



Designation: D7115 – 20 (Reapproved 2026)

Standard Test Method for Measurement of Superpave Gyratory Compactor (SGC) Internal Angle of Gyration Using Simulated Loading¹

This standard is issued under the fixed designation D7115; 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 procedure for the measurement of the Superpave Gyratory Compactor (SGC) internal angle of gyration using an instrument capable of simulating loading conditions similar to those created by an asphalt mixture specimen.

1.2 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard. The value given in rotations per minute is provided for information regarding commonly used units.

1.2.1 **IEEE/ASTM SI 10**, American National Standard for Metric Practice, offers guidance where use of decimal degrees for plane angles (versus radians) and revolutions per minute for rate of gyration (versus radians per second) is acceptable within the **IEEE/ASTM SI 10** system when used on a minimal basis.

1.3 The text of this test method references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard

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.*

¹ This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.20 on Mechanical Tests of Asphalt Mixtures.

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2. Referenced Documents

2.1 *ASTM Standards*:²

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

D8 Terminology Relating to Materials for Roads and Pavements

D2726/D2726M Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures

D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

D6752/D6752M Test Method for Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method

D6925 Test Method for Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyratory Compactor

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

IEEE/ASTM SI 10 American National Standard for Metric Practice

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology **D8**.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *bottom internal angle, n* —the angle formed between the internal mold diameter and the lower mold end plate as a mold is gyrated in an SGC.

3.2.2 *eccentricity, e, n* —the distance away from the axis of gyration at which a force (F) is acting at one end of an SGC mold.

3.2.2.1 *Discussion*—This use of the term eccentricity is

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.

consistent with previous published reports describing the mechanics of gyratory compaction.³

3.2.3 *effective internal angle, n* —the average of the top internal angle and the bottom internal angle.

3.2.4 *external angle, n* —the angle formed between the external mold diameter and a stationary reference axis of the machine frame as a mold is gyrated in the SGC.

3.2.5 *internal angle, n* —the angle formed between the internal mold diameter and a mold end plate as a mold is gyrated in an SGC.

3.2.6 *standard SGC volumetric specimen, n* —a standard sized asphalt mixture specimen prepared using an SGC for purposes of volumetric mix design.

3.2.6.1 *Discussion*—Such a standard specimen, prepared in accordance with Test Method **D6925**, has a diameter of 150 mm and a final compacted height of 115 ± 5 mm.

3.2.7 *tilting moment, n* —a force (F) acting at one end of an SGC mold platen in a direction parallel to the axis of gyration, but acting at some distance (e) away from that axis. The tilting moment at one end of the mold platen is computed as the product of this distance (e) and force (F).

3.2.8 *top internal angle, n* —the angle formed between the internal mold diameter and the upper mold end plate as a mold is gyrated in an SGC.

3.2.9 *total moment, M , n* —the sum total of the tilting moment acting at the top of the mold and the tilting moment acting at the bottom of the mold.

4. Summary of Test Method

4.1 The internal angle of gyration of an SGC is measured dynamically with an instrument inserted into the SGC mold.

4.2 A load (moment) is induced on the SGC while the internal angle is simultaneously measured. The simulated loading conditions are similar to those created by compaction of a standard SGC volumetric specimen.

4.3 The internal angles at each end of the mold are measured and then averaged to obtain the effective internal angle of gyration.

5. Significance and Use

5.1 SGCs are used to produce asphalt mixture specimens in the laboratory to assess volumetric properties and predict pavement performance. In the fabrication of an SGC specimen in accordance with Test Method **D6925**, loose asphalt mixture is placed inside a metal mold, which is then placed into an SGC. A constant consolidation pressure is applied to the sample while the mold gyrates at a nominally constant angle (referred to as the internal angle of gyration) and rate. Consistency in the density of the asphalt specimens produced as measured by Test Method **D2726/D2726M** or **D6752/D6752M** is very important to the validity of the tests performed. Specimens of a consistent density are produced when

an SGC maintains a constant pressure and a known constant internal angle of gyration during the compaction process.

5.2 There are several manufacturers and models of SGC. Each model employs a unique method of setting, inducing, and maintaining the internal angle of gyration. Each model also employs a unique calibration system to measure the external angle of gyration. These existing calibration systems cannot be used universally on all of the different SGC models commercially available. Inconsistencies in asphalt specimens produced on different SGC models have been at least partially attributed to variations in the angle of gyration.

5.3 This method describes instruments and processes that can be used to independently measure the internal angle of gyration of any manufacturer's SGC model under simulated loading conditions. The external shape of the instrument chassis ensures that the points of physical contact between the mold end plates and the instrument occur at a fixed and known distance away from the axis of gyration. As a result, the vertical load is applied at these fixed points, creating tilting moments at each end of the mold.

5.4 Unless otherwise specified, a tilting moment of 466.5 N-m shall be applied to the SGC by the instrument while making this measurement.

NOTE 1—The quality of the results produced by this test method are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of Specification **D3666** are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this test method are cautioned that compliance with Specification **D3666** alone does not completely ensure reliable results. Reliable results depend on many factors; following the suggestions of Specification **D3666** or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.

NOTE 2—A 466.5 N-m tilting moment corresponds to a 22 mm eccentric on the AFLS1 or a 21° cone angle on the DAVII-HMS with an applied load of 10603 N (600 kPa at a 150 mm diameter specimen setting).

6. Interferences

6.1 Debris on the SGC mold, base plates, ram head, reaction surfaces, or instrument can cause errant measurement results. Extreme care should be taken to thoroughly clean the SGC, mold, instrument, and any work areas that will be utilized during the measurement procedure.

6.2 Scarring or irregular surfaces on mold walls and end plates is also known to cause incorrect results. Do not use any equipment that shows signs of damage. The precision required in the execution of this test method necessitates that extreme care must be taken to avoid errors from damaged or improperly maintained equipment.

6.3 Worn parts on the instrument can lead to erroneous measurements.

7. Apparatus

7.1 An instrument capable of being gyrated inside an SGC mold which induces tilting moments at each end of the SGC mold while simultaneously measuring an internal angle of gyration.

³ Guler, M., Bahia, H. U., Bosscher, P. J., and Plesha, M. E., "Device for Measuring Shear Resistance of Hot Mix Asphalt in Gyratory Compactor," *Transportation Research Record*, Vol 1723, No. 1, 2000, pp. 116–124.