



Designation: E3368/E3368M – 23

Standard Specification for Ballistic-Resistant Helmets Worn by U.S. Public Safety Officers¹

This standard is issued under the fixed designation E3368/E3368M; 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 specification specifies minimum performance requirements and test methods for the ballistic resistance of helmets used by U.S. public safety officers and intended to protect the head against handgun and rifle ammunition.

1.1.1 The test methods within this specification were developed and validated for broadly available helmet designs. Some helmet designs may require additional or different testing than that specified in this specification.

1.2 This specification addresses ballistic performance in terms of:

1.2.1 Helmet resistance to penetration (RTP) of shell, fasteners, and weak points;

1.2.2 Helmet shell ballistic limit (V50); and

1.2.3 Face shield RTP and deformation.

1.3 Helmets covered by this specification are classified into RTP ballistic protection levels (see Section 8).

1.4 This specification addresses non-ballistic performance in terms of:

1.4.1 Helmet impact attenuation;

1.4.2 Helmet shell compression resistance;

1.4.3 Face shield resistance to blunt impact, deflection, and projectile impact;

1.4.4 Face shield optics; and

1.4.5 Retention system strength.

1.5 Backface deformation (BFD) measurement is not addressed as a requirement for compliance with this specification. If the user of this specification is interested in BFD measurement, see [Appendix X1](#).

1.6 This specification is applicable for compliance testing, verification testing, certification testing, or research and development testing.

1.7 This specification is divided into the following sections:

¹ This specification 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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1.8 *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.

1.9 *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.*

1.10 *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

E3005 Terminology for Body Armor

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

E3111/E3111M Test Methods for Ballistic Resistant Head Protection

E3236/E3236M Specification for Ballistic-resistant Barriers Used in Homeland Security or Public Safety Applications

E3299/E3299M Test Methods for Compression Resistance of Helmets

E3342/E3342M Specification for Nonballistic-resistant Helmets Specifically Designed to be Worn by Law Enforcement and Corrections Officers When Maintaining Order in Violent Situations

E3343/E3343M Test Methods for Nonballistic-resistant Helmets Worn by Law Enforcement and Corrections

2.2 Other Standards:

ANSI/SAAMI Glossary of Terms³

ANSI/ISEA Z87.1 American National Standard for Occupational and Educational Personal Eye and Face Protection Devices³

ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories⁴

MIL-DTL-46593B (with Amendment 1) Detail Specification: Projectile, Calibers .22, .30, .50, and 20 mm Fragment Simulating⁵

3. Terminology

3.1 Definitions:

3.1.1 The following terms and definitions from Terminology E3005 are applicable.

3.1.2 *ammunition, n*—one or more loaded cartridges consisting of case, primer, propellant, and one or more projectiles.

3.1.3 *backface deformation, BFD, n*—the indentation in the backing material caused by a projectile impact on the test item during testing; synonymous with *backface signature*.

3.1.4 *ballistic resistance, n*—a characteristic of protective equipment or materials describing their ability to provide protection from projectiles.

3.1.5 *cartridge, n*—a single assembled unit consisting of a bullet, propellant, primer, and the case; synonymous with *round*.

3.1.6 *conditioning, n*—a process that exposes an item, prior to testing, to a specified controlled environment or physical stresses, or both.

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 National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

⁵ Available online at ASSIST Quick Search, <http://quicksearch.dla.mil>.

3.1.7 *fair hit, n*—a test threat impact (on a test item) that meets all specified requirements in a particular test method.

3.1.8 *model, n*—the manufacturer's design, with unique specifications and characteristics, of a particular item.

3.1.9 *shot-to-edge distance, n*—the distance from the center of the projectile impact to the nearest test item edge.

3.1.10 *shot-to-shot distance, n*—the distance from the center of the projectile impact to the center of any other projectile impact on the test item.

3.1.11 *supplier, n*—the party that is responsible for ensuring that products meet and, if applicable, continue to meet, the requirements of an ASTM specification, a purchase specification, a contract, or an independent, third-party conformity assessment body (e.g., certifier, testing laboratory).

3.1.12 *test item, n*—a single article intended for testing.

4. Significance and Use

4.1 The purpose of this specification is to provide performance requirements and test methods for the evaluation of ballistic helmets worn by public safety officers.

4.2 This specification may be used by suppliers, certification bodies, testing laboratories, research and development organizations, and others assessing the performance of ballistic helmets.

4.3 The specification may be used by purchasers in their evaluation of products to meet their needs and requirements.

5. Test Threats, Equipment, and Materials

5.1 The test range shall meet the requirements of Specification E3062/E3062M (including the temperature and humidity requirements).

5.1.1 No firearms shall be used for testing.

NOTE 1—Specification E3062/E3062M allows the use of a universal receiver or firearm for testing. This specification does not allow use of firearms for testing.

5.2 The following equipment shall meet the requirements of Test Methods E3111/E3111M, Section 6, Test Equipment and Apparatus: yaw-measuring equipment, headforms, test item fixtures, witness panels, conditioning chambers, dunk tanks, weatherometers, and laser scanning equipment.

5.3 Equipment for non-ballistic testing shall meet the requirements of the relevant sections of Test Methods E3343/E3343M and E3299/E3299M.

5.4 Equipment for test item conditioning shall be as described in Test Methods E3111/E3111M, Section 10, Conditioning of Test Items

6. Test Item Requirements

6.1 Test items shall be actual products that are sized as specified in Sections 9 – 14 of this specification.

6.2 All test items shall be identical in materials of construction and material configuration.

NOTE 2—According to Test Methods E3111/E3111M the supplier shall supply a build sheet and dimensioned diagram.

6.3 Test items of the same size shall be identical in construction.

7. Procedure for Visual Examination

7.1 Verify the group of test items for correct quantity and sizes.

7.2 Examine the group of test items for variations in appearance, materials, and manner of construction.

7.3 Prior to conditioning, photograph at least one test item of each size to document the features.

7.4 Following conditioning, examine the test items for visible damage due to conditioning and photograph any test items showing such damage.

8. Helmet Resistance to Penetration (RTP) Ballistic Protection Levels and Test Threats

8.1 Helmets submitted for testing to this specification shall be evaluated for RTP.

8.1.1 The supplier shall declare the intended RTP ballistic protection level for the helmet model being submitted for testing to this specification.

8.2 This specification identifies five ASTM helmet RTP ballistic protection levels, two for handgun (HG) protection and three for rifle (RF) protection:

- 8.2.1 ASTM-Helmet-HG1,
- 8.2.2 ASTM-Helmet-HG2,
- 8.2.3 ASTM-Helmet-RF1,
- 8.2.4 ASTM-Helmet-RF2, and
- 8.2.5 ASTM-Helmet-RF3.

8.3 The RTP ballistic protection levels and associated test threats are as shown in **Table A1.1** of **Annex A1**.

9. Ballistic Performance Requirements for Helmet Shell RTP and BFD

9.1 The test item shall be tested as specified in Test Methods **E3111/E3111M**, Section 11, Helmet Resistance to Penetration (V0) and Back Face Deformation (BFD) Testing, with the following modifications:

9.1.1 The test items shall be submitted in a size that fits the required headform.

9.1.2 The tolerance for headform dimensions in Test Method **E3111/E3111M**, Figs. A1.1 – A1.6, shall be ± 1 mm.

9.1.3 The test items shall be subjected to the sequence of conditioning procedures from Test Methods **E3111/E3111M**, Section 10, prior to ballistic testing as shown in **Fig. 1**.

9.1.4 Following extreme low or high-temperature conditioning, ballistic testing shall be completed on the test item within 30 min of removal from conditioning.

9.1.4.1 In accordance with Test Methods **E3111/E3111M**, Section 10.2.5, if ballistic testing cannot be completed within 30 min and the test item has been out of conditioning for 1 h or less, recondition the test item for a minimum of 1 h before continuing ballistic testing. If the test item has been out of the conditioning chamber for more than 1 h, recondition the test item for at least 24 h before continuing ballistic testing.

9.2 RTP Performance Requirements:

9.2.1 Each test item shall withstand the required fair hits and shall experience no complete penetrations.

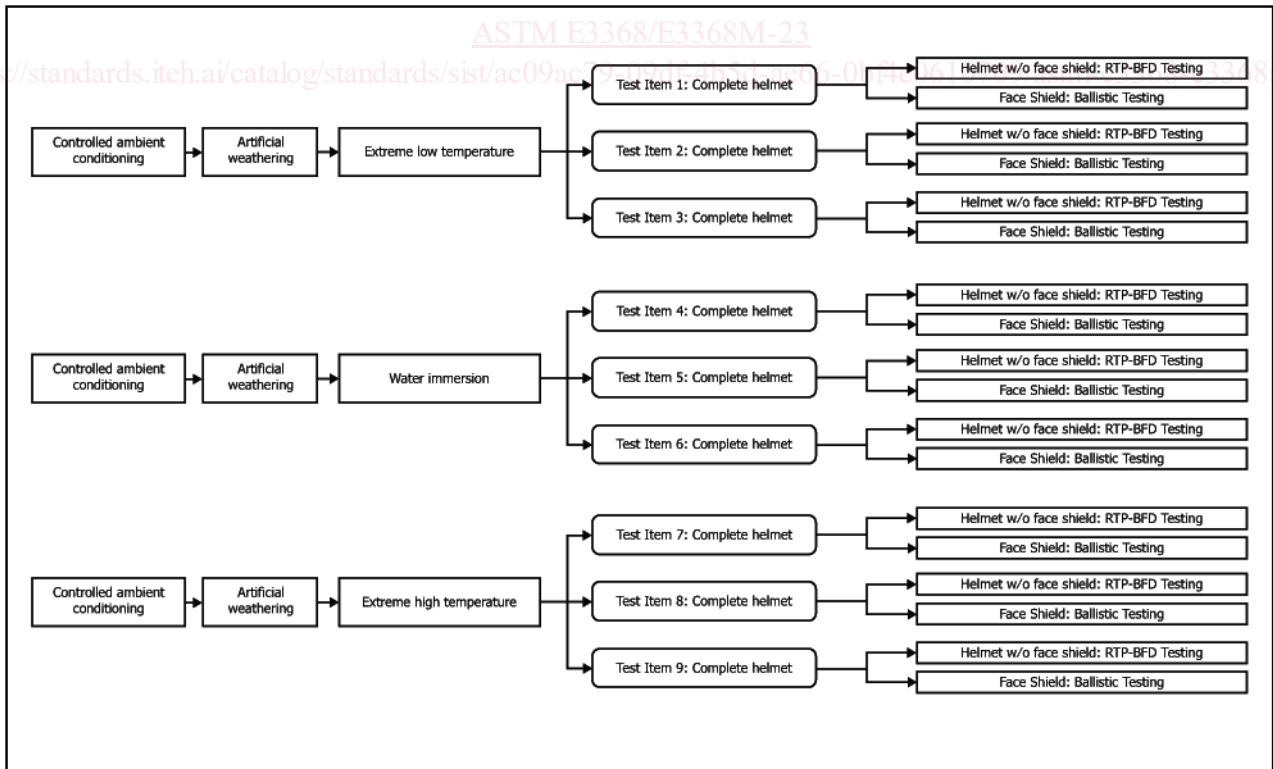


FIG. 1 Conditioning and Testing Sequence for Helmet Shell and Face Shield RTP

9.2.1.1 For helmet shell tests, a complete penetration occurs when the projectile or a fragment of the projectile passes through the shell, as evidenced by the presence of that projectile or projectile fragment on, or in, the clay.

9.2.1.2 Nonmetallic material, such as paint, fibrous materials, edging, or edging adhesive that is emitted from the helmet and rests on the outer surface of the clay impression is not considered a complete penetration.

9.2.2 Any complete penetration by a fair hit shall be considered a failure.

10. Ballistic Performance Requirements for Face Shields

10.1 For helmets that have ballistic-resistant face shields, the test item shall be tested as specified in Test Methods E3111/E3111M, Section 13, Face Shield Ballistic Testing, with the following modifications:

10.1.1 At least nine test items are required per test threat.

10.1.2 The test items shall be face shields that are mounted on helmets.

10.1.3 The helmet shall be clamped in the clamping fixture on each side and the rear of the helmet.

10.1.4 The test items shall be subjected to the sequence of conditioning procedures from Test Methods E3111/E3111M, Section 10, prior to ballistic testing as shown in Fig. 1.

10.1.5 Following extreme low or high temperature conditioning, ballistic testing shall be completed on the test item within 30 min of removal from conditioning.

10.2 Performance Requirements:

10.2.1 There shall be no complete penetration as evidenced by the projectile or any fragments from the projectile or face shield being present in the clay witness material.

10.2.2 Face shield deflection shall be less than 30.0 mm [1.18 in.] as evidenced by contact indicator material being present on the rear of the face shield.

10.2.3 There shall be no visible damage to the face shield attachment points.

11. Ballistic Performance Requirements for Helmet Shell Ballistic Limit (V50)

11.1 The test item shall be tested as specified in Test Methods E3111/E3111M, Section 12, Helmet Ballistic Limit (V50) Testing, with the following modifications:

11.1.1 At least five test items are required per available helmet size in the marketplace, per test threat, to perform the required conditioning procedures from Test Methods E3111/E3111M, Section 10, prior to ballistic testing as shown in Fig. 2.

11.1.2 Following extreme low or high temperature conditioning, ballistic testing shall be completed on the test item within 30 min of removal from conditioning.

11.1.2.1 In accordance with Test Methods E3111/E3111M, Section 10.2.5, if ballistic testing cannot be completed within 30 min and the test item has been out of conditioning for 1 h or less, recondition the test item for a minimum of 1 h before continuing ballistic testing. If the test item has been out of the conditioning chamber for more than 1 h, recondition the test item for at least 24 h before continuing ballistic testing.

11.1.3 The required test threat shall be the 17-grain skirted fragment simulating projectile (FSP) as specified in MIL-DTL46593B, Amendment 1.

11.1.4 A V50 shall be calculated and documented for each helmet size for each conditioning procedure. From all of the documented V50 values, the lowest V50 value obtained shall be reported as the minimum V50 for the helmet.

11.1.5 A complete penetration occurs when the test projectile, any fragment of the test projectile, or any fragment of the helmet shell, has damaged the witness panel such that the light from a light source equivalent to at least 800 lumens can be seen through the witness panel.

11.1.5.1 If the witness panel is broken by the deformation of the helmet shell, then the determination of a partial penetration or complete penetration shall be made based on whether there is an evident perforation through the helmet shell. In this case,

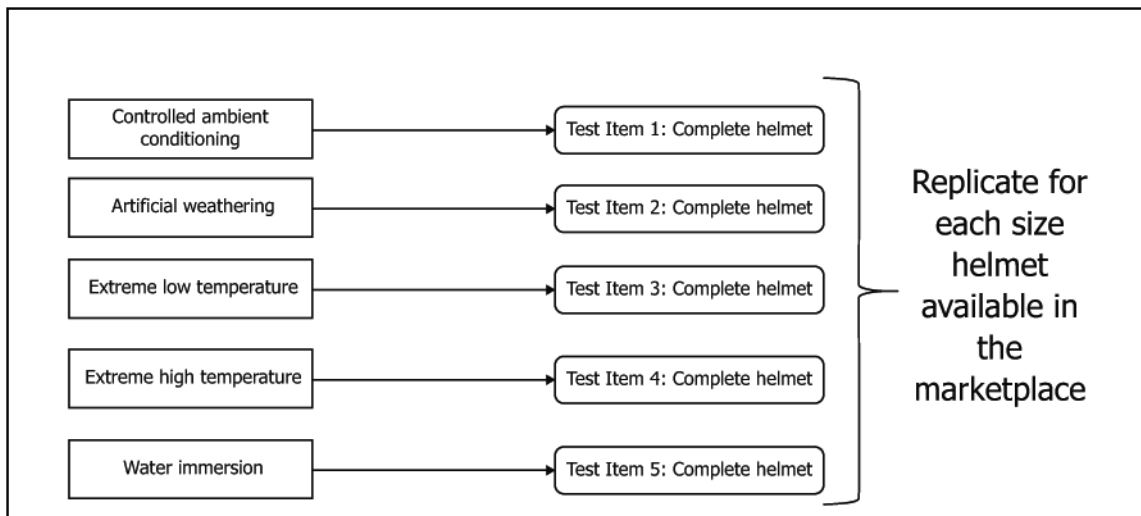


FIG. 2 Conditioning and Testing Sequence for Helmet Shell Ballistic Limit

the test laboratory shall determine whether there was a complete penetration. If it is unclear, then the shot will be repeated on the next shot location.

11.2 *Performance Requirements:*

11.2.1 There is no minimum V50 requirement.

12. **Ballistic Performance Requirements for Fasteners**

12.1 The test item shall be tested as specified in Test Methods E3111/E3111M, Section 14, Fastener RTP Testing, with the following modifications:

12.1.1 The test items shall be submitted in sizes that fit the required headform.

12.1.2 For each unique type of fastener (whether the fastener goes partially into or through the shell), the following shots are required:

12.1.2.1 A single shot is required to be taken on each of three fastener heads (see Test Methods E3111/E3111M, Section 14.3.2). These shots may be taken on more than one helmet, and those helmets may have previously been ballistically tested or may be untested.

12.1.2.2 A single shot is required to be taken glancing each of three fasteners (see Test Methods E3111/E3111M, Section 14.3.3). These shots may be taken on one or more helmets, and those helmets may have previously been ballistically tested or may be untested.

12.1.3 Each test item shall be subjected to controlled ambient conditioning from Test Methods E3111/E3111M, Section 10, prior to ballistic testing.

12.2 *Performance Requirements:*

12.2.1 Each test item shall withstand the required number of fair hits and shall experience no complete penetrations as evidenced by the projectile or any fragments from the projectile or fastener being present in or on the clay witness material. Any complete penetration by a fair hit constitutes a failure.

12.2.2 Nonmetallic material, such as paint, fibrous materials, edging, or edging adhesive that is emitted from the helmet and rests on the outer surface of the clay impression is not considered a complete penetration.

13. **Ballistic Performance Requirements for Weak Points**

13.1 The test item shall be tested as specified in Test Methods E3111/E3111M, Section 15, Weak Point RTP Testing, with the following modifications:

13.1.1 The test items shall be submitted in sizes that fit the required headform.

13.1.1.1 For each unique weak point, three shots are required, taking a single shot on each of three identical weak points. These shots may be taken on more than one helmet, and those helmets may have previously been ballistically tested or may be untested.

13.1.2 Each test item shall be subjected to controlled ambient conditioning from Test Methods E3111/E3111M, Section 10, prior to ballistic testing.

13.2 *Performance Requirements:*

13.2.1 Each test item shall withstand the required number of fair hits and shall experience no complete penetrations as evidenced by the projectile or any fragments from the projectile being present in or on the clay witness material. Any complete penetration by a fair hit constitutes a failure.

13.2.2 Nonmetallic material, such as paint, fibrous materials, edging, or edging adhesive that is emitted from the helmet and rests on the outer surface of the clay impression is not considered a complete penetration.

14. **Non-ballistic Performance Requirements for Helmets and Face Shields**

14.1 The helmet test items shall be tested as specified in Test Methods E3343/E3343M and E3299/E3299M, with the following modifications:

14.1.1 The helmet test items shall be the smallest and largest helmet sizes available from the marketplace.

14.1.2 At least six test items (that is, three smallest and three largest) are required and shall be subjected to the conditioning procedures from Test Methods E3111/E3111M, Section 10, and testing procedures shown in Fig. 3.

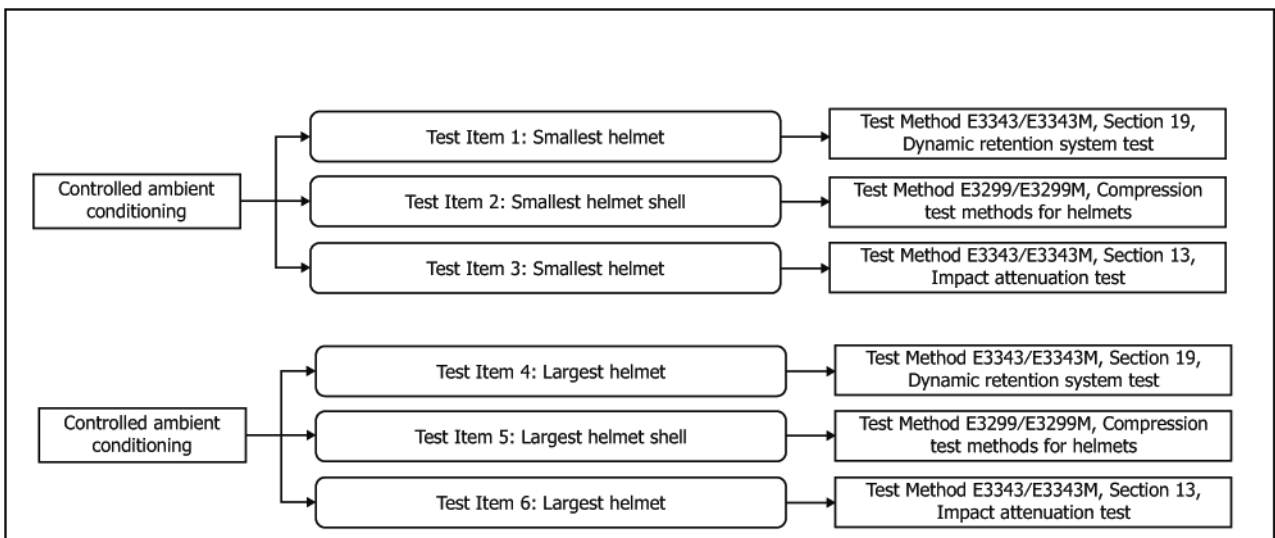


FIG. 3 Helmet Conditioning and Non-ballistic Testing Requirements

14.1.3 Impact attenuation testing shall be done in accordance with Test Methods E3343/E3343M, Section 13, with the modifications below:

14.1.3.1 Two test items (one smallest and one largest) are required.

14.1.3.2 Test items shall only be conditioned to Specification E3342/E3342M, Section 8.2, Controlled Ambient Conditioning.

14.1.3.3 Testing shall be done using the hemispherical anvil with a single impact in each of five locations on the helmet.

14.1.4 Dynamic retention system testing shall be done in accordance with Test Methods E3343/E3343M, Section 19, with the modifications that two test items (one smallest and one largest) are required, and the test items shall only be conditioned to Specification E3342/E3342M, Section 8.2, Controlled Ambient Conditioning.

14.1.5 Compression testing shall be done in accordance with Test Methods E3299/E3299M. The three procedures shall be conducted sequentially on two test items (one smallest and one largest), and the order of testing for each shall be: (1) top to bottom, (2) side to side, and (3) front to back.

14.2 For helmets that have non-ballistic-resistant face shields, the face shields are the test items and shall be tested as required by the following (see Fig. 4):

14.2.1 Test Methods E3343/E3343M, Section 16, Face Shield Projectile Resistance Test, with the following modifications:

14.2.1.1 Two face shields shall be tested using the 1/2-in. chrome steel ball bearing.

14.2.1.2 The face shields shall only be conditioned to Specification E3342/E3342M, Section 8.2, Controlled Ambient Conditioning.

14.2.2 Specification E3342/E3342M, Section 15, Face Shield Deflection and Impact Test Method, with the following modifications:

14.2.2.1 Two face shields shall be tested for deflection, and two face shields shall be tested for impact.

14.2.2.2 The face shields shall only be conditioned to Specification E3342/E3342M, Section 8.2, Controlled Ambient Conditioning.

14.2.3 ANSI/ISEA Z87.1, Section 9.4, Refractive Power, Astigmatism and Resolving Power Tests, and Section 9.5, Prismatic Power Test, shall be performed on the test items with the following modifications:

14.2.3.1 Two face shields shall be tested for each test.

14.2.3.2 The face shields shall only be conditioned to Specification E3342/E3342M, Section 8.2, Controlled Ambient Conditioning.

14.3 Performance Requirements:

14.3.1 Helmet Impact Attenuation:

14.3.1.1 Each test item shall have a maximum recorded acceleration for each impact of less than 2452 m/s² [250 g].

14.3.2 Helmet Retention System:

14.3.2.1 The retention system for each test item shall remain intact during the test, and elongation shall be ≤30 mm [1.2 in.].

14.3.3 Helmet Compression Resistance:

14.3.3.1 The deflection shall be ≤15 mm [0.60 in.], and there shall be no visible delamination, ply separation, distortion, or similar damage.

14.3.4 Face Shield Performance:

14.3.4.1 When tested for impact, each face shield shall: (1) have no visible cracks or splitting, (2) be able to be raised and lowered, and (3) remain fully attached.

14.3.4.2 When tested for deflection, there shall be no contact of face shield with headform nose, and the face shield shall remain attached.

14.3.4.3 When tested for projectile resistance, the test result shall be considered a pass if (1) each face shield shows no visible cracks or splitting and (2) the witness material has no complete penetrations.

14.3.4.4 When tested for face shield optics, the tolerance on refractive power, astigmatism, and resolving power shall be:

(1) Refractive power: ±0.06 D,

(2) Astigmatism: <0.06 D, and

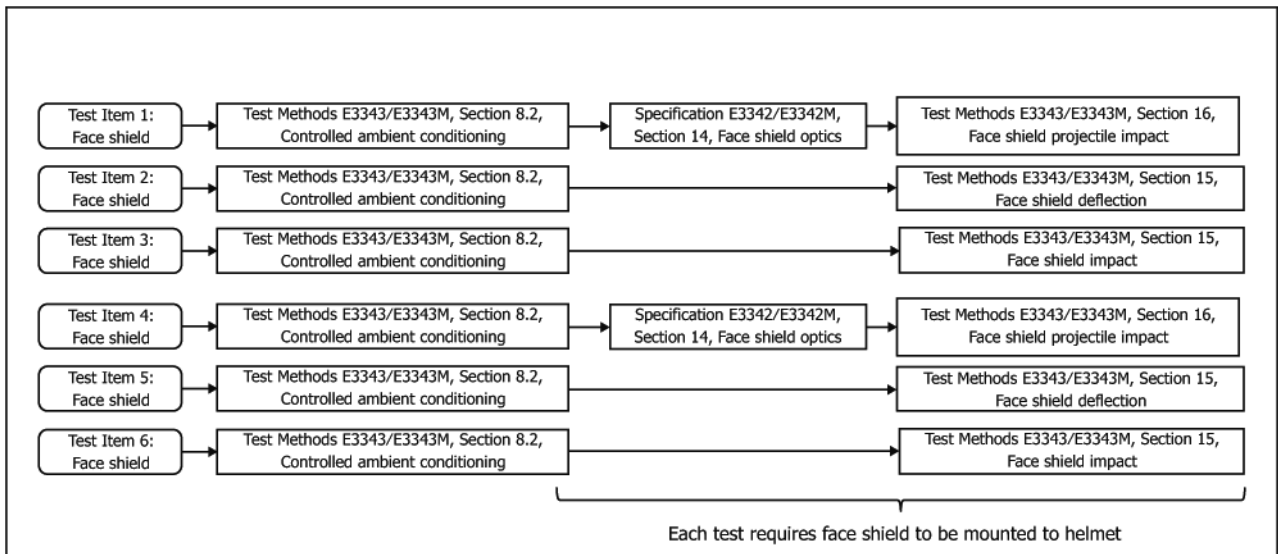


FIG. 4 Non-ballistic Face Shield Conditioning and Non-ballistic Testing Requirements

(3) Resolving power: Pattern 20.

14.3.4.5 When tested for face shield optics, the tolerance on prism and prism imbalance shall be:

- (1) Prism: $<0.25 \Delta$,
- (2) Vertical imbalance: $<0.125 \Delta$,
- (3) Base in imbalance: $<0.125 \Delta$, and
- (4) Base out imbalance: $<0.50 \Delta$.

15. Product Documentation Requirements

15.1 The supplier shall provide with each helmet the following documentation:

- 15.1.1 Supplier name;
- 15.1.2 Supplier contact information;
- 15.1.3 Country of origin;
- 15.1.4 Date of manufacture (that is, month and year);
- 15.1.5 Model designation;
- 15.1.6 Serial number;
- 15.1.7 Ballistic testing summary report as shown in **Annex A2**;
- 15.1.8 Non-ballistic testing summary report as shown in **Annex A3**; and
- 15.1.9 Ballistic protection warranty period.

15.2 The supplier shall provide access to the following information:

- 15.2.1 Instructions for proper use and care, including cautions;
- 15.2.2 Operating temperature range; and
- 15.2.3 Recommended storage practices.

16. Product Label and Package Label Requirements

16.1 The product shall have a product label permanently attached (that is, stamped, printed and attached, or similar).

16.2 The product label shall contain at least the following information:

NOTE 3— A font size that is at least 1.6 mm [$1/16$ in.] in height (based on the lower case “o”) and easy to read should be used.

- 16.2.1 Supplier name;
- 16.2.2 Country of origin;
- 16.2.3 Date of manufacture (that is, month and year);
- 16.2.4 Model designation;
- 16.2.5 Serial number;
- 16.2.6 RTP ballistic protection level;
- 16.2.7 Ballistic protection warranty period; and
- 16.2.8 If applicable, certification body’s label, symbol, or mark.

16.3 The package shall have a package label containing at least the following information:

- 16.3.1 Supplier name;
- 16.3.2 Supplier contact information;
- 16.3.3 Country of origin;
- 16.3.4 Model designation;
- 16.3.5 RTP ballistic protection level; and
- 16.3.6 Ballistic protection warranty period.

17. Test Report

17.1 The test laboratory shall develop a test report that meets the requirements of ISO/IEC 17025 and the test report sections of all test methods referenced in this specification.

17.2 All data and required calculated values shall be included in the test report.

17.3 For each ballistic test procedure, the test report shall state the total number of test items, the total number of test impacts, and the number of impacts per test item.

18. Keywords

18.1 backface deformation testing; ballistic helmet; face shield; helmet; resistance to penetration