

## 49 Seats

Refer to: R17 08-S2, R80 02

### 49.1 Effective date and Scope:

- 49.1.1 Effective date from 2008/1/1, new types of seats using in vehicles of category symbols M and N, and from 2010/1/1 all types of seats using in vehicles of category symbols M and N, shall comply with this regulation.
- 49.1.2 This regulation doesn't apply to side-facing or rearward-facing seats, or to any head restraint fitted to these seats.
- 49.1.3 The applicants applying for low volume safety approval or vehicle-by-vehicle low volume safety approval could exempt from regulation of "seats" except large passenger vehicle and child-only vehicle.

### 49.2 Definitions :

- 49.2.1 "Seat" means a structure which may or may not be integral with the vehicle structure complete with trim, intended to seat one person. Depending on its orientation, a seat is defined as follows:
  - 49.2.1.1 "Forward-facing seat" means a seat which can be used whilst the vehicle is in motion and which faces towards the front of the vehicle in such a manner that the vertical plane of symmetry of the seat forms an angle of less than + 10 degrees or - 10 degrees with the vertical plane of symmetry of the vehicle;
  - 49.2.1.2 "Rearward-facing seat" means a seat which can be used whilst the vehicle is in motion and which faces towards the rear of the vehicle in such a manner that the vertical plane of symmetry of the seat forms an angle of less than + 10 degrees or - 10 degrees with the vertical plane of symmetry of the vehicle;
  - 49.2.1.3 "Side-facing seat" means a seat which, with regard to its alignment with the vertical plane of symmetry of the vehicle, does not meet either of the definitions given in paragraph 49.2.1.1. or 49.2.1.2. above;
- 49.2.2 "Folding seat" means a seat, which is normally folded, can be easily operated and is designed for occasional use by an occupant.

### 49.3 Seats shall according to suitable variants and range of principle are as below :

#### 49.3.1 Vehicle of categories M1 and N:

- 49.3.1.1 the structure, shape, dimensions, materials and the mass of the seats, although the seats may differ in covering and colour; differences not exceeding 5 per cent in the mass of the approved seat type shall not be considered significant;
- 49.3.1.2 the type and dimensions of the adjustment, displacement and locking systems of the seat-back and seats and their parts;
- 49.3.1.3 the type and dimensions of the seat anchorages;
- 49.3.1.4 the dimensions, frame, materials and padding of head restraints, although they may differ in colour and covering;
- 49.3.1.5 the type and dimensions of the attachments of the head restraint and the characteristics of the part of the vehicle to which the head restraint is attached, in the case of a separate head restraint;

#### 49.3.2 Vehicle of categories M2 and M3

- 49.3.2.1 Structure, shape, dimensions and materials of the load bearing parts ;
- 49.3.2.2 Types and dimensions of the seat back adjustment and locking system;
- 49.3.2.3 Dimensions, structure and materials of the attachments and supports (e.g. legs);

### 49.4 In the case of the seats (with or without head restraint) and their anchorages fitted to category symbols M1 and N vehicles, M2 vehicle that selects to conform to paragraph 49.4, and non-passenger seats on category symbols M2 and M3 vehicles:

#### 49.4.1 General requirements applicable to all seats of vehicles:

- 49.4.1.1 The installation of side-facing seats shall be prohibited in vehicles of categories M1, N1, M2 (sitting passenger only) and M3

- (sitting passenger only), except for the installation of side-facing seats that adjacent to wheelchair space for taking care of the wheelchair users.
- 49.4.1.2 It doesn't suitable for ambulance , vehicle for medical treatment, vehicle for civil defense, vehicle for fire fight or vehicle for police.
- 49.4.2 M1 and M2 that selects to conform to paragraph 49.4.:
- 49.4.2.1 Every adjustment and displacement system provided shall incorporate a locking system, which shall operate automatically. Locking systems for armrests or other comfort devices are not necessary unless the presence of such devices will cause additional risk of injury to the occupants of a vehicle in the event of a collision. Folding seats shall lock automatically in the position of use by occupants.
- 49.4.2.2 The surface of the rear parts of seats shall exhibit no dangerous roughness or sharp edges likely to increase the risk of severity of injury to the occupants. This requirement is considered as satisfied if the surface of the rear parts of seats tested in the conditions specified in paragraph 49.4.4. exhibit radii of curvature not less than:
- 2.5 mm in area 1,
  - 5.0 mm in area 2,
  - 3.2 mm in area 3,
- 49.4.2.2.1 Area1:
- 49.4.2.2.1.1 In the case of separate seats without head restraints, this area shall include the rear part of the seat-back between the longitudinal vertical planes situated at 100 mm on either side of the longitudinal median plane of the seat centre line, and above a plane perpendicular to the reference line 100 mm below the top of the seat-back.
  - 49.4.2.2.1.2 In the case of bench seats without head restraints, this area shall extend between the longitudinal vertical planes situated at 100 mm on either side of the longitudinal median plane of each designated outboard seating position defined by the manufacturer and above a plane perpendicular to the reference line 100 mm below the top of the seat-back.
  - 49.4.2.2.1.3 In the case of seats or bench seats with head restraints, this area shall extend between the longitudinal vertical planes, on either side of and 70 mm from the longitudinal median plane of the seat or of the seating position concerned and situated above the plane perpendicular to the reference line 635 mm from the R point. For the test, the head restraint, if adjustable shall be placed in the most unfavourable position (generally the highest) permitted by its adjustment system.
- 49.4.2.2.2 Area 2:
- 49.4.2.2.2.1 In the case of seats or bench seats without head restraints and seats or bench seats with detachable or separate head restraints, area 2 shall extend above a plane perpendicular to the reference line 100 mm distant from the top of the seat-back, other than parts of area 1.
  - 49.4.2.2.2.2 In the case of seats or bench seats with integrated head restraints, area 2 shall extend above a plane perpendicular to the reference line 440 mm distant from the R point of the seat or of the seating position concerned, other than parts of area 1.
- 49.4.2.2.3 Area 3: Area 3 is defined as the part of the back of the seat or the bench seats situated above the horizontal planes passing through the lowest R point in each row of seats, excluding parts situated in area 1 and area 2.

- 49.4.3 General specifications for seats installed on category symbols N vehicles and non-passenger seats installed on category symbols M2 and M3 vehicles. With the exception of paragraph 49.5.1., the requirements also suitable for side-facing seats of all categories of vehicles.
- 49.4.3.1 Seats and bench seats must be firmly attached to the vehicle.
  - 49.4.3.2 Sliding seats and bench seats must be automatically lockable in all the positions provided.
  - 49.4.3.3 Adjustable seat-backs must be lockable in all the positions provided.
  - 49.4.3.4 All seats which can be tipped forward or have fold-on backs and folding seats shall lock automatically in the position of use by occupants. These requirements do not apply to folding seats fitted in wheelchair spaces or areas for standing passengers of vehicles of category M2 or M3.
- 49.4.4 Functional requirements regarding the seat system:
- 49.4.4.1 Seat's status: The seat-back, if adjustable, shall be locked in a position corresponding to a rearward inclination as close as possible to 25 degrees from the vertical of the torso reference line of the manikin, unless otherwise specified by the manufacturer.
  - 49.4.4.2 Folding seats shall be tested in the position of use by occupants.
  - 49.4.4.3 Test of the seat-back and its adjustment systems: this test applies for the seats installed in M1 and the seat of category M2 that chosen to comply with 49.4. refer to Fig 1. A force producing a moment of 530 N-m in relation to the R point shall be applied longitudinally and rearwards to the upper part of the seat-back frame through a component simulating the back of the manikin. No failure shall be shown in the seat frame or in the adjustment systems during or after the tests. Permanent deformations, including ruptures, may be accepted, provided that these do not increase the risk of injury in the event of a collision and the prescribed loads were sustained.
  - 49.4.4.4 Seats fixed devices 、 adjustment 、 lock and displacement system test : this test applies for the seats installed in M1 and the seat of category M2 that chosen to comply with 49.4.
    - 49.4.4.4.1 In the case of seats fitted with an adjustable head restraint, the test shall be conducted with the head restraints placed in the most unfavorable position (generally the highest position) allowed by its adjusting system. The longitudinal adjustment is fixed one notch or 10 mm rearward of the most forward normal driving position or position of use as indicated by the manufacturer. For seats with independent vertical adjustment, the cushion shall be placed in its highest position 、 and proceed to the forward and backward impact test.
    - 49.4.4.4.2 In the case of seats fitted with an adjustable head restraint, the test shall be conducted with the head restraints placed in the most unfavorable position (generally the highest position) allowed by its adjusting system. The longitudinal adjustment is fixed one notch or 10 mm forward of the most rearward normal driving position or position of use as indicated by the manufacturer. For seats with independent vertical adjustment, the cushion shall be placed in its lowest position 、 and proceed to the forward and backward impact test.
    - 49.4.4.4.3 The forward impact test :  
A longitudinal deceleration or, at the choice of the applicant, acceleration of not less than 20 g shall be applied for 30 milliseconds in a direction to the whole shell of the vehicle imitating a frontal collision.
    - 49.4.4.4.4 The backward impact test :  
A longitudinal deceleration or, at the choice of the applicant, acceleration of not less than 20 g shall be applied for 30

milliseconds in a direction to the whole shell of the vehicle imitating a rear collision.

49.4.4.4.5 The imitating collision specified in above paragraphs may be substituted by Fig.4.

49.4.4.4.6 At the request of the manufacturer, the tests specified in above paragraphs may be replaced by a full-width frontal collision test of the complete vehicle in running order against a rigid barrier.

49.4.4.4.7 Before the tests to paragraph 49.4.4.4.3. and 49.4.4.4.4., the seat anchorage and the adjustment, locking and displacement systems shall maintain without being damaged.

49.4.4.4.7.1 After the tests, the displacement systems intended for permitting or facilitating the access of occupants must be in working order; they must be capable, at least once, of being unlocked and must permit the displacement of the seat or the part of the seat for which they are intended.

Any other displacement systems, as well as adjustment systems and their locking systems are not required to be in working order. In the case of seats provided with head restraints, the strength of the seat-back and of its locking devices is deemed to meet the requirements set out in paragraph 49.4.4.3. when, after testing in accordance with paragraph 50.4.3.2.7. of "50 Head restraint", no breakage of the seat or seat-back has occurred: otherwise, it must be shown that the seat is capable of meeting the test requirements set out in paragraph 49.4.4.3. In the case of seats (benches) with more places to sit than head restraints, the test described in paragraph 49.4.4.3 shall be carried out.

49.4.4.5 Tests for checking energy dissipation on the seat-back and head restraint: These tests are applicable for M1 and M2 that selects to conform to the regulations specified in section 49.4 above; whereas the rearmost seats and back-to-back seats are excluded. The rear parts of seats situated in area 1 shall pass the energy dissipation test. The impact points shall be selected by the test laboratory in area 1 by using a rigid headform of 6.8 kg and 165 mm in diameter. The direction of impact from the rear towards the front shall be situated in a longitudinal plane at an angle of 45 degrees from the vertical. The headform shall strike the test item at a speed of 24.1 km/h. The deceleration of the headform does not exceed 80 g continuously for more than 3 ms. Moreover, no dangerous edge shall occur during or remain after the test.

49.4.5 Special requirements regarding the protection of occupants from displaced luggage, for M1 vehicles

49.4.5.1 Test method:

49.4.5.1.1 Seat-backs: Seat-backs and/or head restraints located such that they constitute the forward boundary of the luggage compartment, all seats being in place and in the normal position of use as indicated by the manufacturer, shall have sufficient strength to protect the occupants from displaced luggage in a frontal impact, refer to Fig 2.

49.4.5.1.1.1 General requirements:

49.4.5.1.1.1.1 All measurements 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 luggage compartment.

49.4.5.1.1.1.2 At the option of the car manufacturer, parts whose hardness is lower than 50 Shore A can be removed from the tested seat and head restraint for the tests.

49.4.5.1.1.1.3 Two type 1 (300mmx300mmx300mm, 18kg) test blocks shall be placed on the floor of the luggage compartment. In order to determine the location of the test blocks in the longitudinal direction, they shall first be positioned such that their front side contacts that part of the vehicle, which constitutes the forward boundary of the luggage compartment and that their lower side rests on the floor of the luggage compartment. They shall then be moved backwards and parallel to the longitudinal median plane of

the vehicle until their geometrical center has traversed a horizontal distance of 200 mm. 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. The distance between the longitudinal median plane of the vehicle and the inward facing side of each test block shall be 25 mm to obtain a distance of 50 mm between both blocks.

49.4.5.1.1.1.4 During the test, the seats must be adjusted to ensure that the locking system cannot be released by external factors. If applicable, the seats shall be adjusted as follows:

The longitudinal adjustment shall be secured one notch or 10 mm in front of the rearmost possible position of use specified by the manufacturer (for seats with independent vertical adjustment, the cushion shall be placed to its lowest possible position). The test shall be carried out with the seat-backs in their normal position of use.

49.4.5.1.1.1.5 If the seat-back is fitted with a head restraint, the test must be carried out with the head restraint placed in the highest position, if adjustable.

49.4.5.1.1.1.6 If the back(s) of the rear seat(s) can be folded down, they shall be secured in their upright normal position by the standard locking mechanism.

49.4.5.1.1.1.7 Seats behind which the type 1 block cannot be installed are exempted from this test.

49.4.5.1.1.2 For vehicles with more than two rows of seats: If the rearmost row of seats is removable and/or can be folded down by the user according to the manufacturer's instructions in order to increase the luggage compartment area, then the seat row immediately in front of this rearmost row shall also be tested. However, it may decide not to test one of the two rearmost rows of seats if the seats and their attachments are of similar design and if the test requirement of 200 mm is respected.

49.4.5.1.1.3 When there is a gap, allowing sliding of one type 1 block past the seats, then the test loads (two type 1 blocks) shall be installed behind the seats.

49.4.5.1.2 Test of partitioning systems above the seat-backs: The test may be carried out with the partition systems in place, if these systems are fitted as standard equipment.

49.4.5.1.2.1 General specifications:

49.4.5.1.2.1.1 All measurements 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 luggage compartment. (see figure 3).

49.4.5.1.2.1.2 For the test of the partitioning systems above the seat-backs, the vehicle shall be fitted with a fixed raised test floor having a load surface that locates the center of gravity of the test block centrally between the top edge of the bordering seat-back (without taking into account the head restraints) and the bottom edge of the roof lining. A type 2 test block is placed on the raised test floor with its largest surface 500 x 350 mm, centrally in relation to the longitudinal axis of the vehicle and with its surface 500x125 mm to the front. The test block is placed directly in contact with the partitioning system.

49.4.5.1.2.1.3 Partitioning systems behind which the type 2 test block cannot be installed are exempted from this test.

49.4.5.1.2.1.4 In addition, two type 1 test blocks are positioned in accordance with paragraph 49.4.5.1.1.1 in order to perform a simultaneous test on the seat-backs.

49.4.5.1.2.1.5 If the seat-back is fitted with a head restraint, the test must be carried out with the head restraint placed in the highest position, if adjustable.

49.4.5.1.3 Dynamic test:

49.4.5.1.3.1 The body of the passenger car shall be anchored securely to a test sled, and this anchorage shall not act as reinforcement for seat-backs and the partitioning system.

49.4.5.1.3.2 After the installation of the test blocks as described in paragraph 49.4.5.1.1 and 49.4.5.1.2, the M1 car body shall be decelerated or, at the choice of the applicant, accelerated such that the curve remains within the area of the graph in fig.4, and the total velocity change  $\Delta V$  is 50  $\pm 2$  km/h.

49.4.5.1.3.3 By means of above-described testing process may be substituted by a longitudinal horizontal deceleration or, at the choice of the applicant, acceleration of not less than 20 g shall be applied for 30 milliseconds to simulate frontal collision.

49.4.5.2 Testing standard

49.4.5.2.1 Seat-back:

49.4.5.2.1.1 During and after the test, the seat-backs remain in position and the locking mechanisms remain in place. However, the deformation of the seat-backs and their fastenings during the test is permitted, provided that the forward contour of the parts of the tested seat-back and/or head restraints, that are harder than 50 Shore A, does not move forward of a transverse vertical plane which passes through (excluding the rebound phases of the test blocks):

49.4.5.2.1.1.1 A point of 150 mm forward of the R point of the seat in question, for the parts of the head restraint.

49.4.5.2.1.1.2 A point of 100 mm forward of the R point of the seat in question, for parts of the seat-back.

49.4.5.2.1.1.3 For integrated head restraints, the limit between the head restraint and the seat-back is defined by the plane perpendicular to the reference line 540 mm from the R point.

49.4.5.2.1.2 During the test, the test blocks shall remain behind the seat-back(s) in question.

49.4.5.2.2 Partitioning System:

49.4.5.2.2.1 During the test, the partitioning systems remain in position. However, the deformation of the partitioning system during the test is permitted, provided that the forward contour of the partitioning (including parts of the tested seat-back(s) and/or head restraint(s)) that are harder than 50 Shore A, does not move forward of a transverse vertical plane which passes through:

49.4.5.2.2.1.1 A point of 150 mm forward of the R point of the seat in question, for parts of the head restraint.

49.4.5.2.2.1.2 A point of 100 mm forward of the R point of the seat in question, for parts of the seat-back and part of the partitioning system other than the head restraint.

49.4.5.2.2.1.3 For integrated head restraint, the limit between the head restraint and the seat-back is defined by the plane perpendicular to the reference line 540 mm from the R point.

49.4.5.2.2.2 After the test, no sharp or rough edges likely to increase the danger or severity of injuries of the occupants shall be present.

49.5 In the case of the seats for passenger used, seat anchorages and the fit of seats for M2 and M3 vehicles, shall comply the following

requirements. But city bus having a capacity in excess of 22 passengers (in addition to the driver), for the carriage of seated and standing persons and having a capacity not exceeding 22 passengers (in addition to the driver), and other M2 vehicles than those in paragraph 49.4 can exempt this requirement:

49.5.1 Seat and seat-installing spec

49.5.1.1 General requirements:

- 49.5.1.1.1 Each type of seat shall be subject to the test requirements of either dynamic test or static test 1 and 2 at the request of the manufacturer.
- 49.5.1.1.2 Every adjustment and displacement system provided shall incorporate a locking system which shall operate automatically;
- 49.5.1.1.3 All forward-facing seats shall be approved;
- 49.5.1.1.4 The seat shall have a reference height of at least 1 m;
- 49.5.1.1.5 The H point of the seat immediately behind shall be less than 72 mm higher than H point of the seat in question. If the seat behind has the H point more than 72 mm higher, the seat in question shall be tested in such a position.

49.5.1.2 Requirements for installation of seats:

49.5.1.2.1 While performing the dynamic test specified in section 49.5.1.3, Test1 and 2 shall apply, except as follows:

49.5.1.2.1.1 Test1 shall not apply where the rear of the seat cannot be struck by an unrestrained passenger (i.e., there is no forward-facing seat directly behind the seat to be tested).

49.5.1.2.1.2 Test2 shall not apply:

49.5.1.2.1.2.1 if the rear of the seat cannot be struck by a restrained passenger.

49.5.1.2.1.2.2 if the seat behind is fitted with a 3-point belt with anchorages that comply fully with the seat belt requirements for “anchorage” regulated in this “Standards”.

49.5.1.2.1.2.3 if the seat fulfils the requirements of static test 2(Energy Absorption Characteristics of the rear part of seat backs).

49.5.1.2.2 While performing static test, all tests (including 1 and 2) shall apply, except as follows:

49.5.1.2.2.1 Static test 1 shall not apply if the rear of the seat cannot be struck by an unrestrained passenger (i.e., there is no forward-facing seat directly behind the seat to be tested).

49.5.1.2.2.2 Static test 2 shall not apply:

49.5.1.2.2.2.1 if the rear of the seat cannot be struck by a restrained passenger.

49.5.1.2.2.2.2 If the seat behind is fitted with a 3-point belt with anchorages that comply fully with the safety belt anchorages requirements for “anchorage” regulated in this “Standards”.

49.5.1.3 Dynamic test:

49.5.1.3.1 Preparation of the seat to be tested:

49.5.1.3.1.1 The seat to be tested shall be mounted either on a testing platform representative of the body of a vehicle, or on a rigid testing platform. Then, the platform is mounted onto the trolley.

49.5.1.3.1.2 The anchorage on the testing platform provided for the test seat(s) shall be identified to or have the same characteristics as that used in vehicle(s) in which the seat is intended to be used. The seat to be tested shall be complete with all upholstery and accessories. If the seat is fitted with a table, it shall be in the stowed position.

- 49.5.1.3.1.3 If adjustable laterally, the seat shall be positioned for maximum extension.
- 49.5.1.3.1.4 If adjustable, the seat back shall be adjusted so that the resulting inclination of the torso of the manikin used for determining the H point and the actual torso angle for seating positions in motor vehicles is as close as possible to that recommended by the manufacturer for normal use or, in the absence of any particular recommendation by the manufacturer, as near as possible to 25 degrees towards the rear in relation to the vertical.
- 49.5.1.3.1.5 If the seat back is equipped with a head restraint adjustable for height, it shall be in its lowest position.
- 49.5.1.3.1.7 Safety belts conforming to the requirements for "safety belt" and "anchorage" regulated in "Standards" and mounted on anchorages installed according to the requirements for "safety belt" and "anchorage" regulated in "Standard", shall be fitted to both the auxiliary seat and the seat to be tested.
- 49.5.1.3.2 Test1:
  - 49.5.1.3.2.1 The auxiliary seat may be the same type as the seat being tested and shall be located parallel to and directly behind the seat being tested, the two seats being at the same height, adjusted identically and on a seat spacing of 750 mm.
  - 49.5.1.3.2.2 A manikin shall be freely placed on the auxiliary seat so that its plane of symmetry corresponds to the plane of symmetry of the seating position in question. The manikin's hands shall rest on its thighs with the elbows touching the seat back; the legs shall be extended to the maximum and shall, if possible, be parallel; the heels shall touch the floor.
  - 49.5.1.3.2.3 The impact speed of the trolley shall be between 30 and 32 km/h. The deceleration of the trolley during the impact test shall be in accordance with the provisions shown in Fig. 5 below. Except for intervals totaling less than 3 ms, the deceleration time history of the trolley shall remain between the limit curves shown in Fig 5.
  - 49.5.1.3.2.4 The average deceleration shall be comprised between 6.5 and 8.5 g.
- 49.5.1.3.3 Test 2:
  - 49.5.1.3.3.1 Test 1 shall be repeated with a manikin seated in the auxiliary seat: the manikin shall be restrained by a safety-belt fitted and adjusted in accordance with the manufacturer's instructions. The number of safety-belt anchorage points for the purpose of Test 2 shall be recorded in the communication form.
  - 49.5.1.3.3.2 The auxiliary seat shall be either of the same type as the seat being tested or of a different type,
  - 49.5.1.3.3.3 In the case where Test 2 is conducted with the manikin restrained by a 3-point belt and the injury criteria are not exceeded, the auxiliary seat shall be considered to have met the requirements relating to the static test loads and movement of the upper anchorage during the test for "anchorage" specified in the "Standards" with regard to this installation.
- 49.5.1.3.4 Requirements:
  - 49.5.1.3.4.1 the forward movement of any part of the trunk and the head of the manikin does not pass beyond the transversal vertical plane situated at 1.6m from the R point of the auxiliary seat;
  - 49.5.1.3.4.2 biomechanical acceptability criteria for the instrumented Manikin
    - 49.5.1.3.4.2.1 The head acceptability criterion HIC is less than 500.
    - 49.5.1.3.4.2.2 The thorax acceptability criterion (ThAC) is less than 30 g, except for periods totaling less than 3 ms.
    - 49.5.1.3.4.2.3 The femur acceptability criterion (FAC) is less than 10 kN and the value of 8 kN is not exceeded for



periods totaling more than 20 ms.

49.5.1.3.4.3 No part of the seat, the seat mountings or the accessories becomes completely detached during the test.

49.5.1.3.4.4 The seat remains firmly held, even if one or more anchorages are partly detached, and all the locking systems remain locked during the whole duration of the test

49.5.1.3.4.5 After the test no structural part of the seat or accessories has any fracture or sharp or pointed edges or corners likely to cause any bodily injury.

#### 49.5.1.4 Static test 1

##### 49.5.1.4.1 General requirements

49.5.1.4.1.1 All fittings forming part of the back of the seat or accessories thereto shall be such as to be unlikely to cause any bodily injury to a passenger during impact. This requirement shall be considered satisfied if any part contactable by a sphere 165 mm in diameter presents a radius of curvature of at least 5 mm.

49.5.1.4.1.2 If any part of the fittings and accessories referred to above is made of a material of hardness less than 50 shore A on a rigid backing, the requirements set out in the above spec shall apply only to the rigid backing.

##### 49.5.1.4.2 Test method

49.5.1.4.2.1 Test apparatus: This consists of surfaces with a radius of curvature equal to  $82 \pm 3$  mm of cylindrical and force on upper chair of cylinder a width at least equal to the width of the seat-back of each seating position of the seat to be tested for the upper form, or force on under chair of cylinder are equal to  $320 (-0, +10)$  mm as shown in figure 6.

##### 49.5.1.4.2.2 Test force 1 (upper chair)

49.5.1.4.2.2.1 A test force to  $\frac{1000}{H1} \pm 50$  N shall be applied using a device, conforming to the paragraph 49.5.1.4.2.1 above, to the rear part of the seat corresponding to each seating position of the seat.

49.5.1.4.2.2.2 The direction of application of the force shall be situated in the vertical median plane of the seating position concerned; it shall be horizontal and from the rear towards the front of the seat.

49.5.1.4.2.2.3 This direction shall be situated at the height H1 which shall be between 0.70 m and 0.80 m and above the reference plane. The exact height shall be determined by the manufacturer.

##### 49.5.1.4.2.3 Test force 2 (under chair)

49.5.1.4.2.3.1 A test force equal to  $\frac{2000}{H2} \pm 100$  N shall be applied.

49.5.1.4.2.3.2 The test force shall be applied simultaneously to the rear part of the seat corresponding to each seating position of the seat in the same vertical plane and in the same direction at the height H2 which shall be between 0.45 and 0.55 m above the reference plane, with a device conforming to paragraph 49.5.1.4.2.1 above. The exact height shall be determined by the manufacturer.

49.5.1.4.2.4 Where a seat consists of more than one seating position, the forces corresponding to each seating position shall be applied simultaneously and there shall be as many upper and lower forms as seating positions.

49.5.1.4.2.5 The initial position of each seating position of each of the forms shall be determined by bringing the test devices

- into contact with the seat with a force equal to at least 20 N.
- 49.5.1.4.2.6 The forces indicated in paragraph 49.5.1.4.2.2 and 49.5.1.4.2.3 above shall be applied as rapidly as possible and shall be maintained together at the specified value, whatever the deformation, for at least 0.2 seconds. If the test has been carried out with one or more forces but not with all forces greater than those specified in paragraphs 49.5.1.4.2.2 and 49.5.1.4.2.3 and if the seat complies with the requirements, the test shall be considered to be satisfied.
- 49.5.1.4.3 Requirements
- 49.5.1.4.3.1 The maximum displacement of the central of application of each force prescribed in paragraph 49.5.1.4.2.2 measured in the horizontal plane and in the longitudinal median plane of the relevant seating position does not exceed 400 mm.
- 49.5.1.4.3.2 The maximum displacement of the central of application of each force prescribed in paragraph 49.5.1.4.2.2 measured as described in paragraph 49.5.1.4.3.1 above, is not less than 100 mm.
- 49.5.1.4.3.3 The maximum displacement of the central of application of each force prescribed in paragraph 49.5.1.4.2.3 measured as described in paragraph 49.5.1.4.3.1 above, is not less than 50 mm.
- 49.5.1.4.3.4 No part of the seat, mountings or the accessories becomes completely detached during the test.
- 49.5.1.4.3.5 The seat remains firmly held, even if one or more anchorages is (are) partly detached, and all the locking systems remain locked during the whole duration of the test.
- 49.5.1.4.3.6 After the test no structural part of the seat or accessories has any fracture or sharp or pointed edges or corners likely to cause any bodily injury.
- 49.5.1.5 Static test 2 (The energy-absorption characteristics of the rear part of seat backs):
- 49.5.1.5.1 Elements of the rear part of seat backs situated in the reference zone shall be verified at the request of the manufacturer according to the energy absorbing requirements: Where the angle between the direction of impact and the perpendicular to the surface at the point of impact is 5 degrees or less, the test shall be carried out in such a way that the tangent to the trajectory of the centre of percussion of the pendulum coincides with the direction of impact. The headform (reduced mass at its centre of percussion is 6.8 kg / the lower extremity of the pendulum consists of a rigid headform 165 mm in diameter) shall strike the test component at a speed of 24.1 km/h or, in the case of components which cover an uninflated airbag, at a speed of 49.3 km/h; for this purpose, all accessories fitted shall be tested in all positions of use, except tables which shall be considered in the stowed position. The deceleration of the headform shall not exceed 80 g continuously for more than 3 milliseconds.
- 49.5.1.5.2 A drawing showing the area of the part of the seat back, verified by the energy dissipation test, shall be enclosed.
- 49.5.2 Requirements for seat anchorages of a vehicle type
- 49.5.2.1 General specification
- 49.5.2.1.1 The anchorages for the seats of the vehicle shall be capable of withstanding the static test specified in paragraph 49.5.2.2 below ; or, if the anchorage is mounted on the part of the vehicle structure, the dynamic test prescribed in paragraph 49.5.1.3 above.
- 49.5.2.1.2 Permanent deformation, including breakage, of an anchorage or the surrounding area shall be permissible provided the prescribed force has been sustained throughout the prescribed period.
- 49.5.2.1.3 In the case of vehicle of certified GVW over 5 tons , if the safety-belt anchorages of the corresponding seating

positions are fitted directly to the seats to be installed and these belt anchorages comply with the requirements for “anchorage” regulated in “Standards”.

49.5.2.2 Static test

49.5.2.2.1 A force F shall be applied:

49.5.2.2.1.1 At a height of 750mm above the reference plane and on the vertical line containing the geometrical centre of the surface bounded by the polygon having the different anchorage points as apexes or, if applicable, the extreme anchorages of the seat, by the rigid structure.

49.5.2.2.1.2 In the horizontal direction and directed to the front of the vehicle;

49.5.2.2.1.3 In a delay as short as possible and for a duration of at least 0.2s.

49.5.2.2.2 The force F shall be determined either:

49.5.2.2.2.1 by the following formula:  $F = (5000 \pm 50) \times i$

where :

F is given in N and i represents the number of seating positions of the seat for which the anchorages to be tested are to be approved; or,

49.5.2.2.2.2 In accordance with the representative loads measured during dynamic tests as described in section 49.5.1.3.

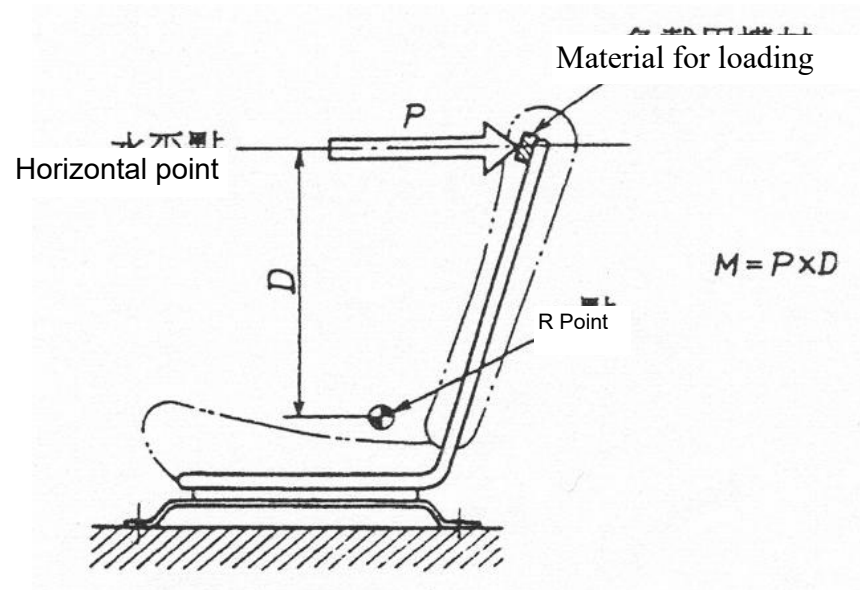


Fig. 1 Strength test of seat-back

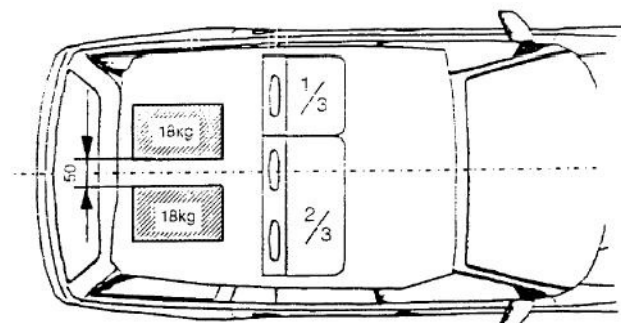


Fig. 2 Position of test blocks before test of rear seat-backs regarding hazard-prevention from the moving luggage

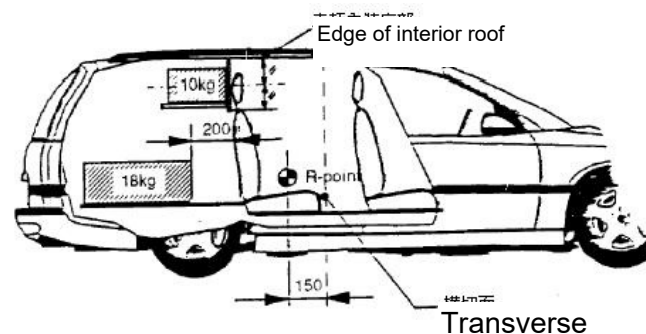


Fig 3. Testing of a partitioning system above the backrest regarding hazard-prevention from the moving luggage

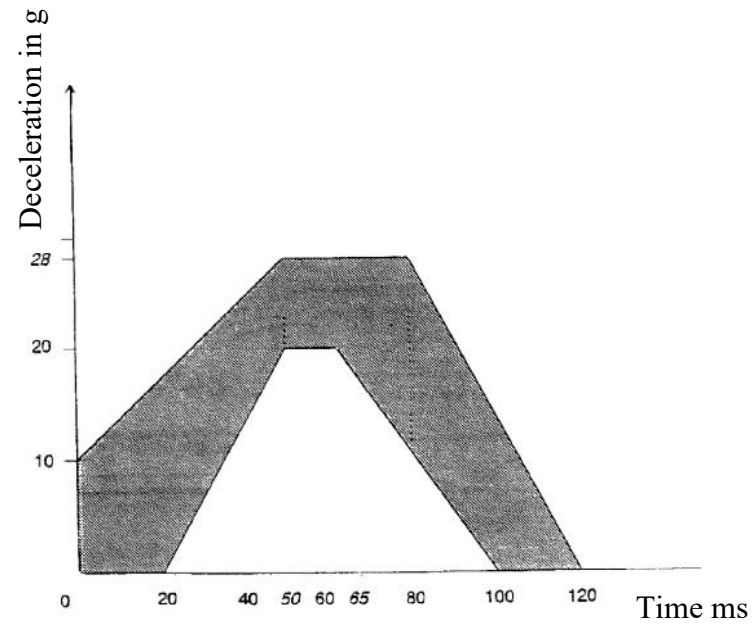


Fig.4 Sled deceleration corridor as a function of time (Simulation of frontal impact)

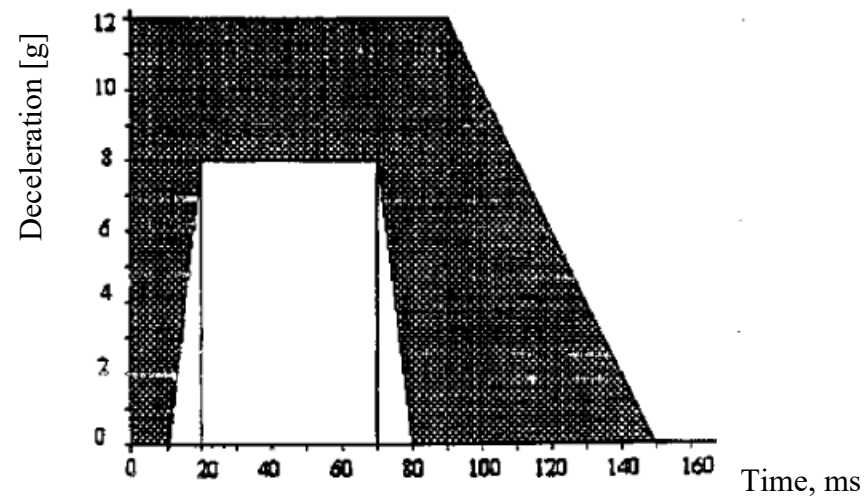


Fig. 5 Trolley's impacting acceleration/deceleration.

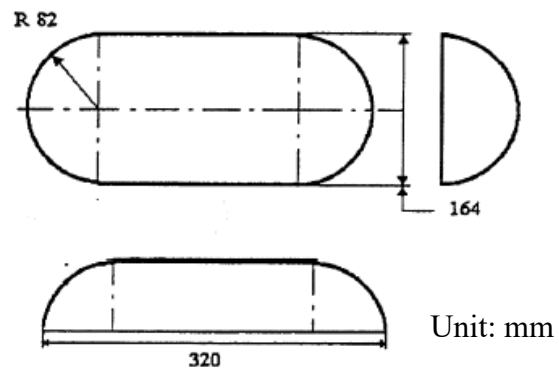


Fig. 6 Static test apparatus