



Occupant Protection - Interior Impact - Armrests

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. To determine whether armrests in the interior of the vehicle are consistent with the latest requirements of:

- Federal Motor Vehicle Safety Standard No. 201 (FMVSS 201).
- Canada Motor Vehicle Safety Standard No. 201 (CMVSS 201).
- Korean Motor Vehicle Safety Standard No. 100 (KMVSS 100).

1.2 Applicability. Passenger cars and multi-purpose passenger vehicles, trucks and buses with a gross vehicle weight rating (GVWR) of 4536 kg (10 000 lb) or less.

1.3 Remarks.

1.3.1 This test procedure contains the armrest tests associated with the requirements of CMVSS 201, FMVSS 201 and KMVSS 100.

1.3.2 Related test procedures are GMW14412 for seatback head impact, GMW14416 for instrument panel head impact, and GMW16609 for interior compartment doors.

2 References

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

2.1 External Standards/Specifications.

CMVSS 201	KMVSS 100	SAE J826
FMVSS 201	SAE J211-1	

2.2 GM Standards/Specifications.

GMW14412	GMW14416	GMW16609
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2.3 Additional References.

- Automotive Regulation Information Database.
- Best Practice KPAC FLRCONS-39 in Auros Active Knowledge System.
- Best Practice KPAC INTDRTR-36 in Auros Active Knowledge System.
- CG4119 Interior Armrest Performance Evaluation Report Template.

2.3.1 Legal Requirements.

2.3.1.1 The Federal, Canada, and Korea Motor Vehicle Safety Standards (FMVSS, CMVSS, and KMVSS) are given only for convenience and may have been summarized from the Automotive Regulation Information Database, as published by Safety Regulations and Certification. This database contains the most recent statement of regulatory requirements and supercedes those in this section. Guidance for interpreting FMVSS, CMVSS, and KMVSS requirements may be obtained from Safety Regulations and Certification.

2.3.1.2 The armrest shall meet at least one of the following (pelvic impact area) requirements: FMVSS 201 and CMVSS 201 can meet a, b, or c as follows; KMVSS 100 can meet a or c as follows.

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- a. It shall be constructed with energy absorbing material and shall deflect or collapse laterally at least 50 mm without permitting contact with any underlying rigid material; **or**
- b. It shall be constructed with energy absorbing material that deflects or collapses to within 32 mm of a rigid test panel surface without permitting contact with any rigid material. Any rigid material between 13 mm and 32 mm from the panel surface shall have a minimum vertical height of not less than 25 mm; **or**
- c. Along not less than 50 mm continuous of its length the armrest shall, when measured vertically in the side direction, provide at least 50 mm of coverage within the pelvic area.

2.3.2 General Information.

2.3.2.1 Note: For final judgment of compliance, the measurement units (whether Système International (SI) metric, non-SI metric, or otherwise) specified in the actual regulation should be used.

3 Resources

3.1 Facilities. Requires facilities having the equipment described in 3.2.

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 Test fixture with a Porta Power or equivalent mechanical (5 kN) device mounted to load selected areas on the armrest and approved data acquisition system with digital string pot. The test fixture needs to withstand a 5 kN load with < 1.0 mm of deflection.

3.2.1 Graduated scale to make measurements.

Note: All instrumentation is to be calibrated per SAE J211-1; record instrumentation details and date of calibration, unless the information is otherwise preserved in the testing facility records.

3.3 Test Vehicle/Test Piece.

3.3.1 A structure such as a short sill cowl, door sheet metal, a complete body or a vehicle to support the console, door trim or hard trim assembly and associated parts.

3.4 Test Time.

Calendar time: 2 days

Test hours: 1 h

Coordination hours: 4 h depending on test request

3.5 Test Required Information. Complete test request and parts.

3.6 Personnel/Skills. Technicians, data processors, imagers and engineering personnel trained in the procedure, method and equipment used in this standard.

4 Procedure

4.1 Preparation.

4.1.1 Pelvic Impact Area. The pelvic impact area for the armrest is determined by the following method.

4.1.1.1 The armrest will be inspected to establish if it is constructed or covered with energy absorbing material, such as foam, padding, soft fabric or other material designed to absorb impact energy. Inspect for hard projections.

4.1.1.2 Mark pelvic impact area as defined in 7.1 and Appendix A, Figure A1. A math data or template cutout may be required to identify the pelvic impact area.

4.1.1.3 Use math data or template cutout to place pelvic impact area in proper orientation in the vertical plane next to the armrest under evaluation.

4.1.1.4 Examine the armrest to record if at least 50 mm of vertical coverage has been provided by the armrest along at least 50 mm of its continuous length. This 50 mm x 50 mm zone must include the most inboard point

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on the armrest within the pelvic impact area. Further requirements to address the curvature or discontinuities in the surface are defined in 4.1.1.4.1, 4.1.1.4.2, and 4.1.1.4.3. Record and document results using Unigraphics (UG) math data model.

4.1.1.4.1 Cross-car (transverse) lines tangent to the surface within this 50 mm x 50 mm zone must be < 20 degrees from a vertical line when measured within a cross-car plane (Figure A2).

4.1.1.4.2 Armrests with a cross-car asymmetrical design must be examined on both the driver and passenger sides. If the armrest is designed to move while the adjacent storage bins remain latched (such as a sliding armrest on a floor console), all positions of the armrest must be examined.

4.1.1.4.3 If the 50 mm x 50 mm zone extends beyond the surface of the armrest such that a part joint is within the zone, the surfaces must be within 5.0 mm flushness of each other. See Figure A3 for an example of a console armrest which did not meet the 5.0mm requirement and Figure A4 for a door trim armrest which met the requirement. When the surfaces are within 5.0 mm, see Best Practice K-PAC FLRCONS-39 (Floor Console Armrest Coverage for FMVSS201 and CMVSS201 Compliance) and Best Practice KPAC INTDRTR-36 (Door Trim Armrest Vertical Coverage Regulatory Compliance Design Guidelines for All Vehicles) in the Auros Active Knowledge System for guidelines on how to apply the zone across the part joint. The supplier shall work with the GM Design Responsible Engineer to comprehend these requirements.

4.1.1.5 If the armrest does not meet the requirements in 4.1.1.4, examine the construction of armrest for the presence of energy absorbing material such as foam, padding, soft fabric or other material designed to absorb impact energy. Record the results. Except in the case of an armrest that folds into the seat back or between two seat backs, perform the following procedure(s) as appropriate:

- Floor Consoles: Perform a math data study to measure the minimal distance from the console armrest surface to closest structural component in the vehicle, typically the adjacent front seat frame.
 - If the minimal distance is > 50 mm, record the results from the UG math data model. Perform a Computer-Aided Engineering (CAE) simulation to replicate the procedure in 4.3. Record the results of the force-deflection curve as described in 4.3.1.5.
 - If the minimal distance is ≤ 50 mm, perform a Computer-Aided Engineering (CAE) simulation to replicate the procedure in 4.3. Record the results of the force-deflection curve as described in 4.3.1.5. Then complete the procedure in 4.3.
- Door and Hard Trim: Complete the procedure in 4.3.

4.2 Conditions.

4.2.1 Environmental Conditions. The console, door trim or hard trim assembly shall maintain ambient temperature of (23 ± 5) °C and relative humidity of (10 to 70)% for testing. Test cannot be conducted unless headform is exposed to the temperature conditions for not less than 4 h.

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. Reference SAE J211-1.

4.3.1 Pelvic Impact Test Setup. The pelvic impact test is performed with the following method.

4.3.1.1 Install the console, door trim or hard trim assembly in the test fixture and position a Porta Power or equivalent mechanical device (Figure A5 and Figure A6) with which to load the armrest along a lateral axis. For console armrest testing, the test fixture should include the passenger and/or driver seats or a rigid surface representation of the seat structure in vehicle position.

4.3.1.2 All armrests with unique geometry, such as an asymmetrical design on a console armrest or door trim armrests that are different between driver and passenger and/or between front and back, shall be evaluated by applying independent loads on each armrest.

4.3.1.3 The load application head is a flat 25 mm x 25 mm square surface and shall be placed at the center-point of the armrest. See Appendix B for the method of determining the center-point of a door trim armrest. The center-point of the console armrest is located at the mid-point along the length of the armrest at the highest vertical location where the load application head can make continuous contact.

4.3.1.4 A quasi-static load of 50 mm/minute shall be applied to the armrest laterally until a deflection of the 50 mm is observed.

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4.3.1.5 As output, the force-deflection curve from the Porta Power or equivalent mechanical device shall be monitored. The change in slope on the curve within the first 50 mm of displacement shall be $< +20\%$ of the initial slope measured in the first 10 mm of the force-deflection curve. Examine the load vs. deflection curve to determine if any underlying rigid material has been contacted by a component in the console, door trim or hard trim assembly. Any sudden spike in the curve implies contact with rigid material and shall be considered as a failure. Figure A7 shows a force-deflection example that met requirements.

4.3.1.6 At any stage, in 4.3.1.5, if underlying rigid material is contacted by a component of the armrest assembly, stop the loading test; examine the armrest construction and the underlying rigid material. The examination may require tearing down of the armrest. Record the measured deflection of the armrest when the rigid material was contacted. The rigid material must not be contacted before the armrest deflects 32 mm. If the rigid material is contacted between (32 and 50) mm of armrest deflection, the height of the rigid material must exceed 25 mm. See Figure A8 for further clarification using a door trim example.

4.3.1.7 Use collected data in steps 4.3.1.5 through 4.3.1.6 to evaluate Pass/Fail performance of the tested armrest.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. Record test results in Interior Armrest Performance Evaluation Report Template CG4119. The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary.

Auros: Active Knowledge System is a Global Technical Memory system for Product Development.

Cross-car: Across the width of the vehicle.

G: G-force refers to either the force of gravity on a particular celestial body or the force of acceleration anywhere. G-force is measured as 1G equals the force of gravity at the Earth's surface (9.8 m/s^2).

Pelvic Impact Area: Any area of the door or body side panel adjacent to any outboard Designated Seating Position (DSP) which is bounded by horizontal planes 177.8 mm (7 in) above and 101.6 mm (4 in) below the Seating Reference Point (SRP) and vertical transverse planes 203.2 mm (8 in) forward and 50.8 mm (2 in) rearward of the SRP. See Figure A1.

Quasi-static Load: Quasi-static loading refers to loading where inertial effects are negligible.

Seating Reference Point (SRP): The manufacturer's design reference point which:

- Establishes the rearmost normal design driving or riding position of each designated seating position in a vehicle; typically the most rearward and lowest seating position. This should be verified for each program.
- Has coordinates established relative to the designed vehicle structure;
- Simulates the position of the pivot center of the human torso and thigh; and
- Is the reference point employed to position the two-dimensional drafting template with the 95th percentile leg described in SAE J826, or, if the drafting template with the 95th percentile leg cannot be positioned in the seating position, is located with the seat in its most rearward adjustment position.

Underlying Rigid Material: Is a body made up of a material that does not deform when a force is applied.

7.2 Acronyms, Abbreviations, and Symbols.

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