



Surface Scanning and H-Point Manikin - Seat Interaction

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. This document provides the procedures for the Three-Dimensional (3-D) surface scanning of seats for Computer Aided Design (CAD) analysis.

1.2 Applicability. These test procedures apply to complete seat systems (production seats or prototypes built at the intended manufacturing quality).

2 References

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

2.1 External Standards/Specifications.

SAE J826 SAE J2732

2.2 GM Standards/Specifications.

GMW16710 GMW16719

3 Resources

3.1 Facilities. Testing area must have a flat, level surface where the vehicle or test fixture can be set up and the Coordinate Measuring Machine (CMM) can be securely fixed in position so as not to allow movement during testing.

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 Coordinate Measuring Machine (CMM).

3.2.2 Three-Dimensional (3-D) Laser Scanner.

3.3 Test Vehicle/Test Piece. A complete seat, mounted in the vehicle or suitable buck.

3.4 Test Time.

Calendar time: 0.75 d

Test time: 4 h

Coordination time: 2 h

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Test requires an engineer or technician capable of operating the testing machinery and processing the recorded data.

4 Procedure

4.1 Preparation. Prior to the surface scanning of the seat cushion, seat back and head restraint, the seat's H-Point must be found. For all General Motors vehicles, the GMW16710 H-Point procedure shall be used. For

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competitive/non-GM seats the GMW16719 H-Point procedure shall be used. The H-Point, along with the thigh angle, torso angle, and heel point should be recorded and saved in the file that will be used when scanning the seat. The seat must not be adjusted once H-Point has been recorded.

Note: On certain surface finishes, such as chrome or very shiny surfaces, the surface scanning attachment may have difficulty picking up the returning signal and thus will not function correctly. To allow the scanner to read shiny surfaces, such as chrome, it is necessary to cover the surface with fine powder to remove glare.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

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. Surface Scanning Procedure.

4.3.1 Preferred Method. Establish a coordinate system and align points to coordinate system. The coordinate system should be referenced in appropriate vehicle coordinates according to the H-Point procedure used. For all General Motors vehicles, the GMW16710 shall be used. For competitive/non-GM vehicles the GMW16719 shall be used. Figure 1 has an example of vehicle coordinates. **Note:** This alignment with the coordinate system allows the seat to be scanned while mounted on a buck outside the vehicle if the locations of seat hard points are known.

4.3.1.1 Alternative Method. If it is not possible to establish a coordinate system that aligns to vehicle coordinates, scanning must be more extensive. The seat tracks and as much of the frame and adjusters as possible should be scanned to allow proper scan alignment in CAD. In addition, as an independent control, once the H-Point manikin is in the appropriate position, scan the seat and manikin. The manikin can then be removed and the un-occupied seat scanned.

4.3.2 Refer to GMW16710 or GMW16719 to measure H-Point, thigh angle and torso angle.

4.3.3 With the surface scanning attachment, scan each of the three surfaces of the seat: seat cushion, seat back and head restraint. It is important to ensure that the entire surface is scanned without any holes in the data. See Figure 2 for an example seat scan.

4.3.4 Clean up the scan data by removing any extraneous scanned surfaces.

4.3.5 Create polygonal model.

4.3.6 Save the points, lines, and planes used for seat positioning and H-Point measurement (e.g., thigh line, torso line, H-Point, seat back pivot, head restraint post, ball of foot, heel point, etc.) shall be saved as a .igs (iges) file. **Note:** Scan data of the seat frame and manikin positioned in the seat is also sufficient.

4.3.7 Save the three surfaces (seat cushion, seat back, and head restraint) as .stl or .jt files.

Figure 1: Example of Vehicle Coordinates

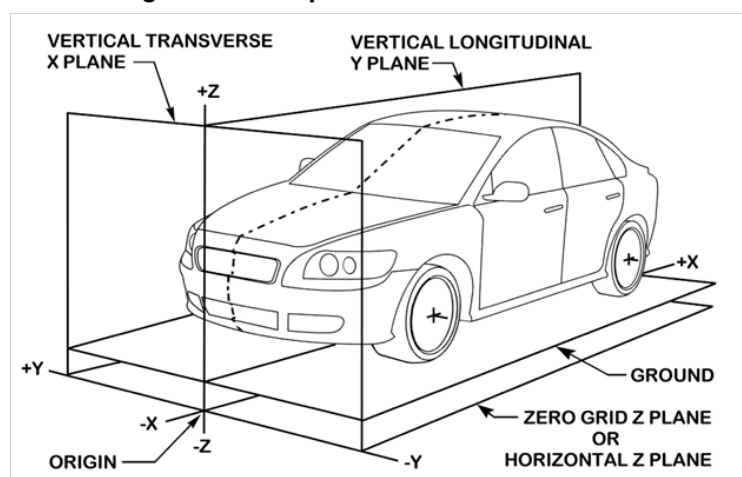


Figure 2: Example of Scanned Seat



5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results.

5.2.1 Prerequisite GM Worldwide Standards.

- GMW16710
- GMW16719

5.2.2 Scan Alignment.

5.2.2.1 Frame Aligned. The surface is left in the scan position, no alignment or modifications are made provided that the setup was done to vehicle coordinates. The frame points that were recorded in the GMW16710 procedure must remain in the released scan data to ensure proper alignment with the math frame points.

5.2.2.2 Occupant Aligned. Each surface (scan or math/CAD) needs to be aligned separately using the measured H-Point, torso angle line, and thigh angle line alignment defined as follows.

5.2.2.2.1 Aligning Seat Cushions. Align seat cushions by matching the measured H-Point and thigh angle lines from each cushion to one common thigh angle line and H-Point. To align the thigh angle lines, it will likely be necessary to rotate the seat cushions about the common H-Point.

5.2.2.2.2 Aligning Seat Backs and Head Restraints. The seat back and head restraint are to be aligned by matching the measured H-Point and torso angle lines from each seat back and head restraint to one common torso angle line and H-Point. To align torso angle lines, it will likely to rotate the seat backs and head restraints about the common H-Point.

5.2.2.2.3 Aligning SAE J826 H-Point Manikin (HPM) to Seats. The scan of the H-Point manikin used to perform the H-Point measurement should be aligned with the A-Surface scans to gauge the interaction of the manikin with the seat. This alignment is done similar to the way the seat backs and seat cushions were aligned.

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Page 3 of 14

- a. The Back Form of the manikin shall be aligned using the torso angle line and H-Point.
- b. The Buttock Form of the manikin shall be aligned using the thigh angle line and H-Point.

5.2.2.3 Using the Appropriate Alignment. The alignment that should be used is based on the aspects of the seat that of interest. Table 1 contains various measurements of interest and which alignment technique should be used.

Table 1: Alignment to be Used Based on Measurement of Interest

Measurement of Interest	Alignment to Use
Overall Width	Frame Aligned
Insert Width	Frame Aligned
Bolster Height	Frame Aligned
Bolster Asymmetry	Frame Aligned
Overall Length	Frame Aligned
Deviation from CAD surface	Frame Aligned
Deflection	Occupant Aligned
Bolster Exit	Occupant Aligned
Thigh Exit	Occupant Aligned
Upper Back Exit	Occupant Aligned
Seat Position Differences	Occupant Aligned
Knee Room (2 nd row) Differences (Competitor to GM)	Occupant Aligned
Contour Differences (Competitor to GM)	Occupant Aligned
Meat-to-Metal Differences (Competitor to GM)	Occupant Aligned
Head Restraint Backset Differences (Competitor to GM)	Occupant Aligned

5.2.3 Critical Cross Sections. The lateral and centerline cross sections that should be measured are from SAE J2732. These cross sections can be seen in Table 2 and Table 3. The SAE J2732 refers to the HPM II manikin; however, the HPM manikin (Oscar) shall be substituted for all measurements listed.

Table 2: Seat Cushion Sections

Section	Definition	Figure
Lateral Cross Section	80 mm behind the reference point	Not applicable
Lateral Cross Section	0 mm forward of the reference point	3
Lateral Cross Section	125 mm forward of the reference point	3
Lateral Cross Section	250 mm forward of the reference point	3
Centerline Cross Section	0 mm lateral of the reference point (plane parallel to the cushion and torso (back) line through the reference point)	4
Centerline Cross Section	± 110 mm on either side of the reference point (Note: that only the positive OR negative side of the centerline is necessary)	4

Table 3: Seat Back Sections

Section	Definition	Figure
Lateral Cross Section	35 mm above the reference point	3
Lateral Cross Section	175 mm above the reference point	3
Lateral Cross Section	350 mm above the reference point	3
Lateral Cross Section	450 mm above the reference point	Not applicable
Centerline Cross Section	0 mm lateral of the reference point (plane parallel to the cushion and torso (back) line through the reference point)	4
Centerline Cross Section	± 110 mm on either side of the reference point (note that only the positive OR negative side of centerline is necessary)	4

Figure 3: Lateral Cross Sections Referenced from H-Point

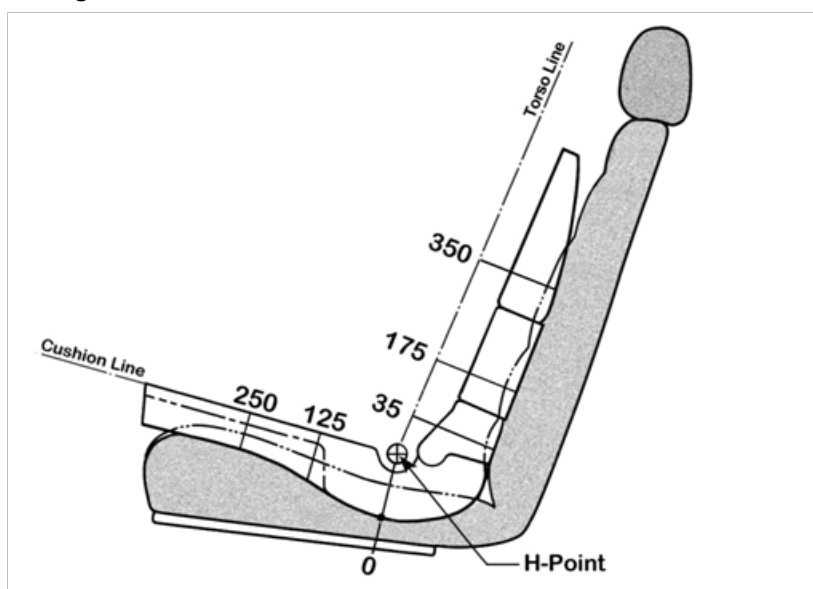


Figure 4: Centerline Cross Sections Referenced from H-Point

