



Designation: E3343/E3343M – 23

Test Methods for Nonballistic-resistant Helmets Worn by Law Enforcement and Corrections¹

This standard is issued under the fixed designation E3343/E3343M; 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 standard provides nonballistic test methods and conditioning procedures for assessing head protection (that is, helmet and face shield) worn by law enforcement and corrections officers.

1.1.1 Conditioning procedures are included to assess durability in terms of resistance to chemicals and cleaning products, extreme temperatures, weathering, and absorption of liquids.

1.1.2 Test methods are included to assess the protective performance against hazards including impact/bump, projectiles (other than bullets), flame, and liquids.

1.1.3 Test methods are included to assess safety and ergonomic aspects of retention system strength, stability of the helmet on the wearer's head, corrosion resistance, and face shield visual acuity, field of view, scratch resistance, and anti-mist properties.

NOTE 1—These test methods reference published standards from ASTM International and other standards developing organizations. **Appendix X1** contains a summary of test methods included in this standard, along with the source and purpose for each.

1.2 These test methods do not address eye protection other than face shields that are attached to the helmet.

1.3 It is anticipated that these test methods will be referenced by suppliers, certifiers, purchasers, or other users to meet their specific needs. Those users will specify, in other standards and specifications, which test methods and conditioning procedures are applicable and will specify any performance categories or levels.

1.3.1 If there is a discrepancy between these test methods and a user-supplied document, the user-supplied document shall take precedence.

1.4 In these test methods, “other standards and specifications” and “unless specified elsewhere” refer to documents (for example, military standards, purchase specifications) that require the use of these test methods. Purchasers and other users

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

Current edition approved Feb. 1, 2023. Published March 2023. Originally approved in 2022. Last previous edition approved in 2022 as E3343/E3343M – 22. DOI: 10.1520/E3343_E3343M-23.

are responsible for the “other standards and specifications” and for specifying any requirements that supersede those of these test methods.

1.5 *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.

1.6 *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.*

1.7 *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

- B117 Practice for Operating Salt Spray (Fog) Apparatus
- E2771 Terminology for Homeland Security Applications
- E3004 Specification for Preparation and Verification of Clay Blocks Used in Ballistic-Resistance Testing of Torso Body Armor
- F803 Specification for Eye Protectors for Selected Sports
- F1446 Test Methods for Equipment and Procedures Used in Evaluating the Performance Characteristics of Protective Headgear
- F1587 Specification for Head and Face Protective Equipment for Ice Hockey Goaltenders
- F2220 Specification for Headforms

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.

2.2 AATCC Standards:³

AATCC Test Method 169 Weather Resistance of Textiles: Xenon Lamp Exposure

2.3 ANSI Standards:⁴

ANSI Z26.1 Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways - Safety Standard

2.4 CSA Standards:⁵

CAN/CSA Z611-02 Riot Helmets and Face shield Protection
CSA Z262.6-14 Specifications for Facially Featured Headforms

2.5 ISO/IEC Standards:⁶

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

2.6 NFPA Standards:⁷

NFPA 1981 Standard on Open-circuit Self-contained Breathing Apparatus (SCBA) for Emergency Services, 2019

2.7 NIJ Standards:⁸

NIJ 0104.02 Standard for Riot Helmets and Face Shields
NIJ 0115.00 Stab Resistance of Personal Body Armor

2.8 SAE Standards:⁹

SAE Recommended Practice J2111/1_201403 Instrumentation for Impact Test - Part 1 - Electronic Instrumentation, 2014

2.9 Other Documents:

Home Office Scientific Development Branch (PSDB) 21/04 PSDB Protective Headwear Standard for UK Police (2004), Public Order Helmet¹⁰

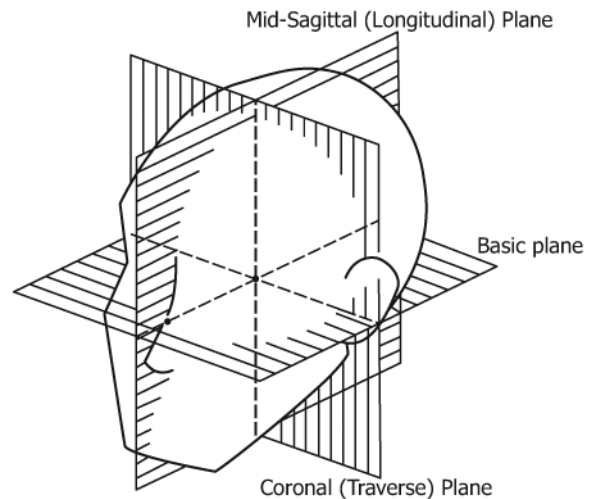


FIG. 1 Anatomical Planes

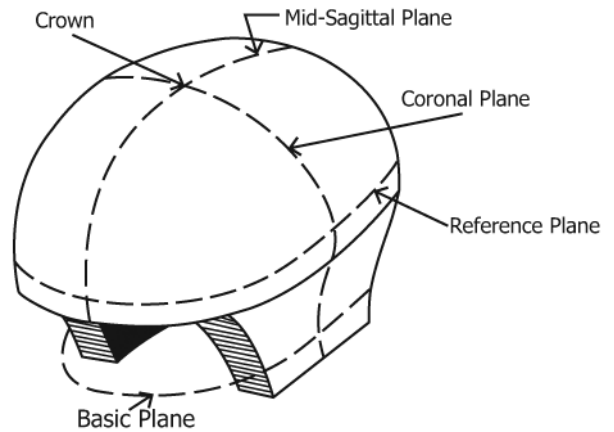


FIG. 2 Headform with Locations for Anatomical Planes

3. Terminology

3.1 Definitions:

3.1.1 *basic plane, n*—an anatomical plane (Frankfort horizontal plane) that includes the superior rim of the external auditory meatus (upper edge of the external openings of the ear) and the inferior margin of the orbit (the lowest point of the floor of the eye socket) (see Fig. 1 and Fig. 2).

(Test Methods F1446)

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

(Terminology E2771)

³ Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709-2215, <http://www.aatcc.org>.

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

⁵ Available from Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON M9W 1R3, Canada, <http://www.csagroup.org>.

⁶ Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

⁷ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

⁸ Available from National Institute of Justice (NIJ), 810 7th St., NW, Washington, DC 20531, <http://nij.gov>.

⁹ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

¹⁰ Available from Home Office Direct Communications Unit, 2 Marsham Street, London, SW1P 4DF, United Kingdom, <http://www.gov.uk/government/organisations/home-office>.

3.1.3 *controlled ambient, n*—conditions with temperature of 20 °C ± 5.5 °C [68 °F ± 10 °F] and 50 % ± 20 % relative humidity (RH).

(Terminology E2771)

3.1.4 *coronal plane, n*—an anatomical plane perpendicular to both the basic and midsagittal planes and passing through the superior rims of the right and left auditory meatuses; the transverse plane corresponds to the coronal plane (see Fig. 1 and Fig. 2).

(Test Methods F1446)

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

(Terminology E2771)

3.1.6 *field of vision, n*—angle of vision as measured on the reference headform (upward, downward, and peripheral).

(Test Methods F1446)

3.1.7 *helmet, n*—a protective device worn on the head in an effort to reduce or minimize injury to that portion of the head that is within an area above the reference plane (as defined in the individual performance standards).

(Test Methods F1446)

3.1.8 *helmet position index (HPI), n*—the vertical distance from the brow of the helmet to the basic plane, when the helmet is placed on a reference headform; the manufacturer

shall specify the size of the headform and the vertical distance.
(Test Methods F1446)

3.1.9 *mid-sagittal plane, n*—an anatomical plane perpendicular to the basic plane and containing the midpoint of the line connecting the notches of the right and left inferior orbital ridges and the midpoint of the line connecting the superior rims of the right and left external auditory meatus; the longitudinal plane corresponds to the midsagittal plane (see Fig. 1 and Fig. 2).
(Test Methods F1446)

3.1.10 *modular elastomer programmer (MEP), n*—a cylindrical-shaped pad used as the impact surface for the spherical impactor.
(Test Methods F1446)

3.1.11 *reference plane, n*—a plane marked on the headforms at a specified distance above and parallel to the basic plane (see Fig. 2).
(Test Methods F1446)

3.1.12 *retention system, n*—the complete assembly that secures the helmet, in a stable position, on the wearer's head.
(Test Methods F1446)

3.1.13 *test area, n*—the area of the helmet on or above a specified reference plane, subject to impact or penetration testing.
(Test Methods F1446)

3.1.14 *test item, n*—a single article intended for testing.
(Terminology E2771)

4. Significance and Use

4.1 The purpose of these test methods is to provide reliable and repeatable nonballistic test methods and conditioning procedures for the evaluation of head protection used in law enforcement and corrections applications.

4.2 It is anticipated that these test methods will be referenced by certifiers, purchasers, or other users in order to meet their specific needs. Those users will specify which test methods and conditioning procedures are applicable, and will specify any performance categories or levels.

4.3 These test methods include some procedures and references to other standards to ensure that relevant properties are addressed.

5. Hazards

5.1 The tests described in these test methods have inherent hazards. It is the responsibility of the testing laboratory to ensure adequate safeguards for personnel and property when conducting these tests.

6. Test Item Requirements

6.1 The test items to be used for each test method shall be specified in the test method. For some tests, the helmet shell alone is the test item while for other tests the test item is the helmet shell with its hardware, suspension system, and retention system.

6.1.1 The face shield shall always be attached to the helmet shell during face shield testing and shall be in the deployed position and locked or secured with supplied hardware, where available.

6.2 There shall be no variation in construction details between individual test items or between any test item and the supplier's documentation for a given model.

7. Conditioning Requirements

7.1 Perform a visual inspection of test items both prior to and after conditioning, and record observations and changes in physical features.

7.2 When conditioning is required prior to a performance test involving impact to test items, unless specified elsewhere, the following requirements apply for each type of conditioning:

7.2.1 Once testing begins, the test item shall not be out of conditioning for more than 5 min at a time and then shall be returned to conditioning for at least 15 min. There is no limit to the number of times the test item can be returned to conditioning over the test series.

NOTE 2—Each test, taking up to 5 min, is followed by at least 15 min of conditioning.

8. Temperature and Humidity Conditioning Procedures

8.1 Environmental Chamber:

8.1.1 The environmental chamber shall be capable of achieving and maintaining the required temperature and humidity within the specified tolerances for the duration of the conditioning procedure.

8.1.2 The monitoring equipment shall include measurement and recording device(s), independent from the chamber controllers.

8.1.3 The monitoring equipment shall provide and allow documentation of temperature and relative humidity measurements inside the chamber.

8.2 Controlled Ambient Conditioning:

8.2.1 Subject each test item to controlled ambient conditions of $20.0\text{ }^{\circ}\text{C} \pm 5.5\text{ }^{\circ}\text{C}$ [$68\text{ }^{\circ}\text{F} \pm 10\text{ }^{\circ}\text{F}$] and $50\% \pm 20\%$ relative humidity (RH) for at least 24 h.

8.3 Extreme Heat Conditioning:

8.3.1 Subject each test item to extreme heat conditioning for between 24 h and 48 h at $71\text{ }^{\circ}\text{C} \pm 5.5\text{ }^{\circ}\text{C}$ [$160\text{ }^{\circ}\text{F} \pm 10\text{ }^{\circ}\text{F}$] and relative humidity of $50\% \pm 20\%$ in a conditioning chamber.

8.4 Extreme Cold Conditioning:

8.4.1 Subject each test item to extreme cold conditioning for between 24 h and 48 h at $-51\text{ }^{\circ}\text{C} \pm 5.5\text{ }^{\circ}\text{C}$ [$-60\text{ }^{\circ}\text{F} \pm 10\text{ }^{\circ}\text{F}$] in a conditioning chamber.

9. Artificial Weathering Conditioning Procedure

9.1 Equipment:

9.1.1 The equipment shall be as described in AATCC Test Method 169.

9.2 Weathering of test items shall be performed in accordance with AATCC Test Method 169 with the modifications listed below:

9.2.1 The test apparatus shall be a xenon weatherometer with reflective panels.

9.2.2 The test apparatus shall be equipped with an automatic light monitor and shall be capable of automatically controlling