



Designation: E3078/E3078M – 23

Standard Practice for Conditioning of Hard Armor Test Items¹

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1. Scope

1.1 This practice applies to the conditioning of hard armor test items prior to ballistic resistance testing. Hard armor is an item of personal protective equipment that is constructed of rigid materials and is intended to protect the wearer from threats that may include ballistic threats, stabbing, fragmentation, or blunt impact, or combinations thereof. (Terminology **E3005**.) Hard armor is also referred to as hard armor plate and plate.

NOTE 1—Ballistic resistance testing is not covered in this practice.

1.2 This practice describes requirements for subjecting test items to conditions intended to assess the capability of the test item to withstand environmental conditions that induce responses similar to those that might result from conditions encountered during use. This practice includes the conditioning procedures listed below:

- 1.2.1 Controlled ambient conditioning procedure,
- 1.2.2 Thermal/temperature shock procedure,
- 1.2.3 Temperature extremes procedure,
- 1.2.4 Weathering procedure,
- 1.2.5 Fluid exposure procedure,
- 1.2.6 Altitude exposure procedure,
- 1.2.7 Vibration conditioning procedure,
- 1.2.8 Impact Durability pre-conditioning,
- 1.2.9 Impact Durability procedure for torso front and back plates, and
- 1.2.10 Impact Durability procedure for other plates (that is, other than torso front and back plates).

1.3 The user of this practice shall determine which conditioning procedures apply.

NOTE 2—This practice may not be applicable to all types of hard armor.

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

the “other standards and specifications” and for specifying any requirements that supersede those of this practice.

1.5 This practice does not address pass/fail requirements for test items subjected to these procedures.

1.6 This practice does not address visual inspections or radiographic inspections of test items that may be required prior to or following conditioning.

NOTE 3—It is recommended that a thorough visual examination of each test item prior to and after the exposures be performed to document any change in physical appearance resulting from the exposure.

1.7 This practice does not address subsequent conditioning or testing of test items.

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.

1.8.1 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.

1.9 *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

D1141 Practice for Preparation of Substitute Ocean Water

¹ This practice 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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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.

**E3005 Terminology for Body Armor****2.2 AATCC Standard:**³

AATCC TM 169 Weather Resistance of Textiles: Xenon Lamp Exposures

2.3 Military Standard:⁴

MIL-STD-810G Test Method Standard for Environmental Engineering Considerations and Laboratory Tests

3. Terminology

3.1 The terms and definitions of Terminology E3005 apply for the following terms: *applique*, *ballistic resistance*, *conditioning*, *controlled ambient*, *hard armor plate*, *in conjunction with armor*, *shoot pack*, *soft armor*, *strike face*, and *test item*.

3.1.1 Within this practice, the definition for *controlled ambient* from Terminology E3005 applies to any direct or indirect reference to controlled ambient, superseding referenced standards that may have a different definition.

4. Significance and Use

4.1 It is anticipated that this practice will be referenced by certifiers, purchasers, and other users in order to meet their specific needs. Those users will specify which conditioning procedures are applicable.

5. Test Items

5.1 The test items are individual hard armor plates.

5.2 The quantity and size of test items to be conditioned and other relevant test item details are specified in other standards or specifications.

5.3 Unless otherwise specified, test items shall be stored in controlled ambient conditions following conditioning procedures.

6. Controlled Ambient Conditioning Procedure

6.1 Test items shall be subjected to controlled ambient conditions for at least 24 h.

7. Temperature Shock Procedure

7.1 Tests shall be performed in accordance with MIL-STD-810G, Method 503.5, Procedure I-A, with the following modifications:

7.1.1 The extreme temperatures shall be T1: $-31.7^{\circ}\text{C} \pm 3.0^{\circ}\text{C}$ [$-25^{\circ}\text{F} \pm 5^{\circ}\text{F}$] and T2: $48.9^{\circ}\text{C} \pm 3.0^{\circ}\text{C}$ [$120^{\circ}\text{F} \pm 5^{\circ}\text{F}$].

7.1.2 Test items shall be subjected to temperature conditioning steps as follows: (1) controlled ambient, (2) T1, (3) T2, and (4) controlled ambient. Transfer of test items from one condition to another shall be accomplished in less than one minute. Ramping of temperature is prohibited.

7.1.3 The test items shall be subjected to T1 and T2, each for a minimum of 2 h, not to exceed 2 h and 15 min.

8. Temperature Extremes Procedure

8.1 Tests shall be performed in accordance with constant temperature exposure procedures of MIL-STD-810G, Method 501.5, Procedure I (high temperature) and Method 502.5, Procedure I (low temperature).

8.2 One set of test items shall be subjected to high temperature, and another set shall be subjected to low temperature. Ramping of temperature is prohibited.

8.2.1 The starting temperature shall be controlled ambient.

8.2.2 One set of test items shall be heated in a chamber operating at $68.3^{\circ}\text{C} \pm 3.0^{\circ}\text{C}$ [$155^{\circ}\text{F} \pm 5^{\circ}\text{F}$] for a minimum of 6 h, not to exceed 24 h.

8.2.3 One set of test items shall be cooled in a chamber operating at $-48.3^{\circ}\text{C} \pm 3.0^{\circ}\text{C}$ [$-55^{\circ}\text{F} \pm 5^{\circ}\text{F}$] for a minimum of 6 h, not to exceed 24 h.

9. Weathering Procedure

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

9.1.1 The test apparatus shall be equipped with an automatic light monitor and shall be capable of automatically controlling irradiance, temperature, and humidity.

9.1.2 The test items shall be positioned with the strike face toward the light source.

9.1.3 The weathering cycle shall be a total of 180 min, consisting of the following in order: 40 min of light, 20 min of light with water spray on the test item, 60 min of light, and 60 min of darkness. The cycle shall be repeated until the total energy exposure is equal to 100 kJ/m^2 , and the weathering cycle shall be terminated at that point.

9.1.4 The spectral irradiance level shall be $0.55\text{ W/m}^2/\text{nm} \pm 0.01\text{ W/m}^2/\text{nm}$ bandpass at 340 nm.

9.1.5 The temperatures and RH shall be as specified in Table 1.

9.2 After the required exposure period, the test items shall be removed from the apparatus.

10. Fluid Exposure Procedure

10.1 MIL-STD-810G, Procedure II, Method 504.1 and Procedure I, Method 512.5 shall be used with modifications as described below:

10.1.1 Test items shall be subjected to conditioning in fluids, with each fluid at a temperature between 16°C and 26°C [60°F and 80°F].

TABLE 1 Temperatures for Weathering Procedure

	Dark Cycle	Light Cycle
Black Panel	$38^{\circ}\text{C} \pm 3^{\circ}\text{C}$ [$100^{\circ}\text{F} \pm 5^{\circ}\text{F}$]	$77^{\circ}\text{C} \pm 3^{\circ}\text{C}$ [$171^{\circ}\text{F} \pm 5^{\circ}\text{F}$]
Relative Humidity	$\geq 95\%$	$50\% \pm 5\%$ (This does not apply to light cycle with water spray.)

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 U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.access.gpo.gov>.