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Standard Test Method for Flexibility of Running Shoes[1]

This standard is issued under the fixed designation F 911; 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 measurement of flexibility in running shoes.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

F 489 Test Method for Using a James Machine[2]

F 539 Practice for Fitting Athletic Footwear[2]

F 609 Test Method for Using a Horizontal Pull Slipmeter (HPS)[2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *ball base-plate*—an approximately 5 by 15 cm (2 by 6 in.) metal plate with its largest dimension parallel to the flex fulcrum and centered opposite the ball hold-down clamp. A force of 334 N (75 lbf) applied to the shoe in the direction of the ball hold-down clamp provides a firm but relatively nondamaging clamping pressure to the shoe.

3.1.2 *ball hold-down clamp*—a trapezoidal shaped metal piece which is intended to approximate the ball of the foot. (See Figs. 1 and 2 for exact dimensions.) Its base in contact with the shoe is 3.8 cm (1.5 in.) long and is congruous with the axis of the flex fulcrum as shown in the attached drawings. Its periphery in contact with the shoe has a radius of 1 cm (0.4 in.).

3.1.3 *flex fulcrum*—the line on the insole, perpendicular to the shoe centerline and at a distance of 70% of the shoe length from the rearmost part of the heel counter about which the flexing torque is applied.

3.1.4 *heel hold-down bridge*—a metal yoke firmly attached the heel plate which can support the heel hold-down clamp. It must have a minimum clearance of 10 cm (4 in.) above the heel reference line and 13 cm (5 in.) of lateral clearance to avoid touching the shoe upper material.

3.1.5 *heel hold-down clamp*—a 3 cm (1.18 in.) diameter, 1 cm (0.39 in.) minimum thickness, metal piece upon which a force of 22.2 N (5 lbf) is directly downward to the insole of the heel in order to keep the shoe in contact with the heel plate covers. Its periphery in contact with the insole is radiused to 1 cm (0.39 in.) to reduce dragging forces. The axis of symmetry is perpendicular to and directed thru the intersection of the fixture and heel plate centerlines. This clamp will be adjustable in height above the heel reference line from about 1 to 5 cm (⅜ to 2 in.).

3.1.6 *heel hold-down reference*—the point on the axis of symmetry of the heel hold-down clamp at the interface with the heel insole material.

3.1.7 *heel plate*—an approximately 7.5 by 15 cm (3 by 6 in.) metal plate at least 6 mm (¼ in.) thick whose centerline (as shown in Figs. 1 and 2) is the pivot point upon which the flexing force is applied. The pivot point is 10.16 cm (4 in.) (from the flex fulcrum center to center).

3.1.8 *heel plate cover*—an approximately 7.5 by 13 cm (3 by 5 in.) fluorocarbon sheet 3 mm (⅛ in.) thick affixed to the top of the heel plate to minimize friction. The fore and aft 1.27 cm (½ in.) of the sheet is beveled down to the heel plate to prevent the catching of any sole cleats.

3.1.9 *heel reference line*—the centerline of the heel plate directly above its pivot points at the interface of the heel plate cover and the shoe sole. When this line is plantar level with the force actuated ball base plate, the minimum flex angle is established by the hold-down clamp reference.

3.1.10 *maximum flex angle*—a 45° angle defined by the intersection of the plane of the bottom of the ball hold-down clamp and the plane formed by the flex fulcrum line/heel hold-down reference. This is the condition of the maximum flexion during the cyclic testing and also where the flex torque is measured.

3.1.11 *minimum flex angle*—the angle defined by the intersection of the plane of the bottom of the ball hold-down clamp and the plane formed by the flex fulcrum line/heel hold-down reference when the shoe is properly installed and both forces applied.

3.1.12 *peak flex torque*—the torque about the flex fulcrum at the maximum flex angle.

3.1.13 *shoe centerline*—line through points used to measure shoe length.

3.1.14 *shoe length*—distance from foremost portion of toe (excluding cleats) to rearmost portion of heel counter.

[1] This test method is under the jurisdiction of ASTM Committee F-8 on Sports Equipment, Surfaces, and Facilities and is the direct responsibility of Subcommittee F08.54 on Footwear.

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[2] *Annual Book of ASTM Standards*, Vol 15.07.

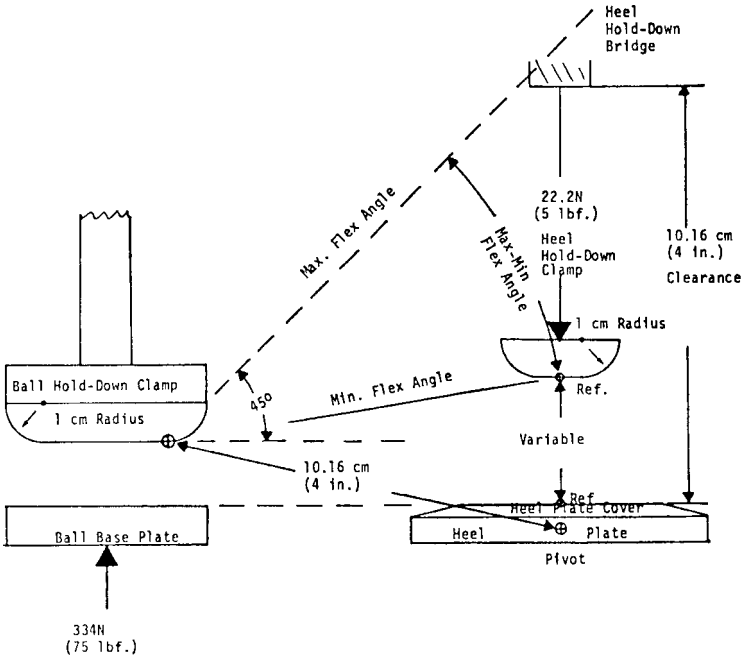

FIG. 1 Side View Running Shoe Flex Fixture

4. Significance and Use

4.1 Flexibility is generally regarded as being a desirable quality to measure in running shoes. This test method provides a guide for measuring the flexibility of running shoes. The degree of correlation between this test and shoeperformance in the field has not been fully determined.

5. Apparatus

5.1 *Shoe Flex Fixture*, as illustrated in Figs. 1 and 2.

6. Test Specimens

6.1 The test specimens shall consist of the number of pairs of running shoes sufficient to achieve the desired statistical confidence.

7. Conditioning

7.1 Condition the apparatus and the test specimens in the standard atmosphere for testing, which is 73 ± 3.6°F (23 ± 2°C) and 50 ± 5% relative humidity, for 24 h prior to test.

8. Procedure

8.1 Use test conditions described in 7.1.

8.2 Place the centerline of the shoe coincident with the centerline of the fixture as shown in Fig. 2.

8.3 Apply a 334-N (75-lbf) compressive force to the ball base plate.

8.4 Apply a force of 22 N (5 lbf) to the heel hold-down clamp.

8.5 Move the heel plate until the heel reference line is plantar level with the ball base plate to establish the minimum flex angle.

8.6 Flex the shoe sinusoidally between the minimum and maximum flex angles for 2400 cycles at the rate of 1 Hz.

8.7 Measure the torque while maintaining peak flex at 1, 3, and 5 min after the completion of the test. This measurement should take into account the mass of the test fixture.

9. Report

9.1 Report the following information:

9.1.1 Description and size of shoe tested, and

9.1.2 Values of peak flex torque at 1, 3, and 5 min in accordance with 8.7. (Round robin testing will determine the acceptability of this procedure and the method of statistical presentation.)

10. Precision and Bias

10.1 The precision and bias of this test method have not been established.