



SURFACE VEHICLE RECOMMENDED PRACTICE

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Lumbar Flexion Test Procedure for the Hybrid III 50th Male Dummy

RATIONALE

This SAE Recommend Practice is being revised for minor formatting issues. The alignment arrows in Figure 8 have been corrected and the minor wording change was made in Figure 4.

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1. SCOPE

This procedure establishes a recommended practice for performing a lumbar flexion test to the Hybrid III 50th male anthropomorphic test device (ATD or crash dummy). This test was created to satisfy the demand from industry to have a certification test which characterizes the lumbar without interaction of other dummy components. In the past, there have not been any tests to evaluate the performance of Hybrid III 50th lumbar.

1.1 Purpose

The intent of this SAE Recommended Practice is to develop a lumbar flexion test procedure for the H-III50M dummy with test corridors for initial angle and force at 22.1 degree, 32.1 degree, and 42.1 degree angles. The test will utilize standard H-III family torso flexion test equipment.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J211/1 Instrumentation for Impact Test - Part 1 - Electronic Instrumentation

SAE J2856 User's Manual for the 50th Percentile Male Hybrid III Dummy

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 Code of Federal Regulations (CFR) Publications

Available from the United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, www.gpo.gov.

Motor Vehicle Regulation No. 572 Test Dummies Specifications - Anthropomorphic Test Dummy for Applicable Test Procedures

3. CERTIFICATION PROCEDURES

3.1 Equipment Required

- a. Lower torso assembly: 78051-070 (without abdomen).
- b. Lumbar spine: 78051-66.
- c. Neck bracket replacement: [Figure 1](#) describes the generic shape, mass, and the pull point dimensions.

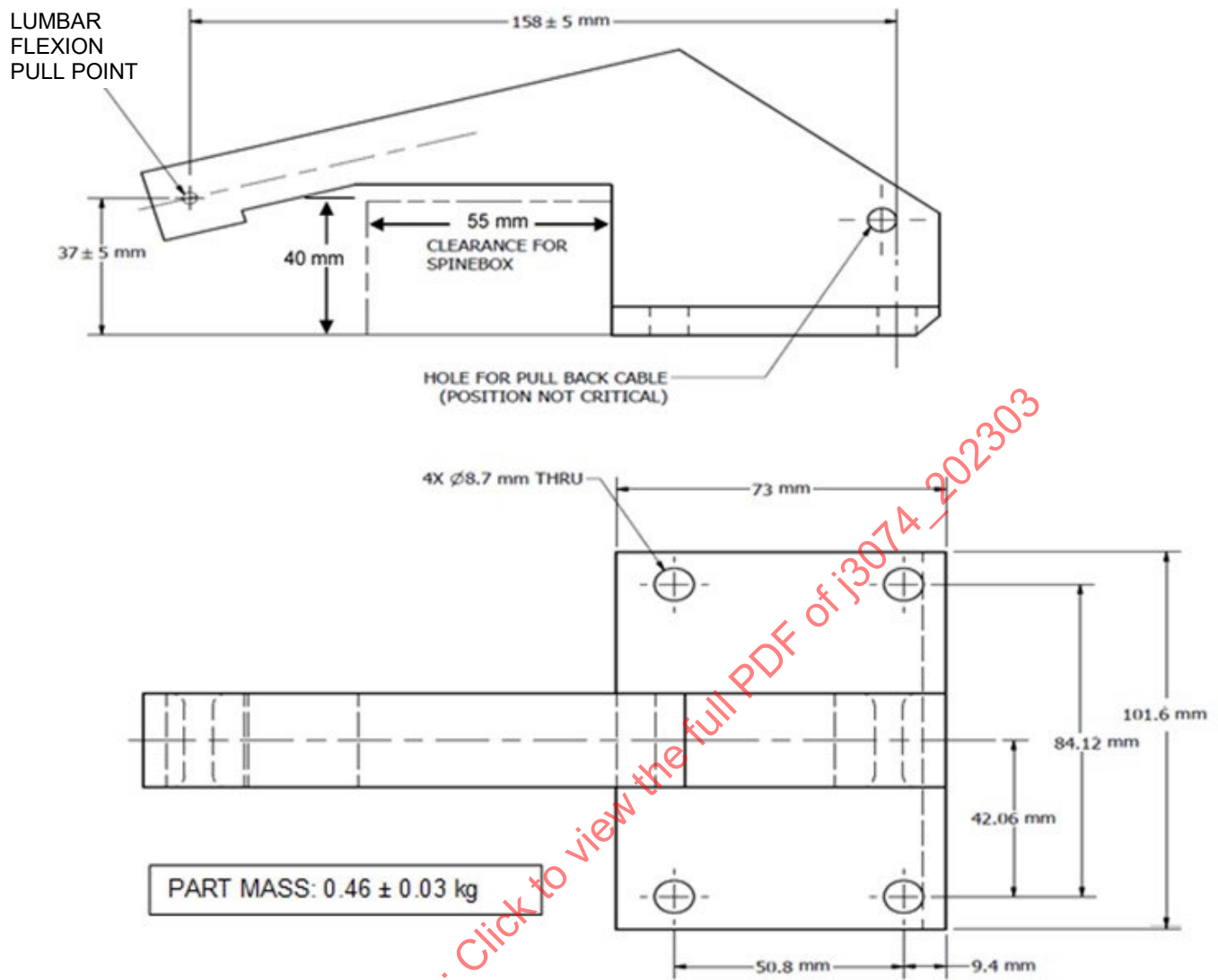


Figure 1 - Neck bracket replacement

- d. Spine box assembly: 78051-179. Shown in [Figure 2](#) without ballast mass insert.



Figure 2 - 78051-179 Spine box

- e. Spine box mounting plate adapter: 78051-362. Shown in [Figure 3](#) mounted between spine box and lumbar.



Figure 3 - 78051-362 Spine box mounting plate

- f. Leg assemblies: 86-5001-001 (left); 86-5001-002 (right). Lower legs and feet may be used, but not required.
- g. Pelvic adapter: The type of pelvic adapter is not critical, as long as it securely fastens to the pelvic instrumentation cover mounting holes and holds the entire assembly firmly with the back of the instrumentation cover mounting surface vertical (± 1 degree) and maintains the pull relationships found in [Figure 7](#).
- h. Angle measurement device: To measure the back of the spine box angle at the instrument cavity. The design of this bracket is not critical, as long as it references the back of the instrumentation cavity. This is the reference plane for all angular measurements ([Figure 4](#)).

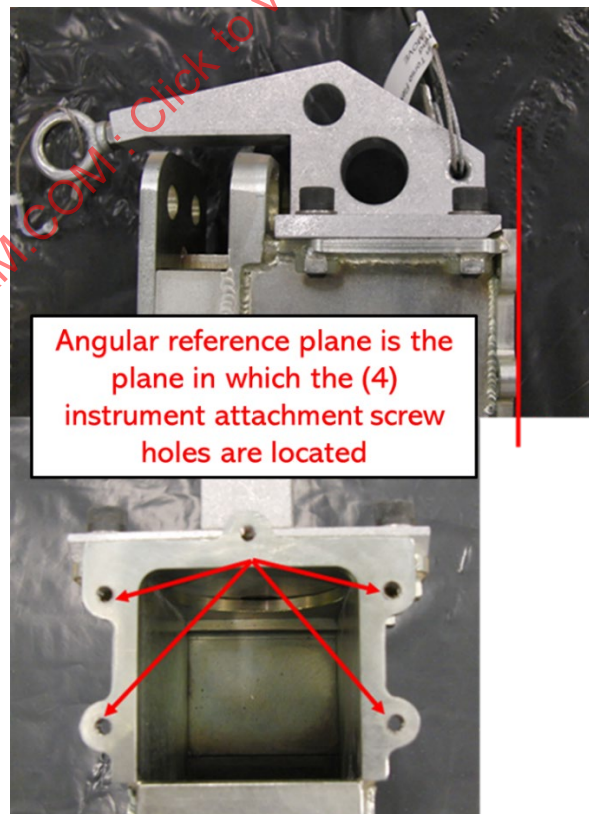


Figure 4 - Angle reference plane

- i. Force measurement device: To measure pull force in-line with the pull-down belt/cable.
- j. Test fixture: The test fixture consists of a standard torso flexion machine used for certifying the torso assemblies of other Hybrid III family dummies. An example of such device is seen in [Figure 5](#).

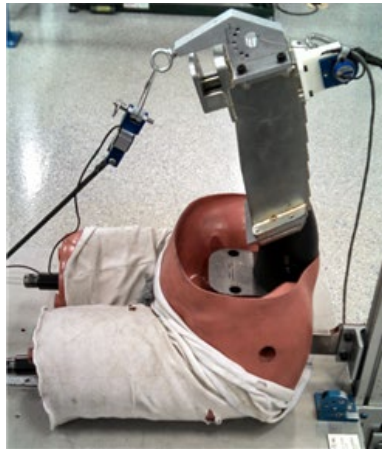


Figure 5 - Lumbar flexion test equipment

- k. Forward pulling mechanism: The pulling mechanism must be able to pull the spine box forward to 45 degrees. The pulling belt/cable angle must be 52.5 degrees (± 2 degrees) when the spine box is at 45 degrees.

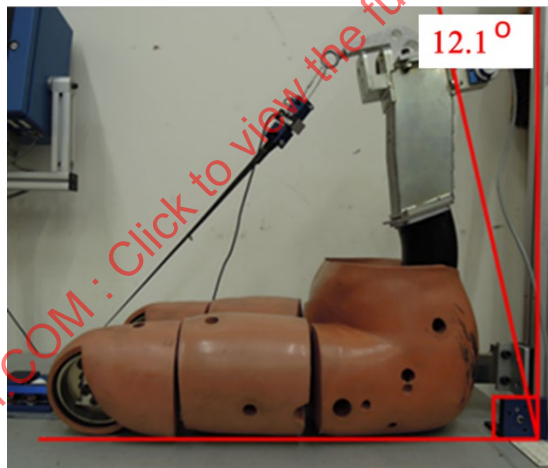


Figure 6 - Hold position for 30 minutes

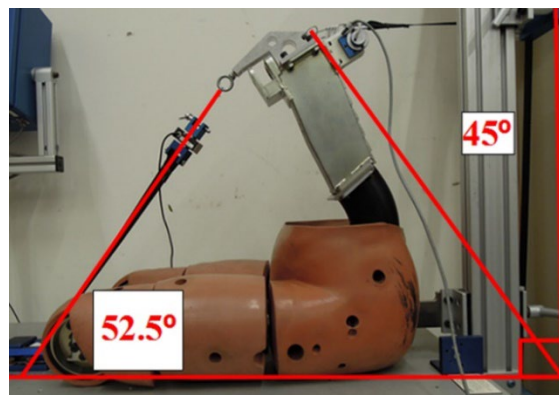


Figure 7 - Pull down angle 52.5 degrees when spine is 45 degrees

- l. Rearward pulling mechanism: The pullback mechanism must be able to pull the spine box back to 12.1 degrees (± 2 degrees) forward of vertical and capable of holding this position for the hold time period. The angle of the pullback mechanism should be horizontal when the spine box is 12.1 degrees forward.
- m. Data collection system: The data acquisition system, including transducers, must conform to the specifications of the latest revision of SAE J211/1 except for sample rate and channel filter class. Test sample rate must exceed 100 Hz and utilize a digital four-pole butterworth forward filter with a cutoff frequency of 2 Hz.

3.2 Instrumentation Specifications

- 3.2.1 A force transducer capable of measuring peak force. The peak force for this test will be approximately 500 N at the 45 degree peak pull angle.
- 3.2.2 The angle transducer must have a maximum error no greater than ± 0.25 degree over the angular range being measured. This may be accomplished with linearization equations if needed. The nominal angular range for this test will be from 10 degrees forward of vertical to 45 degrees forward from vertical when measured on the back of instrumentation cavity cover. This test is very sensitive to angular errors and care needs to be taken to ensure the accuracy of the angular readings are in accordance with this SAE Recommended Practice.
- 3.2.3 Check that all transducers are properly installed, oriented, and calibrated.

3.3 Test Preparation

- 3.3.1 Soak the lumbar assembly in a controlled environment with a temperature between 20.6 to 22.2 °C (69 to 72 °F) and a relative humidity from 10 to 70% for at least 4 hours prior to a test. The test environment should have the same temperature and humidity requirements as the soak environment.
- 3.3.2 Remove upper torso of dummy.
- 3.3.3 Remove lumbar and lumbar cables.
- 3.3.4 Inspect the lumbar assembly for damage.
- 3.3.5 Attach neck bracket replacement to top of spine box.
- 3.3.6 Position the pull down and pull up belt/cable on the test fixture.

NOTE: If using the dummy's spine box, all attachments (including ballast mass insert) will need to be removed down to the 78051-179 level.

- 3.3.7 Attach spine box mounting plate adapter to bottom of spine box.
- 3.3.8 Loosen lumbar cable torque and re-torque to $1.36 \text{ Nm} \pm 0.23 \text{ Nm}$ (12 in-lb $\pm$ 2 in-lb).
- 3.3.9 Attach spine box to lumbar.
- 3.3.10 Attach torso assembly to test fixture (see [Figure 8](#) for example).
- 3.3.11 Attach angle sensor to the spine box at the instrument cavity location.

3.4 Test Procedure

- 3.4.1 Flex the spine box / lumbar assembly forward three times to 30 degrees ± 1.0 degree from vertical at a rate of 0.5 to 1.5 deg/s, and immediately release.
- 3.4.2 Bring the spine box/lumbar assembly up to vertical where back of spine box instrument cavity is 12.1 degrees ± 2 degrees forward.
- 3.4.3 Hold spine box assembly at 12.1 degrees ± 2 degrees for 30 minutes.