



Designation: D3233 – 24

Standard Test Methods for Measurement of Extreme Pressure Properties of Fluid Lubricants (Falex Pin and Vee Block Methods)¹

This standard is issued under the fixed designation D3233; 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 These test methods cover two procedures for making a preliminary evaluation of the load-carrying properties of fluid lubricants by means of the Falex Pin and Vee Block Test Machine.

NOTE 1—Additional information can be found in [Appendix X1](#) regarding coefficient of friction, load gauge conversions, and load gauge calibration curve.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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.*

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.*

2. Referenced Documents

2.1 ASTM Standards:²

[B16/B16M Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines](#)

[D2670 Test Method for Measuring Wear Properties of Fluid Lubricants \(Falex Pin and Vee Block Method\)](#)

[D2783 Test Method for Measurement of Extreme-Pressure](#)

¹ These test methods are under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.L0.11 on Tribological Properties of Industrial Fluids and Lubricates.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

Properties of Lubricating Fluids (Four-Ball Method)

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology [D4175](#).

3.2 Definitions of Terms Specific to This Standard:

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

3.2.1.1 *Discussion*—This gauge reading is irrespective of the particular gauge used, and corrections are made by comparison to a standard reference.

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

3.2.2.1 *Discussion*—This load is equivalent to the true load times the $\cos 42^\circ$.

3.2.3 *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 gauge reference line.

3.2.4 *true load failure value, n*—the true load at which the lubricant tested can no longer support the applied load resulting in either test pin or shear pin breakage, or inability to maintain or increase load.

3.2.4.1 *Discussion*—This value is also referred to as the limit of extreme pressure.

4. Summary of Test Methods

4.1 Both test methods consist of running a rotating steel journal at $290 \text{ rpm} \pm 10 \text{ rpm}$ against two stationary V-blocks immersed in the lubricant sample. Load is applied to the V-blocks by a ratchet mechanism. In Test Method A ([Note 1](#)), increasing load is applied continuously. In Test Method B ([Note 1](#)), load is applied in 250 lbf (1112 N) increments with load maintained constant for 1 min at each load increment. In both methods the load-fail value obtained is the criteria for level of load-carrying properties. Both methods require calibration of the load gauge and reporting of test results as true (corrected) loads rather than actual gauge loads.

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

NOTE 2—Test Method A is referred to as the Falex Run-Up Test. Test Method B is referred to as the Falex One-Minute Step Test.

5. Significance and Use

5.1 Evaluations by both test methods differentiate between fluids having low, medium, and high levels of extreme-pressure properties. The user should establish any correlation between results by either method and service performance.

NOTE 3—Relative ratings by both test methods on the fluids covered in Table X2.1 and Table X2.2 are in good general agreement with four-ball weld-point relative ratings obtained on these same fluids, covered in Test Method D2783.

6. Apparatus

6.1 *Falex Pin and Vee Block Test Machine*,³ illustrated in Fig. 1, Fig. 2, and Fig. 3, fitted with 4500 lbf (20 000 N) gauge or 3000 lbf (13 350 N) gauge.

6.2 *Required for Calibration:*

6.2.1 *Allen Screw*, with attached 10 mm Brinnell ball.⁴

6.2.2 *Back-Up Plug*.⁴

6.2.3 *Standard Test Coupon*,⁴ soft, annealed copper, Hb 37–39.

6.2.4 *Brinnell Microscope*, or equivalent.

6.2.5 *Timer*, graduated in seconds and minutes.

6.2.6 *Rule*, steel, 6 in. (approximately 150 mm) long.

7. Reagents and Materials

7.1 *Standard Coined-Blocks*,⁴ $96^\circ \pm 1^\circ$ angle, AISI C-1137 steel, HRC 20 to 24, surface finish 5 $\mu\text{in.}$ to 10 $\mu\text{in.}$ (1.3×10^{-7} m to 2.5×10^{-7} m), rms.

³ The Falex Pin and Vee Block Test Machine, available from the 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 instruction manual of machine for this information.

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

7.2 *Standard Test Journals*,⁴ $\frac{1}{4}$ in. (6.35 mm) outside diameter by $1\frac{1}{4}$ in. (31.75 mm) long, AISI 3135 steel, HRB 87 to 91 on a ground flat surface, surface finish 5 $\mu\text{in.}$ to 10 $\mu\text{in.}$ (1.3×10^{-7} m to 2.5×10^{-7} m) rms.

7.3 *Locking Pins*,⁴ $\frac{1}{2}$ H brass, conforming to Specification B16/B16M.

7.4 *Solvent*, safe, nonfilming, nonchlorinated.

NOTE 4—Petroleum distillate and benzene, formerly used as solvents in this 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. Preparation of Apparatus

8.1 *Cleaning:*

8.1.1 Thoroughly clean the V-blocks, test journals, lubricant cup, and supports for V-blocks and test journals by washing, successively, with solvent selected in 7.4. Dry the V-blocks, test journals, lubricant cup, and supports by allowing the final solvent to evaporate in air.

8.1.2 After cleaning, handle the test pieces with care to prevent contamination. Particularly, avoid contact of fingers with mating surfaces of V-blocks and test journals.

8.2 *Assembly:*

8.2.1 Insert the test journal into the test shaft and secure with a new brass locking pin, as shown in Fig. 1 and Fig. 3.

8.2.2 Insert the V-blocks into the recesses of the loading device and swing the V-blocks inward to contact the journal so that the V-grooves are aligned with the journal major axis, as shown in Fig. 1 and Fig. 3.

8.2.3 Place 60 mL of test lubricant in the lubricant cup and raise the cup so that the V-blocks are immersed in the test lubricant. With highly viscous fluids, open the jaws slightly to ensure that the wear surfaces are covered with the lubricant.

8.2.4 Place the automatic loading device, with attached gauge, on the jaw arms.

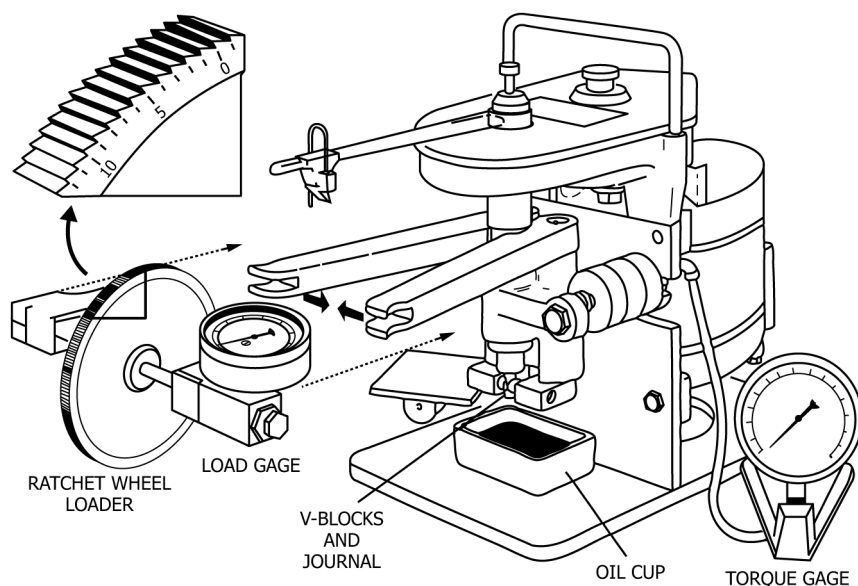


FIG. 1 Schematic Diagram of Falex Standard Pin and Vee Block Test Machine