

**LABORATORY PROCEDURAL GUIDE
FOR CERTIFYING NEWLY MANUFACTURED
PROTECTORS FOR COMMOTIO CORDIS**

NOCSAE DOC (ND) 201 – 21

Prepared By



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ON STANDARDS FOR ATHLETIC EQUIPMENT**

Modified June 2021

TABLE OF CONTENTS

Scope	1
Referenced Documents	1
Test Equipment Required	1
Laboratory Environment	2
Chest Protector Preparation	2
Sample Selection.....	3
Testing Procedure for Certification.....	3
Reports	4
JUNE 2021 MODIFICATIONS/REVISIONS	5

1 Scope

- 1.1 This procedural guide establishes recommended practices for the certification of chest protectors to commotio cordis.
- 1.2 **All testing and requirements of this standard specification must be in accordance with NOCSAE DOC 200, NOCSAE DOC 021, and NOCSAE DOC 001.**
- 1.3 *This recommended practice 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 recommended practice 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) 200: *Standard Test Method and Performance Specification Used in Evaluating the Performance Characteristics of Protectors for Commotio Cordis*
- 2.2 NOCSAE DOC (ND) 021: *Standard Projectile Impact Test Method and Equipment Used in Evaluating the Performance Characteristics of Protective Headgear/Projectiles*
- 2.3 NOCSAE DOC (ND) 001: *Standard Test Method and Equipment Used in Evaluating the Performance Characteristics of Headgear/Equipment*

3 Test Equipment Required

- 3.1 NOCSAE Thoracic Surrogate (NTS) comprising three 750 lb-f maximum capacity single axis load cells.
- 3.2 Air Cannon Assembly with Linear Bearing Table (See NOCSAE DOC 021, Figures 1 and 2)
- 3.3 Impact targeting device accurate within ¼ inch
- 3.4 Data acquisition capable of capturing and recording the cardiac load cell traces.
- 3.5 Baseball or lacrosse ball that complies with the requirements of Section 13, NOCSAE DOC 200. Projectile selection shall be determined by the manufacturer and shall be appropriate for the chest protector's intended activity.
- 3.6 Miscellaneous hand tools

4 System Set-up

- 4.1 The NTS must be tightly connected to a free sliding linear bearing table.
- 4.2 Position the NTS so the base of the surrogate is perpendicular (± 2.5 degrees) to the projectile's line of travel.
- 4.3 Verify the response of the NTS by performing the procedure in Appendix 1 of NOCSAE DOC 200.

5 Laboratory Environment

- 5.1 Expose chest protectors to ambient laboratory environment for a minimum of four hours.

6 Chest Protector Preparation

6.1 General Preparation

- 6.1.1 Note the stated Torso Length provided by the manufacturer of the individual the submitted model/size is intended to fit.

- 6.1.1.1 If the size of the primary protective component remains constant for all model/sizes, confirm that submitted samples include the longest Torso Length of the individual the model is intended to fit.

- 6.1.2 The manufacturer's fitting instructions shall be used to fit the chest protector to the NTS. In the event that these instructions are unclear or result in a fit that is likely to yield erroneous test results, the technician may choose to adjust the fit of the chest protector or suspend the test until the fit issue is resolved.

- 6.1.2.1 The manufacturer may provide additional positioning information by including a chest protector positioning index. If provided, the positioning index shall be used instead of the fitting instructions. Note that the final decision as to reasonableness of fit rests with the test technician/laboratory.

- 6.1.3 Sections that are not critical to the performance of the chest protector may be removed to facilitate a proper fit.

- 6.1.4 A "shim" may be used to take up space between the chest protector fitting system and the back of the NTS to facilitate a proper fit.

- 6.1.5 Chest protectors used for testing must be selected in a random manner.

6.2 Marking the Impact Area (Extent of Protective Coverage)

- 6.2.1 Fit the chest protector onto the NTS using the provided fitting instructions or positioning index.

- 6.2.2 Using the targeting device, locate the center of the cardiac silhouette and mark this location onto the exterior surface of the chest protector.

- 6.2.3 Remove the chest protector from the NTS and lay it on a smooth, flat surface with the exterior surface of the chest protector facing upwards. The chest protector is to be positioned as flat as practical but shall not be deformed from its intended shape or natural curvature.

- 6.2.4 The Torso Length noted in 6.1.1 above is used to determine the radius of the test impact area.

- 6.2.4.1 For Torso Lengths of 13.5 inches or less, the radius is 1.75 inches

6.2.4.2 Torso Lengths of more than 13.5 inches and less than 16.0 inches the radius is 2.0 inches.

6.2.4.3 Torso Lengths of 16.0 or greater the radius is 2.25 inches.

6.2.5 Using the location marked in 6.2.2 as the center, draw the test line on the chest protector using the appropriate radius noted in 6.2.4. The radius shall be projected from the center mark such that it remains parallel to the flat surface.

6.2.5.1 One method that can be used to mark the test line is using a Beam Compass with the tip holder end held perpendicular to the flat surface at the center and the drawing end held perpendicular to the flat surface. A series of dashes is made by rotating the Beam Compass and raising or lowering the drawing end as appropriate.

7 Sample Selection

- 7.1 See Section 11, NOCSAE DOC 001
- 7.2 Each certifier must test an adequate and representative sample size to be reasonably sure that chest protectors released to use, but not actually tested, will meet the requirements as set out in NOCSAE DOC 200.
- 7.3 Certifiers may be faced with processing chest protectors manufactured from variable raw materials. Sample selection must be random yet demonstrate that raw material variabilities have been accounted for.

8 Testing Procedure for Certification

- 8.1 Perform the pre-test impacts to the unprotected NTS as described in Section 11 of NOCSAE DOC 200.
- 8.2 Each submitted chest protector selected for testing must be tested at the center of the cardiac silhouette ($\pm \frac{1}{4}$ inch) and two random locations at either 30 mph or 50 mph ($\pm 3\%$).
 - 8.2.1 Random Locations are selected within the Extent of Coverage and the initial point of contact is at least 1 inch away from any previous impact.
 - 8.2.2 The chest protector is shifted on the NTS so that the targeting system lines up with the chosen random impact site. After shifting, the chest protector fitting system may need to be adjusted to create a reasonable impact scenario. For example, if the chest protector interior surface is in contact with the Cardiac Silhouette padding of the NTS when following Section 6, the test technician shall try to reproduce this setup for the random impact location if possible.
- 8.3 Prior to each test, position the NTS such that the impact site is located within 24 inches from the point that the projectile is in free flight.
- 8.4 Testing may begin at any location or velocity with the same target velocity used for each impact conducted on a single chest protector. It is not necessary to complete all impacts on a given sample before removing the sample from the NTS.
- 8.5 Once all tests have been completed, perform the post-test impacts to the unprotected

NTS as described in Section 11 of NOCSAE DOC 200. The pre-test and post-test system check peak force values (lb-f) must be within 7% to validate the test results.

9 Reports

9.1 All reports must comply with Section 14 of NOCSAE DOC 001.

JUNE 2021 MODIFICATIONS/REVISIONS

- Added requirement of manufacturer specified torso length.
- Clarified fitting of the chest protector to the NTS.
- Added procedure to mark the impact area.