



FMVSS 202a Dimensional and Static Performance Testing for Head Restraints

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. The purpose of This Test Procedure is to determine if a head restraint/seat system meet(s) the dimensional and static requirements of FMVSS 202a.

1.2 Applicability. This standard applies to each front outboard designated seating position and each applicable rear outboard designated seating position with a head restraint.

1.3 Remarks. Head restraints are subjected to strikes simulating the head impact in the case of an accident, as well as dimensional criteria for height, width, retention, and strength of the head restraint to minimize the rotation of the head relative to the torso. The intent is to improve occupant protection and reduce the frequency and severity of neck injury in rear-end and other collisions. Occupant impact protection shall be addressed during the design stages of vehicle development. It is expected that early in the design stage that dimensional layouts have been conducted and that analysis has been completed to ensure the success of the testing. This procedure describes the method for testing the seat outside of the vehicle, however, in some instances the vehicle or portions of it may be required.

All values given in this Test Procedure were valid at the date of issue. For the actual values refer to the newest editions of the standards mentioned in 2.1.

Compliance with FMVSS 202a dimensional and static performance testing for head restraints can be used to show compliance for CMVSS 202.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

49 CFR 571.202a	CMVSS 202	GTR07	SAE J826
49 CFR Part 572	FMVSS 202	KMVSS29/99	UN R17

2.2 GM Standards/Specifications.

None

2.3 Additional References.

Seat System Subsystem Technical Specification (SSTS)

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.1.3 Organization for International Standards (ISO) certified lab facility.

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3.2 Equipment.

3.2.1 SAE J826 Three Dimensional (3D) manikin, Edition 95. Thigh = 10%, Leg = 50%.

3.2.2 Sphere Diameter: (25 ± 0.25) mm.

3.2.3 Steel Tape with accuracy of ± 0.75 mm and sufficient range for measuring the height of the head restraint.

3.2.4 Carpenter's Square.

3.2.5 Calipers with accuracy of ± 0.75 mm.

3.2.6 Head Restraint Measurement Device (HRMD). The SAE J826 three-dimensional manikin with a head form attached.

3.2.7 Spherical head form with a (165 ± 2) mm diameter with surface roughness $< 1.6 \mu\text{m}$, root mean square.

3.2.8 Inclinator with an accuracy of ± 0.2 mm degrees.

3.2.9 Fifth (5th) percentile female HIII 49 CFR Part 572 (non-instrumented).

3.2.10 A cylindrical test device or a device having a (165 ± 2) mm diameter in plane view (perpendicular to the axis of revolution) and a 152 mm length in profile (through the axis of revolution) with a surface roughness of $< 1.6 \mu\text{m}$ root mean square (height retention test).

3.2.11 A load application device capable of applying a force up to 1100 N with a precision of ± 1 N and at variable rate.

3.2.12 A test device having the back pan dimensions and torso reference line vertical centerline, when viewed laterally, with the head room probe in the full back position of the three dimensional SAE J826 manikin (for backset retention and displacement).

3.2.13 Additional Equipment for Energy Absorption Testing.

3.2.13.1 Test stand and fixture setup to retain test vehicle and other test equipment needed to conduct head restraint test.

3.2.13.2 Semispherical head form of mass (6.8 ± 0.05) kg, with a (165 ± 2) mm diameter with surface roughness $< 1.6 \mu\text{m}$, root mean square and capable of attaching to a propulsion device. The impactor shall be instrumented with an accelerometer having the axis coincident with the geometric center of the head form and the direction of impact.

3.2.13.3 Propulsion device capable of propelling the semispherical head form and its base to (23.6 ± 0.5) km/h, and maintaining the impactor trajectory within 2 degrees of horizontal and parallel to the vehicle longitudinal axis for at least a travel distance of 25 mm.

3.3 Test Vehicle/Test Piece. A complete trimmed seat subsystem, consisting of all components necessary to qualify as complete for the model and trim level specified by the Design Release Engineer (DRE), is required.

Testing may be conducted on bed plate. Vehicle may be required when roof prevents the minimum height requirements.

Typically three (3) seats are required for the following measurements:

- One seat set for gap, height, width, backset, strength and height retention.
- One seat set for backset retention, displacement, and strength.
- One seat for energy absorption test.

3.4 Test Time.

Calendar time: 5 days

Test time: 8 h

Coordination time: 8 h

3.5 Test Required Information. Manufacturer's drawing showing seat dimensions, arrangement, and Seating Group Reference Point (SGRP).

3.6 Personnel/Skills. The following individuals are necessary to complete this test procedure: General Motors Validation Engineer, Testing Organization's Test Engineer, Testing Organization's Test Technician.

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4 Procedure

4.1 Preparation. Test plate or vehicle buck and equipment to rigidly affix the seat.

4.2 Conditions.

4.2.1 Environmental Conditions. Test to be performed at ambient temperature.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions. For the tests described from 4.3.2 thru 4.3.7, demonstrate compliance with any adjustable lumbar support adjusted to its most posterior nominal design position. Negative lumbar adjustment.

4.3.1 Determine H-point for Testing Purposes.

4.3.1.1 If the seat cushion adjusts independently of the seat back, adjust the seat cushion to the highest achievable H-point and seat back in design position.

4.3.1.2 Position the three dimensional (3D) mechanical manikin (Figure 1) per SAE J826; record the H-point on Data Sheet A1 (Appendix A) as initial reading. Evaluate to the design SGRP for approximation to highest point in travel box. Contact the GM Validation Engineer or GM Lead Engineer if there is more than a 10 mm conflict between these values before completing the remainder of this test.

4.3.1.3 Measure the seat back angle using the back angle quadrant of the manikin.

4.3.1.4 Adjust lumbar and bolster adjustment to the most non-supportive positions. Adjust the seat back to produce a design torso back angle. If the adjustment is such that the angle is less than design position then adjust to the next rearward position.

4.3.1.5 Record this H-point and the seat back angle on Data Sheet A1 (Appendix A) as test H-point and seat angle.

Note: This H-point and seat back angle are maintained throughout the testing.

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Figure 1: H-Point and Height Measurements



4.3.2 Measurements for Height and Width.

4.3.2.1 Height Measurement.

4.3.2.1.1 Adjust the head restraint to the highest adjustable position. Extend the head probe along a line parallel to the torso reference line to record the height of the top of the head restraint. Ensure the positioning of the manikin to the H-point obtained in 4.3.2. If the head probe cannot be extended due to interference, then measure the height along a line parallel to the torso reference line (Figure 2). Record this as the upper height on Data Sheet A1 (Appendix A).

4.3.2.1.2 The height shall be ≥ 800 mm for front outboard seat and 750 mm for rear seat outboard positions, except where the roof of the vehicle prevents the head restraint from reaching the required height. If this occurs, the head restraint shall be measured in vehicle and be sufficient enough in height to prevent a 25 mm diameter sphere from passing between the top of the head restraint and the roof. It is sufficient to record that the 25 mm diameter sphere does not pass through on Data Sheet A1 (Appendix A) for this case.

4.3.2.1.3 An additional exception for a rear outboard designated seating position exists, in that a head restraint is not required if the height measurement is < 700 mm when measured at the centerline of the seat back or the head restraint-like device. Record this height on Data Sheet A1 (Appendix A), no further measurements are required.

4.3.2.1.4 Adjust the head restraint to the lowest adjustable position. Again measure the height along the torso reference line and record as lower height on Data Sheet A1 (Appendix A).

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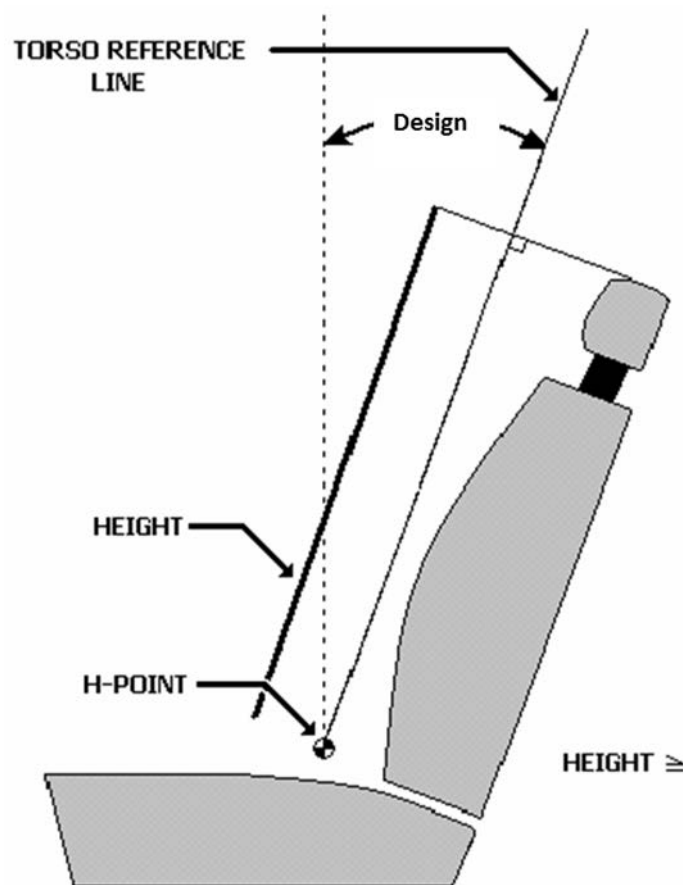
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Figure 2: Height Measurements



4.3.2.2 Width Measurement.

4.3.2.2.1 Measure the width of the head restraint at a distance (65 ± 3) mm below the top of the head restraint and perpendicular to the torso reference line. The minimum width from centerline for either side of head restraint shall be 85 mm for 170 mm minimum (254 mm for front seats requiring the wider head restraints, for example, outboard front seats when a center front design seating position exists). Record this as the width on Data Sheet A1 (Appendix A).

4.3.2.2.2 Removability of Head Restraints. Consult with the GM DRE or GM Validation Engineer to understand if the head restraint is designed to be removable, and, if so, obtain the intended owner's manual instructions for removability. If the owner's manual is not available at the time of testing, confirm with GM DRE that proper verbiage is to be used per the FMVSS 202a Owner's Manual Checklist, pertaining to Removability.

4.3.2.2.2.1 Removable Head Restraints. If deemed to be removable, verify that the action to remove the head restraint is a separate, distinct action from the sequence of adjusting the head restraint upward for normal use.

4.3.2.2.2.1.1 Remove the head restraint according to the intended removability instructions.

4.3.2.2.2.1.2 Reinstall the head restraint according to the intended installation instructions.

4.3.2.2.2.1.3 Record the results on Data Sheet A1 (Appendix A).

4.3.2.2.2.2 Non-Removable Head Restraints. If deemed to be non-removable, confirm that the head restraint removal is for service only, and can only be performed with the use of a tool.

4.3.2.2.2.2.1 Remove the head restraint with the designated tool according to the intended service instructions.

4.3.2.2.2.2.2 Reinstall the head restraint according to the intended service instructions for installation.

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4.3.2.2.2.3 Record the results on Data Sheet A1 (Appendix A).

4.3.3 Backset Measurement.

4.3.3.1 Remove the SAE manikin torso weights.

4.3.3.2 For adjustable head restraints, adjust the head restraint to the largest backset dimension attainable to the head form at height adjustments between 750 mm and 800 mm; if no position exists below 800 mm, adjust to lowest position available. If the head restraint tilts fore and aft, adjust to the rearmost position. For integral or fixed head restraint, measure largest backset dimension between 750 mm and 800 mm height.

4.3.3.3 Attach the 6 torso weights, attaching the two larger weights flat side down last. Attach the remaining four weights by alternating side to side. Weights should be supplied with the HRMD.

4.3.3.4 Attach the HRMD head form and level it by loosening the rear knob and bubble level.

4.3.3.5 Measure the Torso. If the torso angle is not in design position ± 1 degree, remove the buttocks and torso weights, re-adjust the back angle and repeat the four previous steps until a torso angle of design position ± 1 degrees is obtained and the head probe is within 15 mm of the head restraint centerline.

4.3.3.6 Push the central probe toward the head restraint until the probe profile touches the A surface as shown in Figure 3.

4.3.3.7 Record the measurement on Data Sheet A1 (Appendix A) as backset measurement.

4.3.3.8 The measured backset shall be ≤ 55 mm.

Figure 3: Head Restraint Measurement Device



4.3.4 Gap Measurement.

4.3.4.1 If the head restraint is adjustable, adjust the head restraint to the lowest adjustable occupant use locking position and any backset position.

4.3.4.2 Check the torso angle and location of the head probe relative to the centerline of the restraint. Adjust the seat if necessary (Figure 4).

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