



Transport Canada  
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## **Standards and Regulations Division**

# **TEST METHOD 213.4**

## **Built-In Child Restraint Systems and Built-In Booster Cushions**

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## 1. Introduction

*Test Method 213.4 — Built-In Child Restraint Systems and Built-In Booster Cushions* (January 2005) is to be used for demonstrating compliance with the requirements of section 213.4 of Schedule IV to the *Motor Vehicle Safety Regulations*.

(Original signed by)

Director, Standards Research and Development  
for the Minister of Transport  
Ottawa, Ontario

## 2. Definitions

**Specific vehicle shell** means the actual vehicle model part into which the built-in child restraint system or built-in booster cushion is fabricated, including the complete surroundings of the built-in system. If the built-in child restraint system or built-in booster cushion is manufactured as part of

- (a) any seat other than a front passenger seat, these surroundings include the back of the seat in front, the interior rear side door panels and trim, the specific seat, the floor pan, the B and C pillars, and the ceiling; or
- (b) the front passenger seat, these surroundings include the dashboard, the steering wheel column, and attached levers and knobs, the A pillars, any levers and knobs installed on the floor or on a console, the interior front side door panels and trim, the front seat, the floor pan and the ceiling.

*(châssis de véhicule de type particulier)*

**Specific vehicle** means the actual vehicle model into which the built-in child restraint system and/or built-in booster cushion is fabricated.  
*(véhicule de type particulier)*

### **3. Test Procedure**

#### **3.1 Test Devices**

- 3.1.1 The test device used in testing built-in child restraint systems and built-in booster cushions shall be either a specific vehicle shell or a specific vehicle.
- 3.1.2 An anthropomorphic test device (ATD) that represents a three-year-old child and conforms to the requirements of the U.S. *Code of Federal Regulations* (October 1, 1990), Title 49, Part 572, Subpart C, is to be used in the dynamic test and the buckle release test. The ATD must be clothed in:
- (a) thermal knit, waffle-weave polyester and cotton underwear,
  - (b) a size-4 long-sleeved shirt having a mass of 0.1 kg,
  - (c) a size-4 pair of long pants having a mass of 0.1 kg and cut off just far enough above the knee to allow the knee target point to be visible, and
  - (d) size-7M sneakers with rubber toe caps and uppers of dacron and cotton or nylon having a total mass of 0.45 kg.

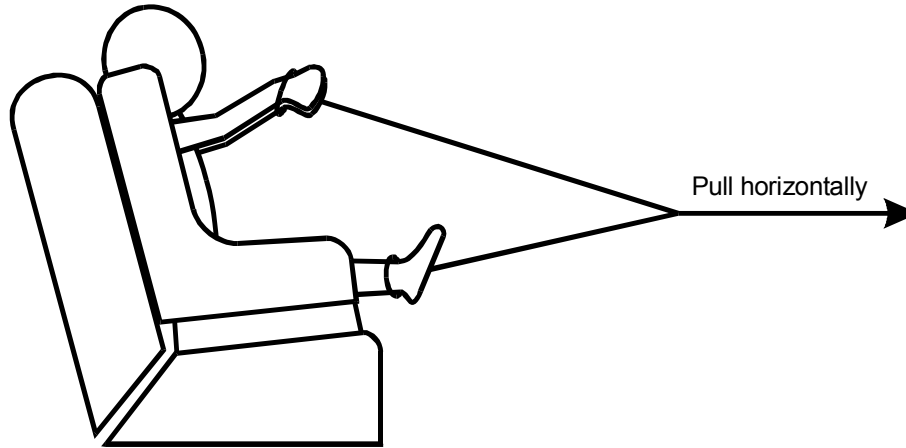
The clothing of the ATD, other than the shoes, shall be machine-washed in water that is 70°C to 82°C and machine-dried at 48°C to 60°C for 30 minutes.

- 3.1.3 Before being used in testing, the ATD shall be conditioned at any ambient temperature from 19°C to 26°C and at any relative humidity from 10% to 70% for at least 4 hours.

#### **3.2 Buckle Release Test Procedure**

- 3.2.1 The belt assembly buckles used for a built-in child restraint system or a built-in booster cushion shall be tested for release force in the following manner:
- (a) install the ATD in the built-in child restraint system or built-in booster cushion in accordance with subsection 3.4.3;
  - (b) tie a self-adjusting sling to the wrists and ankles of the ATD, as illustrated in Figure 1;
  - (c) pull the sling horizontally in the manner illustrated in Figure 1 and parallel to the longitudinal centreline of either the specific vehicle shell or the specific vehicle and apply a force of 200 N;
  - (d) operate the buckle release mechanism; and

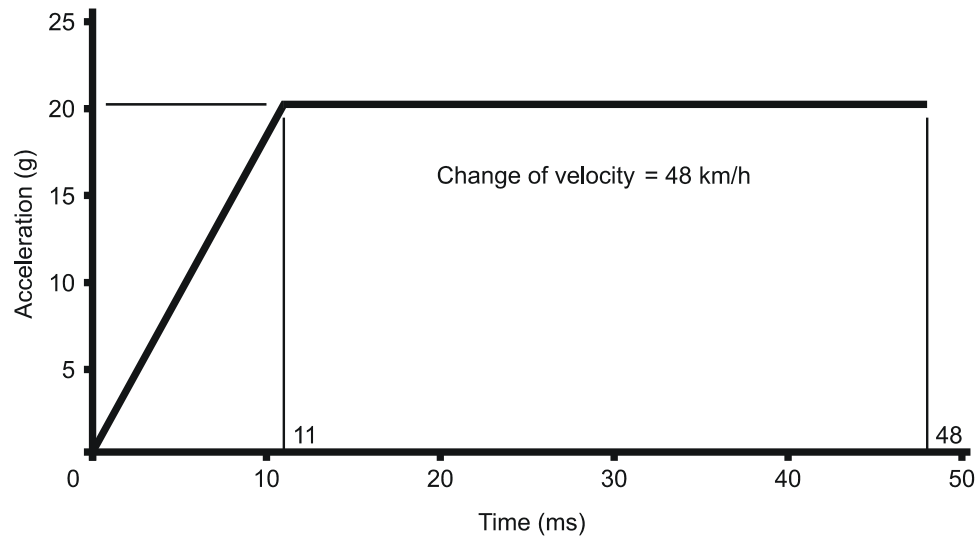
- (e) measure the buckle release force as specified in paragraph S5.2(d) of *Technical Standards Document No. 209 — Seat Belt Assemblies*.



**Figure 1 — Self-Adjusting Sling for the Buckle Release Test**

### ***3.3 Dynamic Test Conditions***

- 3.3.1 The test shall, at the option of the manufacturer, be either
- (a) a frontal impact simulation with the specific vehicle shell mounted on the test platform subject to a change of velocity of 48 km/hr with the acceleration of the test platform entirely within the curve shown in Figure 2; or
  - (b) a frontal barrier crash test of the entire specific vehicle, traveling longitudinally forward at any speed up to and including 48 km/hr impacting a fixed collision barrier that shall be perpendicular to the line of travel of the vehicle.



**Figure 2 — Test Platform Acceleration Graph**

- 3.3.2 When conducting the test with either the specific vehicle shell or the specific vehicle,
- prepare the system in accordance with the manufacturer's instructions that are required by subsection 213.4(19) of the *Motor Vehicle Safety Regulations*;
  - adjustable seats shall be in the adjustment position midway between the forward-most and the rearmost positions, and if separately adjustable in a vertical direction, are 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;
  - adjustable lumbar and side supports shall be adjusted in the lowest position and are not deployed;
  - adjustable seat backs are placed in the manufacturer's nominal design riding position. If a nominal position is not specified, the undeployed vehicle seat back shall be placed in an adjustment position so that the torso line of a 3-dimensional H-point machine installed on the undeployed vehicle seat, as specified in the Society of Automotive Engineers (SAE) Recommended Practice J826, measures as closely as possible to, without exceeding, 25°;
  - adjustable head restraints shall be adjusted to their highest adjustment position if not otherwise specified in the manufacturer's instructions;
  - operable vehicle windows and vents shall be placed in the fully opened or fully closed position;

- (g) convertibles and open-body type vehicles shall have the top, if any, in place in the closed passenger compartment configuration; and
- (h) doors shall be fully closed and latched but not locked.

3.3.3 If the specific vehicle shell is selected for testing,

- (a) it shall be mounted on a dynamic test platform so that the longitudinal centreline of the shell is parallel to the direction of travel of the test platform and so that movement between the base of the shell and the platform is prevented; and
- (b) the test platform shall be instrumented with an accelerometer that is linked to a data processing system, and the accelerometer-sensitive axis shall be parallel to the direction of travel of the test platform. The data shall be filtered with a Class 60 filter, as specified in the SAE Recommended Practice J211, *Instrumentation for Impact Tests* (October 1988).

3.3.4 If the specific vehicle is selected for testing, the vehicle shall be loaded to the following condition:

- (a) in the case of a passenger car,
  - (i) determine the rated cargo and luggage mass (RCLM) by  
$$\text{RCLM} = \text{VCM} \textit{ minus} \text{ NOM};$$
where: VCM is the vehicle capacity mass displayed on the tire placard of the vehicle; and  
NOM is the normal occupants' mass.
  - (ii) determine the adjusted rated cargo and luggage mass ( $\text{RCLM}_{\text{adjusted}}$ ) by  
$$\text{RCLM}_{\text{adjusted}} = \text{RCLM} \textit{ minus} \text{ the combined mass of the appropriate ATDs used to test the built-in child restraint systems and built-in booster cushions.}$$
  - (iii) determine the test mass (TM) by  
$$\text{TM} = \text{UVM} \textit{ plus} \text{ RCLM}_{\text{adjusted}} \textit{ * plus} (2 \textit{ times} \text{ ATDM}) \textit{ plus} \text{ the combined mass of the appropriate ATDs used to test the built-in child restraint systems and built-in booster cushions};$$

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\* This mass shall be secured in the luggage area.

where: UVM is the unloaded vehicle mass; and

ATDM is the mass of each of the two ATDs placed in the front outboard seating positions which may be, at the option of the manufacturer, an ATD that conforms to the requirements of Sub-part B (mass of 74.4 kg) or to the requirements of Sub-part E (mass of 78.6 kg) of the U.S. *Code of Federal Regulations*, Title 49, Part 572, revised as of October 1, 1990.

(b) in the case of a multi-purpose passenger vehicle,

(i) determine the rated cargo and luggage mass (RCLM) by

$$\text{RCLM} = \text{GVWR} \textit{ minus UVM minus (DSC times NOM)};$$

where: GVWR is the gross vehicle weight rating obtained from the compliance label;

UVM is the unloaded vehicle mass;

DSC is the designated seating capacity; and

NOM is the normal occupants' mass.

(ii) determine the adjusted rated cargo and luggage mass ( $\text{RCLM}_{\text{adjusted}}$ ) by

$$\text{RCLM}_{\text{adjusted}} = (\text{RCLM or } 136 \text{ kg, whichever is less}) \textit{ minus the combined mass of the appropriate ATDs used to test the built-in child restraint systems and built-in booster cushions.}$$

This mass is secured to the vehicle and distributed in accordance with subparagraph (iv) below.

(iii) determine the test mass (TM) by

$$\text{TM} = \text{VM}_{\text{adjusted}} \textit{ plus RCLM}_{\text{adjusted}} \textit{ plus the combined mass of the appropriate ATDs used to test the built-in child restraint systems and built-in booster cushions};$$

where:  $\text{VM}_{\text{adjusted}} = \text{UVM plus (2 times ATDM)}$ ; and

ATDM is the mass of each of the two ATDs placed in the front outboard seating positions which may be, at the option of the manufacturer, an ATD that conforms to the requirements of Sub-part B (mass of 74.4 kg) or to the requirements of Sub-part E (mass of 78.6 kg) of the U.S. *Code of Federal Regulations*, Title 49, Part 572, revised as of October 1, 1990.



- (iv) The test mass (TM) must be distributed over each axle so that the mass on each axle, as measured at the tire interface, shall be in proportion to its GAWR, in the following manner:

$$PM_{\underline{F}A} = TM \text{ times } \left( \frac{\text{frontGAWR}}{\text{frontGAWR} + \text{rearGAWR}} \right); \text{ and}$$

$$PM_{\underline{R}A} = TM \text{ times } \left( \frac{\text{rearGAWR}}{\text{frontGAWR} + \text{rearGAWR}} \right).$$

where:  $PM_{\underline{F}A}$  is the proportional mass over the front axle;  
and

$PM_{\underline{R}A}$  is the proportional mass over the rear axle;

*if*  $PM_{\underline{F}A}$  is smaller than or equal to the measured front axle share of the adjusted VM, then the final test mass over the front axle should be retained as the measured front axle share of the adjusted VM and the rear axle shall be loaded with the remaining mass placed over the rear axle in such a manner as to not change the mass over the front axle; or

*if*  $PM_{\underline{R}A}$  is smaller than or equal to the measured rear axle share of the adjusted VM, then the final test mass over the rear axle should be retained as the measured rear axle share of the adjusted VM and the front axle shall be loaded with the remaining mass placed over the front axle in such a manner as to not change the mass over the rear axle.

- (c) in the case of a bus with a GVWR greater than 4 536 kg, determine the test mass (TM) by;

TM = UVM *plus* ([unsecured mass of 54.5 kg at every designated seating position] *minus* [the combined mass of the appropriate ATDs used to test the built-in child restraint systems and booster cushions]) *plus* the combined mass of the appropriate ATDs used to test the built-in child restraint systems and booster cushions.

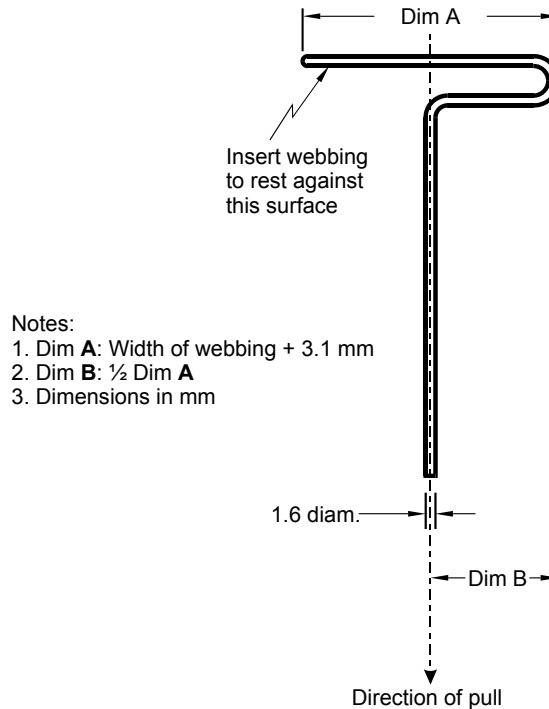
- (d) if a built-in child restraint system or built-in booster cushion is supplied in the vehicle at one of the seating positions requiring the placement of a 50<sup>th</sup> percentile ATD that conforms to Part 572 of the U.S. *Code of Federal Regulations*, then the 3-year-old ATD shall be substituted for the 50<sup>th</sup> percentile ATD, but only at that seating position. The test mass specified above shall be adjusted so that the final test mass remains as if the test had been performed with 50<sup>th</sup> percentile ATDs;

- (e) all instrumentation and data reduction shall be in accordance with SAE J211 OCT88;
  - (f) 50<sup>th</sup> percentile ATDs shall be installed at the applicable front outboard seating positions in accordance with the seating procedure described in *Test Method 208 — Occupant Restraint Systems in Frontal Impact* (December 1996);
  - (g) the parking brake shall be disengaged and the transmission shall be in neutral;
  - (h) the tires shall be inflated to the manufacturer's specification; and
  - (i) the fuel tank shall be filled to any level from 90% to 95% of capacity, and the rest of the fuel system shall be filled to its normal operating capacity in accordance with *Test Method 301 — Fuel System Integrity* (February 8, 2001).
- 3.3.5 The dynamic test shall be conducted at any ambient temperature from 19°C to 26°C and at any relative humidity from 10% to 70%.

### **3.4 Dynamic Test Preparation**

- 3.4.1 Prepare each built-in child restraint system and built-in booster cushion in accordance with the manufacturer's instructions that are required by subsection 213.4(19) of the *Motor Vehicle Safety Regulations*.
- 3.4.2 Place the ATD specified in subsection 3.1.2 in the built-in child restraint system or built-in booster cushion.
- 3.4.3 Position the ATD according to the manufacturer's instructions and as follows:
- (a) Holding the torso upright until it contacts the seat back of the system or cushion, seat the ATD so that the mid-sagittal plane of its head is vertical and parallel to the longitudinal centreline of the specific vehicle shell or the specific vehicle;
  - (b) Lift the arms of the ATD as far upward as possible. Extend the legs as far forward horizontally as possible, with the feet perpendicular to the centreline of the lower legs; and
  - (c) Using a flat square surface with an area of 2 580 mm<sup>2</sup>, apply a force of 180 N perpendicular to the back of the vehicle seat, first against the crotch of the ATD and then against the thorax at the mid-sagittal plane.
- 3.4.4 If shoulder and pelvic belts are provided that directly restrain the ATD, they must be adjusted by tightening the belts until a 10-N force applied simultaneously using a webbing tension pull device (as

illustrated in Figure 3) to the webbing at the top of each shoulder and to the pelvic webbing 50 mm on either side of the mid-sagittal plane of the torso pulls the webbing a distance of 6 mm away from the ATD.



**Figure 3 — Webbing Tension Pull Device**

3.4.5 For a built-in child restraint system or a built-in booster cushion that uses a fixed or movable surface to restrain the occupant, attach all appropriate restraint system belts and tighten them as specified in subsection 3.4.3 or 3.4.4. Position each movable surface in accordance with the manufacturer's instructions.

3.4.6 After the ATD has been installed in the restraint system, rotate each limb downward in a plane parallel to its mid-sagittal plane until the limb touches a surface of the restraint system, booster cushion, or a part of the specific vehicle or specific vehicle shell so that the limbs will not inhibit the movement of the torso or head during the test.

### **3.5 Dynamic Test**

3.5.1 Perform the dynamic test in accordance with the procedure described above.

***3.6 Post-Dynamic Test Buckle Release Test***

- 3.6.1 The buckle release test shall be repeated as described in subsection 3.2 after the dynamic test.