Transport Canada
Motor Vehicle Safety

Transports Canada
Sécurité des véhicules automobiles

TECHNICAL STANDARDS DOCUMENT No. 216, Revision 1R

Roof Crush Resistance

The text of this document is based on Federal Motor Vehicle Safety Standard No. 216a, *Roof Crush Resistance,* as published in the United States *Code of Federal Regulations*, Title 49, Part 571, revised as of May 12, 2009, as well as the Final Rule (correcting amendment) published in the *Federal Register* on Wednesday, April 7, 2010 (Vol. 75, No. 66, p. 17604).

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(Ce document est aussi disponible en français.)

Introduction

As defined by section 12 of the *Motor Vehicle Safety Act*, a Technical Standards Document (TSD) is a document that reproduces an enactment of a foreign government (e.g. a Federal Motor Vehicle Safety Standard issued by the United States National Highway Traffic Safety Administration). According to the Act, the *Motor Vehicle Safety Regulations* may alter or override some provisions contained in a TSD or specify additional requirements; consequently, it is advisable to read a TSD in conjunction with the Act and its counterpart Regulation. As a guide, where the corresponding Regulation contains additional requirements, footnotes indicate the amending subsection number.

TSDs are revised from time to time in order to incorporate amendments made to the reference document, at which time a Notice of Revision is published in the *Canada Gazette*, Part I. All TSDs are assigned a revision number, with "Revision 0" designating the original version.

Identification of Changes

In order to facilitate the incorporation of a TSD, certain non-technical changes may be made to the foreign enactment. These may include the deletion of words, phrases, figures, or sections that do not apply under the Act or Regulations, the conversion of imperial to metric units, the deletion of superseded dates, and minor changes of an editorial nature. Additions are underlined, and provisions that do not apply are ~~stroked through~~. Where an entire section has been deleted, it is replaced by: "[CONTENT DELETED]". Changes are also made where there is a reporting requirement or reference in the foreign enactment that does not apply in Canada. For example, the name and address of the United States Department of Transportation are replaced by those of the Department of Transport.

Effective Date and Mandatory Compliance Date

The effective date of a TSD is the date of publication of its incorporating regulation or of the notice of revision in the *Canada Gazette*, and the date as of which voluntary compliance is permitted. The mandatory compliance date is the date upon which compliance with the requirements of the TSD is obligatory. If the effective date and mandatory compliance date are different, manufacturers may follow the requirements that were in force before the effective date, or those of this TSD, until the mandatory compliance date.

In the case of an initial TSD, or when a TSD is revised and incorporated by reference by an amendment to the Regulations, the mandatory compliance date is as specified in the Regulations, and it may be the same as the effective date. When a TSD is revised with no corresponding changes to the incorporating Regulations, the mandatory compliance date is six months after the effective date.

Official Version of Technical Standards Documents

The PDF version is a replica of the TSD as published by the Department and is to be used for the purposes of legal interpretation and application.

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S1. Scope

This Technical Standards Document (TSD) ~~standard~~ establishes strength requirements for the passenger compartment roof.

S2. Purpose

The purpose of this Technical Standards Document (TSD) ~~standard~~ is to reduce deaths and injuries due to the crushing of the roof into the occupant compartment in rollover crashes.

S3. Application, incorporation by reference, and selection of compliance options

[CONTENT DELETED] For applicability, see Schedule III and subsections 216(1) and 216(2) of Schedule IV to the *Motor Vehicle Safety Regulations*.

S4. Definitions

Altered roof means the replacement roof on a motor vehicle whose original roof has been removed, in part or in total, and replaced by a roof that is higher than the original roof. The replacement roof on a motor vehicle whose original roof has been replaced, in whole or in part, by a roof that consists of glazing materials, such as those in T-tops and sunroofs, and is located at the level of the original roof, is not considered to be an altered roof. (*Toit modifié*)

[1]**Convertible** ~~means a vehicle whose A-pillars are not joined with the B-pillars (or rearmost pillars) by a fixed, rigid structural member.~~ (*Décapotable*)

S5. Requirements

S5.1 When the test device described in S6 is used to apply a force to a vehicle's roof in accordance with S7, first to one side of the roof and then to the other side of the roof:

(a) the lower surface of the test device must not move more than 127 millimetres, and

(b) no load greater than 222 Newtons (50 pounds) may be applied to the head form specified in S5.2 of Title 49 of the U.S. *Code of Federal Regulations* (CFR) 571.201 located at the head position of a 50th percentile adult male in accordance with S7.2 of this TSD ~~section~~.

[1] Please see subsection 2(1) of the *Motor Vehicle Safety Regulations* (MVSR) for the applicable definition.

S5.2 The maximum applied force to the vehicle's roof in Newtons is:

(a) for vehicles with a GVWR of 2 722 kilograms (6 000 pounds) or less, any value up to and including 3.0 times the unloaded vehicle mass ~~weight~~ of the vehicle, measured in kilograms and multiplied by 9.8, and

(b) for vehicles with a GVWR greater than 2 722 kilograms (6 000 pounds), any value up to and including 1.5 times the unloaded vehicle mass ~~weight~~ of the vehicle, measured in kilograms and multiplied by 9.8.

S6. Test device

The test device is a rigid unyielding block whose lower surface is a flat rectangle measuring 762 millimetres by 1 829 millimetres.

S7. Test procedure

Each vehicle must be capable of meeting the requirements of S5 when tested in accordance with the procedure in S7.1 through S7.6.

S7.1 Support the vehicle off its suspension and rigidly secure the sills and the chassis frame (when applicable) of the vehicle on a rigid horizontal surface(s) at a longitudinal attitude of 0 degrees ± 0.5 degrees. Measure the longitudinal vehicle attitude along both the driver and passenger sill. Determine the lateral vehicle attitude by measuring the vertical distance between a level surface and a standard reference point on the bottom of the driver and passenger side sills. The difference between the vertical distance measured on the driver side and the passenger side sills is not more than ± 10 mm. Close all windows, close and lock all doors, and close and secure any moveable roof panel, moveable shade, or removable roof structure in place over the occupant compartment. Remove roof racks or other non-structural components. For a vehicle built on a chassis-cab incomplete vehicle that has some portion of the added body structure above the height of the incomplete vehicle, remove the entire added body structure prior to testing (the vehicle's unloaded vehicle mass ~~weight~~ as specified in S5 includes the mass ~~weight~~ of the added body structure).

S7.2 Adjust the seats in accordance with S8.3.1 of Title 49 of the U.S. CFR 571.214. Position the top center of the head form specified in S5.2 of Title 49 of the U.S. CFR 571.201 at the location of the top center of the Head Restraint Measurement Device (HRMD) specified in Title 49 of the U.S. CFR 571.202a, in the front outboard designated seating position on the side of the vehicle being tested as follows:

(a) Position the three dimensional manikin specified in Society of Automotive Engineers (SAE) Surface Vehicle Standard J826, revised July 1995, "Devices for Use in Defining and Measuring Vehicle Seating Accommodation," (incorporated by reference, see paragraph S3.2), in accordance to the seating procedure specified in that document, except that the length of the lower leg and thigh segments of the H-point machine are adjusted to 414 and 401 millimetres, respectively, instead of the 50th percentile values specified in Table 1 of SAE J826 (July 1995).

(b) Remove four torso weights from the three-dimensional manikin specified in SAE J826 (July 1995) (two from the left side and two from the right side), replace with two HRMD torso weights (one on each side), and attach and level the HRMD head form.
(c) Mark the location of the top center of the HRMD in three dimensional space to locate the top center of the head form specified in Title S5.2 of 49 of the U.S. CFR 571.201.

S7.3 Orient the test device as shown in Figure 1 of this TSD ~~section~~, so that –

(a) Its longitudinal axis is at a forward angle (in side view) of 5 degrees (± 0.5 degrees) below the horizontal, and is parallel to the vertical plane through the vehicle's longitudinal centerline;

(b) Its transverse axis is at an outboard angle, in the front view projection, of 25 degrees below the horizontal (± 0.5 degrees).

S7.4 Maintaining the orientation specified in S7.3 of this TSD ~~section~~ –

(a) Lower the test device until it initially makes contact with the roof of the vehicle.

(b) Position the test device so that –

(1) The longitudinal centerline on its lower surface is within 10 mm of the initial point of contact, or on the center of the initial contact area, with the roof; and

(2) The midpoint of the forward edge of the lower surface of the test device is within 10 mm of the transverse vertical plane 254 mm forward of the forwardmost point on the exterior surface of the roof, including windshield trim, that lies in the longitudinal vertical plane passing through the vehicle's longitudinal centerline.

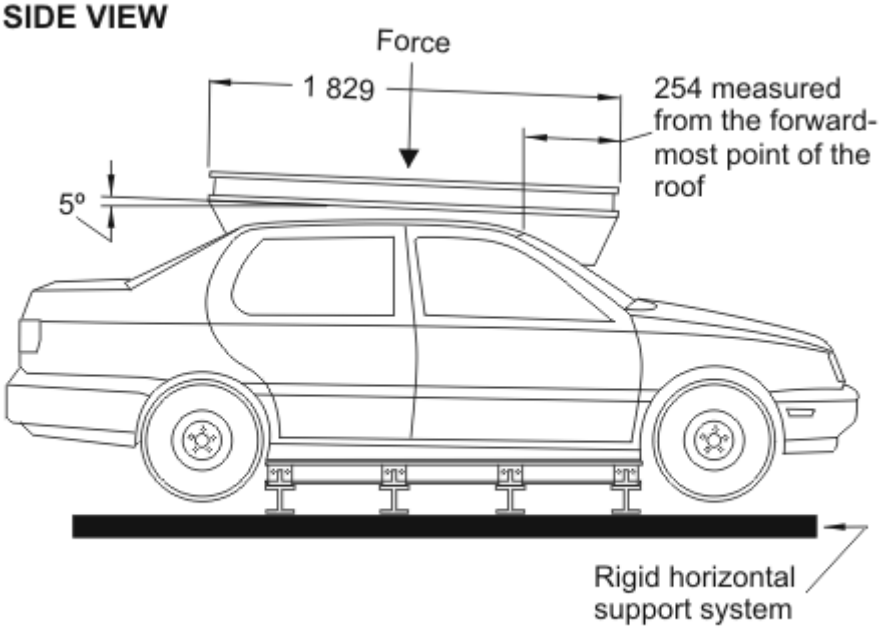
S7.5 Apply force so that the test device moves in a downward direction perpendicular to the lower surface of the test device at a rate of not more than 13 millimetres per second until reaching the force level specified in S5. Guide the test device so that throughout the test it moves, without rotation, in a straight line with its lower surface oriented as specified in S7.3(a) and S7.3(b). Complete the test within 120 seconds.

S7.6 Repeat the test on the other side of the vehicle.

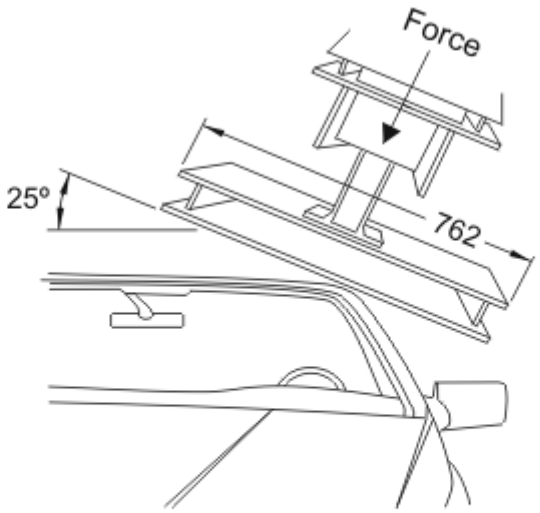
S8 –S9

[CONTENT DELETED]

SIDE VIEW



FRONT VIEW



Notes:
1. Dimensions in mm
2. Not to scale

Figure 1 — Test Device Orientation