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TEST METHOD 208

Occupant Restraint Systems in Frontal Impact

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1. Introduction

Test Method 208 — Occupant Restraint Systems in Frontal Impact (December 1996) is to be used for demonstrating compliance with the requirements of section 208 of Schedule IV to the *Motor Vehicle Safety Regulations*.

2. General Test Conditions

2.1 Applicability

The following conditions shall apply to the frontal barrier test.

2.2 Vehicle Loading

Except as provided for in subsection 2.2.4 of this Test Method, the vehicle, including test devices and instrumentation, shall be loaded as follows:

2.2.1 Passenger Cars. A passenger car shall be loaded to its unloaded vehicle mass, plus its rated cargo and luggage capacity mass secured in the luggage area, plus the mass of the necessary anthropomorphic test devices (ATD).

2.2.2 Multipurpose Passenger Vehicles, Trucks and Buses. A multipurpose passenger vehicle, truck or bus with a gross vehicle weight rating (GVWR) of 4 536 kg or less shall be loaded to its unloaded vehicle mass, plus the following:

- (a) the necessary anthropomorphic test devices,
- (b) a cargo carrying capacity or 136 kg, whichever is less, secured to the vehicle and distributed so that the weight on each axle, as measured at the tire-ground interface, is in proportion to its gross axle weight rating (GAWR), and
- (c) if the weight on any axle, when the vehicle is loaded to the unloaded vehicle weight plus the weight of the ATD, exceeds the axle's proportional share of the test weight, the remaining weight shall be placed on the other axle(s).

2.2.3 Work-performing Accessories. For the purposes of subsection 2.2.2, the unloaded vehicle mass does not include the mass of work-performing accessories.

2.2.4 Fuel System Capacity. The fuel tank shall be filled to any level from 90 to 95 per cent of the vehicle's fuel tank capacity, as defined in section 2 of the *Motor Vehicle Safety Regulations* (MVSRS), with Stoddard solvent having the physical and chemical properties of type 1 solvent, as set out in Table 1 of the American Society for Testing and Materials Standard D 484-71, *Standards Specification for Hydrocarbon Dry Cleaning Solvents*.

2.2.5 Vehicle Test Attitude. The distance between a level surface and a standard reference point on the test vehicle's body directly above each wheel opening, when the vehicle is in its "as delivered" condition, shall be determined. The "as delivered" condition is the vehicle as it was received at the test site, with 100 per cent of all fluid capacities and all tires inflated to the manufacturer's specifications, as listed on the vehicle's tire placard. The distance

between the same level surface and the same standard reference points in the vehicle's "fully loaded condition" shall be determined. The "fully loaded condition" is the test vehicle loaded in accordance with subsection 2.2.1 or 2.2.2, as applicable. The load placed in the cargo area shall be centred over the longitudinal centreline of the vehicle. The pretest vehicle attitude shall be equal to the "as delivered" or "fully loaded" attitude, or it shall be between the "as delivered" attitude and the "fully loaded" attitude.

2.3 Vehicle Adjustments

2.3.1 Adjustable Seats. Adjustable seats shall be in the adjustment position that is midway between the forward-most and rearmost positions and, if separately adjustable in a vertical direction, shall be at the lowest position. If an adjustment position does not exist midway between the forward-most and rearmost positions, the closest adjustment position to the rear of the midpoint shall be used.

2.3.2 Adjustable Seat Belt Anchorages. Adjustable seat belt anchorages shall be adjusted to the manufacturer's nominal design position for a 50th percentile adult male occupant.

2.3.3 Adjustable Seat Back Placement. Adjustable seat backs shall be placed in the manufacturer's nominal design riding position in the manner specified by the manufacturer. If a nominal position is not specified, the seat back shall be positioned so that the accelerometer surface in the head of the ATD, as positioned in the vehicle, is horizontal. If the vehicle is equipped with adjustable head restraints, each shall be adjusted to its highest adjustment position. Adjustable lumbar supports shall be positioned so that they are in their lowest adjustment position.

2.3.4 Adjustable Steering Columns. Adjustable steering columns shall be adjusted so that the steering wheel hub is at the geometric centre of the locus it describes when it is moved through its full range of driving positions.

2.3.5 Movable Windows and Vents. Movable windows and vents shall be placed, at the option of the manufacturer, in the fully closed position.

2.3.6 Convertibles and Open-body Type Vehicles. Convertibles and open-body type vehicles shall have the top, if any, in place in the closed passenger compartment configuration.

2.3.7 Doors. Doors shall be fully closed and latched, but not locked.

2.3.8 Manual Belt Adjustment for Dynamic Testing. With the ATD at its designated seating position, as specified by the requirements of subsection 2.3 and section 3, the Type 2 manual seat belt shall be placed around the ATD and the latch shall be fastened. All slack shall be removed from the lap belt. The upper torso webbing shall be pulled out of the retractor and allowed to retract. This operation shall be repeated four times. A 9-N to 18-N tension load shall be applied to the lap belt. If the belt system is equipped with a tension-relieving device, the maximum amount of slack recommended by the manufacturer for normal use shall be introduced into the upper torso belt. If no manual is provided, the maximum amount of slack that the retractor can provide shall be used. If the seat belt system

is not equipped with a tension-relieving device, the excess webbing in the shoulder belt shall be retracted by the retractive force of the retractor.

2.3.9 Air Bag Cut-off Switch. Any air bag cut-off switch shall be set such that the air bag is functional.

2.4 Anthropomorphic Test Devices

2.4.1 General. The ATDs used for the evaluation of restraint systems shall conform to the requirements of the U.S. *Code of Federal Regulations*, Title 49, Part 572, Subpart E (October 1, 1994) for a 50th percentile adult male dummy.

2.4.2 Clothing. Each ATD shall be clothed in form-fitting cotton stretch garments with short sleeves and mid-calf length pants, as specified in drawings 78051-292 and 78051-293, which are incorporated by reference in the U.S. *Code of Federal Regulations*, Title 49, Part 572, Subpart E (October 1, 1994), or their equivalents. A size 11 EE shoe, as specified in drawings 78051-294 (left) and 78051-295 (right), which are incorporated by reference in the U.S. *Code of Federal Regulations*, Title 49, Part 572, Subpart E (October 1, 1994), or their equivalents, shall be placed on the feet of the ATD.

2.4.3 Joints. The limb joints of the ATD shall be set at 1 g, barely restraining the weight of the limb when extended horizontally. The leg joints shall be adjusted with the torso in the supine position.

2.4.4 Instrumentation. Instrumentation shall not affect the motion of the ATDs during impact.

2.4.5 Temperature. The stabilized temperature of an ATD shall be at any level between 20.5°C and 22°C.

2.5 In-depth Investigation of an Apparent Non-compliance

Where a vehicle fails to meet the applicable compression deflection requirement specified in paragraph 208(22)(c) of Schedule IV to the MVSRs, one or more additional tests may be conducted. The results of these, and any other relevant tests, may be used to determine that the failure is not a result of test variables such as rib temperature, rib stiffness, dummy positioning or instrumentation calibration, and to determine whether the vehicle meets the compression deflection requirement.

3. ATD Positioning Procedure

3.1 Head

The head of the ATD shall be levelled in accordance with the following procedure so that its transverse instrumentation platform is horizontal within 0.5°:

- (a) to level the transverse instrumentation platform of the head of the ATD, adjust the position of the H-point within the limits specified in subsection 3.4.2.1,

- (b) if the transverse instrumentation platform of the head cannot be levelled using the above procedure, adjust the pelvic angle of the ATD within the limits provided for in subsection 3.4.2.2, and
- (c) if the transverse instrumentation platform of the head cannot be levelled using either of the above procedures, adjust the neck bracket of the ATD a minimum amount from the non-adjusted "0" setting so that the transverse instrumentation platform of the head is horizontal within 0.5°. The ATD shall remain within the limits specified in subsections 3.4.2.1 and 3.4.2.2 after adjustment of the neck bracket.

3.2 Arms

3.2.1 The upper arms of the ATD at the driver's position shall be adjacent to the torso with the centrelines as close to the vertical plane as possible.

3.2.2 The upper arms of the ATD at the passenger's position shall be in contact with the seat back and the sides of the torso.

3.3 Hands

3.3.1 The palms of the ATD at the driver's position shall be in contact with the outer part of the steering wheel rim at its horizontal centreline. The thumbs shall be over the rim and lightly taped to it so that the tape releases if the hand is pushed upward by a force of not less than 9 N and not more than 22 N.

3.3.2 The palms of the ATD at the passenger's position shall be in contact with the outside of the thigh. The little finger shall be in contact with the seat cushion.

3.4 Torso

3.4.1 Upper Torso

3.4.1.1 In vehicles equipped with bench seats, the upper torso of the ATDs at the driver and passenger positions shall rest against the seat back. The mid-sagittal plane of the ATD at the driver's position shall be vertical and parallel to the vehicle's longitudinal centreline, and it shall pass through the centre of the steering wheel rim. The mid-sagittal plane of the ATD at the passenger's position shall be vertical and parallel to the vehicle's longitudinal centreline, and it shall be the same distance from the vehicle's longitudinal centreline as the mid-sagittal plane of the ATD at the driver's position.

3.4.1.2 In vehicles equipped with bucket seats, the upper torso of the ATDs at the driver and passenger positions shall rest against the seat back. The mid-sagittal plane of the ATDs shall be vertical and shall coincide with the longitudinal centreline of the bucket seat.

3.4.2 Lower Torso

3.4.2.1 *H-point.* The H-point of the driver and passenger ATDs shall coincide, within 12 mm in the vertical dimension and 12 mm in the horizontal dimension, with a point 6 mm below the position of the H-point as determined by using the equipment and procedures specified in SAE J826 (June 1992), except that the length of the lower leg and thigh segments of the H-

point machine shall be adjusted to 414 mm and 401 mm, respectively, instead of the 50th percentile values specified in Table 1 of SAE J826.

3.4.2.2 Pelvic Angle. As determined by inserting the pelvic angle gauge [GM drawing 78051-532, which is incorporated by reference in the U.S. *Code of Federal Regulations*, Title 49, Part 572, Subpart E (October 1, 1994)] into the H-point gauging hole of the ATD, the angle measured from the horizontal on the 76-mm flat surface of the gauge shall be $22.5^\circ \pm 2.5^\circ$.

3.5 Legs

The upper legs of the ATDs at the driver and passenger positions shall rest against the seat cushion to the extent permitted by the placement of the feet. The initial distance between the outboard knee clevis flange surfaces shall be 270 mm. To the extent practicable, the left leg of the ATD at the driver's position and both legs of the ATD at the passenger's position shall be in vertical longitudinal planes. To the extent practicable, the right leg of the ATD at the driver's position shall be in a vertical plane. Further adjustment of the legs is permitted, if necessary, in order to accommodate the placement of the feet in accordance with the requirements of subsection 3.6 below and different passenger compartment configurations.

3.6 Feet

3.6.1 Placement of the Feet of the ATD at the Driver's Position

3.6.1.1 The right foot of the ATD shall rest on the undepressed accelerator pedal with the rearmost point of the heel on the floor pan in the plane of the pedal. If the foot cannot be placed on the accelerator pedal, it shall be set initially perpendicular to the lower leg and placed as far forward as possible in the direction of the pedal centreline, with the rearmost point of the heel resting on the floor pan. Except as prevented by contact with a vehicle surface, the right leg shall be placed so that the upper and lower leg centrelines fall, as closely as possible, in a vertical plane without inducing torso movement.

3.6.1.2 The left foot shall be placed on the toe board with the rearmost point of the heel resting on the floor pan as close as possible to the point of intersection of the planes described by the toe board and the floor pan, but not on the wheel well projection. If the foot cannot be positioned on the toe board, it shall be set initially perpendicular to the lower leg and placed as far forward as possible with the heel resting on the floor pan. If the foot is in contact with the vehicle's brake or clutch pedal, rotate it about the lower leg. If there is still interference, rotate the left leg outboard about the hip the minimum distance necessary to prevent the interference. Except as prevented by contact with a vehicle surface, the left leg shall be placed so that the upper and lower leg centrelines fall, as closely as possible, in a vertical plane. For vehicles with a foot rest that does not elevate the left foot above the level of the right foot, the left foot shall be placed on the foot rest so that the upper and lower leg centrelines fall in a vertical plane.

3.6.2 Placement of the Feet of the ATD at the Passenger's Position

3.6.2.1 Vehicles with a Flat Floor Pan/Toe Board. The right and left feet shall be placed on the vehicle's toe board with the heels resting on the floor pan as close as possible to the intersection point with the toe board. If the feet cannot be placed flat on the toe board, they shall be set perpendicular to the lower leg centrelines as far forward as possible, with the heels resting on the floor pan.

3.6.2.2 Vehicles with Wheelhouse Projections in the Passenger Compartment. The right and left feet shall be placed in the well of the floor pan/toe board and not on the wheelhouse projection. If the feet cannot be placed flat on the toe board, initially they shall be set perpendicular to the lower leg centrelines as far forward as possible, with the heels resting on the floor pan.

4. Positioning of the ATD for Latch Plate Access

The reach envelope referred to in subsection 208(33) of Schedule IV to the MVSRs shall be obtained by positioning an ATD in the driver's or passenger's seat with the seat in its forward-most adjustment position. The lines for the inboard and outboard arms shall be attached to the ATD as described in Figure 1. Each line shall be extended backward and outboard to generate the compliance arcs of the outboard reach envelope of the ATD's arms.

5. Positioning of the ATD for the Retraction Test

The vehicle shall be tested under the conditions specified in subsections 2.3.1, 2.3.2 and 2.3.3 of this Test Method. The arms of the ATDs shall be removed, and the ATDs shall be positioned in accordance with the requirements of section 3. For the purposes of the retraction requirements specified in subsection 208(35) of Schedule IV to the MVSRs, outboard armrests that are capable of being stowed in vehicle seats shall be placed in their stowed positions.

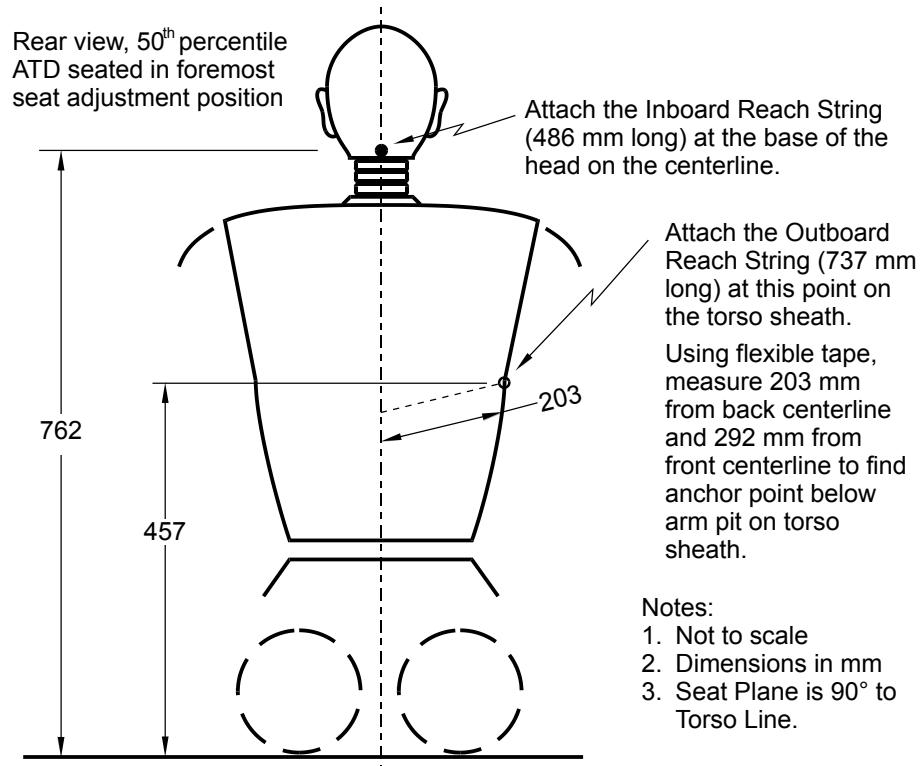


Figure 1: Location of the Anchoring Points for the Latch Plate Reach Limiting Chains or Strings to Test for Latch Plate Accessibility

6. Clearance Test Block

The clearance test block referred to in subsection 208(34) of the MVSRs is shown in Figure 2 below.

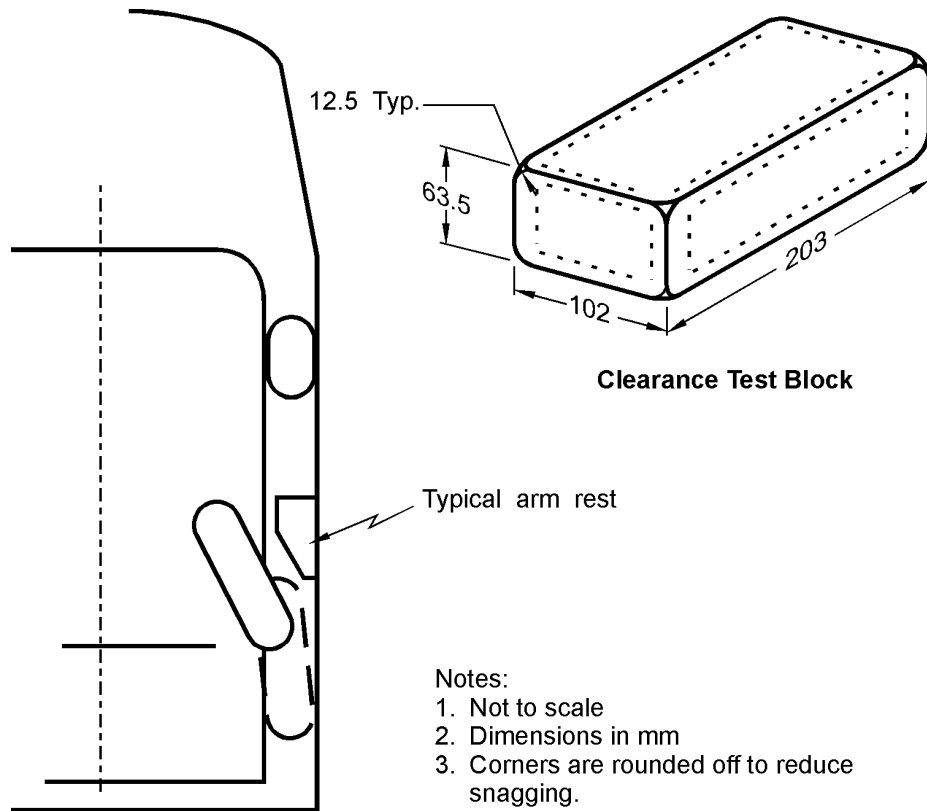


Figure 2: Use of the Clearance Test Block to Determine Hand and Arm Access

7. Measurement of the Distance Between the Rear of a Front Seat and the Backrest of a Rear Seat

7.1 In order to make the measurement required by paragraph 208(25)(b) of the MVSRs, the seat shall be adjusted as described in subsection 2.3.1 and the seat back as described in subsection 2.3.3 of this test method.

7.2 The distance between the rear of a front seat and the backrest of a rear seat shall be measured along a longitudinal horizontal line tangent to the highest point of the rear seat bottom in the longitudinal vertical plane according to the following:

- (a) in a vehicle equipped with front bucket seats, the vertical plane at the centre of the driver's seat cushion or
- (b) in a vehicle equipped with a front bench seat, the vertical plane that passes through the centre of the steering wheel rim.