



Designation: E3107/E3107M – 23

Standard Test Method for Resistance to Penetration and Backface Deformation for Ballistic-resistant Torso Body Armor and Shoot Packs¹

This standard is issued under the fixed designation E3107/E3107M; 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 addresses resistance to ballistic penetration and to backface deformation (BFD) for ballistic-resistant torso body armor and shoot packs.

1.2 This test method is intended for testing of soft body armor, hard armor plates, in conjunction with armor, and shoot packs mounted on a clay block as the backing assembly.

NOTE 1—This test method does not apply to ballistic helmets, inserts, trauma packs, trauma plates, or accessories.

1.3 The test method does not specify performance criteria or usage of the test results.

1.4 This test method does not address conditioning of test items.

1.5 It is anticipated that this test method will be referenced by certifiers, purchasers, or other users in order to meet their specific needs.

1.5.1 Purchasers and other users will specify the ballistic test threats to be used. Within this test method, the reference defining the ballistic test threats is called the “test threats document.”

1.5.2 In this test method, “other standards and specifications” and “unless specified elsewhere” refer to documents (for example, military standards, purchase specifications) that require the use of this test method. Purchasers and other users are responsible for the “other standards and specifications” and for specifying any requirements that supersede those of this test method.

1.6 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

¹ This test method is under the jurisdiction of ASTM Committee E54 on Homeland Security Applications and is the direct responsibility of Subcommittee E54.04 on Public Safety Equipment.

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1.6.1 The user of this standard will identify the system of units to be used, and it is critical to ensure that any cross-referenced standards maintain consistency of units between standards.

1.7 *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.*

1.8 *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

E3004 Specification for Preparation and Verification of Clay Blocks Used in Ballistic-Resistance Testing of Torso Body Armor

E3005 Terminology for Body Armor

E3062/E3062M Specification for Indoor Ballistic Test Ranges for Small Arms and Fragmentation Testing of Ballistic-resistant Items

E3068 Test Method for Contact Measurement of Backface Deformation in Clay Backing During Body Armor Testing

2.2 *ISO Standard*:³

ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories

2.3 *NIJ Standard*:⁴

NIJ Standard-0101.06 Ballistic Resistance of Body Armor

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 International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

⁴ Available from National Institute of Justice (NIJ), 810 7th St., NW, Washington, DC 20531, <http://nij.gov>.



3. Terminology

3.1 For terms not defined in this test method, the following definitions of Terminology **E3005** apply: *accessories, angle of incidence, applique, backface deformation, backing assembly, backing material, backing fixture, body armor, complete penetration, fair hit, hard armor, in conjunction with armor, obliquity, partial penetration, plate, shoot pack, shot-to-edge distance, shot-to-shot distance, soft body armor, stop, strike face, striking device, test item, test series, unfair hit, warmer round, witness panel, and yaw*.

4. Summary of Test Method

4.1 This test method specifies the methods for assessing penetration resistance and backface deformation for ballistic-resistant torso soft body armor, hard armor plates, in conjunction with armor, and shoot packs.

4.2 Individual test items are subjected to ballistic tests with specified test threats. The type and velocity of the test threats are specified in a test threats document, and the number of shots and shot pattern are specified in other standards or specifications, or both.

5. Significance and Use

5.1 U.S. Department of Defense and U.S. Department of Justice standards and specifications require assessing the penetration resistance and backface deformation of ballistic-resistant body armor.

5.2 This test method may be used by private-sector and government laboratories, manufacturers, research and development organizations, and others assessing the ballistic resistance of body armor or performing research and development of new materials.

5.3 It is intended that this test method be referenced by other standards, specifications, or test methods.

6. Test Equipment and Apparatus

6.1 Test threats shall be specified in a separate test threats document.

6.2 The ballistic test range shall meet the requirements of Specification **E3062/E3062M**.

6.3 The method of measuring yaw may be with a yaw card, flash radiography, high speed video, or photography and shall be capable of determining, at the point of measurement, whether the angle of yaw was greater or less than 5°.

6.4 Clay blocks shall be used as backing assemblies behind test items and shall meet the requirements of Specification **E3004**.

6.5 Measurement of BFD may be performed using contact or non-contact measurement instruments, and other standards and specifications will specify which method to use.

6.5.1 When the contact method for BFD measurement is used, the equipment shall be as specified in Test Method **E3068**.

7. Hazards

7.1 The ballistic tests described in this test method have inherent hazards. Adequate safeguards for personnel and property shall be employed when conducting these tests.

8. Sampling and Test Items

8.1 The test items shall be individual soft armor panels, hard armor plates, in conjunction with systems, or shoot packs.

8.2 Test item details, including quantity, size, and conditioning, shall be specified in other standards and specifications.

NOTE 2—It is recommended that spare test items be provided.

8.3 When the use of a spare test item is required, details about selecting the appropriate spare item shall be specified in other standards and specifications.

9. Test Requirements

9.1 The intended angle of incidence, obliquity, or other shot direction details, if any, for all shots shall be specified in other standards and specifications.

NOTE 3—Typical angles of incidence are 0°, 30°, and 45°, with most testing at an angle of incidence of 0°.

9.2 When warmer rounds are necessary, a number of test threats shall be fired through the projectile firing system.

NOTE 4—Examples of when warmer rounds may be necessary include, but are not limited to, at the start of a new day of testing and upon reconfiguration of the test range.

9.3 Unless specified elsewhere, each ballistic impact shall meet the requirements listed below to be considered a fair hit. See **Annex A1** for flowchart showing the decision logic for determination of fair hit.

9.3.1 The test threat shall impact the test item at an angle of incidence or obliquity within 5° from the intended angle.

9.3.2 The test threat shall have yaw verified using a yaw card, flash radiography, high speed video, or photography. Yaw shall be checked for every test threat shot and shall be ≤3° for rifle threats or ≤5° for fragment and handgun threats.

9.3.2.1 The yaw measurement equipment shall be positioned perpendicular to the projectile line of flight. The yaw measurement equipment shall be securely mounted and anchored to maintain its required position and alignment.

9.3.2.2 When photographic means are used to assess the projectile yaw angle, the assessment shall be made as close as practical to the strike face of the test item but not more than 305 mm [12 in.] from the front of the strike face.

9.3.2.3 When yaw cards are used to assess the projectile yaw angle, unless specified elsewhere, the cards shall be positioned between 91 cm and 152 cm [3 ft to 5 ft] from the front of the strike face of the test item.

9.3.3 The test threat shall impact the test item no closer to the edge of the test item than the minimum shot-to-edge distance. The measurement for shot-to-edge distance shall be taken from the center of the projectile impact to the nearest edge of the ballistic material in the test item. When not specified elsewhere, the minimum shot-to-edge distance shall be 51 mm [2 in.].