

**STANDARD METHOD OF IMPACT TEST AND
PERFORMANCE REQUIREMENTS FOR
FOOTBALL FACEGUARDS**

NOCSAE DOC ND087-18m18

Prepared by



**NATIONAL OPERATING COMMITTEE ON
STANDARDS FOR ATHLETIC EQUIPMENT**

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1. Scope

- 1.1. This Standard establishes methods of testing and performance requirements for new football faceguards as supplied by manufacturers. The requirements of this standard shall be subject to Level 3 compliance criteria unless otherwise stated herein.
- 1.2. **All testing and requirements of this standard specification must be in accordance with NOCSAE DOC 001, except where modified herein.**
- 1.3. *This standard does not purport to address all of the safety problems, 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. NOCSAE DOC (ND) 001: *Standard Test Method and Equipment Used in Evaluating the Performance Characteristics of Headgear/Equipment*

3. Purpose

- 3.1. To test new faceguards and attachment system to determine their fit, deflection, strength, suitability of guard and attachment design and materials, and shock absorbent properties, recognition is made that the chinstrap system is part of this system.

4. Requirements

- 4.1. Faceguards must be tested on a helmet that meets the NOCSAE football helmet standard.
- 4.2. Faceguards must be tested on every helmet model that the faceguard is intended to fit.

5. Performance

- 5.1. When an impact attenuation test is conducted in accordance with section 8, the Severity Index (SI) is defined as:

$$SI = \int_0^T A^{2.5} dt$$

Where: A is the instantaneous resultant acceleration expressed as a multiple of g (acceleration of gravity); dt are the time increments in seconds; and the integration is carried out over the essential duration (T) of the acceleration pulse.

- 5.2. The faceguard shall not contact the face during the 13.89 ft/s drop as determined by carbon paper transfer, electrical contact of any equivalent technique, according to requirements of section 8. Contact with the chinstrap/chin cup shall be a failure, however, if the model passes with the thinnest chinstrap/chin cup offered by the manufacturer for that helmet faceguard combination but makes contact on thicker chinstrap/chin cup options for that helmet faceguard combination that shall not be judged as a failure.
- 5.3. The faceguard or any of its component attachment parts shall not fail in terms of cracked welds, broken screws, broken T nuts, strap tears or pull-outs, according to requirements of section 8.

- 5.4. The headgear must meet in addition to the above requirements the following;
 - 5.4.1. 1200 SI shall not be exceeded on any drop.
 - 5.4.2. No structural failure allowed, e.g.: fracture or cracked weld or broken attachment on any drop this includes chin strap systems.
- 5.5. The standoff measurements for both the nose and chin obtained in Section 8.1.1 shall not exceed 2.75 inches (70 mm).
- 5.6. The peak force shall not be less than 550 lbs. force and there shall be no mechanical failure resulting in an exposed material end when tested to the requirements of section 9.

6. General

6.1. Labeling

- 6.1.1. Each faceguard shall be reasonably permanent and legibly labeled in a manner such that the following information can be easily read.

- 1. Name of Manufacturer
- 2. Model
- 3. Month and Year of Manufacture
- 4. "SEI Certified, Meets NOCSAE Standard®"

- 6.1.2. The manufacturer shall make publicly available a list of NOCSAE compliant helmet models on which the faceguard has been tested and certified as meeting this Standard Performance Specification.

NOTE: You must have an executed, valid license agreement with NOCSAE to use any of the NOCSAE logos at any time. NOCSAE, the NOCSAE seals/logos, and the National Operating Committee on Standards for Athletic Equipment are registered marks and the exclusive property of the Committee. Use of the marks in any manner is prohibited without prior written permission of the NOCSAE Board of Directors.

- 6.2. The choice of components shall be such as to combine mechanical strength and durability to impact loading over a temperature range from 0°F (-17°C) to 120°F (49°C). And shall be unlikely to fracture, delaminate or become broken, dislodged or separated in a manner that could result in a sharp object presentation that may induce injury.
 - 6.2.1. Components in mounting systems shall be compatible with one another. Mounting system components should not undergo significant loss of strength or other physical change as a result of contact with perspiration, blood, oil or grease from wearer's hair, or from exposure to ultra-violet rays.
 - 6.2.2. Finishes: All components shall be well finished and free of sharp edges and other irregularities which would present the potential hazards of scratching and cutting the user or an opposing player. Wire or metallic tubular protectors shall have protective coating.
 - 6.2.3. Attachment System: The method of attaching the faceguard to the helmet shall be such as to prevent the faceguard disengaging while under load and in use and in such a way as to minimize static distortion of attachment straps and helmet.

- 6.2.4. Faceguards which have overlapping structures within the facial cutout of the shell, and do not have a structural terminus on the inner surface, shall be tested in accordance with section 8.
- 6.2.5. Faceguards not constructed in accordance with 6.2.4 shall be tested in accordance with section 8 and shall also be subjected to a rigid mount deformation test in section 9.
- 6.2.6. All faceguard ends will be terminated with a full radius.
- 6.2.7. Should the guard's lower perimeter fall completely above the chin measurement location described in section 8.1 at the extents of typical fitting as determined by the technician, then that guard cannot be certified.

7. Reports

- 7.1. See Section 14, NOCSAE DOC 001.

8. Drop Test Procedures

Before subjecting a faceguard to the drop test series, prepare it as follows:

- 8.1. **Helmet Drop Test Positioning:** Attach a new faceguard to any size 7¼ helmet that meets the NOCSAE standard for football headgear for which the guard is designed, using attachment equipment and procedures specified by the manufacturer of the faceguard. Prior to each drop, fit the helmet on the standard medium sized headform such that the ear holes are concentric with the model ear index holes and the front rim is located with the HPI supplied by the manufacturer of the helmet or according to the helmet manufacturer's fitting instructions. The head model and helmet shall be dry to maximize friction. Secure the helmet with the chinstrap and procedure specified by the manufacturer. Measure and record the distance from nose and chin of the model in the midsagittal plane, and the inside surface of the faceguard (standoff distance). The helmet shall be positioned within the extents allowed by the manufacturers fitting instructions so that the standoff measurements can be investigated to ascertain if both nose and chin distances can be adjusted to less than 2 ¾ inches (70 mm) which shall be the position used for impact testing. Note that if the manufacturer supplies a HPI then the measurements shall be made at that position only.
 - 8.1.1. **Measurement Points and Procedure:** The nose and chin points are located on the midsagittal plane on the face of the headform distal from the coronal plane. The nose point is 0.650" below the basic plane on the medium headform; the chin point is located 3.400" below the basic plane on the medium headform. See figure 1 NOCSAE DOC 001. Faceguard standoff measurements will be made parallel to the basic plane to the inside surface of the guard. Should the guard not have a surface on the line projected from the measurement spot toward the faceguard then a surface shall be created using a material that is able to conform to the inside surface of the guard components adjacent to the measurement points in a way that will provide a reference surface at the desired point for the measurement. The thickness of this measurement aid should be as thin as practical and will be accounted for in the measurement so that a very close approximation ± .025" of the true measure of the stand-off distance is obtained. For headforms with an

indicator groove molded in to locate the midsagittal plane, measurements may be made from the immediately adjacent surface so as to avoid the measurement probe from engaging the depth of the groove, or the groove may be filled with a material to prevent the probe from entering. In either case the measurement point on the headform must be flush with the surface of the outward edges of the groove.

8.2. Conditioning

Immediately prior to the testing sequence, condition the helmet in accordance with the following procedures:

- 8.2.1. Ambient Conditions: Exposed to $72^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($22.2^{\circ}\text{C}, \pm 2.8^{\circ}\text{C}$), for at least four hours and a maximum of twenty-four (24) hours.
- 8.2.2. High Temperature: Exposed to a temperature of $120^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($49^{\circ}\text{C} \pm 2.6^{\circ}\text{C}$), for at least four hours and a maximum of twenty-four (24) hours.
- 8.2.3. Low Temperature: Exposed to temperature of $0^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($-17.8^{\circ}\text{C} \pm 2.2^{\circ}\text{C}$), for at least four hours and a maximum of twenty-four (24) hours.
- 8.2.4. If during testing, the time out of the conditioning environment exceeds five minutes, return the sample to the conditioning environment for a minimum of three minutes for each minute out of the conditioning environment or four hours, whichever is less, prior to resumption of testing.

8.3. Test Conditions

- 8.3.1. Head Model: Physical properties of the NOCSAE headforms are defined in NOCSAE DO. 001.
- 8.3.2. Mechanical Test System: A diagram of the helmet drop test system to be used in these tests is defined in NOCSAE DOC 001

8.4. Impact Attenuation Tests

- 8.4.1. Surface: Impact attenuation is measured by determining the head model resultant center of gravity acceleration-time history when the head model/helmet/face guard assembly is dropped in guided free-fall to land with the guard striking a flat, rigid MEP (see appendix in NOCSAE DOC 001 for faceguard MEP specifications)¹.
- 8.4.2. Drop tests shall be conducted on a separate sample for each of the impact locations, in each of the three temperature conditions, in each of the faceguard sizes offered for sale to fit size 7 ¼ helmets². It is permissible to restore the shape and re-use guards for subsequent tests after completion of a series at any location. If a guard fails a test after such restoration, the test

¹ The NOCSAE football drop test anvil with the Standard helmet pad replaced by the faceguard pad, will serve as the impact surface. Elevation by pedestal is necessary to provide clearance for the head model position adjuster for other than front drops.

² Large size faceguards shall be tested on helmets, which encompass the 7 ⅜– 7 ⅞ size range, shimmed or pressurized in the rear or side to fit the medium head model.

must be repeated using a new sample. Two of each guard in each size must pass each test in order for model certification. Time interval between drops in a single location will be 75 ± 15 sec (this is primarily to allow the helmet to restore its shape and provide a consistent format).

- 8.4.3. Faceguards shall be impacted in accordance with Table 1 below and as depicted in Figure 1. All faceguards shall be drop tested at the Front impact location. Only faceguards that meet the requirements of 8.4.4 below shall be impacted at the Bottom impact location.
- 8.4.4. Bottom Impact Location: Complete the following steps to determine if faceguards require drop tests on the bottom location.
 - 8.4.4.1. Fit the helmet onto the headform as described in section 8.1.
 - 8.4.4.2. Adjust the drop fixture so it is placed in the Bottom Impact Location position. Pin locations for this position are shown in Figure 1.
 - 8.4.4.3. Extend a perpendicular line that originates from the top surface of the MEP. This line shall terminate at the center of the lowest point of the chin of the headform. If the surface that is created by and contained within the perimeter of the faceguard intersects the perpendicular line, the faceguard shall be subjected to Bottom Location impacts.

Table 1
LOCATION³ – DROP velocities – ft/s (m/s)
 (All drop velocities must be within +3% -0%)

	Front	Bottom
72°F ± 5°F (22.2°C ± 2.8°C)		
Drop 1	13.89 (4.23)	13.89 (4.23)
Drop 2	17.94 (5.46)	17.94 (5.46)
120°F ± 5°F (49°C ± 2.6°C)		
Drop 1	17.94 (5.46)	
0° ± 5°F (-17°C ± 2.0°C)		
Drop 1	17.94 (5.46)	

9. Rigid Mount Deformation Test

- 9.1. Two additional untested faceguards must be submitted for this test.
- 9.2. Condition the faceguard to be tested at ambient laboratory temperature for a minimum of four hours prior to testing.
- 9.3. Create a test jig (see figure 2) that will allow the faceguard to be held as rigidly as possible using mounting locations as close to the helmet mount locations as reasonably possible.
- 9.4. Place the test jig with rigidly mounted faceguard in a suitable compression test device capable of a crosshead speed of at least 10 inch per minute.

³ See Figure 1 for picture guides to positions.

- 9.5. Use an approximate 1-inch diameter flat steel face plunger, align the rigidly mounted faceguard so that the plunger compresses the apex of the faceguard.
- 9.6. Compress the faceguard with a crosshead speed of $10 \pm 3\%$ inches per minute so as to deflect the outside apex of the guard inwards until the deflection distance reaches a total of not less than 3 inches.
- 9.7. Record the resultant peak pounds force and total deflection of the guard.

10. Recertification Procedure For Metal Faceguards

- 10.1. Only those guards which have been previously certified by a manufacturer to have met the NOCSAE Standard may be recertified.
- 10.2. In the reconditioning process, all faceguards must be removed from the helmet for inspection.
 - 10.2.1. Deformed guards must be discarded. Any bar bent more than 1/8 inch (3.2 mm) from its normal shape at any point constitutes deformation.
 - 10.2.2. Each guard is inspected for weld separation, or other crack, by an appropriate non-destructive test. Any guard found with either type failure shall be discarded.
- 10.3. For guards to be re-coated the following specifications must be met:
 - 10.3.1. The method employed to remove old coating/residue must not compromise the integrity of the guard.
 - 10.3.2. A permanent seal of recertification identifying the re-certifier. The appropriate labels must be affixed in the same location as placed by the original manufacturer.
 - 10.3.3. The guard is to be re-attached to a helmet, in the same manner as the original faceguard manufacturer's instructions.
 - 10.3.4. A statistically relevant sample⁴ of remanufactured faceguards must be tested according to NOCSAE Standard certification procedure for football faceguards, to provide assurance that all guards that have undergone the recertification process meet the Standard. This will be limited to ambient temperature drops. One impact at 13.89 ft/s on the front to verify no facial contact and one impact from 17.94 ft/s, in the front location to verify no SI over 1200 and no mechanical failure as outlined above.
 - 10.3.5. If a faceguard contacts the face during the 13.89 ft/s drop, determine if the attachment hardware and attachment locations on the helmet are according to section 8.3.3. If not, correct and repeat the test on a fresh guard. If the guard still contacts the face, do not re-certify any guards of that model until the problem is understood and corrected. The stipulation $SI \leq 1200$, must be

⁴ Samples in a sufficient amount in any model so as to insure compliance of all faceguards being reconditioned. Guidance as to how many to test is provided in NOCSAE Doc 001.

met in each test, guard models that fail to limit SI to less than 1200 must not be recertified.

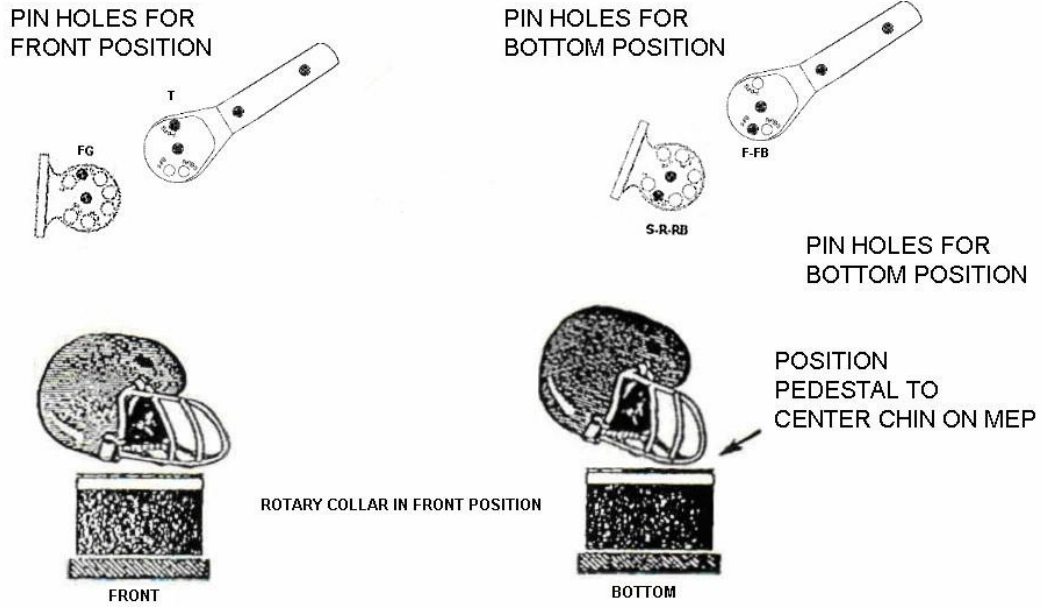


Figure 1

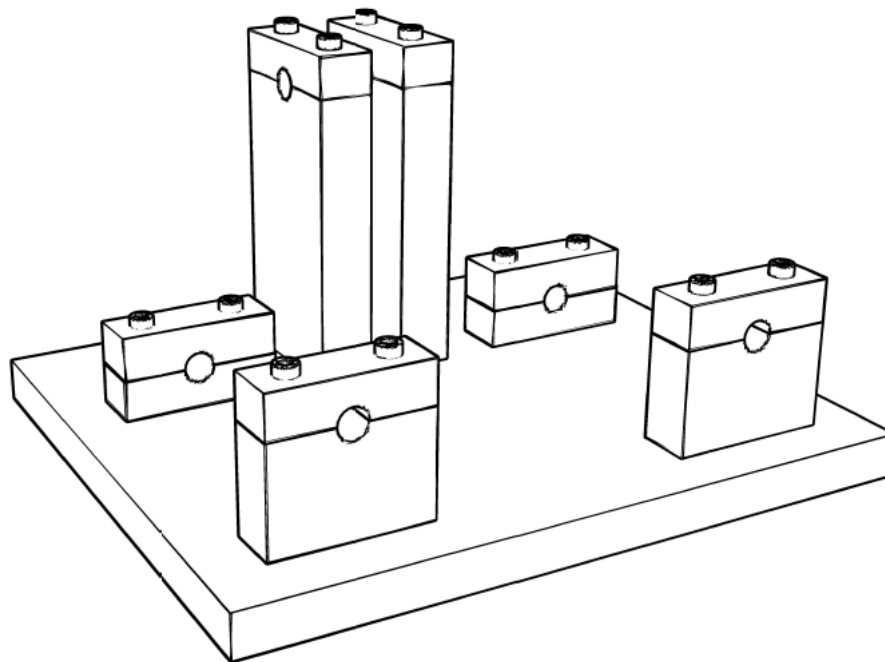


Figure 2

The Faceguard Test Jig shall be configured and dimensioned appropriately so as to rigidly hold the guard in a manner that uses similar attachment points as when the guard is mounted to a helmet.

JULY 2009 MODIFICATIONS/REVISIONS

- REVISION: Specified that chinstrap and associated hardware are subject to the requirements in section 5
- REVISION: Changed section 7 to clarify faceguard to face measurement procedure.
- Modified sections 8.3.4 and 8.3.5 to clarify SI requirements

DECEMBER 2009 MODIFICATIONS/REVISIONS

- Modified conditioning environments to conform with NOCSAE DOC 001 requirements

MAY 2010 MODIFICATIONS/REVISIONS

- REVISION: Changed bottom impact location. Modified figure 1 to specify pinhole locations. Changed requirements for bottom impact location. Deleted faceguard types.

FEBRUARY 2011 MODIFICATIONS/REVISIONS

- REVISION: Change drop heights to drop velocities. Corrected typos

MAY 2012 MODIFICATIONS/REVISIONS

- REVISION: section 5.2, chin cup contact and section 6.2.6, faceguard coverage requirement
- Added labeling requirement in section 6, for model identification
- Added statements to clarify sections 7.1 and 7.4

SEPTEMBER 2014 MODIFICATIONS/REVISIONS

- Added reference to ND001 for faceguard MEP specifications
- Clarified section 8.3.2
- Corrected typo in section 8.3.5

OCTOBER 2014 MODIFICATIONS/REVISIONS

- Updated document to include level of compliance requirements.
- Added Date specification becomes effective
- Updated title name of NOCSAE DOC. 001
- Added SEI Certification NOCSAE Logo to Section 6.1, "Labeling"

JUNE 2015 MODIFICATIONS/REVISIONS

- Updated NOCSAE seal/logo artwork

JANUARY 2017 MODIFICATIONS/REVISIONS

- REVISION: Increased low temperature conditioning requirement to 0°F from -20°F.
- Clarified 8.4.4 for bottom impact location requirement
- Clarified maximum standoff requirement
- Added section requiring a list of compatible helmets on which faceguard has been tested.

JUNE 2017 MODIFICATIONS/REVISIONS

- Changed the word “specimen” to “sample” in Section 8.4.2.
- Changed the word “model” to “sample” in Section 8.4.2.

JULY 2017 MODIFICATIONS/REVISIONS

- Section 5.3 – Changed reference from section 7 to section 8.

FEBRUARY 2018 MODIFICATIONS/REVISIONS

- REVISION: Added provision to address alternative faceguard design and added a test method and performance criteria to evaluate those designs
 - Changed section 6.2.4
 - Added section 6.2.5 to address multiple faceguard design requirements
 - Added section 5.6, requirements for deformation test
 - Added section 9, Rigid Mount Deformation Test procedure
- Removed material skin disease language
- Corrected typos and reformatted document
- Added Figure 2