STANDARD TEST METHOD AND SPECIFICATION USED IN EVALUATING THE CORROSION CHARACTERISTICS AND EFFECTS ON METALLIC HARDWARE DISASSEMBLY

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NATIONAL OPERATING COMMITTEE
ON STANDARDS FOR ATHLETIC EQUIPMENT

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1. **Scope**

1.1. This standard test method and specification describes laboratory equipment, test methods and performance requirements pertinent to corrosion testing metallic hardware. It is hoped this standard will facilitate emergent access to an injured player. Method 1 is likely to be successful in most situations but if compliance to the requirements cannot be determined, method 2 shall be used.

1.2. *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. STANDARD TEST METHOD AND EQUIPMENT USED IN EVALUATING THE PERFORMANCE CHARACTERISTICS OF HEADGEAR/EQUIPMENT, NOCSAE DOC.001.

3. **Sample Size**

3.1. A statistically relevant sample must be tested, see NOCSAE DOC ND001 section 11.

3.2. For any standalone test report; at least twelve (12) sets of hardware must be submitted. Three randomly selected sets of hardware will be subjected to the corrosion test and three randomly selected sets are used as control samples for comparative purposes. A total of six sets per test method used is required.

4. **Corrosion Test**

4.1. Sample Preparation (including control set)

4.1.1. Note the manufacturer instructions or standard technique(s) required to assemble and unassembled the hardware as applicable before cleaning and corrosion testing.

4.1.2. Metallic components must be immersed and agitated in isopropyl alcohol (91%) for no less than 15 seconds, and allowed to air dry at ambient laboratory temperature, 72° F, ± 5° F (22° C, ± 2° C) for a minimum of one hour prior to testing. If the part does not appear to be free of surface lubricants or temporary preservatives or other foreign matter that may affect the test, then addition immersion and mechanical cleaning with a non-metallic brush or cloth must be used.

4.1.3. Forceps, gloves or an equivalent device must be used to handle the metallic parts after they have been immersed/cleaned so as to not transfer foreign matter to the samples.

4.2. Hardware Assembly/Operation

4.2.1. Hardware shall be assembled following manufacturer's instructions if available or standard assembly technique(s) as intended for use prior to submersion. For example, t-nuts and fasteners shall be placed through a shell opening (a suitable size of shell surrounding the opening shall be used) and fastened through

washers, hangers or other hardware as designed for use in attaching components to headgear/equipment.

4.2.2. Method 1 (used first):

4.2.2.1. Particular attention must be taken to the ease (or difficulty) of assembly/operation of the hardware. The ease/difficulty of assembly/operation shall be described in the report.

4.2.2.2. If a set appears more difficult to assemble/operate than the others, that set shall be set aside and a new one selected from the submitted samples.

4.2.3. Method 2 (This method is used if compliant results of method 1 are undetermined.):

4.2.3.1. The amount of force used to assemble/operate the hardware must be noted. For example, the amount of torque applied to a screw is determined and recorded. The force(s) required to assemble/operate the set shall be described in the report.

4.2.3.2. If a set requires a force greater than 15% to assemble than the others, that set shall be set aside and a new one selected from the submitted samples.

4.2.4. If for any reason two complete sets of six hardware cannot be assembled without meeting the requirements in 4.2.2.2 or 4.2.3.2 above (depending on method used), the test is to be aborted and the hardware declared defective.

4.2.5. The three sets of hardware used as control sets per method shall be stored in a sealed, vented container away from any corrosive material in a controlled ambient laboratory environment.

4.3. Submersion (Both Methods)

4.3.1. Obtain a minimum of 0.500 L saline solution, which is made with a ratio of 4 - 6% (by weight) table salt and warm (approximately 98 ºF) sodium-free distilled water; agitate solution until all salt appears to be dissolved, there should be little or no sediment. To the saline solution just prior to using add an appropriate amount of 3% solution of hydrogen peroxide, to obtain an 8 – 10% (by weight) solution of hydrogenated saline solution.

4.3.2. Assemblies/components shall be submerged in the hydrogenated saline solution and placed in a nonmetallic chemically inert, lidded container. The metallic parts shall be totally covered by the saline solution. Hardware that is not intended to be joined shall be isolated from one another while submerged.

4.3.3. The lidded container, to reduce evaporation but not allow pressure buildup, shall be placed in a 120 ± 5 ºF environment for 120 ± 4 hours. If evaporation to the point of exposing any part of any test component occurs, the test shall be invalid. Solution may not be added to the container during the test.

4.3.4. The hardware shall then be removed from the hydrogenated saline solution and allowed to air dry at ambient laboratory temperature for a minimum of 48 hours not to exceed 50 hours prior to inspection. The hardware shall be inspected within 4 hours after the conclusion of the air drying time. Discard the used solution in an appropriate manner.

4.4. Inspection of Hardware

4.4.1. The metallic parts will be visually inspected for signs of corrosion and pitting under ordinary light using a low magnification glass (i.e. 10x loop or less) if necessary to determine the extent of corrosion and pits that may have formed in the metal. A probe may be used to investigate the extent of any pits that occur in a coating or plating to determine if the pits extends into the base material. Results of the examination are reported as simple comments and are not part of the performance criteria.

4.4.2. Method 1:

4.4.2.1. Verify that the hardware functions in the manner intended after exposure to the hydrogenated saline solution. This can be determined by observing the ease/difficulty required to disassemble/operate the hardware of the control set as compared to the ease/difficulty required to perform the same operation on the test set after submersion exposure and air drying.

4.4.3. Method 2:

4.4.3.1. Verify that the hardware functions in the manner intended after exposure to the hydrogenated saline solution. This must be determined by observing the force(s) required to disassemble/operate the hardware of the control set as compared to the force(s) required to perform the same operation on the test set after submersion exposure and air drying.

4.5. Performance Requirements

4.5.1. For Method 1:

4.5.1.1. Using the instructions and tools provided by the manufacturer or standard disassembly techniques, the control and test samples shall disassemble in a similar manner as determined by the test technician.

4.5.1.1.1. The test technician may use perceived effort, disassembly time, or a measurable quantity such as force or torque to compare the control and test samples.

4.5.1.2. Hardware that functions in a manner that results in perceived differences that creates difficulty in the disassembly/operation of the hardware between the control set and the test set constitutes an inconclusive test. Method 2 must be used to determine compliance.

4.5.2. For Method 2:

4.5.2.1. Hardware that functions in a manner that results in a difference of less than 20% of the force(s) required in the disassembly/operation of the hardware between the control set and the test set constitutes a compliant test.

4.5.2.2. Hardware that functions in a manner that results in a difference of 20% or greater of the force(s) required to assemble/operate the hardware to the disassembly/operation of hardware between the control set and the test set constitutes a failure (noncompliance).

5. **Reports**

5.1. See NOCSAE DOC ND001 section 14

5.1.1. The observed ease/difficulty of assembly/operation in section 4.2.2

5.1.2. The observed force(s) of assembly/operation in section 4.2.3

5.1.3. Results of visual inspection performed in section 4.4.1.

5.1.4. Results of hardware function performed in section 4.4.2.

5.1.5. Results of hardware function performed in section 4.4.3. if conducted.

MAY, 2009 MODIFICATIONS/REVISIONS

- Modified section 5.2.1 and 5.4.1 for clarity

OCTOBER, 2014 MODIFICATIONS/REVISIONS

- Updated title name of NOCSAE DOC. 001

JANUARY, 2015 MODIFICATIONS/REVISIONS

- ***Revision-*** Added two methodologies to specification for testing samples.
- Modified Scope section 1.1 to include methods of testing
- Deleted section Definitions, Definition of Hardware in ND001
- Modified Sample Size 3.1 and 3.2 to require 24 sets, 3 random control sets and 3 random test sets
- Added use of gloves to section 4.1.3
- Added section 4.2 Hardware Assembly/Operation and divided procedure for Method 1 and Method 2
- Added time tolerances to sections 4.3.3 and 4.3.4
- Added sections 4.4.2 and 4.4.3, methods to disassemble/operate hardware for methods 1 and 2
- Added sections 4.2.4 and 4.2.5, Instructions for handling sample sets
- Added sections 4.5.1 and 4.5.2, Performance Requirements
- Updated Report requirements section 5

AUGUST, 2016 MODIFICATIONS/REVISIONS

- Modified section 4.5.1.1 to clarify performance requirement.
- Modified section 3.2 sample submission quantity.