
**Road vehicles — Securing of cargo in
passenger cars, station wagons and
multi-purpose vehicles — Requirements
and test methods**

*Véhicules routiers — Arrimage des charges à bord des voitures
particulières, des breaks et des véhicules à usages multiples —
Exigences et méthodes d'essai*



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Contents

Page

Foreword	iv
Introduction.....	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Requirements.....	3
4.1 General	3
4.2 Backrests/seats	4
4.3 Partitioning system	4
4.4 Lashing points	5
4.5 Loading instructions	6
5 Testing	6
5.1 Equipment	6
5.2 Test preparation	7
5.2.1 General	7
5.2.2 Test block positioning for seat testing	7
5.2.3 Test block positioning for testing of the partitioning system	11
5.3 Dynamic testing of backrests and partitioning systems.....	14
5.4 Testing of lashing points	14
5.4.1 Test procedure.....	14
5.4.2 Calculation	14
Bibliography.....	15

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 27955 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 12, *Passive safety crash protection systems*.

Introduction

Vehicles with variable space for transporting passengers, cargo, luggage and recreational equipment have been developed, produced and marketed successfully in recent years by nearly all vehicle manufacturers. In order to ensure all-embracing internal safety of these vehicles, it is necessary to effectively reduce the danger to occupants which could arise from the above-mentioned objects during extreme driving manoeuvres and also in accidents.

Regulations governing the resistance capabilities of the backrests of the rear seats and for the retaining equipment (partitioning systems) of vehicles of the M₁ class, which are intended to protect the occupants from the danger of shifting cargo during a frontal impact, are included in UNECE Regulation No.17, which first came into force in March 1999.

Since November 2007, uniform conditions have been included in UNECE Regulation No.126 for the approval of retrofit partitioning systems intended to protect the occupants from shifting cargo.

Up until now, there has been no complete and internationally recognized and harmonized specification of testing conditions for the resistance capability of front and rear seats in vehicles having a variable space concept.

DIN 75410-2, published in July 1992, is used increasingly, even at international level. In this standard, minimum requirements and tests are defined for devices for the securing of cargo (strength of seat backs, partitioning systems and lashing points) in cars, station wagons and multi-purpose vehicles. This is intended to enable a transport and an operational securing of cargo in vehicles, in order to reduce the risk of injuries to occupants caused. The main idea behind DIN 75410-2 was that lashing points in the luggage compartment, as well as sufficiently resistant seat backs and a partitioning system, are the basic elements for the protection of occupants.

For all commercially-used cars, station wagons and multi-purpose vehicles that are concerned by the accident prevention regulation for vehicles (BGV D29), compliance with DIN 75410-2 is mandatory in Germany. Furthermore, in certain countries, drivers are obliged by law to properly secure cargo in vehicles in compliance with state of the art.

In this context, ISO/TC 22/SC 12/WG 9 has analysed the requirements of UNECE Regulation No.17, UNECE Regulation No.126 and DIN 75410-2 and has harmonized requirements and test methods in accordance with state of the art. The result is this International Standard, which is a contribution to the international harmonization of requirements to increase the safety of vehicles.

Road vehicles — Securing of cargo in passenger cars, station wagons and multi-purpose vehicles — Requirements and test methods

1 Scope

This International Standard applies to devices for the securing of cargo in passenger cars¹⁾, station wagons¹⁾ and multi-purpose passenger cars¹⁾, where the seats directly delimit the loading space.

This International Standard defines minimum requirements and tests for front and rear seats and partitioning systems, in order to improve the protection of the vehicle occupants against shifting load during a frontal impact. In addition, this International Standard defines minimum requirements and tests for lashing points in the above-mentioned vehicles in order to be able to secure a load (luggage or goods) in a reliable and roadworthy way.

For vehicles²⁾ primarily designed for the transportation of cargo and derived from a passenger car¹⁾, only the requirements concerning the lashing points of this International Standard apply. Additional requirements for these vehicles²⁾ and requirements for any other delivery vans are specified in ISO 27956.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6549, *Road vehicles — Procedure for H- and R-point determination*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

single seat

seat structure, complete with trim, having a backrest not attached to the vehicle structure, and intended to seat one occupant

3.2

seat bench

seat structure, complete with trim, intended to seat more than one occupant

1) M₁ class vehicles (see 70/156/EEC), also defined as Category 1-1 Vehicles in UN ECE WP29 — Special resolution No. 1 (TRANS/WP.29/1045).

2) N₁ class vehicles (see ECE document TRANS/WP.29/78/Rev.1/Amend.2).

3.3

foldable seat or bench

seat or bench intended for normal use, or occasional use, or both, and which can be folded

3.4

anchorage

system by which the seat assembly is secured to the vehicle structure, including the affected parts of the vehicle structure

3.5

locking system

device ensuring that the seat and its parts are maintained in the position of use

3.6

adjustment system

device by which the seat or its parts can be adjusted to a position suited to the anthropometry of the seated occupant

NOTE This device can, in particular, permit longitudinal, vertical and angular displacement.

3.7

displacement system

device by which the seat or one of its parts can be displaced, or rotated, or both, to permit easy access of occupants to the space behind the seat concerned

3.8

head restraint

device whose purpose is to limit the rearward displacement of an adult occupant's head in relation to his torso, in order to reduce the risk of injury in the event of an accident

3.9

lashing point

attachment part on the vehicle or an integrated device, to which **lashing devices** (3.10) can be connected in a form-fit manner, and designed to transfer the forces applied by the lashing devices to the vehicle structure

EXAMPLE Ring, loop, tie-down, hook, eye, lug, hook-in edge, thread connection, rail.

3.10

lashing device

device that is designed to be attached to the lashing points in order to secure the load (luggage and goods) in the vehicle

NOTE Such a device can consist of a net, a tensioning device (e.g. belt, strap), a tensioning element (e.g. wrench, ratchet, spanner) and connections (e. g. hook, eyelet), as defined by the vehicle manufacturer.

3.11

partitioning system

parts or devices (e.g. partition, bulkhead, grid, net) which, in addition to the seat backs, are intended to protect occupants from displaced luggage

3.12

longitudinal plane

plane parallel to the median longitudinal plane of the vehicle

[ISO 3409:1975, definition 3.5]

3.13**transverse plane**

plane vertical to the median longitudinal plane of the vehicle

NOTE Adapted from ISO 3409:1975, definition 3.4.

3.14**test block**

test equipment, simulating cargo

3.15**luggage compartment**

area in the vehicle behind the second seat row or behind the last unfoldable/undetachable seat row (whatever row is located more rearward) normally used for the transportation of cargo

See Figure 2.

3.16**loading space**

area in the vehicle consisting of the luggage compartment plus an area which can variably be used for the transportation of occupants, or cargo, or both, as specified by the vehicle manufacturer

See Figure 3.

3.17**cargo**

load, luggage and goods which might be transported in the loading space

3.18**backrest**

part of the seat, designed to support the back, the shoulders and possibly the head of the occupant

4 Requirements

4.1 General

Table 1 provides a summary of the applicable requirements of this International Standard.

Table 1 — Overview

Element to which requirements apply	Passenger cars having backrests directly delimiting the loading space ^a	Station wagons, multi-purpose vehicles	Applicable test procedure
Backrests	Yes	Yes	5.3
Partitioning systems	Yes ^b	Yes ^{cd}	5.3
Lashing points	Yes ^b	Yes ^c	5.4
^a For example, sedans, notchbacks, hatchbacks. ^b If equipped. ^c At least optional equipment. ^d Only required if test block positioning in accordance with 5.2.3 is possible.			

4.2 Backrests/seats

In terms of stability, backrests that are intended to take on the function of delimiting the loading space shall be designed in such a way that they improve the protection of vehicle occupants against shifting load during severe deceleration of the vehicle (see Figure 16).

During the test in accordance with 5.3, the test blocks shall be retained by the backrest and the locking system of the backrest shall still be engaged. Permanent deformations of the backrest, seat, anchorages, adjustment systems and displacement systems are permissible as long as they do not cause injury risks to the occupants. After the test, no sharp or rough edges likely to increase the danger or severity of injuries of the occupants shall be present.

NOTE The requirements of this paragraph are deemed to be met for any seat system type approved in accordance with the luggage retention requirements of UNECE Regulation No.17.

4.3 Partitioning system

Occupants sitting on the rearmost row of seats directly delimiting the loading space should be protected by a partitioning system in order to improve the protection against unsecured load also above the backrests.

During the test in accordance with 5.3, the test blocks shall be retained by the partitioning systems, or the integrated vehicle parts, or both. The partitioning systems, or the integrated vehicle parts, or both, shall remain in position and shall not break away from its attachment points.

During the test in accordance with 5.3, the front surface of the partitioning systems, or the integrated vehicle parts, or both, if defined as being part of the partitioning system (see Note below), shall not be displaced forward more than 300 mm beyond a transverse plane which touches the rear edge of the seat backs in design position.

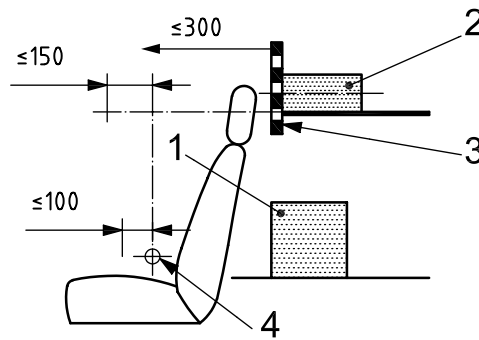
If, in exceptional cases, the forward movement exceeds 300 mm, the manufacturer shall demonstrate, e.g. with the help of high-speed films, that there is no additional risk for the occupants. In these cases, the following limits may not be exceeded by the forward contour of the partitioning system, or integrated vehicle parts, or both, if they are harder than 50 shore A:

- up to a transverse plane 100 mm forward of the R point;
- up to a transverse plane 150 mm forward of the R point for head restraints taking on partially or totally the function of the partitioning system;
- all measurement shall be taken in the longitudinal median plane of the corresponding seat or seating position for each seating position constituting the forward boundary of the loading space.

Permanent deformations or partial destructions of the partitioning system are permissible as long as no sharp edges, or separated parts, or both, cause additional injury risks to the occupants.

NOTE The vehicle manufacturer can define whether the head restraints or other integrated vehicle parts (e.g. folded backrests) are designed to take on the function of a partitioning system.

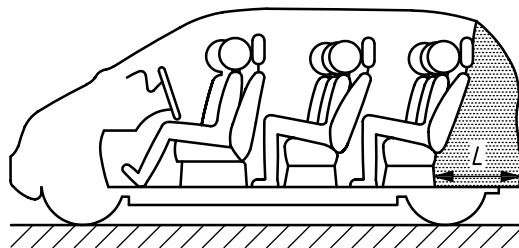
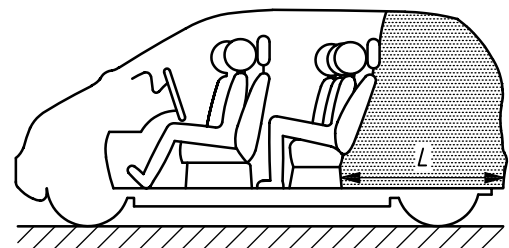
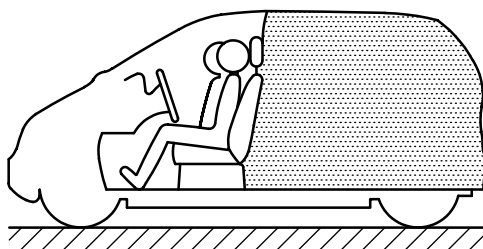
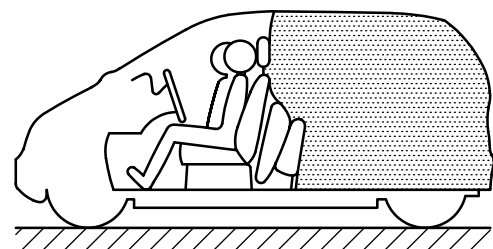
Dimensions in millimetres

**Key**

- 1 test block type 1
- 2 test block type 2
- 3 partitioning system
- 4 R-point (seat reference point)

Figure 1 — Limits of forward displacement for partitioning system**4.4 Lashing points**

4.4.1 For vehicles to be equipped with lashing points (see Table 1), the **luggage compartment** (3.15) shall be equipped with at least four lashing points. It is also recommended to install lashing points into the entire **loading space** (3.16) (see Figure 3). If the length L [measured on the floor at $y = 0$ and the rear seat(s), if longitudinally adjustable, and positioned in design position] of the luggage compartment in longitudinal direction is less than 700 mm (see Figure 2), one lashing point pair (two lashing points) is sufficient.

**a) Example of 3rd seat row = rear most seat row**
(delimiting the luggage compartment)**b) Example of 2nd seat row = rear most seat row**
(delimiting the luggage compartment)**Figure 2 — Definition of luggage compartment****a) 2nd seat row removed****b) 2nd seat row folded****Figure 3 — Definition of loading space**

4.4.2 Lashing points shall be located on the floor, or side walls, or both, as closely as possible to the floor, but not more than 150 mm above the floor of the loading area. The lashing points should be arranged in pairs, located opposite to each other and distributed as evenly as possible alongside the loading area. The longitudinal distance between two adjacent lashing points shall not be more than 1 200 mm.

4.4.3 Each lashing point shall be designed for a nominal tension force F_N and shall withstand the test force applied under any angle in the range between 15° and 45° to the vertical during the test specified in 5.4. Permanent deformation is permissible, provided the lashing point retains its functionality, as defined in 3.9.

$$F_N = 1/2 m_P \times g$$

but at least 3 kN and not more than 3,5 kN, where

F_N is the nominal tension force, in N;

m_P is the maximum payload, in kg;

g is the acceleration of gravity (9,81 m/s²), in m/s².

4.4.4 If the lashing point consists of a ring, the useable inner diameter shall be ≥ 20 mm. In case smaller rings are fitted, the vehicle manufacturer shall provide appropriate connecting elements.

4.4.5 If a lashing point consists of a threaded port, the vehicle manufacturer shall provide appropriate connecting elements.

4.5 Loading instructions

In the owner's manual, provided with each vehicle, the vehicle manufacturer shall give the following information:

- information about lashing devices and partitioning systems for cargo securing with which the vehicle is equipped or which can be fitted;
- instructions for cargo securing with regard to traffic and operational safety and for various loading space configurations.

5 Testing

5.1 Equipment

Test blocks, as specified in Table 2 and as shown in Figures 4 and 5, shall be used for testing in accordance with 5.3.

The test blocks shall have the following characteristics: rigid body with the centre of gravity in the geometric centre. Recommended materials are hard plywood and aluminium.

Hollows and drilled holes for adjustment of weight and inertia, for attachment of rebound straps and for the installation of measuring devices (e.g. for accelerometers) are permitted.

Table 2 — Test blocks

Dimensions in millimetres

Types	Shape	Dimensions	Radius of edges	Mass
1	Cube	300 × 300 × 300	20	18 kg ± 100 g
2	Cuboid	500 × 350 × 125	20	10 kg ± 100 g

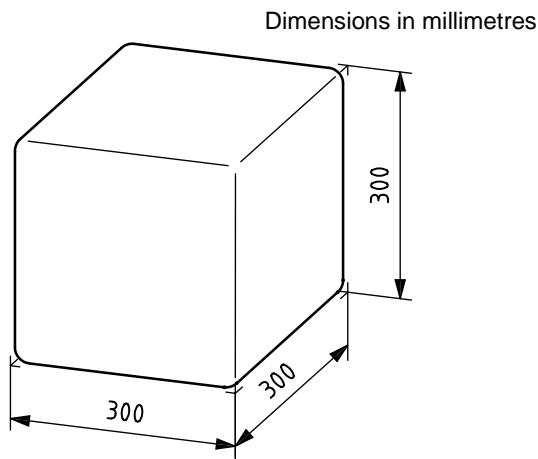


Figure 4 — Test block type 1

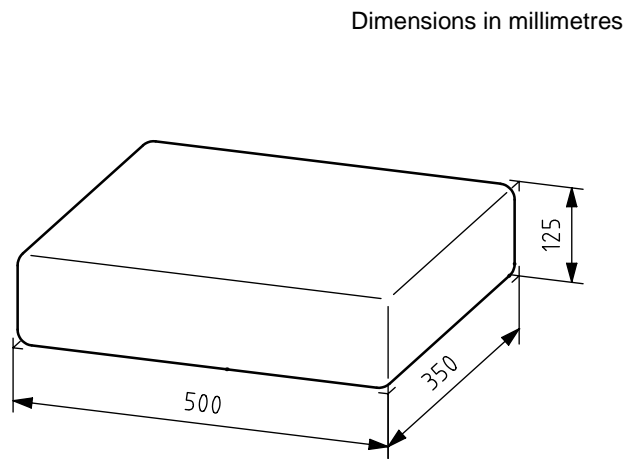


Figure 5 — Test block type 2

5.2 Test preparation

5.2.1 General

The tests shall be conducted within an appropriate vehicle body (see Table 1). A complete vehicle or a body in white, containing all the equipment required, shall be used for the testing. If head restraints are standard equipment for the seat to be tested, they shall be put in the highest position, if adjustable. If a partitioning system is installed behind seats with optionally equipped head restraints, the test of the partitioning system shall be carried out without head restraints. The test report shall specify whether a test was conducted with or without head restraints.

The position of the seat backs to be tested shall be in their unfolded normal position, for use with the locking system engaged, if any. Unless otherwise specified by the manufacturer, adjustable seat backs shall be locked in a position corresponding to a rearward inclination as close as possible to 25° from the vertical in relation to the torso reference line of the H-point machine as described in ISO 6549.

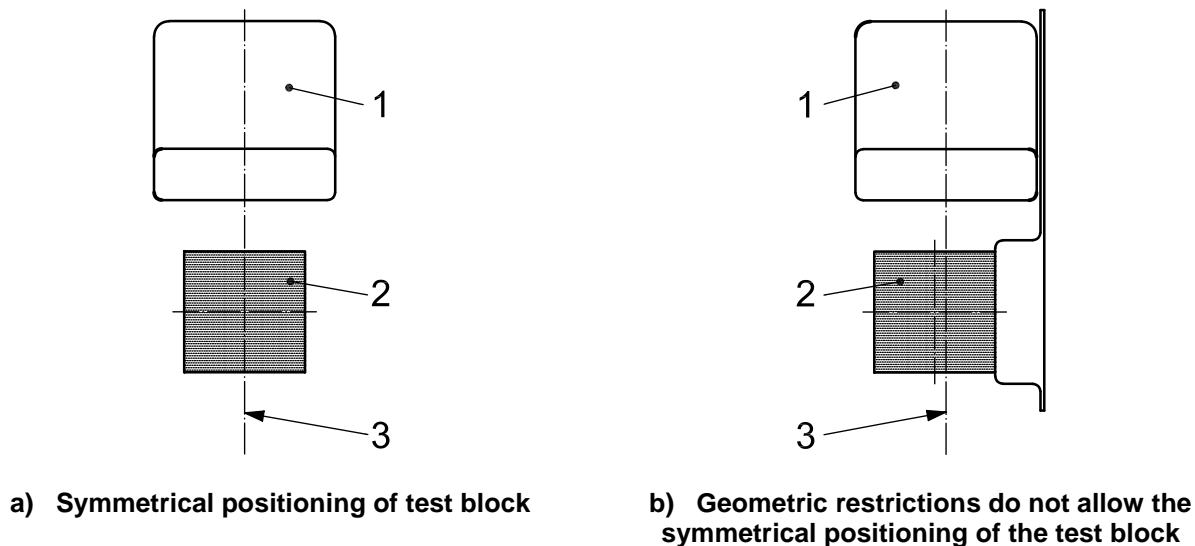
Seats to be tested shall be adjusted in such a way that the locking system cannot be released by external factors during the test. Longitudinal adjustable seats shall be secured one notch or 10 mm in front of their rearmost possible position of use, as specified by the manufacturer. For seats with vertical adjustment independent from any other adjustments, the seat/cushion shall be placed to its lowest possible position.

5.2.2 Test block positioning for seat testing

The test blocks shall be positioned within the loading space behind the backrests to be tested without being attached in any way. However, rebound straps are permitted provided the strap does not influence the kinematics of the test block during the test.

5.2.2.1 Transversal positioning behind single seats

5.2.2.1.1 For testing of single seats, a test block (type 1) shall be placed behind the seat to be tested with its centre of gravity in line with the median longitudinal plane of the seat as shown in Figure 6 a). If the dimensions or other restrictions of the loading space do not allow to position a test block in line with the longitudinal median plane of the seat, or stable on its contact area to the ground, or both, the centre of gravity of the test block shall be positioned as near as possible to the median longitudinal plane of the seat [see Figure 6 b)].

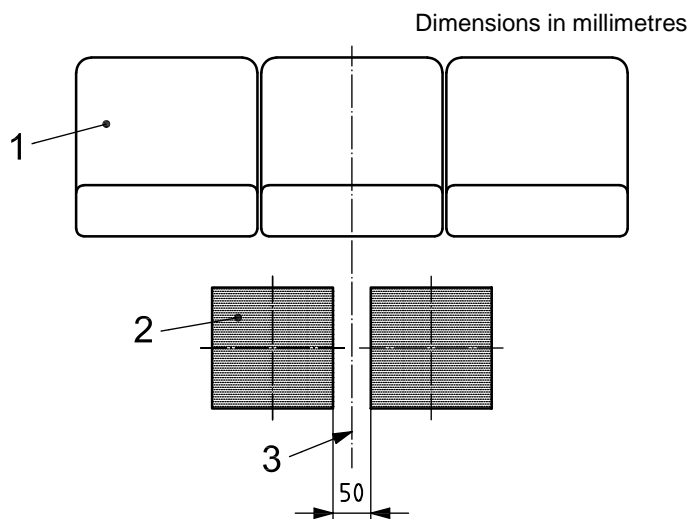


Key

- 1 single seat
- 2 test block type 1
- 3 median longitudinal plane of the seat

Figure 6 — Testing of a single seat

5.2.2.1.2 For the testing of single seats combined in a row, two test blocks (type 1) shall be placed side by side symmetrically to the median longitudinal plane of the vehicle behind the row of seats to be tested as shown in Figure 7. The distance between the longitudinal median plane of the vehicle and each test block shall be 25 mm, to obtain a distance of 50 mm between both blocks.



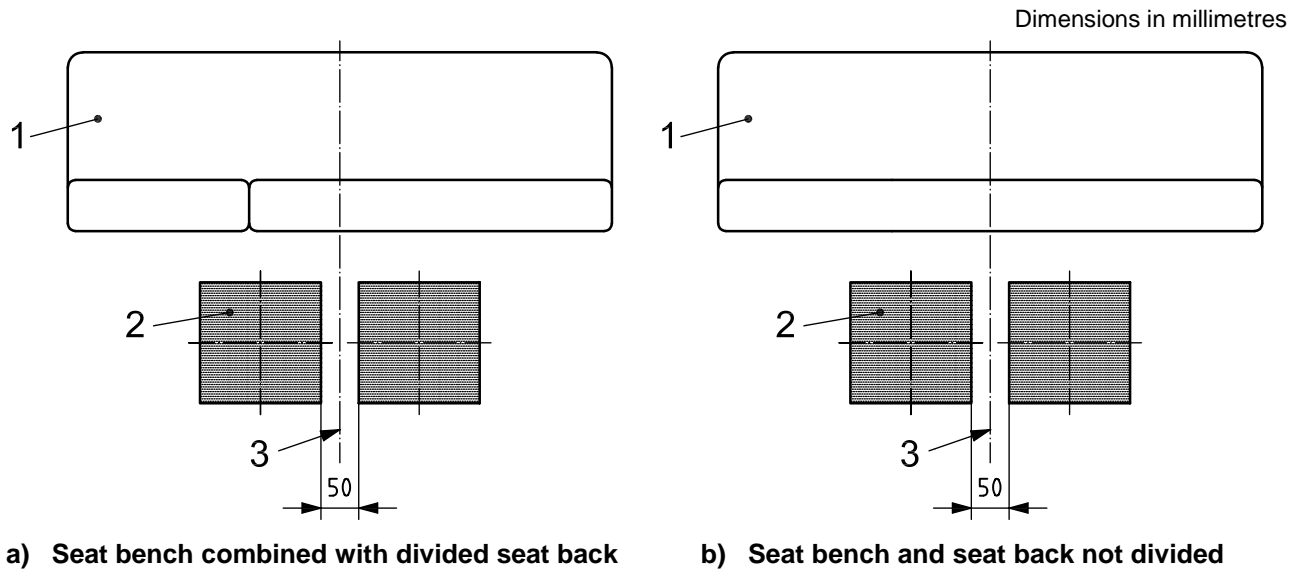
Key

- 1 row of single seats
- 2 test block type 1
- 3 median longitudinal plane of the vehicle

Figure 7 — Testing of three single seats combined in one row

5.2.2.2 Transversal positioning behind a seat bench

Two test blocks (type 1) shall be placed side by side symmetrically to the median longitudinal plane of the vehicle behind a seat bench as shown in Figure 8. The distance between the longitudinal median plane of the vehicle and any test block shall be 25 mm, to obtain a distance of 50 mm between both blocks.



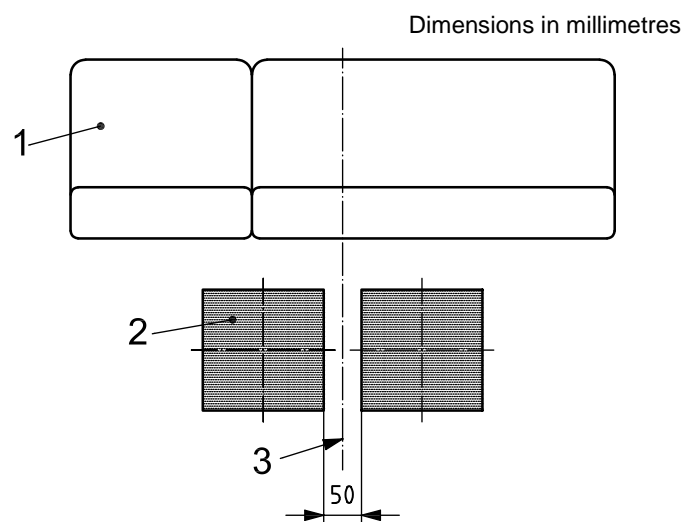
Key

- 1 seat bench
- 2 test block type 1
- 3 median longitudinal plane of the vehicle

Figure 8 — Testing of a seat bench with and without separate (foldable) seat backs

5.2.2.3 Transversal positioning behind combinations of single seats and seat benches

5.2.2.3.1 Two test blocks (type 1) shall be placed side by side symmetrically to the longitudinal median plane of the vehicle behind the seat bench to be tested as shown in Figure 9. The distance between the longitudinal median plane of the vehicle and each test block shall be 25 mm, to obtain a distance of 50 mm between both blocks.

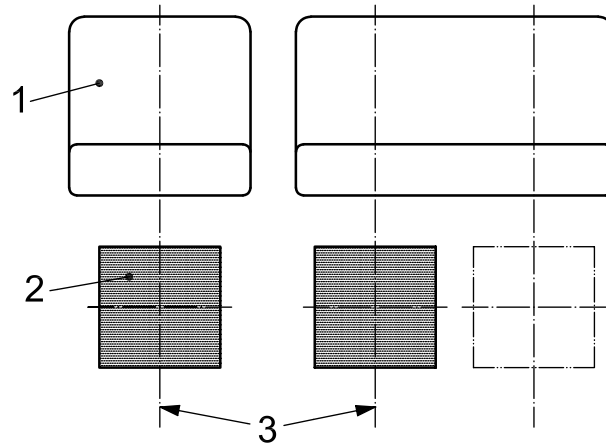


Key

- 1 seat bench
- 2 test block type 1
- 3 median longitudinal plane of the vehicle

Figure 9 — Testing of a combination of a single seat and a seat bench (normally a rear-seat bench)

5.2.2.3.2 If there is a gap between the single seat and the seat bench of more than 200 mm, so that the test blocks could pass through, the test block (type 1) behind the single seat shall be positioned as described in 5.2.2.1.1 and the test block (type 1) behind the seat bench shall be placed with its centre of gravity in line with the median longitudinal plane of one of the seating positions of the seat bench (worst-case testing) as shown in Figure 10.



Key

- 1 seat and seat bench
- 2 test block type 1
- 3 median longitudinal plane of the seat or seating position

Figure 10 — Testing of a combination of a single seat and a seat bench with a gap in between

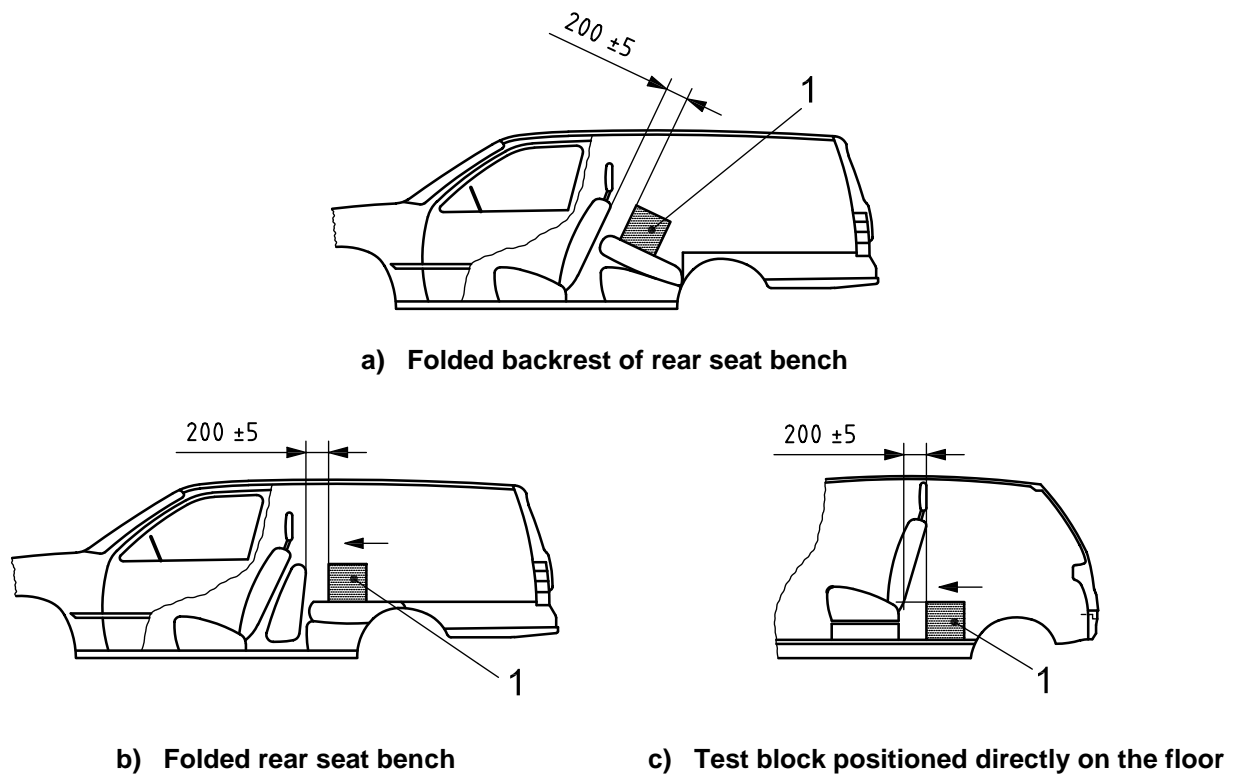
5.2.2.4 Longitudinal positioning behind single seats or seat benches

The positioning depends on

- the various loading space configurations (see 4.5),
- the design of the seat or seat bench behind the seat to be tested, and
- the manufacturer's instructions.

The test blocks (type 1) should be placed in a realistic way as the luggage or goods would be placed. Some examples are shown in Figure 11.

Dimensions in millimetres

**Key**

1 test block type 1

Figure 11 — Longitudinal positioning of test blocks depending on local conditions behind the seat or seat bench to be tested

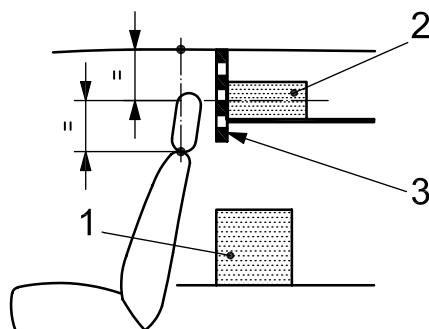
In order to determine the position of the test blocks (type 1) in longitudinal direction behind the seats, the following procedure shall be applied:

- position the blocks on the floor of the loading space (see 5.2.2.1);
- bring them in contact with the seat or the seat bench to be tested;
- then move them backwards, parallel to the median longitudinal plane of the vehicle until they have traversed a distance of (200 ± 5) mm (see Figure 11).

If the dimensions of the luggage compartment do not allow a distance of 200 mm and if the rear seats are horizontally adjustable, these seats shall be moved forward to the limit of the adjustment range intended for normal occupant use, or to the position resulting in a distance of 200 mm, whichever is less. In other cases, the test blocks shall be placed as far as possible behind the rear seats.

5.2.3 Test block positioning for testing of the partitioning system

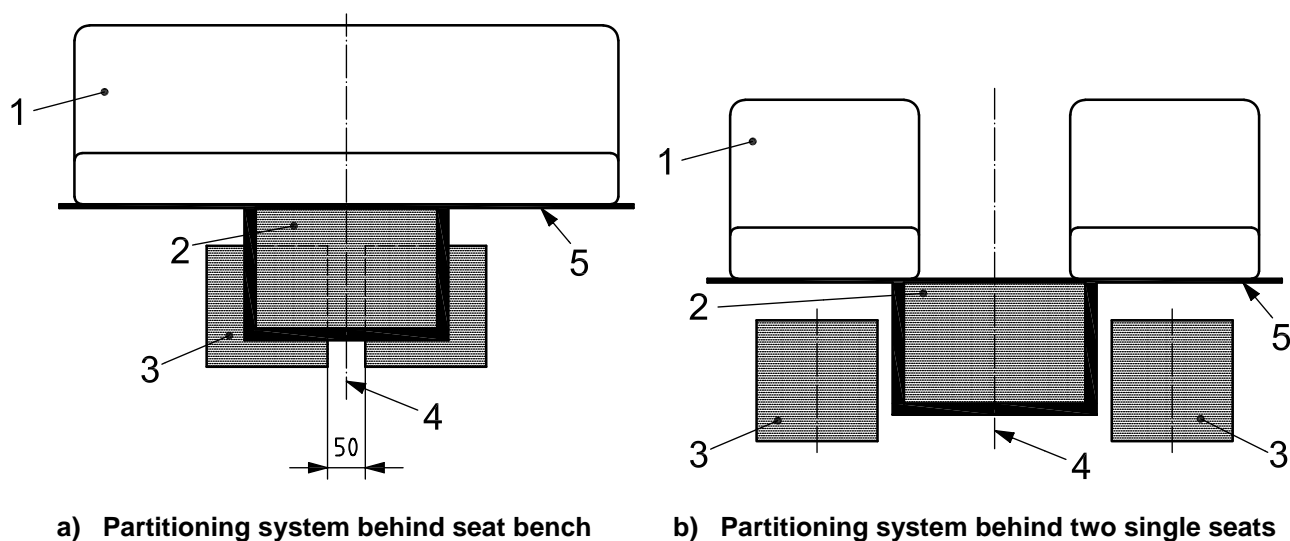
5.2.3.1 For the test of the partitioning systems above the backrests, the vehicle shall be fitted with a fixed raised test floor having a horizontal load surface that locates the centre of gravity of the test block (type 2) centrally between the top edge of the bordering backrest (without taking into account the head restraints) and the bottom edge of the roof lining (see Figure 12).

**Key**

- 1 test block type 1
- 2 test block type 2
- 3 partitioning system

Figure 12 — Vertical positioning of the raised test floor supporting test block type 2

5.2.3.2 A test block (type 2) is placed on the raised test floor with its largest surface (500×350) mm, centrally in relation to the median longitudinal plane of the vehicle and with its surface (500×125) mm to the front (see Figure 13). The test block (type 2) shall be placed directly in contact with the partitioning system. In addition, two type 1 test blocks shall be positioned in order to perform a simultaneous test on the backrests and the partitioning system. The test blocks shall be positioned in accordance with 5.2.2 if the seat backs are not covered by the partitioning system. If the partitioning system covers the entire height of the loading space, the test blocks type 1 shall be brought into contact with the partitioning system and moved backwards 200 mm.

**Key**

- 1 seat bench or single seat
- 2 test block type 2
- 3 test block type 1
- 4 median longitudinal plane of the vehicle
- 5 partitioning system

Figure 13 — Transversal positioning of the test block type 2

5.2.3.3 Figures 14 a) to 14 d) illustrate the testing a partitioning system above the backrest. Figures 15 a) to 15 d) illustrate the testing of a partitioning system covering the entire height of the loading space. Partitioning systems, behind which the type 2 test block cannot be installed, are exempted from this test.

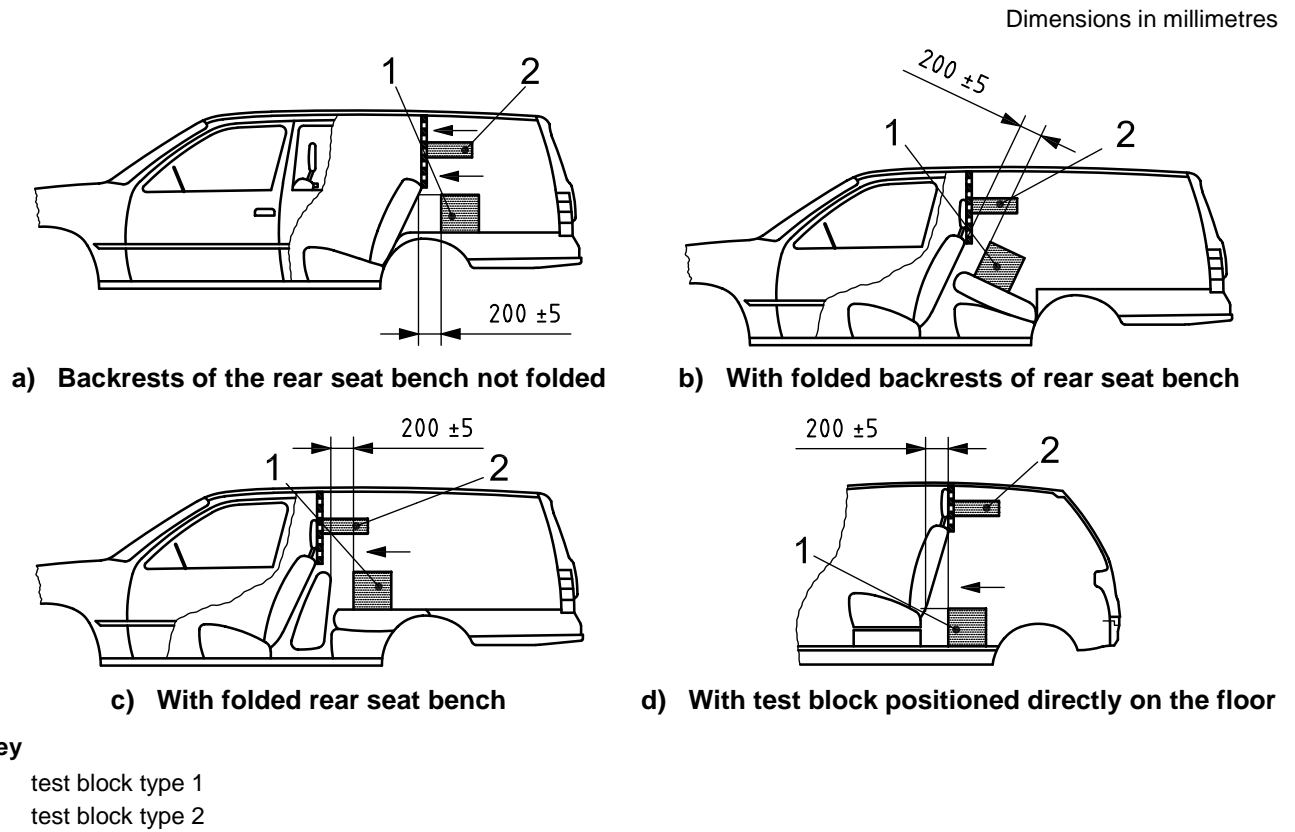


Figure 14 — Testing of partitioning systems arranged above the backrests

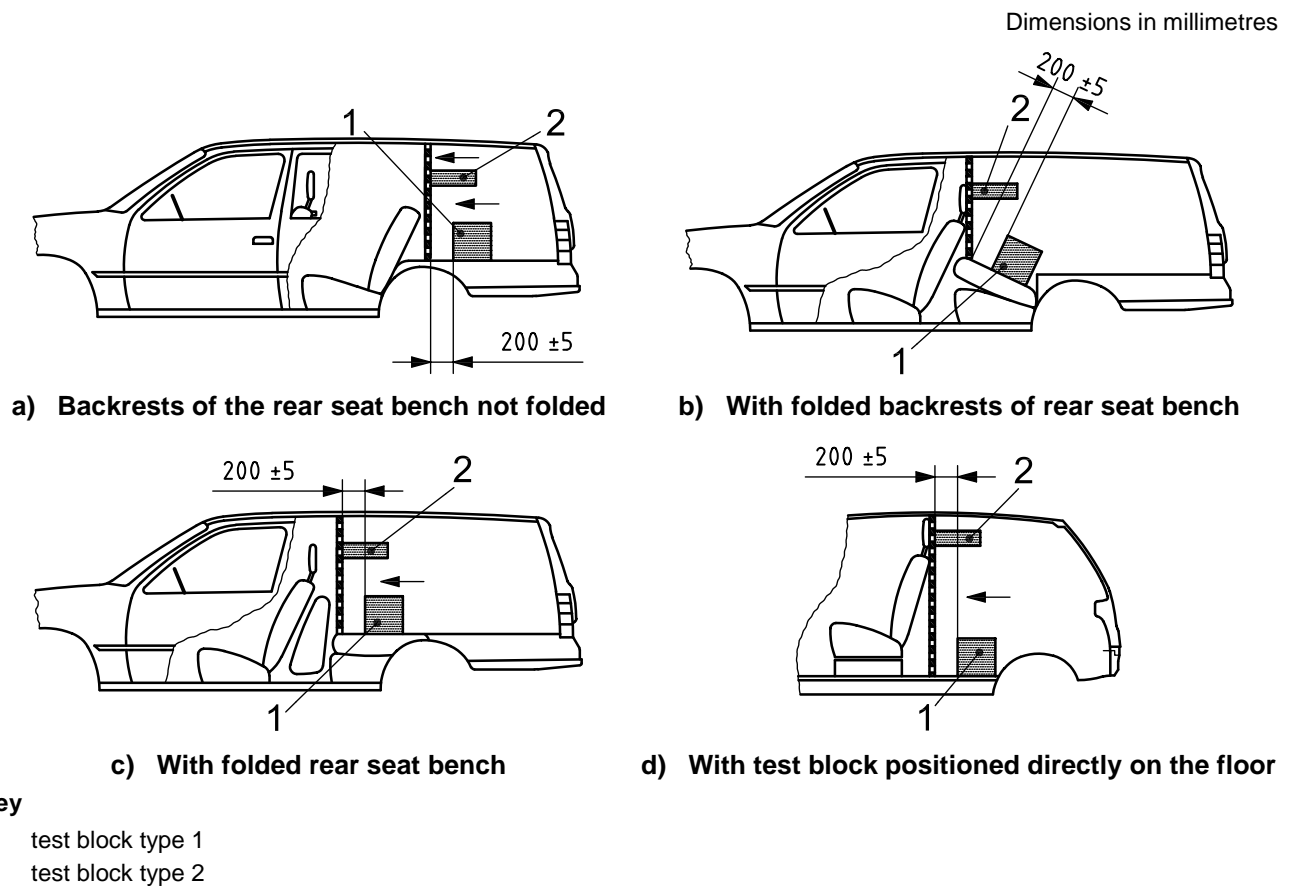
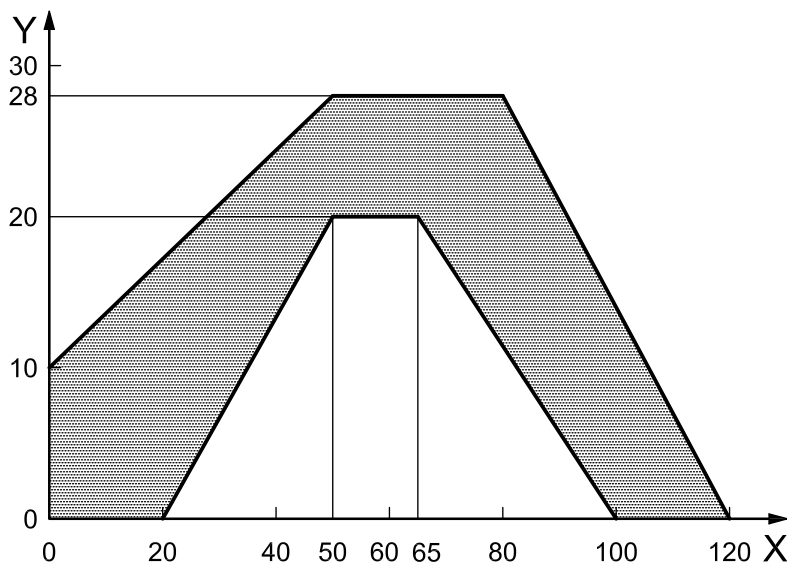


Figure 15 — Testing of partitioning systems covering the entire height of the loading space

5.3 Dynamic testing of backrests and partitioning systems

The body of the vehicle shall be anchored securely to a test sled, and this anchorage shall not act as reinforcement for backrests and the partitioning system. After the installation of the test blocks as described in 5.2.2 and 5.2.3, the vehicle body shall be decelerated or, at the choice of the manufacturer, accelerated such that the curve remains within the area shown in Figure 16, and the total velocity change Δv is $50 \text{ km} \begin{smallmatrix} +0 \\ -2 \end{smallmatrix} \text{ km/h}$.



Key

X time, in ms

Y deceleration/acceleration, due to gravity (g)

Figure 16 — Corridor of sled deceleration or acceleration as a function of time

5.4 Testing of lashing points

5.4.1 Test procedure

Any lashing point at the vehicle may be selected for testing. The lashing point shall be loaded with a lashing device suitable for the test. The test force F_t shall be applied at an angle between 15° and 45° to the vertical, and should be typically oriented towards another lashing point.

$$F_t = 1,25 \times F_N$$

where F_N is the nominal tension force (see 4.4.3).

The test force shall be applied within 20 s up to F_t and shall be maintained for at least 30 s.

5.4.2 Calculation

Testing is not required provided the vehicle manufacturer can demonstrate that the calculation used to verify the performance of the lashing points is equivalent to the testing.

Bibliography

- [1] ISO 3409:1975, *Passenger cars — Lateral spacing of foot controls*
- [2] ISO 27956, *Road vehicles — Securing of cargo in delivery vans — Requirements and test methods*
- [3] DIN 75410-2, *Securing of cargo in road vehicles — Part 2: Securing of cargo in passenger cars, station wagons and multi-purpose passenger cars*
- [4] UNECE Regulation No.17, *Uniform provisions concerning the approval of vehicles with regard to the seats, their anchorages and any head restraints*
- [5] UNECE Regulation No.126, *Uniform provisions concerning the approval of partitioning systems to protect passengers against displaced luggage, supplied as non original vehicle equipment*

