



Head Restraint Operational, Performance and Durability Tests

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 scope of this test procedure covers the required test method for various head restraint designs with regard to operational, performance, and durability requirements. Only applicable testing for the particular head restraint design should be conducted as determined by the Validation Cross Reference Index (VCRI).

1.2 Applicability. This test procedure covers various types of head restraints in passenger cars, light duty and medium duty trucks. This includes, but not limited to, manual and power head restraint systems and their functional adjustments. For example; head restraint systems adjustable for height, rotation, fore/aft and folding features.

1.3 Remarks. Not applicable

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14011

GMW14188

GMW14957

2.3 Additional References.

Head Restraint - Component Technical Specification (CTS)

Seat - Global Subsystem Technical Specification (GSSTS)

3 Resources

3.1 Facilities. An approved GM certified test lab with an adequate bed plate or equivalent work surface necessary for mounting the test sample and associated test fixtures appropriate for the procedure to be run.

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.

3.2 Equipment.

3.2.1 A fixture capable of holding a sample rigidly when required forces and moment are applied.

3.2.2 Equipment capable of accurately measuring and applying required loads and moments up to 250 N.

3.2.3 An XY recorder to record the travel-force diagrams and torque-angle of rotation diagrams, or a recorder in accordance with the current state of the art.

3.2.4 Climatic Chamber.

3.2.5 Suitable setup to release and reset applicable head restraint functions. For example; equipment to release and return a foldable head restraint to evaluate function.

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3.2.6 Actuators or similar device to operate switches for power systems.

3.3 Test Vehicle/Test Piece. Complete head restraint system including all relevant parts to verify the design.

3.4 Test Time.

Calendar time: 14 days
 Test hours: 300 hours
 Coordination hours: 18 hours

3.5 Test Required Information. In addition to this test procedure, it is necessary to access the Head Restraint - Component Technical Specification (CTS) and the Seat - Global Subsystem Technical Specification (GSSTS) for the required forces, cycles, efforts, etc., to verify performance. In other words, this procedure explains how to test and the technical specifications explain the performance level.

3.6 Personnel/Skills. A Test Engineer or Technician capable of completing the required tests and evaluating and documenting the test results.

4 Procedure

4.1 Preparation.

4.1.1 Test Samples. Samples should be cycled three to five times through all actuation cycles before starting test.

4.1.1.1 Required Sample Size. A total of 22 samples are typically required for these scheduled tests. See Figure 1 for distribution and for type of test refer to the specific VCRI.

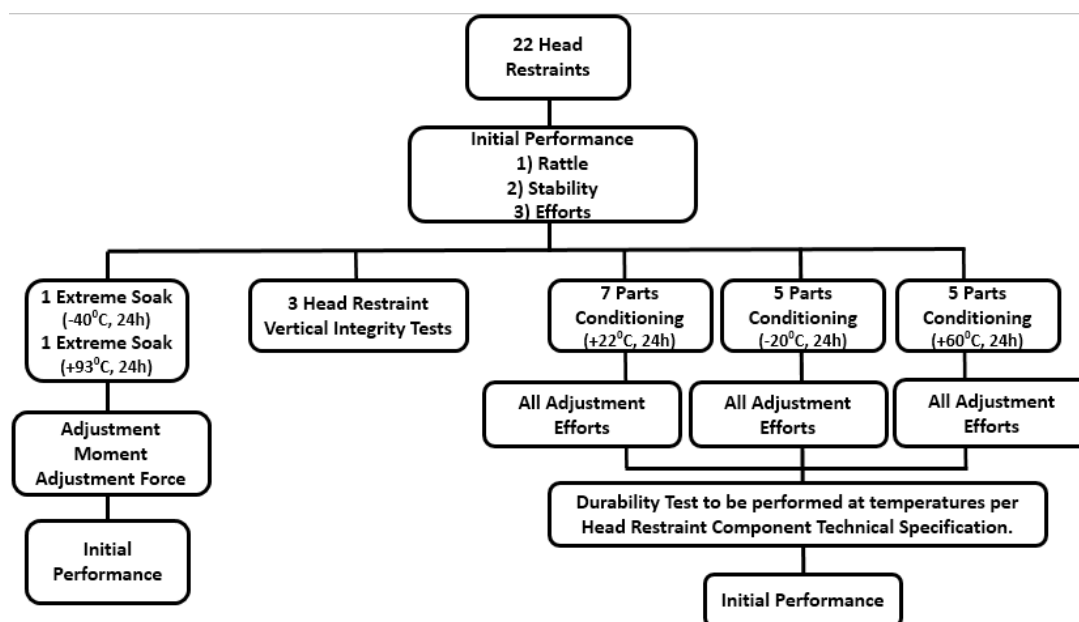


Figure 1: Test Sample Reference Diagram

4.2 Conditions.

4.2.1 Environmental Conditions. The conditioning is defined in each test sequence.

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.

Samples of components or material released to the specification shall be tested for conformity with the requirements of this specification and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

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Any change to the component or material, for example; design, function, properties, manufacturing process and or location of manufacture, require a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases a shorter test can be agreed to between the responsible GM Department and the supplier.

4.3 Instructions.

4.3.1 Test of Adjustment Force and Adjustment Moment.

4.3.1.1 General-Adjustment.

4.3.1.1.1 The testing shall be performed at temperatures per Head Restraint - Component Technical Specification (CTS). The measurements shall be conducted within the climatic chamber.

4.3.1.1.2 After the measurement of the adjustment force and moment, the values shall be in compliance with the Technical Specification.

4.3.1.1.3 After each test setup is complete, prior to initiating testing, the Test Engineer shall cycle head restraint (refer to 4.1.1) and verify that the head restraint does not produce any objectionable noise during operation and shall lock in any lockable position without slippage. If either condition occurs, contact the GM responsible engineer before continuing durability testing.

4.3.1.1.4 To determine seat back angle, also known as seat back frame angle; in math, locate the seat cushion to seat back connection point (for fixed back seats) or recliner pivot point (for adjustable back seats) ("A") and the locus of the centerline of the head restraint guide as it crosses the opening at the top of the head restraint guide ("B"). Strike a chord between these two points and measure the resultant angle. This is the seat back frame angle. To measure hardware (i.e., physical seat assembly), a measureable point/surface such as the head restraint rod as it exits the head restraint guide will be necessary. See Figure 2.

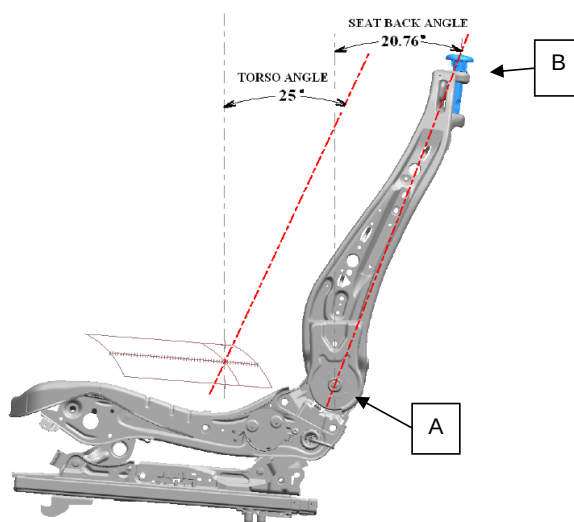


Figure 2: Determination of Angle

4.3.1.2 Measurement of Height Adjustment-Force.

4.3.1.2.1 Applicable to head restraint with up and down functionality. See Figure 2.

4.3.1.2.2 The test shall be performed using a complete head restraint assembly including foam pad and trim cover.

4.3.1.2.3 The complete head restraint shall be mounted into a full seat subsystem including design representative foam and trim cover.

4.3.1.2.4 Adjust the seat to design position.

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Note: Exercise the head restraint three times by adjusting to full length of adjustment, returning to original position before any effort measurements are taken.

4.3.1.2.5 The head restraint shall be adjusted to its lowest locking position. When tilt adjustment is available, it shall be adjusted to the rearmost position. When fore/aft adjustment is available, it shall be adjusted to the rearmost position.

4.3.1.2.6 Wrap a strap (safety belt test webbing) around the cross car centerline of the head restraint. If the head restraint has a push button or release feature for adjustment, ensure button/release feature is disengaged during measurement.

4.3.1.2.7 To measure up efforts, pull up in the direction of the head restraint adjustment from the lowest position to the highest position. Ensure the pull is in the direction of the head restraint adjustment movement. See Figure 3.

4.3.1.2.8 To measure down efforts, push on the top and cross car centerline of the head restraint, in the direction of the head restraint adjustment from the topmost position to the lowest position. Ensure the push is in the direction of the head restraint adjustment movement. See Figure 3.

4.3.1.2.9 Loading rate is 1000 mm/minute $\pm$ 10 mm/minute.

4.3.1.2.10 The actuation force versus displacement shall be determined: $F=f(s)$.

4.3.1.2.11 The resultant force versus displacement diagram shall be recorded and provided as part of the test report.

4.3.1.2.12 Record the peak value of the adjustment range. Exclude values recorded 5 mm from the full up and down locking positions.

4.3.1.2.13 Repeat the measurement three times and record.

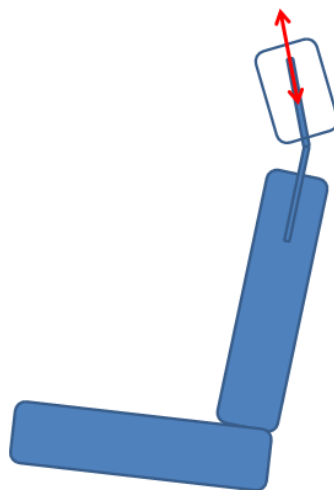


Figure 3: Vertical Adjustment

4.3.1.3 Measurement of the Tilt Adjustment.

4.3.1.3.1 Applicable to head restraint with tilt functionality. See Figure 3.

4.3.1.3.2 The test shall be performed using a complete head restraint assembly including foam pad and trim cover.

4.3.1.3.3 The complete head restraint shall be mounted in a seat subsystem. If a surrogate for the seat subsystem is used for this test it must be approved by the GM responsible engineer.

4.3.1.3.4 Adjust the seat to design position.

4.3.1.3.5 The head restraint shall be adjusted to its lowest locking position and rearmost tilt position.

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4.3.1.3.6 To measure forward effort, push on the cross car centerline of the head restraint backside 10 mm from the edge of the head restraint with the maximum distance to the rotation axis. The head restraint shall be adjusted through the entire tilting adjustment range from the rearmost to the foremost position. See Figure 4.

4.3.1.3.7 To measure rearward effort, push on the cross car centerline of the head restraint front side 10 mm from the edge of the head restraint with the maximum distance to the rotation axis. The head restraint shall be adjusted through the entire tilting adjustment range from the foremost to the rearmost position. See Figure 4.

4.3.1.3.8 Adjusting rate is ≤ 20 degrees per second ($^{\circ}/s$).

4.3.1.3.9 The adjusting moment shall be determined as a function of the adjusting angle: $M=f(\text{angle})$.

4.3.1.3.10 The resultant diagram shall be recorded.

4.3.1.3.11 Record the peak value of the adjustment range. Exclude values recorded five (5) degrees of the full forward and full rearward lock positions.

4.3.1.3.12 Repeat the measurement three times and record.

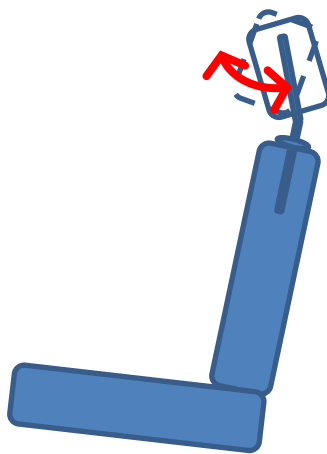


Figure 4: Tilt Adjustment

4.3.1.4 Measurement of Fore/Aft Adjustment Force.

4.3.1.4.1 Applicable to head restraint with fore/aft adjustment. See Figure 5.

4.3.1.4.2 The test shall be performed using a complete head restraint assembly including foam pad and trim cover.

4.3.1.4.3 The complete head restraint shall be mounted in a seat subsystem. If a surrogate for the seat subsystem is used for this test it must be approved by the GM responsible engineer.

4.3.1.4.4 Adjust the seat to design position.

4.3.1.4.5 The head restraint shall be adjusted to its lowest locking position and rearmost locking position.

4.3.1.4.6 Attach a fixture to the moving part of the head restraint. If the head restraint has a push button or release feature for adjustment, ensure button/release feature is disengaged during measurement.

4.3.1.4.7 To measure forward effort, pull perpendicular to the direction of the head restraint adjustment from the rearmost position to the foremost position.

4.3.1.4.8 To measure rearward effort, push perpendicular to the direction of the head restraint adjustment from the foremost position to the rearmost position.

4.3.1.4.9 Loading rate is 1000 mm/minute $\pm$ 10 mm/minute.

4.3.1.4.10 The actuation force versus displacement shall be determined: $F=f(s)$.

4.3.1.4.11 The resultant diagram shall be recorded.

4.3.1.4.12 Record the peak value of the adjustment range. Exclude values recorded 5 mm from the full forward and full rearward locking positions.

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