Designation: G77 – 17 (Reapproved 2022)

Standard Test Method for Ranking Resistance of Materials to Sliding Wear Using Block-on-Ring Wear Test[1]

This standard is issued under the fixed designation G77; 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 laboratory procedures for determining the resistance of materials to sliding wear. The test utilizes a block-on-ring friction and wear testing machine to rank pairs of materials according to their sliding wear characteristics under various conditions.

1.2 An important attribute of this test is that it is very flexible. Any material that can be fabricated into, or applied to, blocks and rings can be tested. Thus, the potential materials combinations are endless. However, the interlaboratory testing has been limited to metals. In addition, the test can be run with various lubricants, liquids, or gaseous atmospheres, as desired, to simulate service conditions. Rotational speed and load can also be varied to better correspond to service requirements.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only. Wear test results are reported as the volume loss in cubic millimetres for both the block and ring. Materials of higher wear resistance will have lower volume loss.

1.4 *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.*

1.5 *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]

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

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

G40 Terminology Relating to Wear and Erosion

3. Terminology

3.1 *Definitions:*

3.1.1 *sliding wear, n*—wear due to the relative motion in the tangential plane of contact between two solid bodies.

3.1.2 *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.

3.1.3 For additional definitions pertinent to this test method, see Terminology G40.

4. Summary of Test Method

4.1 A test block is loaded against a test ring that rotates at a given speed for a given number of revolutions. Block scar volume is calculated from the block scar width, and ring scar volume is calculated from ring weight loss. The friction force required to keep the block in place is continuously measured during the test with a load cell. These data, combined with normal force data, are converted to coefficient of friction values and reported.

5. Significance and Use

5.1 The significance of this test method in any overall measurement program directed toward a service application

[1] This test method is under the jurisdiction of ASTM Committee G02 on Wear and Erosion and is the direct responsibility of G02.40 on Non-Abrasive Wear.

Current edition approved Nov. 1, 2022. Published November 2022. Originally approved in 1983. Last previous edition approved in 2017 as G77 – 17. DOI: 10.1520/G0077-17R22.

[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.

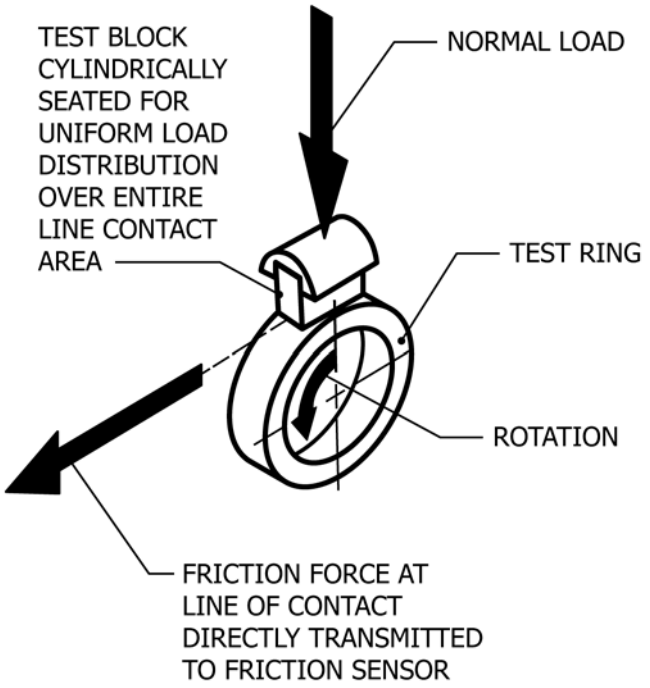

FIG. 1 Test Schematic

will depend on the relative match of test conditions to the conditions of the service application.

5.2 This test method seeks only to prescribe the general test procedure and method of calculating and reporting data. The choice of test operating parameters is left to the user. A fixed amount of sliding distance must be used because wear is usually non-linear with distance in this test.

6. Apparatus and Materials

6.1 *Test Schematic*—A schematic of one possible block-on-ring wear test geometry is shown in Fig. 1.[3]

6.2 *Test Ring*—A typical test ring is shown in Fig. 2. The test ring must have an outer diameter of 34.99 mm ± 0.025 mm (1.377 in. ± 0.001 in.) with an eccentricity between the inner and outer surface of no greater than 0.00125 mm (0.0005 in.). For couples where surface condition is not under study, it is recommended that the outer diameter be a ground surface with a roughness of 0.152 µm to 0.305 µm (6 µin. to 12 µin.) rms or center line average (CLA), in the direction of motion. However, alternate surface conditions may be evaluated in the test, as desired. It should be kept in mind that surface condition can have an effect on sliding wear results.

6.3 *Test Block*—A test block is shown in Fig. 3. Block width is 6.35 + 0.000, −0.025 mm (0.250 + 0.000, −0.001 in.). For couples where surface condition is not a parameter under study, a ground surface with the grinding marks running parallel to the long axis of the block and a roughness of 0.102 µm to 0.203 µm (4 µin. to 8 µin.) CLA in the direction of motion is recommended. However, other surface conditions may be evaluated as desired.

6.4 *Analytical Balance,* capable of measuring to the nearest 0.1 mg.

6.5 *Optical Device* (or equivalent), with metric or inch-pound unit calibration, is also necessary so that scar width can be measured with a precision of 0.005 mm (0.0002 in.) or equivalent.

7. Reagents

7.1 *Methanol.*

8. Preparation and Calibration of Apparatus

8.1 Run the calibration procedure that is in Test Method D2714 to ensure good mechanical operation of the test equipment.

9. Procedure

9.1 Clean the block and ring using a procedure that will remove any scale, oil film, or residue without damaging the surface.

9.1.1 For metals, the following procedure is recommended: clean the block and ring in a non-chlorine containing solvent, ultrasonically, if possible; a methanol rinse may be used to remove any traces of solvent residue. Allow the blocks and rings to dry completely. Handle the block and ring with clean, lint-free cotton gloves from this point on.

9.2 Make surface texture and surface roughness measurements across the width of the block and the ring, as necessary. Note that a surface profile does not completely describe a surface topology. Scanning electron micrographs may be used, as desired, to augment the description of the wear surfaces. Clean the block and the ring if necessary as in 9.1.

9.3 Demagnetize the metal specimens and ferrous assembly. Weigh the block and ring to the nearest 0.1 mg.

9.4 Measure the block width and ring diameter to the nearest 0.025 mm (0.001 in.).

9.5 Clean the self-aligning block holder, ring shaft, and lubricant reservoir with solvent.

9.6 Put the self-aligning block holder on the block.

9.7 Place the block in position on the machine and, while holding the block in position, place the ring on the shaft and lock the ring in place, using a test method in accordance with the requirements of the specific machine design.

9.8 Center the block on the ring while placing a light manual pressure on the lever arm to bring the block and ring into contact. Be sure the edge of the block is parallel to the edge of the ring and that the mating surfaces are perfectly aligned. This is accomplished by making sure the specimen holder is free during mounting so that the self-aligning block holder can properly seat itself. Release the pressure on the lever arm.

[3] Several machines have been found satisfactory for the purposes of this test. These models may differ in lever arm ratio, load range, speed control (variable or fixed), speed range, and type of friction measuring device.