



Frontal Dynamic Testing for Seats

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 ensure that the seat system integrity is suitable for frontal barrier and sled testing in vehicle or rigid buck. Refer to United States (U.S.) and European Union (EU) New Car Assessment Programs (NCAP) front impact tests. This also includes offset testing as well as direct frontal impacts for rigid plate testing such as ECE R 21 Annex 8 for subsystem performance.

1.2 Applicability. This test procedure is applicable to all seating systems.

1.3 Remarks. The intent of the test is to determine whether the seat structure is capable of maintaining the required load for dynamic testing in accessing occupant performance. Occupant protection must be addressed during the design stages of the vehicle. This procedure describes the method for testing the seat outside of the vehicle, however, in some instances the vehicle body or portions of it may be required.

In conducting dynamic testing for structural integrity Hybrid III Anthropomorphic Test Dummies (ATD) representing, 5th percentile female, 50th percentile male, and 95th percentile male are utilized.

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 section 2 References.

2 References

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

2.1 External Standards/Specifications.

ECE R 21 Annex 8	FMVSS 208	SAE J211/1	SAE J1100
EU NCAP	ISO/IEC 17025	SAE J826	U.S. NCAP

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- Seat Global Subsystem Technical Specification (GSSTS) and Appendix B of the contractual agreement.
- Vehicle Interior Drawings per SAE J1100 (dimensional data on seat and seat belt to body structure attachments).

3 Resources

3.1 Facilities. Sled facility and rigid plate that is capable of reproducing velocities per U.S. NCAP and EU NCAP front impact test. The test facility shall be ISO/IEC 17025 certified or a GM recognized test facility.

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. The sled facility shall have capability of performing film analysis on the required targets and will have at a minimum:

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- Two (2) high speed cameras stationary on the left and right side of the sled (right angled, total view).
- Two (2) high speed cameras mounted on left and right side to view the slides to the recliners.
- One (1) high speed camera mounted on the sled in the back of seat to view the seat slides and belt attachment points.
- Acceleration sensor fixed on the sled.
- String pots mounted through the seatback bight (where the bottom cushion meets the seat back) and attached to the pelvis of the ATD and seat anchorages.
- Targets for placement at the hip point of the ATD, at a fixed point on the sled plate and various other areas as required to assess displacement and occupant movement relative to the seat as shown in Figure 1 Test Point Example.

Test Point Example

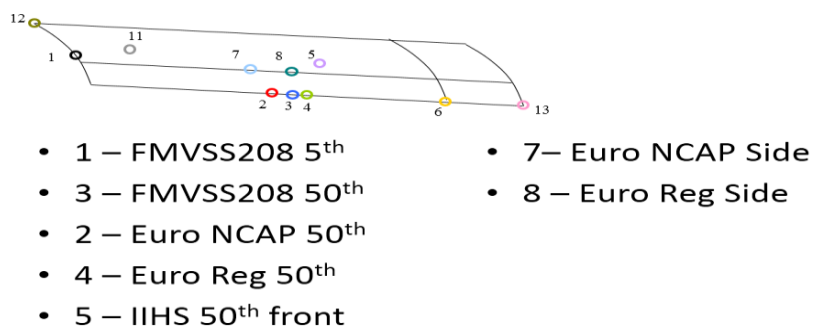


Figure 1: Test Point Example Relative to Seat Travel Box

- Hybrid III ATDs representing, 5th percentile female, 50th percentile male, and 95th percentile male.
- Load cells capable of recording the shoulder and lap belt loads.

3.3 Test Vehicle/Test Piece.

3.3.1 Seat Assembly. If the test is being utilized to determine structure capability, a suitably trimmed out seat will be required in order to predict the ATD kinematics.

3.3.2 Fixture. A vehicle body, or partial vehicle body can be used. This will vary based on the mounting of the seats and seat belts. At a minimum, the fixture/body has to retain the seat to the sled plate, in vehicle orientation, and retain the ends of the occupant seat belt in the same locations as in vehicle orientation with respect to the seat. Consult the vehicle interior drawings per SAE J1100 for dimensional data on seat and seat occupant seat belt to body structure attachments.

Note: Load cells need to be packaged at the shoulder belt and at the left and right side of pelvis belt to measure seat belt loads. Load cells need to be placed in a way that there is no interaction with surrounding parts during the pulse

3.4 Test Time.

Calendar time: 2 d
 Test hours: 8 h
 Coordination hours: 8 h

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3.5 Test Required Information.

- **Weight of the Seat.** Provided with the test specimen or completed as preparation and noted in the test report.
- **H-Point of the Seat.** Provided with the test specimen or completed as preparation and noted in the test report.
- **Seat Global Subsystem Technical Specification (GSSTS) and Appendix B** of the contractual agreement.
- **Sled Pulse.** Provided by General Motors Responsible Engineer or as specified in Appendix B of the contractual agreement.
- **Orientation Angle of the Seat.** Provided by General Motors Responsible Engineer or as specified in Appendix B of the contractual agreement.
- **Safety belts activation timing** for pretensioning, if available, per Appendix B of the contractual agreement.
- **Hybrid III ATDs** sized per designated seating position. Provided in Appendix B of the contractual agreement.
- **Heel point** of the various ATDs in vehicle environment. Consult the vehicle interior drawings.
- **Mounting footprint of the seat anchorage** points for attachment to the bed plate. Consult the vehicle interior drawings.
- **Car Environment Geometrical Data.** Consult the vehicle interior drawings.
- **A reaction surface for the knees and feet** for 2nd and subsequent rows to represent the forward seat row.

3.6 Personnel/Skills.

The following individuals are necessary to complete this test procedure:

- **General Motors Responsible Engineer.** Provides seat and Appendix B criteria.
- **Testing organization Test Engineer.** Test Organization contact for General Motors Responsible Engineer. Ensures test is setup and executed properly.
- **Testing Organization Test Technician.** Sets up the test. Some fabrication and welding skills may be required depending on fixture/body preparation.

4 Procedure

4.1 Preparation.

4.1.1 Weigh the test seat(s) using the scale, and measure H-Point (mechanically hinged hip point of a manikin) per SAE J826 if not provided.

4.1.2 Fabricate the test fixture, or prepare the test vehicle body with load cells, and mount the fixture/body to the sled plate.

4.1.3 If utilizing a rigid plate, install the seat to the rigid fixture which represents the attachment to the body. Position the seat parallel to the test plate unless the test is representing an offset pulse, then position the seat to the offset angle to simulate vehicle environment as shown in Figure 2. For ECE R 21 Annex 8, the heel plate is set parallel to the seat. Position the specific Hybrid III ATD as shown in 4.1.3.1 through 4.1.3.3 for generic tests for seat development. There should be a reaction surface for the knees and feet which represent the forward row of seats if testing a 2nd or subsequent row. If the test performed is to a specific regulatory or NCAP requirement, such as FMVSS 208 or EU NCAP, then refer to the specific requirement setup position. The setup positions are different among various requirements as shown in Figure 1.

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