Designation: ~~D2714 – 94 (Reapproved 2009)~~ D2714 – 94 (Reapproved 2014)

Standard Test Method for Calibration and Operation of the Falex Block-on-Ring Friction and Wear Testing Machine[1]

This standard is issued under the fixed designation D2714; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers the calibration and operation of a block-on-ring friction and wear testing machine.

1.2 The values in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided 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. Terminology

2.1 *Definitions:*

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

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

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum ~~Products~~ Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.L0.05 on Solid Lubricants.

This test method was prepared under the joint sponsorship of the American Society of Lubrication Engineers with the cooperation of the Coordinating Research Council, Inc. (CRC) Aviation Committee on Bonded Solid-Film Lubricants.

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2.1.1.1 *Discussion—*

A distinction is often made between *static coefficient of friction* and *kinetic coefficient of friction*.

2.1.2 *friction force*—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.

2.1.3 *kinetic coefficient of friction*—the coefficient of friction under conditions of macroscopic relative motion between two bodies.

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

3. Summary of Test Method

3.1 The test machine is operated using a steel test ring rotating against a steel test block, the specimen assembly being partially immersed in the lubricant sample. The velocity of the test ring is 7.9 ± 0.16 m/min (26 ± 0.52 ft/min) which is equivalent to a spindle speed of 72 ± 1 rpm. The specimens are subjected to 68 kg (150 lb) normal load applied by 6.8 kg (15 lb) of dead weight on the 10:1 ratio lever system. Test duration is 5000 cycles.

3.2 Three determinations are made: (*1*) The friction force after a certain number of revolutions, (*2*) the average width of the wear scar on the stationary block at the end of the test, and (*3*) the weight loss for the stationary block at the end of the test.

4. Significance and Use

4.1 This test method is used for the calibration of a block-on-ring testing machine by measuring the friction and wear properties of a calibration fluid under the prescribed test conditions.

4.2 The user of this test method should determine to his or her own satisfaction whether results of this test procedure correlate with field performance or other bench test machines. If the test conditions are changed, wear values can change and relative ratings of fluids can be different.

5. Apparatus

5.1 *Falex Block-on-Ring Test Machine,* [2] shown in Fig. 1 and Fig. 2 and described in detail in Annex A1.

NOTE 1—Consult the instruction manual for each machine to determine respective capabilities and limitations.

5.2 *Analytical Balance,* capable of weighing to the nearest 0.1 mg.

5.3 *Measuring Magnifier Glass,* with SI or inch-pound calibration so that the scar width can be measured with a precision of 0.01 mm, or equivalent.

6. Reagents and Materials

6.1 *Test Rings, Falex Type S-10,* [2] SAE 4620 carburized 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 shall be 0.15 to 0.30 µm (6 to 12 µin.) rms.

6.2 *Test Blocks, Falex Type H-30,* [2] SAE 01[3] tool steel having two ground test surfaces of 0.10 to 0.20 µm (4 to 8 µin.) rms. The test block has a test surface width of 6.35 mm ~~(0.250 in.)~~ (0.250 in.) and a length of 15.76 mm (0.620 in.). The test block has a hardness of 27 to 33 HRC.

6.3 *Solvents,* safe, nonfilming, nonchlorinated.

NOTE 2—Each user should select a solvent that can meet the applicable safety standards and still thoroughly clean the parts.

6.4 *Calibration Fluid,* consisting of white mineral oil conforming to *U. S. Pharmacopeia XVII*, p. 399, and with a viscosity at 37.8°C (100°F) of 63 to 65 cSt.

7. Preparation of Apparatus

7.1 Before each test, thoroughly clean the specimen holder and chamber as well as the tapered section, threaded section, lock nut, lock washer, a new test ring and block using solvents selected in 6.3.

7.2 Weigh each test ring and test block to the nearest 0.1 mg on the analytical balance. Then store the specimens in a desiccator until ready for use.

7.3 Place the block holder on the block and carefully place block and holder in upper specimen holder in test chamber. Mount the test ring on the test shaft, taking care not to touch the test area. Tighten the test ring on the shaft with 440 N ~~(100 lbf)~~ (100 lbf) as measured on the friction force meter on the digital instrument unit.

[2] Trademarked and manufactured by Falex Corp., 1020 Airpark Dr., Sugar Grove, IL 60554.
[3] SAE 01 is also known as Starrett 496 or Marshall Oil-crat.

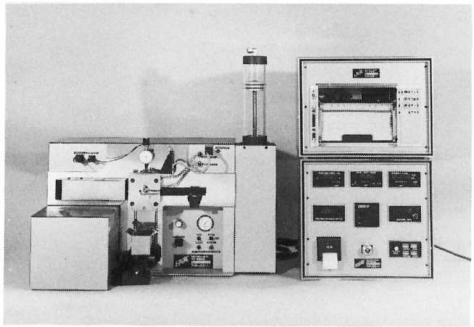

FIG. 1 Falex Block-On-Ring Variable Drive Testing Machine