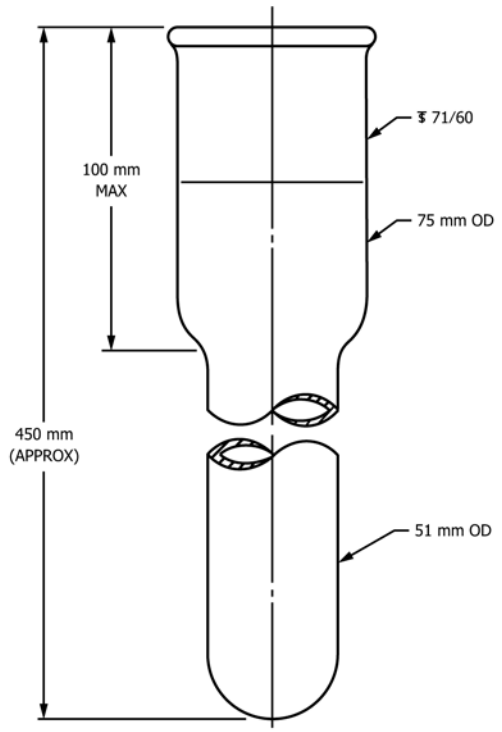


FIG. 1 Sample Tube

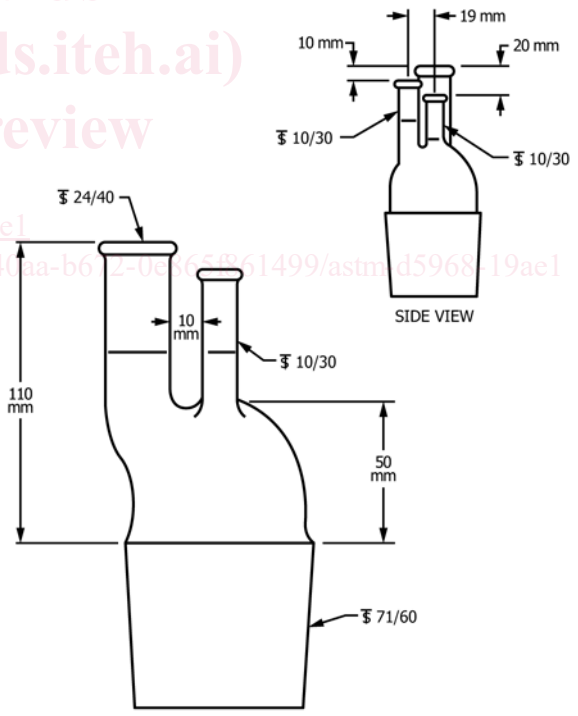


FIG. 2 Sample Tube Head

5.2.3 *Adapter,* [7,8] Polytetrafluoroethylene for 10/18 joint for sealing of air tube to sample tube head.

5.3 Other items and equipment are:

[5] 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.

[6] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

[7] A satisfactory source for this item is Kontes Glass Co., Vineland, NJ 08360.

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ASTM D5968-19ae1
https://standards.iteh.ai/catalog/standards/sist/17050778-6688-40da-b612-0e3685f61499/astm-d5968-19ae1

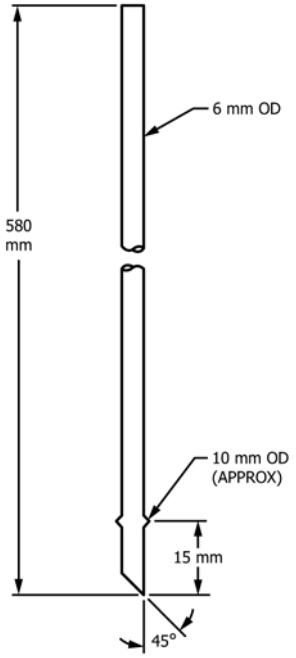


FIG. 3 Air Tube

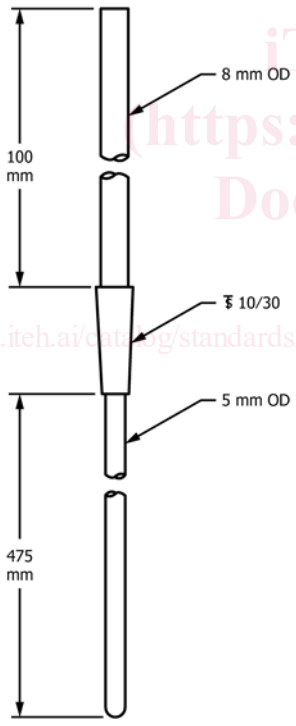


FIG. 4 Thermocouple Tube

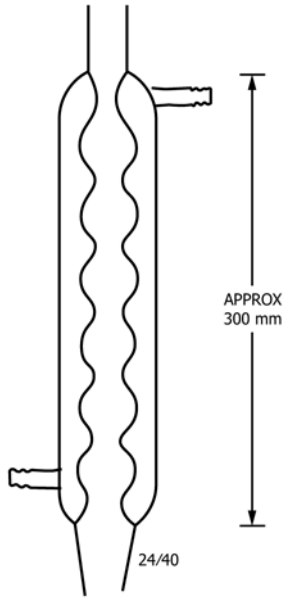


FIG. 5 Condenser, Allihn Type

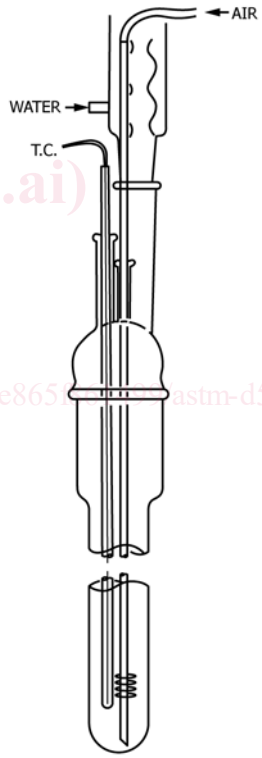


FIG. 6 Assembled Apparatus

iTeh Standards (https://standards.iteh.ai) Document Preview
ASTM D5968-19ae1
https://standards.iteh.ai/catalog/standards/sist/17050778-6688-40aa-b672-0e865a...astm-d5968-19ae1

5.3.1 *Heating Bath,* constant temperature control within ±0.5 °C of test temperature with an immersion depth of 23 cm to 35 cm. Oil or aluminum baths are recommended. (**Warning—**There are exposed hot surfaces on apparatus. Avoid skin contact by use of protective equipment.)

5.3.2 *Hood Ventilation,* to adequately remove fumes during heating.

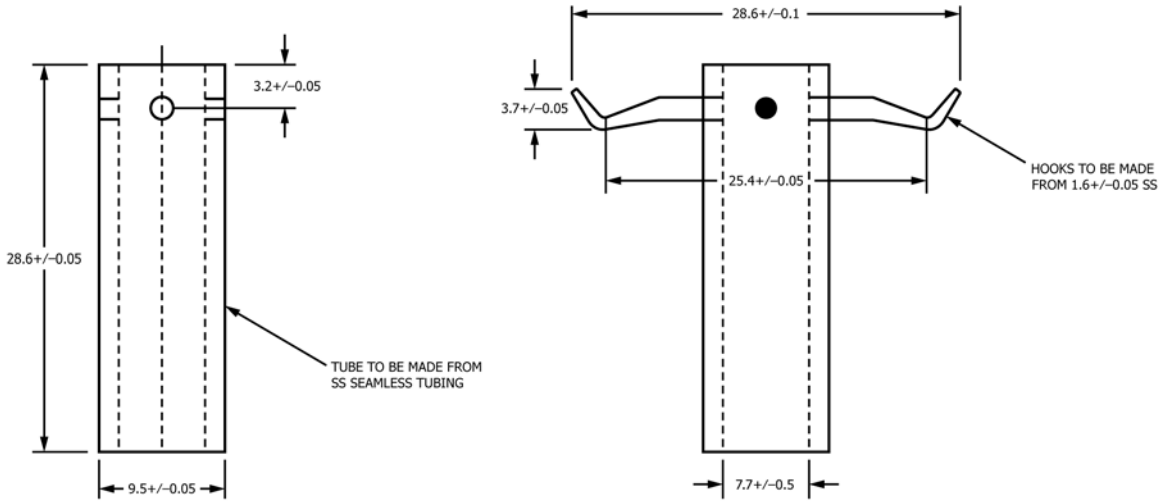
5.3.3 *Air Supply,* use air from a clean, dry source.

5.3.4 *Flowmeter,* capable of measuring 10 L/h ± 1 L/h.

5.3.5 *Balance,* analytical sensitivity 0.1 mg.

5.3.6 *Balance, Laboratory,* 2500 g capacity, 0.1 g sensitivity.

[8] The sole source of supply of the apparatus known to the committee at this time is noted in the adjoining footnote. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.



NOTE 1—All dimensions in mm.

FIG. 7 Specimen Hanger

5.3.7 *Assembly Fixture,* wood slotted to hold coupons squares (assembly as shown in Fig. 7) for tying with wire.

5.3.8 When air needs to be conditioned there is a need for an air drier. The method used is optional provided the air characteristics of 5.3.3 are attained. For drying, a satisfactory method is the use of a glass column containing 8-mesh anhydrous calcium sulfate with a column diameter such that velocity of air does not exceed 1.2 m/min.

5.3.9 *Oven,* optional, to dry glassware at elevated temperature.

5.3.10 *Forceps,* stainless steel.

5.3.11 *Thermocouple.*

5.3.12 *Brush,* short-bristled, stiff (old-style typewriter cleaning brush or equivalent).

6. Reagents and Materials

6.1 *Purity of Reagents*—Use reagent grade chemicals in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[9]

6.2 *Metal Specimens:* [10,8]

6.2.1 Specimens are 0.081 cm thick by 2.5 cm square, except the lead specimen, which is 0.157 cm thick. One specimen from each of the following metal types, each with two drilled holes (as shown in Fig. 7), is required:

6.2.1.1 Copper (R401-A),

6.2.1.2 Lead (R401-lead),

6.2.1.3 Tin (R401-tin), and

6.2.1.4 Phosphor Bronze (R401-LEADz).

6.3 *Abrasive Paper,* 240 grit aluminum oxide and 400 grit silicon-carbide.[11] Do not use iron-containing abrasives such as natural emery.

6.4 *Cotton,* absorbent.

6.5 *Acetone* (ACS), sulfur-free. (**Warning—**Flammable. Health hazard.)

6.6 *Degreasing Solvents,* heptane. (**Warning—**Flammable. Health hazard.)

6.7 *Glassware Cleaning Solution,* Contrad (trademarked) 70.[12,8](**Warning—**Health hazard.)

6.8 *Carbon Remover for Glassware*[13,8], Oakite Stripper R-8. (**Warning—**Corrosive, causes severe burns.)

6.9 *Naphtha, Aromatic.* (**Warning—**Flammable. Health hazard.)

6.10 *Filter Paper.*

6.11 *Kimwipe Tissues,* or similar.

6.12 *Industrial Reference Oil.* [2]

7. Preparation of Apparatus

7.1 *Cleaning of Glassware from Previous Run:*

7.1.1 Rinse all glassware items and the air tube adapter with degreasing solvent to remove residual oil, and air dry. (**Warning—**Harmful if inhaled.)

7.1.2 Fill or immerse the sample tube, air tube, and the 9 mm glass spacers in carbon remover at room temperature until carbonaceous deposits are removed. Water rinse after removal. (**Warning—**Corrosive, causes severe burns.)

[9] *ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

[10] Satisfactory metal specimens may be obtained from: Test Engineering, Inc. (TEI), 12718 Cimarron Path, San Antonio, TX 78249-3423. This is the only coupon source to be used for obtaining a valid reference run and data for certification.

[11] Suitable abrasive paper meeting these specifications is included with the metal coupons from the source indicated in 6.2.

[12] Contrad 70 is available from Decon Laboratories, Inc., 460 Glennie Circle, King of Prussia, PA 19406, (800) 332–6647.

[13] Oakite Stripper R-8 is available from Oakite Products, Inc., 50 Valley Rd., Berkeley Heights, NJ 07922. It has been found satisfactory for this purpose.

iTeh Standards (https://standards.iteh.ai) Document Preview
ASTM D5968-19a1
https://standards.iteh.ai/catalog/standards/sist/17050778-66f...-9ae1