



Seat Stability - Free-Play (Chuck) and Deflection Performance

1 Scope

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. This test procedure evaluates the seat system free-play when loads are applied in the fore/aft and lateral direction on the seat back and in the cushion and adjuster of the seat. The test is intended to be completed on the seat structure.

1.2 Foreword. Not applicable.

1.3 Applicability. This test shall be applied to all General Motors vehicles with free-standing fixed, folding or removable seat systems mounted on adjusters and/or risers.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

None

3 Resources

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

3.2 Equipment.

3.2.1 Mounting Blocks. An appropriate model mounting blocks to hold seat subsystem in body position.

3.2.2 Load Cell. A hand held load cell capable of recording up to 500 N load and appropriate fixture in order to apply load in a repeatable condition.

3.2.3 Transducer. Displacement transducer with a minimum length of 51 mm (2 in).

3.2.4 Clamp. Clamp to attach the loading device to the cushion structure for applying vertical forces up to 1000 N. The clamp structure and attachment to the bottom frame has to resist this force (if necessary).

3.2.5 Recorder. Type: HP 7090A or equivalent.

3.2.6 Loading Device. An appropriate device which is capable of applying the load up to 1000 N, and providing a force output for plotting.

3.3 Test Vehicle/Test Piece.

3.3.1 Complete Seat Structural Subsystem. An appropriate seat structure or subsystem consisting of a back frame, bottom frame (pan), adjuster, and recliner as specified by the design release engineer. No padding or upholstery required.

3.4 Test Time.

Calendar time: 1 day
Test hours: 1 hour
Coordination hours: 4 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills.

- 3.6.1** General Motors Design Release Engineer.
- 3.6.2** General Motors Validation Engineer.
- 3.6.3** Testing Organization's Test Engineer.
- 3.6.4** Testing Organization's Test Technician.

4 Procedure

4.1 Preparation.

4.1.1 Mounting. Mount the seat subsystem on the appropriate model mounting blocks in vehicle position. Include mounting spaces if specified for installation.

4.1.2 Positioning. Seat back Recline to the design angle position, seat track at mid position, and seat cushion at highest position for all stability testing. In addition, another fore/aft rocking test should be done when track is at full-rear, seat cushion at full-down, keeping front tilt at highest position (as worst case condition).

4.1.3 Load Application Point.

4.1.3.1 Seat Fore/Aft and Lateral Rocking Direction (See Appendix A, Figures A1 and A2). The load application height shall be the same in fore/aft and lateral chuck, and is a distance of 500 mm (in seat back direction) measured from the center of the recliner hinge point as shown in Appendix A, Figure A1. In case that the geometry of the seat back structure does not allow applying a force perpendicular to back-frame at this height or it is desired to apply the load on the top of the seat back, then:

- a. In agreement with the GM responsible engineer, recalculate the loading point position and the force value so that the load produces the moment. Measuring direction should also start perpendicular to back-frame. When the measuring point is moved together with the application point, the measured total displacement has also to be recalculated in order to compare it with the allowable free-play and deflection.
- b. Use a clamp to apply the fore/aft load on the seat back.
- c. Do not use any clamp or device which has possibility to give an influence to the test result while conducting Y direction test.

4.1.3.2 Cushion-Frame Lateral Direction (See Appendix A, Figure A5). The load direction is in the y-axis, perpendicular to cushion-frame and applied at center of cushion-frame side member.

4.1.3.3 The Z Direction. The load application point shall be in a vertical line with the Seating Group Reference Point (SgRP). In case that the geometry of the seat cushion structure does not allow applying a vertical force on it at this point, then; use a clamp to apply the vertical load on the seat cushion.

4.1.3.4 Cushion structure to seat structure displacement (See Appendix A, Figure A5). The seat structure is to be mounted to a rigid fixture and an opposing load such as a reaction plate, applied at the seat cushion structure. The intent is to obtain the displacement between the cushion pan structure and the seat structure by eliminating relative movement of the seat mechanisms or other seat structure movement.

4.1.4 Attach Transducer. The following set of displacement transducers is necessary for both tests, in order to capture the chuck and rocking free play. In a case that all the displacements cannot be measured at the same time, the test can be repeated as many times as necessary in order to obtain all the measurements required.

4.1.4.1 All measuring points shall be agreed upon with the GM Design Release Engineer (DRE) and the GM Validation Engineer if the following conditions cannot be achieved in the seat structure.

- A - On the side part of the top of the back frame y-vehicle axis.
- B - On the center point of the top of the back frame in x-vehicle axis.

- C, D, E, F - At each corner of the cushion structure in z-vehicle axis (to capture rocking vertical component). (See Appendix A, Figure A1.)

4.1.4.2 It shall be guaranteed that the displacements transducers and applied forces are aligned with the global vehicle axis.

Optionally an additional displacement transducer can be mounted on the seat recliner. This transducer (J) shall be located on the opposite side to the lateral force application point, and half the way between the upper sensor and the bolt attachment of the riser to bottom frame.

Comparing the hysteresis plots resulting from this sensor and the ones attached to the backrest top (y direction) and to the seat frame (y direction) it is possible to get information about the lateral displacement of the backrest frame in relation to the seat frame due to the stability in the recliner area and also about the stability of the backrest frame itself. These stabilities have a big influence on the seat structure first resonance frequency.

4.1.4.3 There shall be no change of free play resulting from the mounting of the seat (e.g., by tension or clamping).

4.2 Conditions.

4.2.1 Environmental Conditions. Conduct test in a room temperature environment.

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.

4.3.1 Fore/Aft Chuck Performance Test.

4.3.1.1 Apply the load specified in the Global Subsystem Technical Specification (GSSTS) (if not otherwise specified and with approval of DRE, use 300 N for height adjustable seats in order to reach free-play by eliminating the pretension introduced by the adjusting springs) to the load application point on the back frame (or on the clamp if need), in the rearward direction. The load shall be contained on the symmetry plane of the seat back frame, and aligned with the global x-vehicle axis. (See Appendix A, Figure A1).

4.3.1.2 Record displacement in global axis using a processor in order to produce a diagram similar to Appendix A, Figure A3.

4.3.1.3 Apply the same load at the same application point, in the forward direction. The load shall be contained on the symmetry plane of the seat back frame, and aligned with the global x-vehicle axis.

4.3.1.4 Record displacement in global axis notation, using the plotted diagram.

4.3.1.5 Record the sum of the total displacements resulting from the forward and rearward loading. (See Appendix A, Figure A2).

4.3.2 Lateral Chuck Performance Test.

4.3.2.1 Apply the load specified in the GSSTS (if not otherwise specified and with approval of DRE, use 300 N for height adjustable seats in order to reach free-play by eliminating the pretension introduced by the adjusting springs) to the load application point on the side of the back frame in vehicle cross direction. The load shall be aligned with the global y-vehicle axis. (See Appendix A, Figure A1).

4.3.2.2 Record displacement in global axis, using a processor to plot a diagram as shown in Appendix A, Figure A3.

4.3.2.3 Apply the same load at the same application point, in opposite direction in 4.3.2.1. The load shall be aligned with the global y-vehicle axis.

4.3.2.4 Record displacement in global axis, using the plotted diagram to distinguish the freeplay.

4.3.2.5 Record the sum of the total displacements resulting from vehicle cross directional loading.

4.3.3 Rocking Stability Performance Test.

4.3.3.1 Apply the load specified in the GSSTS (if not otherwise specified and with approval of DRE, use upward load of 100 N) to the load application point on the cushion frame (or on the clamp if need), in z direction. The load shall be contained on the symmetry plane of the seat cushion frame, and aligned with the global z-vehicle axis.

4.3.3.2 Record the displacement as shown in a plotted diagram.