TROUBLESHOOTING GUIDE FOR TEST EQUIPMENT AND IMPACT TESTING

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ON STANDARDS FOR ATHLETIC EQUIPMENT

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1 Scope

This operation and troubleshooting guide addresses potential problems that may be encountered while utilizing NOCSAE Drop Test equipment.

2 Referenced Documents

2.1 STANDARD DROP TEST METHOD AND EQUIPMENT USED IN EVALUATING THE PERFORMANCE CHARACTERISTICS OF PROTECTIVE HEADGEAR, NOCSAE DOC.001.

2.2 STANDARD PROJECTILE IMPACT TEST METHOD AND EQUIPMENT USED IN EVALUATING THE PERFORMANCE CHARACTERISTICS OF PROTECTIVE HEADGEAR/PROJECTILES, NOCSAE DOC.021.

2.3 Performance Specifications or Procedural Guides that may reference NOCSAE DOC.001.

3 Significance and Use

The purpose of this operation and troubleshooting guide is to provide aid to users of NOCSAE drop test equipment and associated data acquisition systems. It is based on experience and reported difficulties and will be updated as needed[1].

4 Severity Index Computer - KME series 200

4.1 The severity index computer should be turned on for a minimum of forty-five minutes prior to using. It is necessary to have all NOCSAE equipment, including the Severity Index Computer stabilized at 72 F° ± 5 F° (22 C°, ± 2 C°) for a minimum of four hours prior to using. Temperatures lower than the specified range may cause the severity index computer to perform erratically during operation.

4.2 While performing the pulse through procedure, make sure that the polarity of the banana plug connectors are maintained. Crossing from the positive to the negative poles will cause the severity index computer to give incorrect readings. Be certain to remove all banana plug connections before attempting any drop tests.

4.3 When making adjustments on the computer use 1/8 to1/4 turns on the potentiometer and note the direction of rotation; this will cut down on overshooting of target values.

[1] This document has been prepared and is maintained by Southern Impact Research Center (SIRC). For technical assistance or the latest revision to this document, call SIRC.

4.4 If you're using a KME 200 SI Analyzer, pulse through the computer several times at each voltage before making adjustments to the computer. The first few pulse throughs may give erroneous readings. If there appears to be incorrect severity index readings, perform a quick check pulse through of the Severity Index Computer at the 1.42v DC level (1200 SI and 142 Peak g) to confirm computer operation. This is accomplished by jumping (with banana cable) from Dycal to Channel Y and reading volts with DVM connected to analog output. Adjust Dycal to get 1.42v DC; do not adjust Y potentiometer as this will effect headform calibration. Once you have achieved 1.42v DC, set Dycal to pulse and pulse through in the normal manner.

5 **Headforms**

5.1 The center bolt, located inside the headform interface assembly on the headform should be tightened to 180 in-lbs (15 ft-lbs). Check for tightness before each use of headform. The four nuts holding the collar to the headform interface assembly should be checked for tightness also; lock washers should be used to maintain tightness during use of headforms.

5.2 To prevent breakage, in addition to the other steps passed on to you in the past, to prevent headform, or headform coupler breakage, we recommend you also take these steps with any new or repaired headform you receive:

5.2.1 Torque to 15 ft-lbs (180 in-lbs) prior to the first calibration drop.

5.2.2 After calibrating in the front position, re-torque prior to calibrating in the side position.

5.2.3 After calibrating in the side position, re-torque prior to calibrating in the top position.

5.2.4 After calibrating in the top position, re-torque prior to performing post-calibration checks.

5.2.5 After performing the post-calibration checks, re-torque prior to testing.

5.2.6 During testing, re-torque every hour.

5.2.7 Keep re-torquing until you are satisfied that the coupler is permanently seated and it is "always" at 15 ft-lbs (180 in-lbs) each time you check.

5.2.8 Repeat 5.2.1 through 5.2.7 each time you use the headform unless you see it has not loosened up.

5.3 The headforms may leak, especially when new, a small amount of an oil like fluid; this is normal during use. However if a large amount of fluid (more than 2 Tablespoons) is observed, then the headform may be damaged. Sometimes the leakage may be caused by a loose center bolt; use Teflon tape on the threads and re-tighten the bolt to 180 inch/pounds (15 ft/lbs). ***Do not remove the bolt unless the headform is resting on its top. Do not allow contamination to enter the headform by leaving the headform open for extended periods.***

6 Accelerometers

6.1 The accelerometer cable should be secured to the headform collar to minimize movement during drop tests. This will help prevent the wires from breaking free from the accelerometer. A strong tape is a good way of securing the cable to the collar, carriage and to the computer equipment stand. It is important that the cable not be able to wiggle the connector that enters the computer when you make a drop. So when you tape it to the computer stand, tape it as near to that end as possible.

6.2 Before inserting the triaxal accelerometer into the headform, inspect the connections to the individual accelerometers. If a loose wire is observed do not use until repairing. The base of the triax must be kept clean and free of debris; wiping the base with a cotton wipe and alcohol should clean the base adequately.

6.3 Be sure to orient the accelerometer into the headform correctly. Using "the right hand rule" will help you identify the x, y, and z axis. That is, by extending the thumb, index and middle finger of the right hand with the middle finger bent 90 degrees from the index finger, the thumb will point in the direction of the z axis, index finger in direction of x axis, and middle finger in direction of y axis. The x axis should point to the rear of the headform and the y axis will point towards the left side of the headform. The z axis will point down towards the base of the headform. If you remember the phrase "to the rear and ear" and, as there is only two ways to bolt the triax to the headform, always be sure an accelerometer is pointing towards the rear and the ear of the headform.

7 Mechanical Assembly

7.1 All components of each assembly (i.e., the headform, headform adjuster, headform rotator stem, headform collar, etc.) must be rigidly connected. Any looseness or play will cause spurious signals (false SI results).

7.2 Inspect the carriage assembly before each use. Pay close attention to the welded joints; if small cracks are observed, discontinue use of carriage. Small cracks indicate that the carriage may break if use is continued, send the carriage in for repair.

7.3 Check the positioner and rotator assembly for signs of cracks also. It is much less expensive to repair these items before they break (as they sometimes will after much use) than to replace after they have broken completely.

7.4 Check the bushings in the tubes where the guide wires are inserted. Sometimes they may become loose and need to be reinserted into the tubes. If they are too loose, double sided tape may be used to prevent these nylon bushings from sliding out of the tubes.

8 MEP Pads

8.1 Test MEP pads may roughen after being impacted many times. If the Front Boss, 18" (46 cm) before and after test drops begin to differ from values obtained when the MEP pad was new by more than 7%, than the MEP pad needs to be replaced.

8.2 Always secure the MEP pad to the anvil with all bolts tightened. Keep the top of the anvil and the base of the MEP pad clean and free of debris.

8.3 Never use the 3" (7.7 cm) calibration MEP pad for any helmet tests. The 3" (7.7 cm) calibration MEP pad is for bare headform drops only.

8.4 Never attempt to clean a MEP pad with any solvent as this may modify the MEP pads characteristics.

9 Test Procedure

9.1 During drop testing the Severity Index Computer may trigger prematurely (false trigger) causing an erroneous reading to be obtained this may be remedied by the following actions.

9.1.1 Push the reset button just prior to drop testing to reduce false triggering.

9.1.2 Sometimes the release mechanism will cause false triggering. Apply a light coating of machine oil to the rings on the carriage assembly and the hook of the release; this is particularly helpful with newer equipment.

9.1.3 Inspect the accelerometer cable for crimped or pinched wires. Check the accelerometer connections for loose wires; be sure the accelerometer is securely tightened in the headform base.

9.1.4 Secure a wire from the headform collar to a ground terminal on the Severity Index Computer. **This is particularly helpful if static charges are noticed while testing.**

9.1.5 If the helmet you are testing is difficult to place on the headform, verify that the correct size headform is being used and that the fit is proper. If it is still difficult, a thin (2 mil) polyethylene bag, or talc, may be placed over the headform to allow easier helmet placement so long as fit (as described in Section 20, NOCSAE DOC.001) is not compromised.

9.1.6 Always check that the positioner bolts and headform collar are securely tightened during testing as loose fittings will result in inaccurate results.

10 **Anvil Positioning**

10.1 No matter whether you are calibrating a headform, performing post-calibration checks or testing, there are specific places your anvil (and therefore your MEP pad) should be placed. Most important is that you hit as near the center of the MEP as possible without impact to the nose of the headform in the front position. Further you should note the location of the MEP relative to the left guide wire, record this measurement and always use the same locations for future impacts for a given headform. Bear in mind the location of this wire relative to the eyehook and maintain that same relationship after any tension adjustment.

This measurement is made from the nearest edge of the MEP to the left guide wire of your NOCSAE Drop System.

10.1.1 Front impacts - Approximately 3 inches (7.6 cm) record your own measurement for each headform.

10.1.2 Front Boss impacts – Approximately 5 inches (12.7 cm) record your own measurement for each headform.

10.1.3 Top impacts - Approximately 10.75 inches (27.3 cm) record your own measurement for each headform.

10.1.4 Side, Rear and Rear Boss impacts - Approximately 4 inches (10.2 cm) record your own measurement for each headform.

Using repeatable position placement of the MEP will yield consistency in your test results. To simplify setting up these distances each time you have to move the anvil, make up a set of small pipes, dowels or tubes and cut one to each of these four (4) lengths. Mark them as to which is which and your job of positioning the anvil will be simplifies. Any change in head form size or serial number will require you to reevaluate these dimensions.

APRIL, 2002 MODIFICATIONS/REVISIONS

- Simplified document references within document.

JANUARY, 2003 MODIFICATIONS/REVISIONS

- Clarified the ideal anvil position in section 10

APRIL, 2003 MODIFICATIONS/REVISIONS

- Modified naming convention and added NOCSAE logo to cover page.

MAY, 2009 MODIFICATIONS/REVISIONS

- Modified section 10 clarifying MEP placement