Designation: D3704 – 96 (Reapproved 2012)

Standard Test Method for Wear Preventive Properties of Lubricating Greases Using the (Falex) Block on Ring Test Machine in Oscillating Motion[1]

This standard is issued under the fixed designation D3704; 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 determination of wear properties of lubricating greases by means of the Falex block-on-ring friction and wear test machine.

1.2 The values stated in SI units are to be regarded as standard except where equipment is supplied using inch-pound units and would then be regarded as standard. The metric equivalents of inch-pound units given in such cases in the body of the standard may be approximate.

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:*[2]

D1403 Test Methods for Cone Penetration of Lubricating Grease Using One-Quarter and One-Half Scale Cone Equipment

D2714 Test Method for Calibration and Operation of the Falex Block-on-Ring Friction and Wear Testing Machine

G40 Terminology Relating to Wear and Erosion

3. Terminology

3.1 *Definitions:*

3.1.1 *coefficient of friction, μ or f, n—in tribology*, the dimensionless ratio of the friction force (*F*) between two bodies to the normal force (*N*) pressing these two bodies together.

$$\mu \text{ or } = (F/N) \quad (1)$$

3.1.1.1 *Discussion*—A distinction is often made between *static coefficient of friction* and *kinetic coefficient of friction.* **G40**

3.1.2 *friction force, n*—the resisting force tangential to the interface between two bodies when, under the action of an external force, one body moves or tends to move relative to the other. **G40**

3.1.3 *kinetic coefficient of friction, n*—the coefficient of friction under conditions of macroscopic relative motion between two bodies. **G40**

3.1.4 *wear, n*—damage to a solid surface, generally involving progressive loss of material, due to relative motion between that surface and a contacting substance or substances. **G40**

4. Summary of Test Method

4.1 The tester is operated with a steel test ring oscillating against a steel test block. Test speed, load, angle of oscillation, time and specimen surface finish and hardness can be varied to simulate field conditions.

4.2 The width of the wear scar, developed on the test block from contact with the oscillating test ring, is measured.

5. Significance and Use

5.1 This test method is used to differentiate between greases having high, medium, and low wear preventive properties using oscillating motion. The user of this method should determine to his own satisfaction whether results of this test procedure correlate with field performance or other bench test machines.

6. Apparatus

6.1 *Falex Block-on-Ring Test Machine with Friction Recorder,*[3] described in detail in Annex A1 and illustrated in Fig. 1.

[1] 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.L0.05 on Solid Lubricants.

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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.

[3] The sole source of supply of the apparatus known to the committee at this time is Falex Corp., 1020 Airpark Dr., Sugar Grove, IL 60554. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

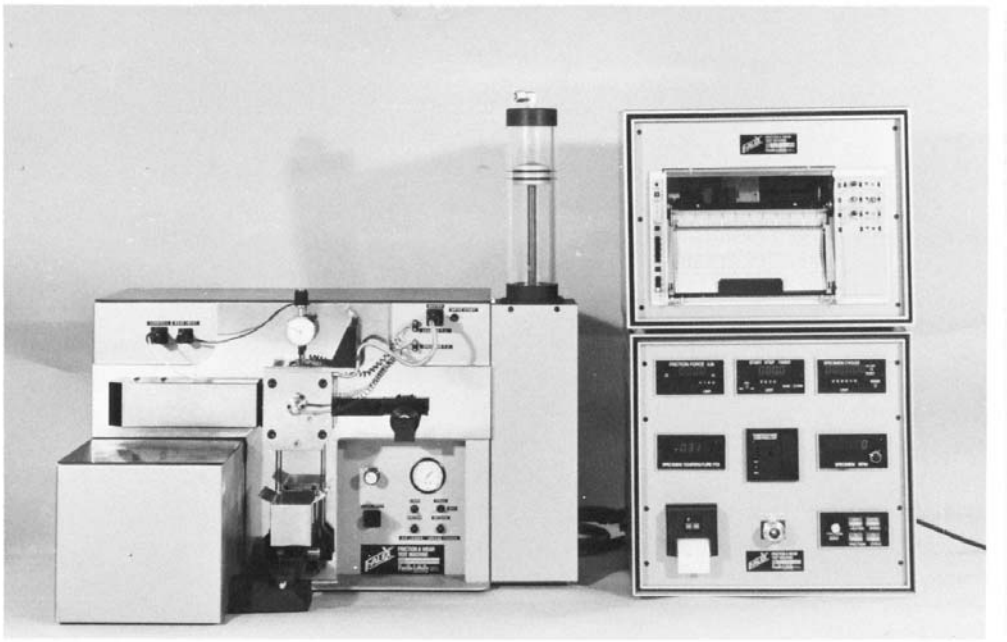

FIG. 1 Falex Block on Ring Test Machine

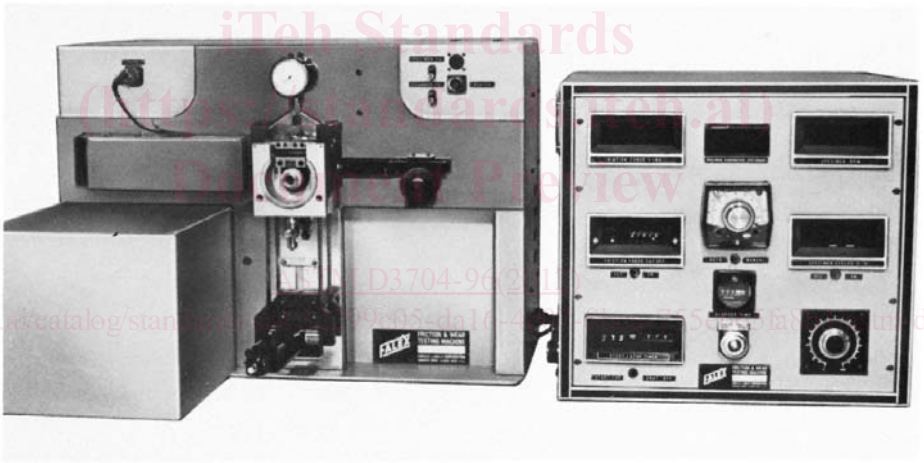

FIG. 1 Falex Ring and Block Test Machine *(continued)*

6.2 *Falex Oscillating Drive Accessory,*[3] described in detail in A1.6 and illustrated in Fig. 2.

6.3 *Microscope,* low-power (50× to 60×) having sufficient clearance under objective to accommodate the test block. It should be fitted with a filar micrometer so that scar width may be measured with accuracy of ±0.01 mm.

6.4 *Timer,* graduated in minutes and seconds.

7. Reagents and Materials

7.1 *Test Rings, Falex Type S-10 or S-25*[3]—SAE 4620 carburize steel, having a hardness of 58 to 63 HRC. The test ring has a width of 8.15 mm (0.321 in.), a diameter of 35 mm (1.3775 in.), and a maximum radial run out of 0.013 mm (0.0005 in.). The surface roughness of the S-10 ring shall be 0.15 to 0.30 µm (6 to 12 µin.) rms. The surface roughness of the S-25 ring shall be 0.51 to 0.71 µm (22 to 28 µin.) rms.

7.2 *Test Blocks, Falex Type H-30 or H-60*[3]—SAE 01 tool steel having two ground test surfaces of 0.10 to 0.20 µm (4 to 8 µin.) rms. The test block has a width 6.35 mm (0.250 in.) and a 15.76 mm (0.620 in.) length. The H-30 test block has a hardness of HRC 27 to 33. The H-60 test block has a hardness of HRC 58 to 63.

7.3 *Solvent,* non-film forming, nonchlorinated.

NOTE 1—Solvents formerly used in this test method were eliminated due to possible toxic effects. Each user should select a solvent that can meet his applicable safety standards and still thoroughly clean the machine parts.