Designation: ~~F2232 – 09~~ F2232 – 14

Standard Test Method for Determining the Longitudinal Load Required to Detach High Heels from Footwear[1]

This standard is issued under the fixed designation F2232; 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 determination of the force required to detach the heel from footwear through the application of longitudinal tensile force at a constant displacement rate. The longitudinal test force simulates the most common heel failure mode. Heel height of 20 mm (13⁄16 in.) or larger is needed to perform this test method properly. Most women's medium and high heeled footwear meets this requirement.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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]

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E105 Practice for Probability Sampling of Materials

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

E456 Terminology Relating to Quality and Statistics

2.2 *European Standard:*

~~EN~~BSEN 12785 Footwear, Test Method for Whole Shoes—Heel Attachment[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *forefoot*—the portion of the shoe extending forward from the break of the joint to the toe, also called forepart.

3.1.2 *heel attachment strength*—the force in pounds measured under the testing conditions of Test Method F2232 required to detach the heel from the sole/insole assembly.

3.1.3 *heel breast*—the front face of the shoe heel.

3.1.4 *heel height*—the vertical distance from the top back edge of the heel to the plane of the tread (wear) surface of the heel.

3.1.5 *insole*—the part of the shoe that is a structural anchor to which the upper and heel are fastened during manufacture. It may or may not be covered on the foot side by material referred to as a socklining.

3.1.6 *outsole*—the bottom (sole) of the shoe: including the surface which is exposed to wear.

3.1.7 *seatboard*—a reinforcement (if used) of the insole where the heel is attached.

3.1.8 *shank*—a reinforcement in the arch (instep) of the shoe between the insole and outsole made from steel, wood, fiberboard or plastic (individually or in combination).

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[1] This test method is under the jurisdiction of ASTM Committee F13 on Pedestrian/Walkway Safety and Footwear and is the direct responsibility of Subcommittee F13.30 on Footwear.

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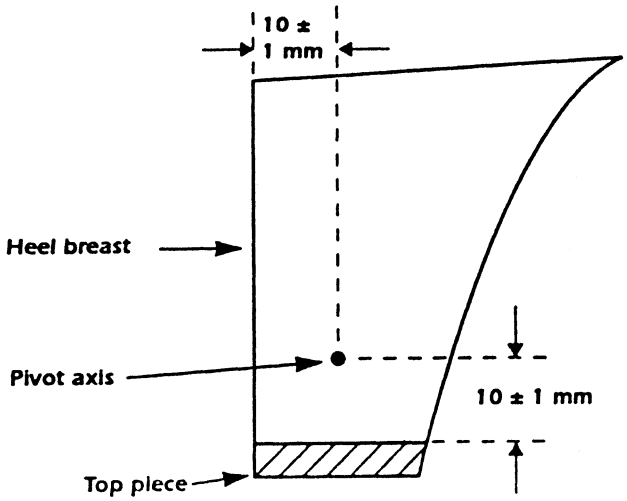
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Orders for all BSI, International and foreign standards publications should be addressed to Customer Service.



NOTE 1—Heel height is from the top of the heel breast to the bottom of the top piece.

FIG. 1 Location of Pivot Axis on Heel

3.1.9 *shankboard*—the back part of the insole which is fabricated from a firm fiberboard. It is contoured to the arch of the foot for support.

3.1.10 *top piece (toplift)*—the bottom layer of a heel (wear surface) usually made of leather, rubber, plastic, steel, or elastomers.

3.2 For definitions of other terms relating to footwear, refer to the Footwear Products Glossary.[4]

4. Significance and Use

4.1 Since the heel is an integral support element of the shoe, the heel-attaching strength is a significant factor in ensuring the wearer's safety, as well as the longevity and serviceability of the shoe.

4.2 This test should be performed on each new style shoe and when any changes are made in the design, material or method of shank or heel area of the shoe, or both, or in the attachment of the heel in an existing shoe.

5. Apparatus

5.1 *Tensile Testing ~~Machine,~~ Machine*—~~with~~ A CRE-type (constant rate of expansion type) or CRT-type (constant rate of traverse type) with extension or traverse rate of 100 mm/min (4 in./min) ~~and autographic recorder.~~with autographic recorder or automatic microprocessor data gathering system.

5.1.1 *Upper and Lower Attaching Mechanism,* to clamp the heel jig attachment or wire and toe and shank end of the shoe. See Fig. 2 and Fig. 4.

5.2 *Drill Press.*

5.3 *Drill Bit,* 5 mm (3⁄16 in.).

5.4 *Vise,* used to hold the shoe heel for drilling.

5.5 *Wire,* 2.5 mm (3⁄32 in.) diameter piano or other high strength wire.

5.5.1 In place of the wire described in 5.5, a jig using a yoke and a 5 mm (3⁄16 in.) diameter rod may be used. See Fig. 3.

6. Sampling

6.1 Perform random testing of shoes from production or from stock in accordance with Practices E29, E105, and E122, and Terminology E456.

6.2 Determine test sample size by lot size. A testing plan used by U.S. Military Procurement for footwear is:

Lot Size	Number of Test Shoes
800 or less	2
801 to 22 000	3
22 001 and over	5

[4] Available from American Apparel & Footwear Assoc. (AAFA), 1601 N. Kent St., Suite 1200, Arlington, VA 22209.

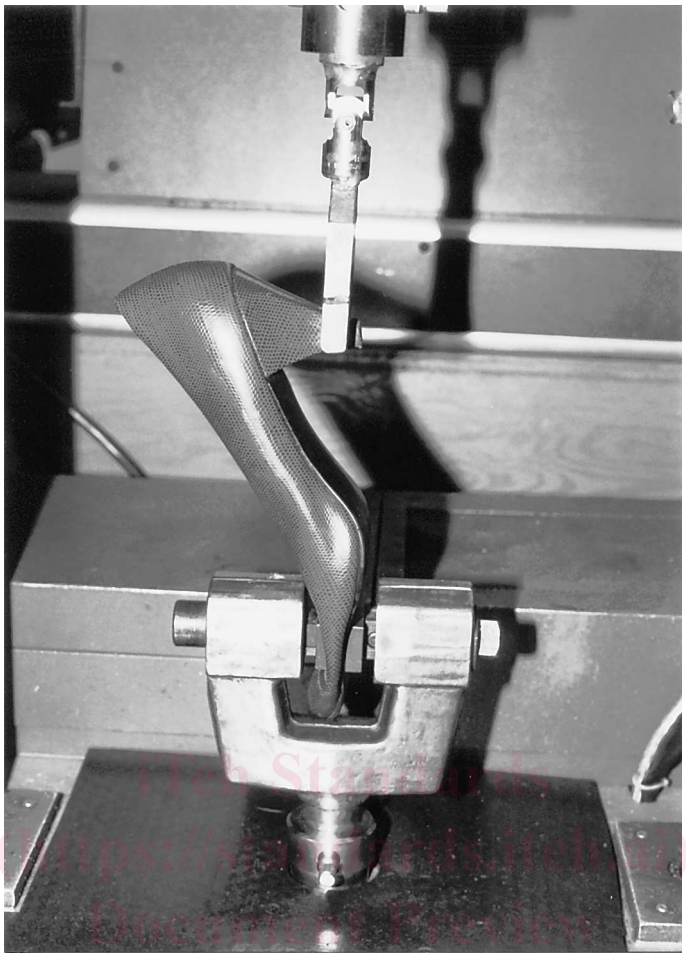


FIG. 2 Heel Jig Attachment

7. Conditioning

7.1 Maintain the temperature and humidity of the testing room at 22 ± 1°C (72 ± 2°F) and 50 % ± 2RH.

7.2 For most purposes it is not necessary to condition the footwear in a controlled atmosphere before testing.

8. Procedure

8.1 Calibrate the machine with the autograph chart ~~recorder.~~recorder or automatic microprocessor data gathering system.

8.2 Prepare the shoe for testing by drilling a hole through the heel 10 mm (⅜ in.) up from the surface of heel excluding the top lift and the same distance in from the breast side, marking a center drilling line on both sides of the heel. See Fig. 1.

8.3 Secure the heel in the vise and drill a 5 mm (3⁄16 in.) hole through the center line.

8.4 Insert the wire (5.5) or rod (5.5.1) through the hole ~~making sure of~~ensuring there is free rotation. See Fig. 2 and Fig. 3.

8.5 Attach the wire or rod to the testing machine upper attaching mechanism, attach the forepart, including the toe and end of shank of the test shoe, to the bottom attaching mechanism. See Fig. 2 or Fig. 4. Ensure the heel detachment process can be fully observed. Fix test specimen in the machine so that the base of the sole and the heel is completely visible to the test observer. Align the plane of the ground contact (outsole and heel lift) of the shoe and the longitudinal axis of the shoe backpart with the axis of the tensile testing machine (as shown in Fig. 4). Ensure that the shoe in this position is subjected to zero force.

8.6 Apply a load at the specified rate until the heel is completely detached. See Fig. 5.

NOTE 1—When a slender heel cannot be drilled, a holding jig similar to Fig. 2 in BSEN 12785 will be needed.

9. Calculations

9.1 Record the maximum ~~heel detachment force to the nearest 0.23 kg (0.5 lb).~~force measured during the heel detachment process.