Designation: ~~G98 – 02 (Reapproved 2009)~~ G98 – 17

Standard Test Method for Galling Resistance of Materials[1]

This standard is issued under the fixed designation G98; 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 a laboratory test which ranks the galling resistance of material couples. Most galling studies have been conducted on bare metals and alloys; however, non-metallics, coatings, and surface modified alloys may also be evaluated by this test method.

1.2 This test method is not designed for evaluating the galling resistance of material couples sliding under lubricated conditions because galling usually will not occur under lubricated sliding conditions using this test method.

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~~ safety, health and ~~health~~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]

~~G40~~E177 ~~Terminology Relating to Wear and Erosion~~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

G83 Test Method for Wear Testing with a Crossed-Cylinder Apparatus (Withdrawn 2005)[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *galling*—a form of surface damage arising between sliding solids, distinguished by macroscopic, usually localized, roughening and creation of protrusions above the original surface; it often includes plastic flow or material transfer, or both.

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

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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 last approved version of this historical standard is referenced on www.astm.org.

3.1.1.1 *Discussion*—

The onset of galling usually requires that the contact pressure exceeds some threshold value. Galling can be a precursor to seizing or loss of function. The identification of galling is somewhat subjective, and complete agreement does not exist, even among experts.~~G40~~

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *threshold galling stress*—the stress midway between the highest non-galled stress and the lowest galled stress as determined by this test method.

4. Summary of Test Method

4.1 This test method uses available laboratory equipment capable of maintaining a constant, compressive load between two flat specimens, such as hydraulic or screw feed compression testing machines. One specimen is slowly rotated one revolution 360° relative to the other specimen. The surfaces are examined for galling after sliding. The criterion for whether galling occurs is the

appearance of the specimens based on unassisted visual examination. If the specimens have not galled, a new set of specimens is tested at increased load. This process is continued until galling occurs.

4.2 Appropriate load intervals are chosen to determine the threshold galling stress within an acceptable range.

4.3 The higher the threshold galling stressing, the more galling resistant is the test couple.

5. Significance and Use

5.1 This test method is designed to rank material couples in their resistance to the failure mode caused by galling and not merely to classify the surface appearance of sliding surfaces.

5.2 This test method should be considered when damaged (galled) surfaces render components non-serviceable. Experience has shown that galling is most prevalent in sliding systems that are slow moving and operate intermittently. The galling and seizure of threaded components is a classic example which this test method most closely simulates.

5.3 Other galling-prone examples include: sealing surfaces of value trim which may leak excessively due to galling; and pump wear rings that may function ineffectively due to galling.

5.4 If the equipment continues to operate satisfactorily and loses dimension gradually, then mechanical wear should be evaluated by a different test such as the crossed cylinder Test Method (see Test Method G83). Chain belt pins and bushings are examples of this type of problem.

5.5 This test method should not be used for quantitative or final design purposes since many environmental factors influence the galling performance of materials in service. Lubrication, alignment, stiffness and geometry are only some of the factors that can affect how materials perform. This test method has proven valuable in screening materials for prototypical testing that more closely simulates actual service conditions.

6. Apparatus

6.1 Commonly available laboratory equipment has been used to conduct galling tests. Both Brinell hardness testers and servo-hydraulic testing machines have proven to be satisfactory as loading devices. Any apparatus that can apply and maintain a constant compressive load should be acceptable.

7. Test Specimens

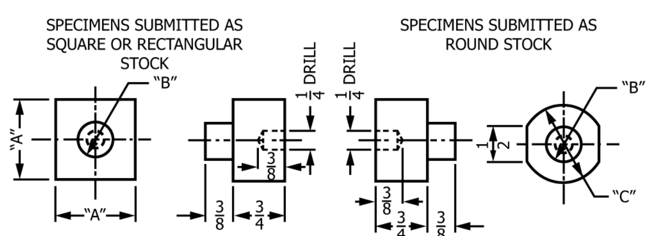
7.1 This test method uses a cylindrical flat-on-flat geometry. One specimen is called the button (or pin) and is generally (but not necessarily) rotated about its axis on the flat specimen called the block.

7.2 Some typical button geometries are shown in Fig. 1.

7.3 The only critical dimension is diameter "B'' of the contact area. The 6.4-mm (0.25-in.) diameter hole accommodates a ball bearing for alignment purposes during the test. All other dimensions may be varied to the user's convenience.

7.4 The block specimen must have sufficient area to accommodate at least one test; however, most users have found that blocks of length 76 mm (3 in.) to 152 mm (6 in.) are ideal for multiple tests. A reasonable width is 19 mm (0.75 in.). Thickness is not critical. Tests have been successfully run on blocks with thicknesses from 1.5 mm (0.06 in.) to 25.4 mm (1 in.).

7.5 Maintain block flatness at 0.33 mm/m (0.004 in./ft).



DIM. "A": FOR SQUARE OR RECT. BARS – $\frac{5}{8}$" TO $1\frac{1}{8}$" ON EITHER SIDE
DIM. "B": 0.500" ± 0.003
DIM. "C": FOR ROUND BARS - $\frac{5}{8}$" TO $1\frac{1}{8}$" DIA. ($\frac{1}{2}$" FLAT NOT NECESSARY ON $\frac{5}{8}$ TO $\frac{7}{8}$ DIA.)

Metric Equivalents

in.	mm	in.	mm
¼	6.4	⅝	16
⅜	10	¾	19
½	13	⅞	22
0.500 ± 0.003	12.7 ± 0.08	1⅛	29

FIG. 1 Typical Button Geometries