



Standard Test Method for Measuring Rolling Friction Characteristics of a Spherical Shape on a Flat Horizontal Plane¹

This standard is issued under the fixed designation G194; 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 the use of an angled launch ramp to initiate rolling of a sphere or nearly spherical shape on a flat horizontal surface to determine the rolling friction characteristics of a given spherical shape on a given surface.

1.1.1 Steel balls on a surface plate were used in interlaboratory tests (see [Appendix X1](#)). Golf balls on a green, soccer and lacrosse balls on playing surfaces, bowling balls on an lane, basketballs on hardwood, and marbles on composite surface were tested in the development of this test method, but the test applies to any sphere rolling on any flat horizontal surface.

1.1.2 The rolling friction of spheres on horizontal surfaces is affected by the spherical shape's stiffness, radius of curvature, surface texture, films on the surface, the nature of the counterface surface; there are many factors to consider. This test method takes all of these factors into consideration. The spherical shape of interest is rolled on the surface of interest using a standard ramp to initiate rolling and standard techniques to measure and treat the rolled distance after leaving the ramp.

1.1.3 This test method produces a rolling resistance number on a specific spherical shape on a specific surface. It is intended for comparing similar tribosystems. For example, the rolling resistances of marbles on a particular surface are not to be compared with the rolling resistance of soccer balls on grass, because their masses and diameters are very different as are the counterface surfaces on which they roll.

1.1.4 Different launch ramps for are appropriate for different types of spherical shapes. If a sphere of interest cannot be accommodated with using one of the launch ramps discussed in [Appendix X1](#) and [Appendix X2](#), a different launch ramp can be developed and added with future revisions to this test method.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[G40 Terminology Relating to Wear and Erosion](#)

[G115 Guide for Measuring and Reporting Friction Coefficients](#)

[G143 Test Method for Measurement of Web/Roller Friction Characteristics](#)

3. Terminology

3.1 *Definitions:*

3.1.1 *rolling friction force, n* —in tribology, a force, opposite to the direction of rolling, resisting rolling of a spherical shape, ball, roller, wheel, etc. forced against and rolling in a direction on another surface. **G40**

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *coefficient of rolling resistance (CORR)*—dimensionless measure of rolling retardation experienced by a spherical shape (sphere and the like) on a flat horizontal plane of interest; it is the ratio of the vertical distance between the sphere's point of contact with the launch ramp and the horizontal plane divided by the distance rolled on the horizontal plane after leaving the launch ramp.

3.2.2 *rolling resistance number (RR), n* —dimensionless measure of the retardation produced on a spherical shape rolling on a flat horizontal surface: the higher the number, the higher the retardation. This number is obtained by multiplying the CORR by 100.

4. Summary of Test Method

4.1 A vee-shaped launch ramp with known height, length and vee angle is placed on a flat and level (most flat and level

¹ This test method is under the jurisdiction of ASTM Committee [G02](#) on Wear and Erosion and is the direct responsibility of Subcommittee [G02.50](#) on Friction.

Current edition approved Nov. 15, 2013. Published November 2013. Originally approved in 2008. Last previous edition approved in 2008 as G194 – 08. DOI: 10.1520/G0194-13.

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.