



# Standard Specification for Headgear Used in Women’s Lacrosse (excluding Goalkeepers)<sup>1</sup>

This standard is issued under the fixed designation F3137; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification defines performance requirements for headgear to be used by field player’s participating in the sport of women’s lacrosse. The technical requirements in this specification do not address the administrative requirements of lacrosse governing bodies, so it should not be assumed that any headgear satisfying this specification will be acceptable for use in sanctioned lacrosse events.

1.2 The purpose of this specification is to provide reliable and repeatable test methods for the evaluation of protective headgear for women’s adult and youth lacrosse training and play. When designated optional equipment by lacrosse governing bodies, it is important that it not increase the risk of injury to players who choose not to wear it. Impacts from stick, ball, other player, ground, or other objects may be decreased in severity by use of this headgear. However, the relationship between impact and injury is not fully understood.

1.3 No headgear can provide protection against all impacts, foreseeable or not. This specification does not address the potential for injury from any type of impact.

1.4 All testing and requirements of this specification shall be in accordance with Test Methods F1446 and Specification F3077, except where noted in this specification. If there is a conflict between this standard and Test Methods F1446 and Specification F3077, this standard shall control.

1.5 Partial compliance with this standard is prohibited.

1.6 The values stated in SI (International System of Units) units are to be regarded as the standard. The values given in parentheses are for information only. Metric units of measurement in this specification are in accordance with the International System of Units (SI). If a value for measurement as given in this specification is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F08 on Sports Equipment, Playing Surfaces, and Facilities and is the direct responsibility of Subcommittee F08.53 on Headgear and Helmets.

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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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

F1446 Test Methods for Equipment and Procedures Used in Evaluating the Performance Characteristics of Protective Headgear

F2220 Specification for Headforms

F3077 Specification for Eye Protectors for Women’s Lacrosse

### 2.2 Other Standards:

ND001 NOCSAE Standard Test Method and Equipment Used in Evaluating the Performance Characteristics of Protective Headgear/Equipment

ND021 NOCSAE Standard Projectile Impact Testing Method and Equipment Used in Evaluating the Performance Characteristics of Protective Headgear, Faceguards or Projectiles

ND049 NOCSAE Standard Performance Specification For Newly Manufactured Lacrosse Balls

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, see Test Methods F1446.

### 3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *helmet position index (HPI), n*—a manufacturer of headgear may specify the HPI to be used to achieve a reasonable fit during testing. If no HPI is specified, the fitting instructions shall be used to obtain a reasonable fit. If the specified HPI does not provide a reasonable fit as determined by the technician, or the fit with the specified HPI or fitting instructions is likely to yield erroneous test results, the technician shall fit the headgear to the best of their ability on the most appropriate headform.

<sup>2</sup> 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.

**4. Significance and Use**

4.1 Women’s Lacrosse is a distinctive sport with inherent risks. Participation in the sport implies acceptance of risk of injury. This specification was developed to address forces of some of the incidental stick and ball to headgear impacts to non-goaltending field players that may occur while engaging in Women’s Lacrosse. Although headgear satisfying this specification may provide limited protection against some impacts, catastrophic/life threatening impacts are not addressed by this specification. In addition, the cumulative effect of multiple sub-concussive impacts is not addressed here.

NOTE 1—Protection provided by headgear satisfying this specification is not equivalent to the protection provided by “helmets” used in many other sports activities. Headgear that meets these standard specifications may not provide significant protection in some head impact situations.

**5. Classification**

5.1 Women’s lacrosse headgear (adult and youth) shall be classified into the following types:

5.2 *Type I*—A headgear without protective eyewear, in the condition offered for sale, that allows for the proper use of protective eyewear meeting Specification F3077.

5.3 *Type II*—A headgear designed to be worn with specific protective eyewear meeting Specification F3077 integrated into the headgear, in the condition as offered for sale.

**6. General Construction**

6.1 *Materials of Construction:*

6.1.1 Materials coming into contact with the wearer’s face or skin shall not be of a type known to cause skin irritation.

6.1.2 Materials coming into contact with the wearer’s face or skin, except replaceable padding, shall not undergo significant loss of strength or flexibility, or other physical change as a result of perspiration, oil, or grease from the wearer’s skin and hair.

6.1.3 Any material used in the construction of headgear shall not be adversely affected by ordinary household soap and water, mild household detergent, or cleaners recommended by the manufacturer.

6.1.4 For Type II Headgear, any components relating to the specific protective eyewear used to pass Specification F3077 can be omitted from 6.1 (Materials of Construction) and 6.2 (Construction).

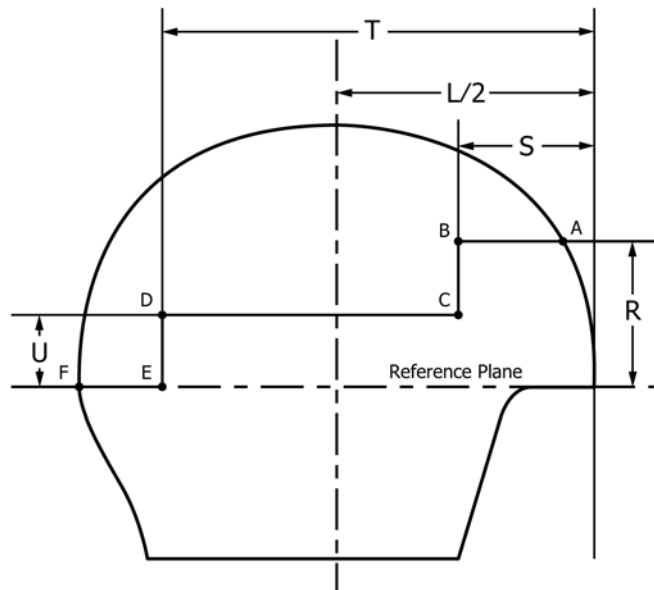
6.1.5 Exterior surfaces of the headgear portion must be of a flexible composition and this is to be confirmed by using the deformation test as described in 14.4 (Deformation Test).

6.2 *Construction:*

6.2.1 Any optional devices, excepting eye protection, for the headgear shall be designed so that they are unlikely to cause any injury to the wearer or other participants during contact.

6.2.2 All edges shall be smooth and rounded and there shall be no rigid projections on the inside of the headgear that could come in contact with the wearer’s head.

6.2.3 All external projections shall be smooth to other surfaces.



Headform Size	Dimension				
	T	L/2	U	R	S
A	137.0	88.0	25.0	50.0	19.5
E	146.5	94.5	25.0	50.0	20.5
J	155.0	101.0	25.0	50.0	20.5

FIG. 1 Headform Test Line

6.3 *Protected Area*—The area above the test line (see Fig. 1) shall be considered the protected area. All parts of the wearer’s head covered by the area of the headgear shall be protected at least to the minimum performance requirements of 7.2 (Shock Absorption Test), 7.3 (Ball Impact Absorption Test) and 7.4 (Deformation Test). Within the Deformation Test, the portions which relate to the specific protective eyewear can be omitted, see 6.1.4.

## 7. Performance Requirements

7.1 *General*—Headgear shall be capable of meeting the requirements in this performance specification throughout their full range of adjustment.

7.2 *Shock Absorption Test*—When tested in accordance with Section 14 (Mechanical Tests), the peak acceleration of any impact shall not exceed 80 g.

7.3 *Ball Impact Absorption Test*—When tested in accordance with Section 14 (Mechanical Tests), the peak acceleration of any impact shall not exceed 80 g.

7.4 *Deformation Test*—When tested in accordance with Section 14 (Mechanical Tests), the headgear must make contact with the MEP pad on both sides of the half-rod anvil as indicated by contact paste.

7.5 The headgear shall remain intact with no visible cracks through the thickness of the outer covering.

## 8. Apparatus

8.1 Apparatus used for this testing shall be in accordance with Test Methods F1446 except as noted herein.

8.2 *Shock Absorption Test*—The apparatus for the shock absorption test shall consist of the following:

8.2.1 *Test Headforms*—Test headforms that correspond to the physical dimensions defined in Specification F2220 as sizes A, E, and J. The weight of the drop assembly, including the headform, shall be in accordance with 8.2.3. The test headforms shall include surface markings corresponding to the basic, coronal, midsagittal, and reference planes.

8.2.2 *Guide Assembly*—The headform shall be attached to the free fall drop assembly carriage by an adjustable mounting that will allow impacts to be delivered to any prescribed point on the headgear. For more information see Test Methods F1446.

8.2.3 *Headform and Carriage Assembly*—The test headforms shall be made of K1A magnesium material. The headform and carriage assembly shall have a mass of:

J-headform and carriage assembly =  $4.7 \pm 0.14$  kg  
 E-headform and carriage assembly =  $4.1 \pm 0.12$  kg  
 A-headform and carriage assembly =  $3.1 \pm 0.10$  kg

8.2.3.1 The carriage assembly (excludes ball arm and clamp) shall contribute to no more than 50 % of the total mass.

8.2.4 *Impact Surface*—The impact surface shall be a flat modular elastomer programmer (MEP) 152.4 mm (6 in.) in diameter and 25.4 mm (1 in.) in thickness which is firmly fixed to the top surface of a flat anvil. The MEP required is a  $60 \pm 5$  Durometer Shore A Hardness impact surface. The base shall consist of a rigid slab weighing at least 136.1 kg (300 lb). The top surface of this base may be used as the flat metal anvil if

it is faced with a steel plate with minimum thickness of 25.4 mm (1 in.) and minimum top surface area of  $0.09 \text{ m}^2$  ( $1 \text{ ft}^2$ ). If a detachable flat metal anvil is used it must have a top surface area of at least  $290.3 \text{ cm}^2$  ( $45 \text{ in.}^2$ ). The MEP is mounted on an aluminum plate with a minimum thickness of 5.6 mm (0.220 in.) after grinding.

### 8.3 Ball Impact Absorption Test:

8.3.1 Apparatus used for this testing shall be in accordance with NOCSAE ND001 and NOCSAE ND021 except as noted herein.

8.3.2 The propelling device shall be capable of hurling the test projectiles horizontally at the speed described in 14.3.2.

8.3.3 Projectiles (balls) shall be intended for use in the game of women’s lacrosse and shall meet the requirements of NOCSAE ND049.

8.3.4 Equipment employed to measure the speed of the test ball within 1.0 m of impact shall be accurate to within  $\pm 1.0$  m/s muzzle velocity. Each impact velocity shall be measured and if not within the tolerance, that impact is not valid.

8.3.5 *Test Headforms*—Headforms to be used shall be NOCSAE small headforms and meet the headform specifications outlined in NOCSAE ND001.

### 8.4 Deformation Test:

8.4.1 *Test Headforms*—Test headforms that correspond to the physical dimensions defined in Specification F2220 as sizes A, E, and J. The weight of the drop assembly, including the headform, shall be in accordance with 8.4.3. The test headforms shall include surface markings corresponding to the basic, coronal, midsagittal, and reference planes.

8.4.2 *Guide Assembly*—The headform shall be attached to the free fall drop assembly carriage by an adjustable mounting that will allow impacts to be delivered to any prescribed point on the headgear. For more information, see Test Methods F1446.

8.4.3 *Headform and Carriage Assembly*—The test headforms shall be made of K1A magnesium material. The headform and carriage assembly shall have a mass of:

J-headform and carriage assembly =  $4.7 \pm 0.14$  kg  
 E-headform and carriage assembly =  $4.1 \pm 0.12$  kg  
 A-headform and carriage assembly =  $3.1 \pm 0.10$  kg

8.4.3.1 The carriage assembly (excludes ball arm and clamp) shall contribute to no more than 50 % of the total mass.

8.4.4 *Impact Surface*—The impact surface shall be a flat modular elastomer programmer (MEP) described in 8.2.3 with the addition of the Rod Anvil described in 8.4.5. The rod anvil shall be affixed on top of the MEP surface and be centrally located so as to always divide the MEP surface in equal halves. Impact surface is to be covered with a layer of contact paste. Layer of paste should be no thicker than 1.5 mm (0.0625 in.).

8.4.5 *Rod Anvil*—The rod anvil shall be one half of a cylinder with a diameter of  $12.7 \text{ mm}$  ( $0.5 \text{ in.}$ )  $\pm 0.5 \text{ mm}$  and a minimum length of  $152.4 \text{ mm}$  ( $6 \text{ in.}$ ) (see Fig. 2). The rod anvil shall be of steel construction and rigidly attached to the MEP surface, so as to not move during the Deformation Test.

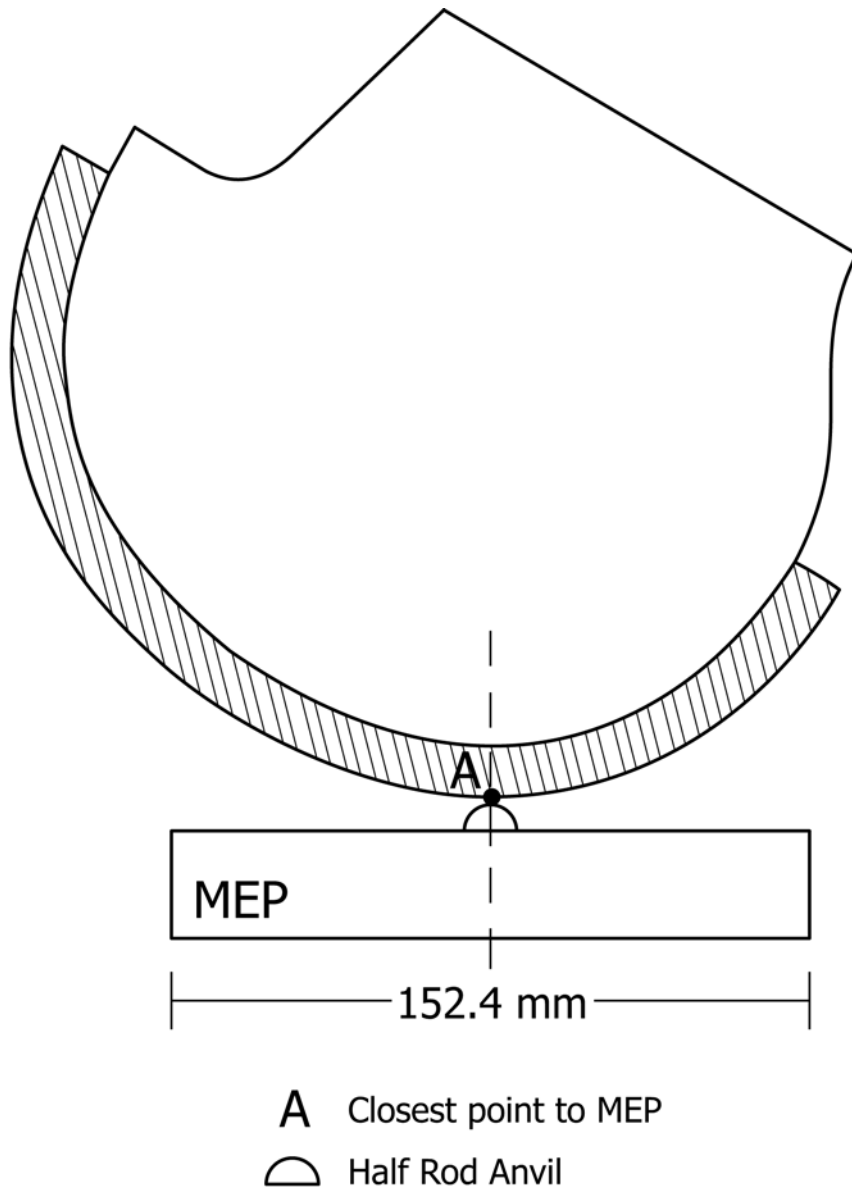


FIG. 2 Deformation Test: Lowest Point on Headgear to Touch Half Rod Anvil

## 9. Equipment Calibration and System Checks

9.1 Instrumentation used in testing shall be calibrated according to the requirements of Test Methods F1446, as noted herein.

9.2 *Shock Absorption Test Instrument System Check*—The system instrumentation shall be checked before and after each series of tests by dropping the spherical impactor onto the MEP pad at an impact velocity of  $2.6 \pm 0.1$  m/s ( $8.53 \pm 0.3$  ft/s). Impact velocity shall be measured during the last 40 mm (1.575 in.) of free fall for each test. The weight of the drop assembly (which is the combined weight of the instrumented spherical impactor and supporting assembly) for the shock absorption test shall be  $5 \pm 0.1$  kg ( $11.00 \pm 0.2$  lb). Three such impacts, at intervals of  $75 \pm 15$  s, shall be performed before and after each series of tests. The peak acceleration obtained during impact shall be  $148 \pm 8$  g. If the average peak acceleration obtained in the post test impacts differs by more than 5 % from

the average peak acceleration obtained in the pretest impacts, the following checks shall be made. Checks of the mechanical condition of the drop system and checks of the calibration of the instruments and transducers are required and all data obtained during that series of headgear tests should be discarded.

9.3 *Ball Impact Absorption Test Instrument System Check*—The system instrumentation shall be checked before and after each series of tests by referencing the calibration methods outlined in NOCSAE ND001 (Headform Calibration & System Check).

## 10. Samples for Testing

### 10.1 Conditions and Attachments:

10.1.1 Both Type I & Type II Headgear shall be tested complete, in the condition as offered for sale.

10.1.2 *Number of Samples*—Submit at least 5 specimen headgear for each size to be tested under the various conditions as described in Section 11 (Conditioning Requirements).

## 11. Conditioning Requirements

11.1 Prior to testing, condition headgear as follows:

11.2 *Ambient Condition*—Three samples of each size headgear shall be conditioned at the ambient condition defined in Test Methods F1446.

11.3 *High Temperature*—One sample of each size headgear shall be conditioned at the high temperature conditions as defined in Test Methods F1446.

11.4 *Water Immersion*—One sample of each size headgear shall be conditioned at the water immersion conditions as defined in Test Methods F1446.

11.5 Testing of conditioned samples must occur within 2 min after removal of the sample from the conditioning environment. If a sample is out of the conditioning environment for more than 2 min, it shall be reconditioned 15 min for each 5-min period they are out of the conditioning environment, up to a maximum of 4 h.

## 12. Projectile Specifications

12.1 *Requirements*—Projectile for testing shall meet the requirements of NOCSAE ND049.

## 13. Test Methods

13.1 *Testing Environment*—Conduct all testing under the recorded conditions of room temperature and humidity. These conditions must be in accordance with those stated in Test Methods F1446.

13.2 *Impact Locations and Test Schedule*—The impact locations and test line are defined in this section.

13.2.1 *Definitions*:

13.2.1.1 *Front*—The point on the midsagittal plane which is 50 mm (1.969 in.) above the anterior intersection with the reference plane.

13.2.1.2 *Side*—The point 25 mm (0.984 in.) above the reference plane and 90° from the anterior intersection of the midsagittal plane and the reference plane (intersection of the reference and coronal planes).

13.2.1.3 *Rear*—The point at the posterior intersection of the midsagittal and reference planes.

13.2.1.4 *Crown*—The point where the central vertical axis meets the top of the headform.

13.2.1.5 *Rear Boss*—A point in a plane 135° (2.36 rad) in a clockwise direction from the anterior intersection of the median and reference planes and on the reference plane.

13.2.1.6 *Front Boss*—A point in a plane 45° (0.78 rad) from the median plane as measured in a clockwise direction and 25.4 mm (1 in.) above the reference plane.

13.2.1.7 *Test Line*—Draw test line A-B-C-D-E-F on the headform as indicated in Fig. 1.

13.2.2 *Shock Absorption Test*—Condition one headgear at ambient, one at high temperature and one in water immersion. One ambient conditioned headgear shall be tested at the front,

front boss, side, rear, rear boss, crown, and one non-prescribed locations only. The high temperature conditioned headgear shall be impacted at the location that yielded the single highest peak acceleration ( $g_{max}$ ) from the headgear tested at ambient condition. The water immersion conditioned headgear shall be impacted at the location that yielded the single highest peak acceleration ( $g_{max}$ ) from the headgear tested at ambient conditions.

13.2.3 *Ball Impact Absorption Test*—Condition one headgear at ambient. One ambient conditioned headgear shall be impacted one time at the front, side, and rear locations only.

13.2.4 *Impact Locations on Headform and Headgear*—Determine an impact location on the headform, then mark this location on the headform. Place the headgear on the headform as specified by the manufacturer's head positioning index (HPI) and mark the corresponding impact location on the headgear before performing the impact. The impact location may be determined and marked first on the headgear and then marked on the headform. If marking the headgear first, make sure the corresponding mark on the headform is on or above the test line. Do this for all impact locations.

13.2.5 *Headgear Positioning*—Each headgear model presented for testing shall be furnished with an HPI (see 3.2.1) as established by the headgear manufacturer. This HPI shall be used when placing the headgear on the headform for testing. If no HPI is specified, the fitting instructions shall be used to obtain a reasonable fit. If the specified HPI does not provide a reasonable fit as determined by the technician, or the fit with the specified HPI or fitting instructions is likely to yield erroneous test results, the technician shall fit the headgear to the best of their ability on the most appropriate headform. The HPI used should be stated on the test report. If a headgear size range, as identified by the manufacturer's instructions, is capable of fitting two different headforms, the larger headform shall be used. Place the headgear to be tested on the test headform and secure in accordance with the manufacturer's instructions prior to testing.

13.2.6 *Deformation Test*—Condition one headgear at ambient. One ambient conditioned headgear shall be tested once at two non-prescribed locations. These non-prescribed locations shall be chosen by the technician and follow requirements described in 13.2.7 (Non-Prescribed Impact Locations). The chosen locations shall be homogenous surfaces which represent materials of primary construction. On Type II headgear, omit areas of the headgear construction which pertain to portions of the eye protector.

13.2.6.1 The two non-prescribed test locations must be positioned so that the lowest point on the headgear is also the first point of contact between the rod anvil and the headgear (see Fig. 2).

13.2.6.2 The two non-prescribed test locations must be positioned so that at least one portion of the headgear is at most 12.7 mm (0.5 in.) from the MEP pad in both of the dedicated curvature zones. This measurement will be taken when the first point of contact on the headgear is lowered until it is touching the rod anvil (see Fig. 3).

13.2.7 *Non-Prescribed Impact Locations*—Non-prescribed impacts shall be located on the headform. The first point of

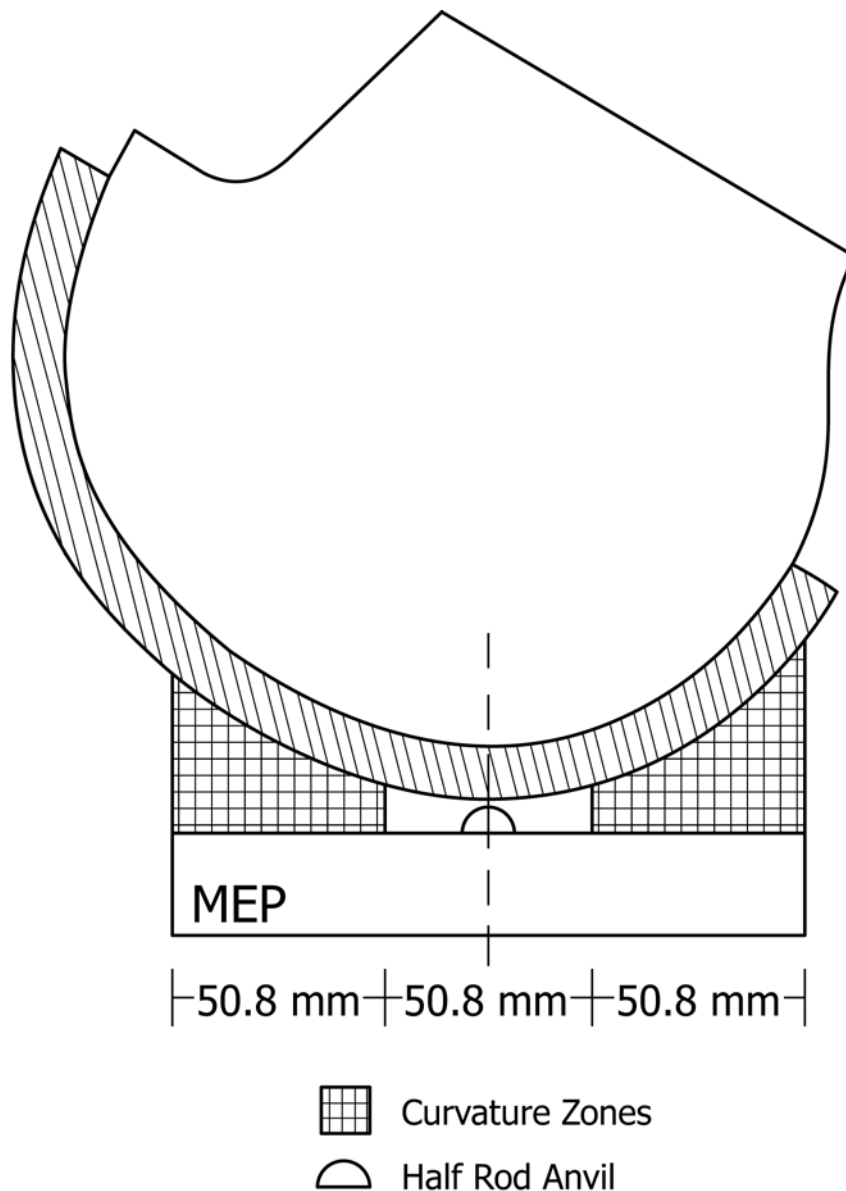


FIG. 3 Deformation Test: Dedicated Curvature Zones

contact with the anvil for any non-prescribed impact location shall be on or above the test line and at least 25 mm (0.984 in.) from any prior impact location on that headgear. The headform is positioned so that the impact location is the first point of contact with the anvil. The headgear is then placed on the headform as specified by the manufacturer’s head positioning index (HPI). The location of the non-prescribed impact locations may be identified by the arc distance along the reference plane from the anterior intersection of the midsagittal plane with the reference plane, clockwise or counterclockwise, and the perpendicular arc distance from that point on the reference plane to the non-prescribed impact location.

13.3 *Multiple Impact Locations*—For the Shock Absorption Test impact the ambient conditioned headgears three times at each of the locations described in 13.2.1. Impact the high temperature and water immersion conditioned headgears one

time at each of the locations described in 13.2.2. For the Ball Impact Test & Deformation Test only one impact is needed at each location.

#### 14. Mechanical Tests

14.1 With the headgear placed on the headform in accordance with the manufacturer’s instructions, the headgear may be impacted anywhere within the impact area. Coverage need not be continuous within the impact area, as long as the impact tests provide satisfactory results in accordance with this specification.

##### 14.2 *Shock Absorption Test:*

14.2.1 The anvil to be used for the shock absorption test is described in 8.2.4.

14.2.2 Prior to impact testing, conduct the instrumentation system checks (see Section 9).

14.2.3 The impact velocity shall be  $2.2 \pm 0.1$  m/s ( $7.2 \pm 0.3$  ft/s). The time interval between impacts shall be not less than 30 s or more than 90 s.

**14.3 Ball Impact Absorption Test:**

14.3.1 Prior to impact testing, conduct the instrumentation system checks (see Section 9).

14.3.2 The impact velocity shall be  $27 \pm 0.8$  m/s ( $88.6 \pm 2.6$  ft/s).

**14.4 Deformation Test:**

14.4.1 The anvil to be used for the deformation test is described in 8.4 (Deformation Test).

14.4.2 The impact velocity shall be  $1.5 \pm 0.1$  m/s ( $4.9 \pm 0.3$  ft/s).

14.4.3 For Type II Headgear, any components relating to the specific protective eyewear used to pass Specification **F3077** can be omitted from 14.4 (Deformation Test).

## 15. Compliance

15.1 Compliance with this standard shall be in accordance with the requirements of Section 6 – Certification of Test Methods **F1446**.

## 16. Product Marking

16.1 Headgear shall bear the following visible and permanent (marked so as not to become unidentifiable with normal use) markings.

16.1.1 Manufacturer's identity,

16.1.2 Headgear model identity, and

16.1.3 A date code with week and year of manufacture.

16.2 A label or tag bearing the following information shall be securely attached to or accompany, each headgear at the time of sale. If packaged, this information can be placed on the packaging.

16.2.1 A warning stating that if the headgear is severely impacted, short of failure, then the degree of protection provided will be reduced and the headgear must be replaced. Failure to do so may result in permanent injuries;

16.2.2 A warning stating to the user that “no headgear can protect against all foreseeable impacts and that for maximum protection”, the headgear must be fitted and attached properly to the wearer's head in accordance with the manufacturer's fitting instructions; and

16.2.3 Cleaning, fitting, and inspection information to be recommended by the manufacturer.

16.2.4 With Type I Headgear, a statement of use and fit instructions on how to properly select, fit, and wear eye protection meeting Specification **F3077** with the headgear. With Type II Headgear, eye protection information for that which is integrated into the product.

16.3 A clear statement on the product shall state that the headgear has been tested and is in compliance with ASTM Specification F3137.

## 17. Precision and Bias

17.1 No statement is made about either the precision or the bias of the tests defined in this specification since the result merely states whether there is conformance to the criteria for success specified in the procedure.

## 18. Keywords

18.1 ball impact; protective headgear; stick impact; women's lacrosse

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