Designation: D5581 – 07a (Reapproved 2021)ε1

Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6 in. Diameter Specimen)[1]

This standard is issued under the fixed designation D5581; 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.

ε1 NOTE—Section 1 was updated editorially in December 2021.

1. Scope

1.1 This test method covers the measurement of the resistance to plastic flow of cylindrical specimens of bituminous paving mixture loaded on the lateral surface by means of the Marshall apparatus. This test method is for use with mixtures containing asphalt cement and aggregate up to 1½ in. (37.5 mm) nominal maximum size.

1.2 The values stated in inch-pound units are to be regarded as standard except for reference to sieve sizes and size of aggregate as measured by testing sieves in which SI units are standard according to Specification E11. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 The text of this standard 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

D2493/D2493M Practice for Viscosity-Temperature Chart for Asphalt Binders

D6926 Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus

D6927 Test Method for Marshall Stability and Flow of Asphalt Mixtures

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

2.2 *AASTHO Standards:*[3]

T 316 Viscosity Determination of Asphalt Binder Using Rotational Viscometer

3. Significance and Use

3.1 This test method is used in the laboratory mix design of bituminous mixtures. Specimens are prepared in accordance with the method and tested for maximum load and flow. Density and voids properties may also be determined on specimens prepared in accordance with the method. The testing section of this method can also be used to obtain maximum load and flow for bituminous paving specimens cored from pavements or prepared by other methods. These results may differ from values obtained on specimens prepared by this test method.

4. Apparatus

4.1 *Specimen Mold Assembly*—Mold cylinders nominal 6.5 in. (165.1 mm) outside diameter steel tubing with

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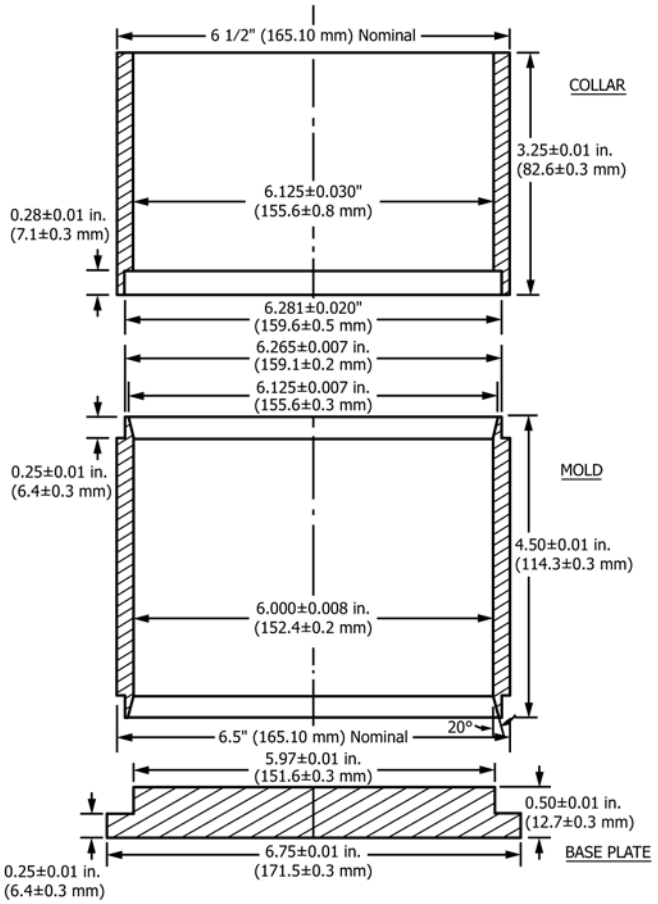
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.



Note: collar should fit the mold.

FIG. 1 Compaction Mold

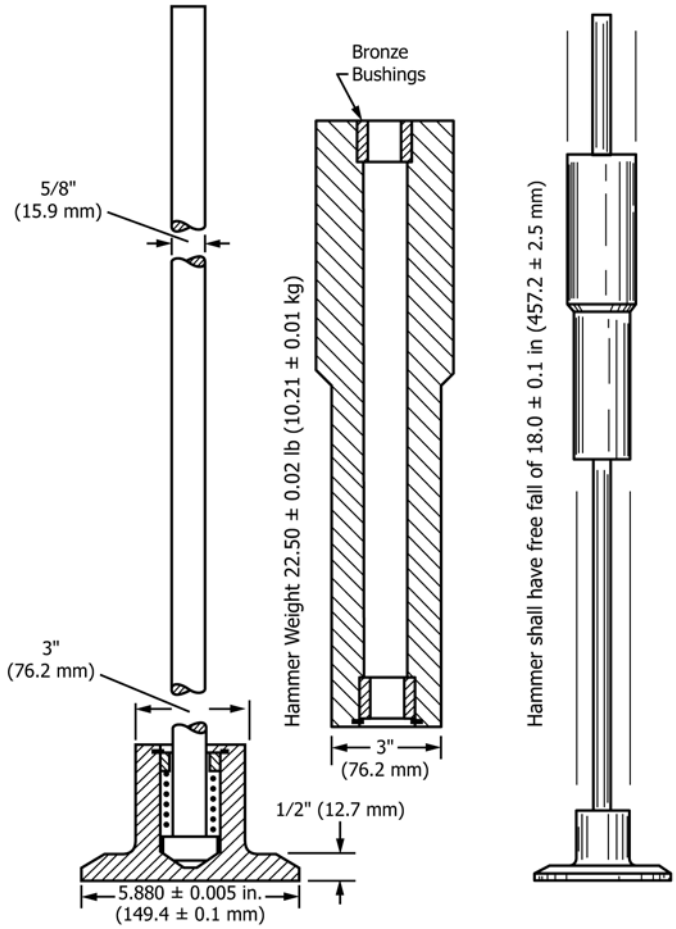


FIG. 2 Compaction Hammer (Generic)

6.000 ± 0.008 in. (152.4 ± 0.2 mm) inside diameter by 4.5 in. (114.3 mm) in height, base plates, and extension collars shall conform to the details shown in Fig. 1. Nine mold cylinders are recommended.

4.2 *Specimen Extractor,* steel, in the form of a disk with a diameter from 5.950 to 5.990 in. (151.1 to 152.1 mm) and 0.5 in. (13 mm) thick for extracting the compacted specimen from the specimen mold with the use of the mold collar. A suitable bar is required to transfer the load from the ring dynamometer adapter to the extension collar while extracting the specimen.

4.3 *Mechanical Compactor and Compaction Hammer*—Compactor with ⅓ hp (250 W) minimum motor, chain lift, frame, and automatic sliding weight release. The compaction hammer (Fig. 2) shall have a flat, circular tamping face 5.88 in. (149.4 mm) in diameter and a 22.50 ± 0.02 lb (10.21 ± 0.01 kg) sliding weight with a free fall of 18.0 ± 0.1 in. (457.2 ± 2.5 mm). Two compaction hammers are recommended.

4.4 *Compaction Pedestal*—The compaction pedestal shall consist of an 8 by 8 by 18 in. (203.2 by 203.2 by 457.2 mm) wooden post capped with a 12 by 12 by 1 in. (304.8 by 304.8 by 25.4 mm) steel plate. The wooden post shall be oak, pine, or other wood having an average dry weight of 42 to 48 lb/ft^3 (0.67 to 0.77 g/cm^3). The wooden post shall be secured by four angle brackets to a solid concrete slab. The steel cap shall be firmly fastened to the post. The pedestal assembly shall be installed so that the post is plumb and the cap is level.

4.5 *Specimen Mold Holder,* mounted on the compaction pedestal so as to center the compaction mold over the center of the post as shown in Fig. 3 or equivalent arrangement. It shall hold the compaction mold, collar, and base plate securely in position during compaction of the specimen.

4.6 *Breaking Head*—The breaking head (Fig. 4) shall consist of upper and lower cylindrical segments or test heads having an inside radius of curvature of 3 in. (76.2 mm) accurately machined. The lower segment shall be mounted on a base having two perpendicular guide rods or posts extending upward. Guide sleeves in the upper segments shall be in such a position as to direct the two segments together without appreciable binding or loose motion on the guide rods. When a 6.000 in. (152.4 mm) diameter by 4 in. (100 mm) thick metal block is placed between the two segments, the inside diameters and the gaps between the segments shall conform to Fig. 4. All steel components shall be plated.

4.7 *Loading Jack*—The loading jack (Fig. 5) shall consist of a screw jack mounted in a test frame and shall produce a