Designation: D 1367 – 96 (Reapproved 2001)

An American National Standard

Standard Test Method for Lubricating Qualities of Graphites[1]

This standard is issued under the fixed designation D 1367; 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 evaluation of the abrasive properties of graphites that are used for lubricating purposes.

1.2 The values stated in SI units are to be regarded as the standard. The values stated 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. Summary of Test Method

2.1 A representative sample of the graphite is suspended in mineral oil, and the mixture containing 15 % by weight of graphite is circulated through a ball bearing by means of an impeller and duct assembly. The bearing shaft is driven at 1750 rpm for a period of 2 h. The loss in weight of the bearing is determined.

3. Significance and Use

3.1 This test method can be used to determine the relative abrasiveness of graphites under the test conditions, and if the test conditions are changed, the relative ratings may be different. No correlation has been established between this test method and field service.

4. Apparatus

4.1 *Graphite Lubricant Tester,*[2] as illustrated in Fig. 1, consisting of the following:

4.1.1 *Bearing Holder Assembly,*[2] as shown in Fig. 2. It consists of a shaft on which the bearing is mounted, a propeller at the end of the shaft to maintain the graphite in uniform suspension, and a duct to direct the flow of fluid through the bearing. The duct, in two sections, is arranged in the form of a cylinder around the bearing. The upper section of the cylinder, containing three port holes, is permanently mounted. The lower section, which is removable, widens to a bell shape around the propeller.

FIG. 1 Graphite Lubricant Tester

4.1.2 *Motor*, capable of driving the test bearing at 1750 ± 50 rpm, and equipped with a coupling which may readily be detached from the shaft described in 4.1.1.

4.1.3 *Griffin Beaker*, 400-mL, 75 mm in diameter, or a metal container of similar dimensions.

4.1.4 *Stand*, designed to support the equipment referred to in 4.1.1, 4.1.2, and 4.1.3 in a rigid vertical position.

4.2 *Transfer Pipet*, 50-mL, provided with a rubber bulb.

5. Reagents and Materials

5.1 *Double-Row Ball Bearing*, without closure (seal) having an internal bore of 12.00 mm (0.4724 in.), a diameter of 32.0

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.L on Joint ASTM-ASLE Committee on Industrial Lubricants.

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[2] Detail drawings of the apparatus are available at a nominal cost from ASTM. Request Adjunct No. ADJD1367.

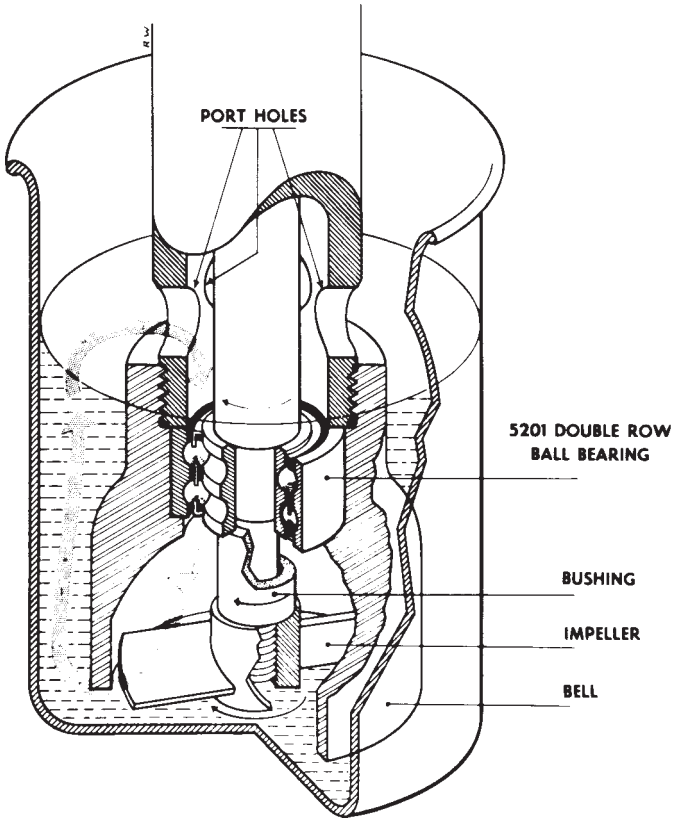

FIG. 2 Bearing Holder Assembly

mm (1.2598 in.), and a width of 15.875 mm (0.6250 in.). Seven balls, each having a diameter of 5.97 mm (0.235 in.) are fitted into each race and retained with a steel separator.[3]

5.2 *Paraffin Oil*, having a viscosity of 20.53 to 22.85 cSt (100–110 SUS) at 37.8°C (100°F), and which is clear and free of sediment.

5.3 *Solvent*, safe, nonfilming, nonchlorinated.

6. Preparation of Bearing

6.1 Thoroughly clean the bearing of preventive material (Note 1) by immersing and washing it succesively in a beaker of solvent selected in 5.3. Dry the bearing by placing it in an oven at 98.9 to 104°C (210 to 220°F) for a period of ½ h. Allow to cool in a desiccator.

NOTE 1—Bearings as-received should be coated with a low-viscosity rust-preventive oil. To ensure receiving bearings that are slushed with this type of material, orders may be placed directly with the manufacturer with the following stipulation:" To be slushed with low-viscosity rust-preventive oil."

7. Procedure

7.1 After the dry bearing has been brought to room temperature in a desiccator, weigh it to the nearest 0.1 mg. Repeat the cleaning and drying operations as described in Section 6 until a constant weight is obtained.

7.2 Place the bearing in the upper end of the bell, so that the outer ring is seated firmly. Screw the bell tightly by finger on the cylindrical duct, thereby locking the bearing outer ring in place. Place the bushing on the shaft and finger screw the propeller tightly on the left-hand thread located at the bottom of the shaft. The bushing serves to lock the inner ring of the bearing to the shaft. At this point the equipment should be checked as to freedom from applied loads in accordance with the procedure outlined in Annex A1.

7.3 Using the 400-mL-Griffin beaker, prepare a mixture of 36 ± 0.1 g of the sample graphite and 204 ± 0.1 g of the mineral oil (see 5.2).

7.4 Disperse the graphite in the oil by stirring with a spatula until scraping of the bottom of the beaker shows no aggregates of graphite.

7.5 When uniform suspension of the graphite has been achieved, place the beaker in the seat provided in the base plate of the stand. Then lower the bearing assembly into the beaker until there is a 6.4-mm (0.25-in.) clearance between the bottom of the bell section of the duct and the beaker.

7.6 By means of the pipet, draw off a sufficient quantity of the mixture to lower the level of the liquid to coincide with the oil level mark on the upper section of the cylinder duct. When the liquid is at this level, one-half of the area of each port hole is covered by the mixture.

NOTE 2—The level of the mixture may rise during the test to a point almost completely covering the port hole. This is due to thermal expansion and aeration of the mixture.

7.7 Turn on the motor and operate the bearing, revolving counterclockwise for 2 h ± 5 min.

7.8 At the end of the test period, dismantle the apparatus. Wash the bearing in solvent selected in 5.3 for 1 min. Transfer to a second beaker of solvent and rinse. Dry the bearing in an oven at 98.9 to 104°C (210 to 220°F) for a period of ½ h.

7.9 After the dry bearing has been brought to room temperature in a desiccator, weigh it to the nearest 0.1 mg. Repeat the cleaning and drying operations as described in Section 4 until a constant weight is obtained.

NOTE 3—When the procedure described in 7.1 to 7.9 is followed, using 240 g of the mineral oil and omitting the graphite, the bearing should show a weight loss of less than 2.0 mg. Greater wear indicates that the apparatus is not functioning properly. Refer to Annex A1 for inspection procedures.

8. Report

8.1 Report the weight loss of the bearing to the nearest 0.1 mg.

9. Precision and Bias

9.1 The precision of this test method is not known to have been obtained according to RR: D02-1007, "Manual on Determining Precision Data for ASTM Methods on Petroleum Products and Lubricants."[4]

9.1.1 The precision of this test method as determined by statistical examination of interlaboratory results is as follows:

9.1.1.1 *Repeatability*—The difference between two test results obtained by the same operator with the same apparatus

[3] New Departure Bearing No. 5201 has been found to be satisfactory. A similar bearing NSK without closures meets these design and dimensional requirements. In the case of referee tests, bearings from the same manufacturer should be used.

[4] *Annual Book of ASTM Standards*, Vol 05.03.

under constant operating conditions on identical test material would, in the long run in the normal and correct operation of the test method, exceed the following values only in one case in twenty:

Bearing Weight Loss in Area, mg	Repeatability, percent of mean
10	35
20	25
170	15

9.1.1.2 *Reproducibility*—The difference between two single and independent results obtained by different operators working in different laboratories on identical test materials would, in the long run in the normal and correct operation of the test method, exceed the following values only in one case in twenty:

Bearing Weight Loss in Area, mg	Reproducibility, percent of mean
10	50
20	25
170	25

9.2 *Bias*—The procedure in this test method has no bias because the weight loss value so measured can be defined only in terms of a test method.

10. Keywords

10.1 ball bearing; graphite; relative abrasiveness

ANNEX

(Mandatory Information)

A1. INSPECTION OF GRAPHITE TESTER TO ENSURE THAT TEST BEARING HAS NO APPLIED LOAD

A1.1 After locking the outer race of the bearing by screwing the bell finger-tight onto the upper section of the cylinder duct, it should be possible to raise the spindle and pilot bearing about 0.8 mm (0.031 in.). Having this play ensures that no axial load has been applied to the inner race of the test bearing.

A1.2 By screwing the propeller nut and the sleeve onto the shaft, the inner race of the test bearing is locked between the sleeve and a shoulder on the spindle. Thus, the axial 0.8-mm (0.031-in.) play mentioned in A1.1 is eliminated. At this time and throughout the duration of the test run the only load on the bearing is the weight of the spindle.

A1.3 Assemble the coupling so that the rubber disk has approximately 0.8-mm (0.031-in.) axial clearance. This avoids transmitting the armature load through the coupling to the test bearing.