Designation: ~~D2670 – 95 (Reapproved 2010)~~ D2670 – 95 (Reapproved 2016)

Standard Test Method for Measuring Wear Properties of Fluid Lubricants (Falex Pin and Vee Block Method)[1]

This standard is issued under the fixed designation D2670; 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 a procedure for making a preliminary evaluation of the wear properties of fluid lubricants by means of the Falex Pin and Vee Block Lubricant Test Machine.

NOTE 1—Certain fluid lubricants may require different test parameters depending upon their performance characteristics.

1.2 The values stated in inch-pound 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:*[2]

B16/B16M Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *actual ~~gage~~gauge load, n*—the value obtained from the ~~gage~~gauge while running the test and before any corrections are made.

[1] This test method is under the jurisdiction of Committee D02 on Petroleum ~~Products~~ Products, Liquid Fuels, and Lubricantsand is the direct responsibility of Subcommittee D02.L0.11 on ~~Tribological~~Tribological Properties of Industrial Fluids and Lubricates.

This test method was prepared under the joint sponsorship of the American Society of Lubrication Engineers. Accepted by ASLE in May 1967.

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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.

3.1.1.1 *Discussion*—

The ~~gage~~gauge reading is irrespective of the particular ~~gage~~gauge used, and corrections are made by comparison to a standard reference.

3.1.2 *direct load, n*—the load that is applied linearly, bisecting the angle of the vee block corrected to either the ~~800 lbf or 3000 lbf gage~~ 800 lbf or 3000 lbf gauge reference.

3.1.2.1 *Discussion*—

This load is equivalent to the true load times the cos 42°.

3.1.3 *true load, n*—the sum of the applied forces normal to the tangents of contact between the faces of one vee block and the journal pin corrected to the ~~4500 lbf gage~~ 4500 lbf gauge reference line.

3.1.4 *wear teeth, n*—a measurement of wear, which in this test, is based on the number of ratchet wheel teeth advanced during the test while maintaining load.

3.1.4.1 *Discussion*—

The number of teeth is directly related to the total wear (inches).

4. Summary of Test Method

4.1 The test consists of running a rotating steel journal against two stationary steel V-blocks immersed in the lubricant sample. Load is applied to the V-blocks and maintained by a ratchet mechanism. Wear is determined and recorded as the number of teeth of the ratchet mechanism advanced to maintain load constant during the prescribed testing time.

5. Significance and Use

5.1 This test method may be used to determine wear obtained with fluid lubricants under the prescribed test conditions. 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 may change and relative ratings of fluids may be different.

6. Apparatus

6.1 *Falex Pin and Vee Block Lubricant Test Machine,*[3] illustrated in Figs. 1-3.

7. Reagents and Materials

7.1 *Required for Calibration of Load ~~Gage:~~Gauge:*

7.1.1 *Allen Screw,* with attached ~~10-mm~~10 mm Brinell ball.[4]

7.1.2 *Back-Up Plug.* [4]

7.1.3 *Standard Test Coupon,* [4] soft, annealed copper, HB 37 to 39.

7.1.4 *Brinell Microscope,* or equivalent,

7.1.5 *Timer,* graduated in seconds and minutes, and

7.1.6 *Rule,* steel, ~~6-in.~~6 in. (approximately ~~150-mm)~~150 mm) long.

7.2 *Required for Test:* [4]

7.2.1 *Standard Coined V-Blocks,* [4] ~~96~~96° ± 1° angle, AISI C-1137 steel HRC 20 to 24, surface finish ~~55~~ µin. to ~~10 µin.~~ 10 µin. (1.3×10^{-7} to 2.5×10^{-7} m), rms,

[3] The Falex Pin and Vee Block Test Machine available from Falex Corp., 1020 Airpark Dr., Sugar Grove, IL 60554 has been found satisfactory for this purpose. A new model of this machine has been available since 1983. Certain operating procedures are different for this new model. Consult the instruction manual of machine for this information.

[4] Available from Falex Corp., 1020 Airpark Dr., Sugar Grove, IL 60554.

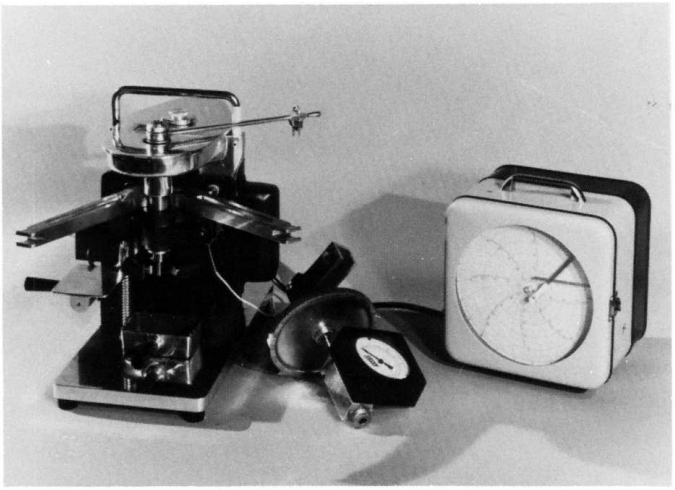

FIG. 1 Falex Pin and Vee Block Test Machine

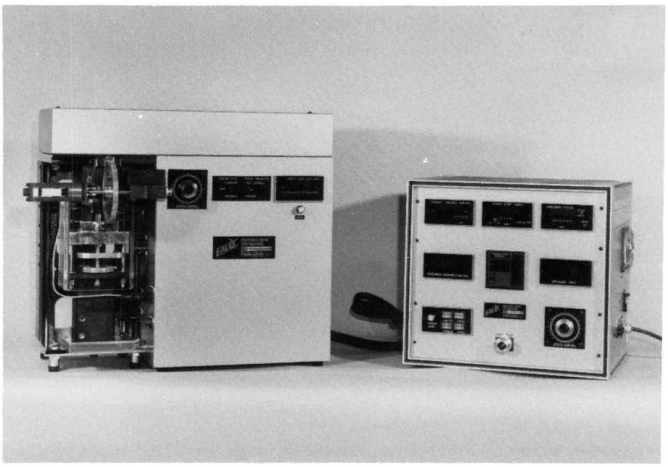

FIG. 2 Falex Digital Pin and Vee Block Test Machine

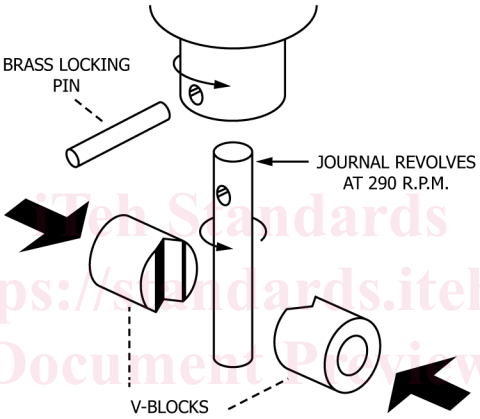

FIG. 3 Exploded View of V-Blocks and Journal Arrangement, Falex Pin and Vee Block Lubricant Test Machine

7.2.2 *Standard Test Journals,* [4] 1¼ ~~in. (6.35 mm)~~ in. (6.35 mm) outside diameter by 1¼ ~~in. (31.75 mm)~~ in. (31.75 mm) long, AISI 3135 steel, HRB 87 to 91 on a ground flat surface, surface finish ~~55~~ 55 µin. to ~~10 µin.~~ 10 µin., (1.3×10^{-7} to 2.5×10^{-7} m), rms,

7.2.3 *Locking Pins,* [4] ½ H brass, conforming to Specification B16/B16M.

7.2.4 *Timer,* graduated in seconds and minutes.

7.2.5 *Solvent,* safe, nonfilming, nonchlorinated.

NOTE 2—Petroleum distillate and benzene, formerly used as solvents in this test method, have been eliminated due to possible toxic effects. Each user should select a solvent that can meet applicable safety standards and still thoroughly clean the parts.

8. Calibration of Load ~~Gages~~Gauges

8.1 *Apparatus with ~~800-lb~~800 lb or ~~3000-lb Gage:~~3000 lb Gauge:*

8.1.1 Remove the Allen set screw and ½ ~~in. (12.70 mm)~~ in. (12.70 mm) ball from the left jaw socket (Fig. 4).

8.1.2 Insert the special Allen screw with the attached ~~10 mm~~10 mm Brinell ball into the working face of the left jaw. Adjust so that ball projects about 5⁄32 (approximately ~~4 mm)~~ 4 mm) from face of jaw.

8.1.3 Insert the back-up plug in the counterbore of the right-hand jaw. Adjust so that the plug projects about 1⁄32 ~~in.~~ in. (approximately 0.8 mm) from the face.

8.1.4 Support the standard test coupon so that the upper edge of the coupon is about 3⁄32 in. (approximately ~~2.5 mm)~~ 2.5 mm) below the upper surface of the jaws. Place a steel rule across the face of the jaws. Adjust the Allen screw with the attached ~~10 mm~~10 mm ball until the face of the jaws are parallel to the steel rule with the test coupon in position for indentation.

8.1.5 With the test coupon in position for the first impression, place the load ~~gage~~gauge assembly on the lever arms.

8.1.6 Place the loading arm on the ratchet wheel and actuate the motor. Allow the motor to run until the load ~~gage~~gauge indicates a load of ~~200 lb.~~ 200 lb. A slight takeup on the ratchet wheel is required to hold the load due to the ball sinking into the test coupon. After a ~~200 lb~~200 lb load is obtained, hold for ~~1 min~~ 1 min for the indentation to form.

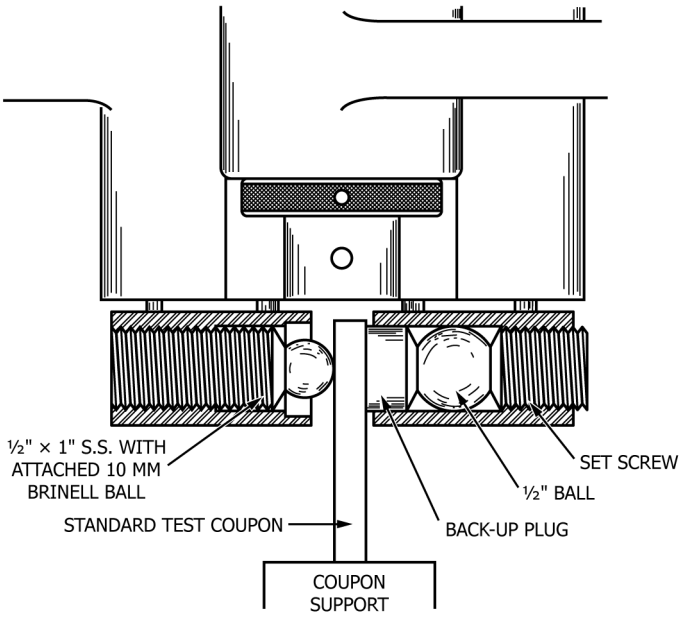

FIG. 4 Schematic Drawing of Calibration Accessories for Falex Pin and Vee Block Lubricant Test Machine

8.1.7 Turn off the machine and back off the load until the test coupon is free from the jaws. Advance the test coupon approximately ⅜ ~~in. (approximately 9.5 mm)~~ in. (approximately 9.5 mm) (additional indentations should be separated by a minimum distance of ~~2.5 × the~~2.5× the diameter of the initial indentation). Check the alignment of the jaws, and repeat the procedure described in 8.1.6 at ~~gage~~gauge loads of ~~400, 600, and 800 lb~~ 400 lb, 600 lb, and 800 lb when using an ~~800-lb gage.~~800 lb gauge. If a ~~3000-lb gage~~3000 lb gauge is used, check at ~~800, 1500, and 2500 lb.~~800 lb, 1500 lb, and 2500 lb.

8.1.8 Remove the load ~~gage~~gauge assembly and test coupon and measure the diameter of each indentation to ~~0.01 mm~~ 0.01 mm with a microscope. Make three measurements of the indentation diameter, rotating the test coupon to ensure that no two measurements represent the same points. Average the three measurements of each impression and record.

8.1.9 Plot the four impression readings versus ~~gage~~gauge load readings on log-log paper (K and E 467080 or equivalent). From the plot determine the ~~gage~~gauge load reading corresponding to an impression diameter of ~~3.30 mm.~~ 3.30 mm. Typically, this ~~gage~~gauge load reading will be about ~~700 lb.~~ 700 lb. This ~~gage~~gauge load shall be used in Section 12. A typical plot of impression diameter versus ~~gage~~gauge readings is shown in Fig. 5.

8.2 *Apparatus with ~~4500-lb Gage~~—4500 lb Gauge*—Use the same procedure as with ~~800-lb gage,~~800 lb gauge, above, except obtain impressions at ~~gage~~gauge readings of ~~300, 500, 750, and 1000 lb.~~ 300 lb, 500 lb, 750 lb, and 1000 lb. Plot the impression readings and determine the ~~gage~~gauge load corresponding to an impression diameter of ~~3.30 mm.~~ 3.30 mm. Typically, this ~~gage~~gauge load reading will be about ~~900 lb.~~ 900 lb. This ~~gage~~gauge load shall be used in the procedure, (Section 13). Fig. 4 includes a typical plot of impression diameter versus ~~gage~~gauge readings for the ~~4500-lb gage.~~4500 lb gauge.

9. Test Standards Check

9.1 Prepare a blend containing 0.10 weight % of sulfur,[5] precipitated powder, USP, and 99.90 weight percent white mineral oil,[6] USP, having a viscosity at ~~100°F (37.8°C)~~100 °F (37.8 °C) of 340 to 390 SUS (73.4 to ~~84.2 cSt).~~ 84.2 cSt). Heat the blend, in a glass beaker, to ~~240~~240 °F to ~~250°F (116~~250 °F (116 °C to ~~121°C)~~121 °C) and stir (glass stirrer) for ~~15 min.~~ 15 min. Designate this mixture as Blend A.

9.2 Prepare, similarly, a blend containing 0.20 weight % of sulfur and 99.80 weight % of white mineral oil. Designate this mixture as Blend B.

9.3 Refer to Section 8 for recommended use of these standards.

10. Apparatus and Testing Check

10.1 The purpose of this check is to establish that the apparatus is in satisfactory condition and that the test is being run in conformance to the procedure covered in Section 13. For such check purposes the fluid standards covered in Section 9 should be used (Note 3). The average of triplicate runs on the fluid standards should fall within the following limits (Note 4):

[5] Sulfur, so specified, from J. T. Baker Chemical Co. has been found satisfactory. 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.

[6] Available from most petroleum refining companies. Also available from most drug stores, typically labeled White Mineral Oil Extra Heavy. See Table X1.1 for specific products found satisfactory in cooperative test work.