

AUTOMOTIVE INDUSTRY STANDARD

**Automotive Vehicles -
Seats, their Anchorages and Head
Restraints for Category M1 -
Specifications**

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ON BEHALF OF :

AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE
UNDER
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE
SET-UP BY
MINISTRY OF ROAD TRANSPORT & HIGHWAYS
GOVERNMENT OF INDIA

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Status chart of the Standard to be used by the purchaser
for updating the record

Sr. No.	Corr- igenda.	Amend- ment	Revision	Date	Remark	Misc.

General Remarks :

Introduction

The Automotive Industries Standards Committee (AISC) functions under the guidance of CMVR Technical Standing Committee. AISC is setup to assist the Automotive Industry as well as Government of India in the preparation of new standards and review of the existing standards. ARAI acts as the Secretariat for AISC.

Seats, seat belts, seat belt anchorages, etc., are safety critical items for the passenger in case of sudden acceleration/deceleration and accidents. Further, seats and their design, mounting, etc., constitute substantially to the ride comfort of the vehicle users. Presently there are no Indian standards or CMVR covering the seats and related items. AISC identified these as one of the priority items and a series of standards are being drafted by a Panel. This standard is one of them.

This standard on seats for M1 category vehicles is based on ECE R-17.07 (April 2000) and 74/408/EEC as amended by 96/37/EEC. As seen, the ECE R-17 has been amended 7 times and 07 Series of amendments has come into force from January 2000 and this requirement is yet to be covered by EEC. Considering that the requirements of seats is being introduced for the first time in India and Series 07 amendments may require substantial design changes both on the seat and the vehicle; and EEC may also undergo changes as it has been recently introduced, the Panel recommends that implementation of all the requirements except para 5.9 (luggage retention), can be planned earlier while the implementation of 5.9 be given appropriate additional lead time.

The Panel responsible for preparation of the standard is given in Annexure-II.

Annexure-III gives the list of the members of AISC.

Automotive Vehicles - Seats, their Anchorages and Head Restraints for Category M1 - Specifications

1. SCOPE

- 1.1 This standard specifies the requirements of the strength of the seats and their anchorages, whether or not fitted with head restraints, the characteristics of head restraints and devices intended to protect the occupants from the danger resulting from the displacement of luggage in a frontal impact, of vehicles of category M1.
- 1.2 It does not apply to folding, side-facing or rearward-facing seats, or to any head restraints fitted to these seats.

2. REFERENCES

- 2.1 The following Indian/ISO Standards are necessary adjunct to this standard :
- 2.1.1 IS:13749-1993 : Automotive vehicle – Determination of H-Point – Method of Test (under revision)
- 2.1.2 IS:14272 (Part-I)-1995 : Automotive Vehicles – Types - Terminology
- 2.1.3 ISO:6487-1987 - Road Vehicles - Measurement Techniques in Impact Test - Instrumentation.

3. DEFINITIONS

For the purposes of this Standard

- 3.1 Approval of a Vehicle means the approval of a vehicle type with regard to the strength of the seats and their anchorages , the design of the rear parts of the seat-backs and the characteristics of their head restraints;
- 3.2 Vehicle Type means a category of motor vehicles which do not differ in such essential respects as:
 - 3.2.1 The structure, shape, dimensions, materials and the mass of the seats, although the seats may differ in covering and colour; differences not exceeding 5% in the mass of the approved seat type shall not be considered significant;
 - 3.2.2 The type and dimensions of the adjustment, displacement and locking systems of the seat-back and seats and their parts;
 - 3.2.3 The type and dimensions of the seat anchorages;

- 3.2.4 The dimensions, frame, materials and padding of head restraints, although they may differ in colour and covering;
- 3.2.5 The type and dimensions of the attachments of the head restraints and the characteristics of the part of the vehicle to which the head restraint is attached, in the case of a separate head restraint;
- 3.3 Seat means a structure which may or may not be integral with the vehicle structure complete with trim, intended to seat one adult person. The term covers both an individual seat or part of a bench seat intended to seat one person;
- 3.4 Bench Seat means a structure complete with trim, intended to seat more than one adult person;
- 3.5 Anchorage means the system by which the seat assembly is secured to the vehicle structure, including the affected parts of the vehicle structure;
- 3.6 Adjustment System means the device by which the seat or its parts can be adjusted to a position suited to the morphology of the seated occupant. This device may, in particular, permit:
- 3.6.1 Longitudinal displacement;
 - 3.6.2 Vertical displacement;
 - 3.6.3 Angular displacement;
- 3.7 Displacement System means a device by which the seat or one of its parts can be displaced and / or rotated, without a fixed intermediate position, to permit easy access of occupants to the space behind the seat concerned;
- 3.8 Locking Systems means a device ensuring that the seat and its parts are maintained in the position of use;
- 3.9 Folding Seat means an auxiliary seat intended for occasional use and normally folded;
- 3.10 Transverse Plane means a vertical plane perpendicular to the median longitudinal plane of the vehicle;
- 3.11 Longitudinal Plane means a plane parallel to the median longitudinal plane of the vehicle;
- 3.12 Head Restraint means a 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 danger of injury to the cervical vertebrae in the event of an accident;

- 3.12.1 Integrated Head Restraint means a head restraint formed by the upper part of the seat back. Head restraints meeting the definitions of para 3.12.2 or 3.12.3 below but which can only be detached from the seat or the vehicle structure by the use of tools or by partial or complete removal of the seat covering , meet the present definition;
- 3.12.2 Detachable Head Restraint means a head restraint consisting of a component separable from the seat , designed for insertion and positive retention in the seat – back structure ;
- 3.12.3 Separate Head Restraint means a head restraint consisting of a component separate from the seat, designed for insertion and/or positive retention in the structure of the vehicle;
- 3.13 R-Point or the seating reference point means the design point defined by the manufacturer which has co-ordinates determined in relation to the vehicle structure and corresponds to the theoretical positions of the point of torso/legs rotation for the lowest and the most rearmost normal driving position or position of use given to each seat provided by the vehicle manufacturer (Ref. Fig.1).
- 3.14 Torso Reference Line of the manikin is a straight line passing through the joint between the leg and the pelvis and the theoretical joint between the neck and thorax (Ref. Fig.1).
- 3.15 Partitioning System means parts or devices which, in addition to the seat backs, i.e. intended to protect the occupants from displaced luggage, in particular, a partitioning system may be constituted by netting or wire mesh located above the level of the seat backs in their upright or folded down position.

4 REQUIREMENTS

- 4.1 General Requirements Applicable to All Seats of Vehicles of Category M1
- 4.1.1 Every adjustment and displacement system provided shall incorporate a locking system, which shall lock automatically. Locking systems for armrests or other comfort devices are not necessary unless the absence of such devices will cause additional risk of injury to the occupants of a vehicle in the event of a collision.
- 4.1.2 The unlocking control for a device as referred to in para 3.8 shall be placed outside of the seat and accessible from the door. It shall be easily accessible to the occupant of the seat immediately behind the seat concerned, in case the entry to the rear seat is through the front door.
- 4.1.3 The rear parts of seats situated in area 1, defined in para 5.8.2 shall pass the energy dissipation test prescribed in para 5.8. This requirement is deemed to be met if in the tests carried out by the procedure specified in para 5.8, the deceleration of the head form does not exceed 80 g continuously for more than 3 ms. Moreover, no dangerous edge shall protrude out during or after the test.

- 4.1.4 The requirements of para 4.1.3 shall not apply to rearmost seats and back-to-back seats.
- 4.1.5 The surface of the rear parts of the 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 para 5.1 exhibit radii of curvature not less than;
- 2.5 mm in area 1 (para 5.8.2)
5.0 mm in area 2 (para 5.8.3)
3.2 mm in area 3 (para 5.8.4)
- 4.1.6 This requirement does not apply to :
- 4.1.6.1 The parts of the different areas exhibiting a projection of less than 3.2 mm from the surrounding surface, which shall exhibit blunted edges, provided that the height of the projection is not more than half its width;
- 4.1.6.2 Rearmost seats and back-to-back seats;
- 4.1.6.3 Rear parts of seats situated below a horizontal plane passing through the lowest R point in each row of seats (where rows of seats have different heights, starting from the rear, the plane shall be turned up or down forming a vertical step passing through the R point of the row of seats immediately in front);
- 4.1.6.4 Parts such as “flexible wire mesh”
- 4.1.7 In area 2, defined in para 5.8.3, surfaces may exhibit radii less than 5 mm, but not less than 2.5 mm provided that they pass the energy dissipation test prescribed in para 5.8. Moreover, these surfaces must be padded to avoid direct contact of the head with the seat frame structure.
- 4.1.8 If the areas defined above contain parts covered with material softer than 50 Shore A hardness, the above requirements, with the exception of those relating to the energy-dissipation test prescribed in para 5.8 shall apply only to the rigid parts.
- 4.1.9 A head restraint shall be mounted on every outboard front seat. Seats fitted with head restraints intended for fitment in other seating positions and other categories of vehicles may also be tested according to this standard.
- 4.2 Special Requirements for Seats Fitted or Capable of being Fitted with Head Restraints
- 4.2.1 The presence of the head restraint must not be an additional cause of danger to occupants of the vehicle. In particular, it shall not in any position of use exhibit any dangerous roughness or sharp edge liable to increase the risk or seriousness of injury to the occupants.

- 4.2.2 Parts of the front and rear faces of the head restraints situated in area 1, as defined in para 5.8.2 shall pass the energy absorption test. This requirement is deemed to be met, if in the tests carried out by the procedure specified in para 5.8, the deceleration of the head form does not exceed 80 g continuously for more than 3 ms. Moreover, no dangerous edge should protrude out during or after the test.
- 4.2.3 Parts of the front and rear faces of the head restraints situated in area 2, as defined in para 5.8.3.2, shall be so padded as to prevent any contact of the head with the components of the structure and shall meet the requirements of para 4.1.3 applicable to the rear parts of seats situated in area 2.
- 4.2.4 The requirements of para 4.2.2 and 4.2.3, shall not apply to parts of rear faces of head restraints designed to be fitted to seats behind which no seat is provided.
- 4.2.5 The head restraint shall be secured to the seat or to the vehicle structure in such a way that no rigid and dangerous parts project from the padding of the head restraint or from its attachment to the seat-back as a result of the pressure exerted by the head form during the test.
- 4.2.6 In the case of a seat fitted with a head restraint, the provisions of para 4.1.3 may, after agreement of the test agency, be considered to be met if the seat fitted with its head restraint complies with the provisions of para 4.2.2.
- 4.2.7 In the case of a seat capable of being fitted with a head restraint, the provisions of para 4.1.3 and 4.2.2 above shall be verified.
- 4.3 Requirements of Seat Back, Seat Anchorage and the Adjustment, Locking and Displacement Systems
- 4.3.1 No failure shall occur in the seat frame or in the seat anchorage, the adjustment and displacement systems or their locking devices during or after the tests prescribed in para 5.2 and 5.3. Permanent deformation, including ruptures, may be accepted, provided that these do not increase the risk of injury in the event of collision and the prescribed loads were sustained.
- 4.3.2 No release of the locking systems shall occur during the tests described in para 5.3
- 4.3.3 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.
- 4.3.4 Any other displacement as well as adjustment and their locking systems are not required to be in working order, after the tests.

4.3.5 In the case of seats provided with the head restraints, the strength of the seat back and its locking devices is deemed to meet the requirements set out in para 5.2 when, after testing in accordance with para 5.4.2.8, 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 para 5.2. In the case of bench seats with more places to sit than head restraints, the test described in para 5.2 shall be carried out.

4.4 Height of Head Restraints

4.4.1 The height of head restraints shall be measured as described in para 5.5 below

4.4.2 For head restraints not adjustable for height, the height shall be not less than 750 mm in the case of front seats and 700 mm in the case of other seats.

4.4.3 For Head Restraints Adjustable for Height

4.4.3.1 The height shall be not less than 750 mm in the case of front seats and 700 mm in the case of other seats; this value shall be obtained in any one position between the highest and the lowest position to which adjustment is possible.

4.4.3.2 In the case of seats other than the front seats, the head restraints may be such that they can be displaced to a position resulting in a height of less than 700 mm, provided that such position is clearly recognisable to the occupant as not being included for the use of the head restraint.

4.4.3.3 In the case of front seats, head restraints may be such that they can be automatically displaced when the seat is not occupied, to a position resulting in a height upto 700 mm, provided that they automatically return to the position of use when the seat is occupied.

4.4.4 The dimensions mentioned in para 4.4.2 and 4.4.3.1 above may be less than 750 mm in the case of front seats and 700 mm in the case of other seats to leave adequate clearance between the head restraint and the interior surface of the roof, the windows or any part of the vehicle structure. However, the clearance shall not exceed 25 mm. In the case of seats fitted with displacement and/or adjustment systems, this shall apply to all seat positions.

4.5 Width of Head Restraint

The width of the head restraint shall be such as to provide appropriate support for the head of a person normally seated. As determined according to the procedure described in para 5.6, the head restraint shall cover an area extending not less than 85 mm to each side of the vertical median plane of the seat for which the head restraint is intended.

4.6 Requirements of Head Restraint Gaps

- 4.6.1 There shall be no gap of more than 60 mm between the seat-back and the head restraint in the case of a device not adjustable for height. If the head restraint is adjustable for height, it shall, in its lowest position, be not more than 25 mm from the top of the seat back. In the case of seats or bench seats adjustable in height provided with separate head restraints, this requirement shall be verified for all the positions of the seat or bench seat.
- 4.6.2 In the case of head restraints integral with the seat-back, the area to be considered is :
- 4.6.2.1 Above a plane perpendicular to the reference line at 540 mm from the R point.
- 4.6.2.2 Between the two vertical longitudinal planes passing at 85 mm on either side of the reference line. In this area, one or more gaps which regardless of their shape can show a distance "a" (refer Fig.2 and Fig.3) of more than 60 mm when measured as described in para 5.7 below, are permitted provided that, after the additional test under para 5.4.2.5 below, the requirements of para 4.7 below are still met.
- 4.6.2.3 In the case of head restraint adjustable for height, one or more gaps, which regardless of their shape can show a distance "a" (refer Fig.2 and Fig.3) of more than 60 mm when measured as described in para 5.7, are permitted on the part of the device serving as a head restraint provided that, after the additional test under para 5.4.2.5, the requirements of para 4.7 are still met.

4.7 Requirements of Head Restraint Performance

- 4.7.1 The head restraint and its anchorage shall be such that the maximum backward displacement X of the head permitted by the head restraint and measured in conformity with the static procedure laid down in para 5.4.2, is less than 102 mm.
- 4.7.2 The head restraint and its anchorage shall be strong enough to bear without breakage the load specified in para 5.4.2.8. In the case of head restraints integral with the seat back, the requirements of this para shall apply to the part of the seat back structure situated above a plane perpendicular to the reference line at 540 mm from the R point.
- 4.7.3 If the head restraint is adjustable, it shall not be possible to raise it beyond the maximum operational height except by deliberate action on the part of the user, distinct from any act necessary for its adjustment.

4.8 Requirements Regarding the Protection of Occupants from Displaced Luggage

4.8.1 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. This requirement is deemed to be met if, during and after the test described in para 5.9, 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 tested seat back and/or head restraint does not move forward of a transverse vertical plane which passes through a point of 150 mm forward of the R point of the seat in question, excluding the rebound phase(s) of the test blocks. 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. In case of the head restraint systems, the measurements of the forward contour shall be taken for all rigid parts according to the provisions of para 4.1.8. During the test described in para 5.9, the test blocks shall remain behind the seat back(s) in question.

4.8.2 Partitioning Systems

4.8.2.1 At the request of the vehicle manufacturer, the test described in para 5.9, may be carried out with the partitioning systems in place, if these systems are fitted as standard equipment for the particular type of vehicle.

Partitioning systems, netting wire mesh located above the seat backs in their normal position of use, shall be tested according to para 5.9.3.4.

4.8.2.2 This requirement is deemed to be met if, during the test, the partitioning systems remain in position. 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 restraint(s), that are harder than 50 shore A, does not move forward of a transverse vertical plane which passes through a point of 150 mm forward of R point of the seats in question, for the parts of the head restraint and a point of 100 mm forward of R point of the seats in question, for the parts of seat back excluding the rebound phases of the test blocks. 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.

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

4.8.3 Head Restraints

Head restraints fitted as standard equipment for the particular type of vehicle shall be considered as part of the partitioning system during the tests described in para 5.9.

4.8.4

The requirements mentioned in para 4.8.1 and 4.8.2 above shall not apply to luggage retention systems which are activated automatically in case of an impact. The manufacturer shall demonstrate to the satisfaction of the test agency that the protection offered by such systems is equivalent to that described in para 4.8.1 and 4.8.2.

5. TESTS

5.1 General Specifications Applicable to all Tests

5.1.1 The seat-back, if adjustable, shall be locked in a position corresponding to a rearward inclination as close as possible to 25° from the vertical of the torso reference line of the manikin described in IS:13749-1993, unless otherwise specified by the manufacturer.

5.1.2 When a seat, its locking mechanism and its installation are identical or symmetrical with respect to another seat on the vehicle, the test agency may test only one such seat.

5.1.3 In the case of seats with adjustable head restraints, the tests shall be conducted with the head restraints placed in the most unfavourable position (generally, the highest position) allowed by its adjusting system.

5.1.4 Technical specifications of the seats, its anchorages and head restraints as specified in Annexure-I of this standard, should be provided by the vehicle manufacturer for evaluation as per the requirements of this standard.

5.2 Test of Strength of the Seatback and its Adjustment Systems

A force producing a moment of 530 Nm in relation to 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 described in IS:13749-1993. In the case of a bench seat, where part or all of the supporting frame (including that of the head restraints) is common to more than one seating position, the test shall be conducted simultaneously for all those seating positions.

5.3 Test of Strength of the Seat Anchorage and the Adjustment, Locking and Displacement Systems

5.3.1 Requirements

A longitudinal horizontal deceleration of not less than 20 g shall be applied for 30 milliseconds in the forward and rearward directions to the whole shell of the vehicle one after the other, in accordance with the requirements of para 5.3.3. At the request of the manufacturer, the test pulse described in Fig.4 may be used alternatively.

5.3.2 Test Set-up

- 5.3.2.1 The requirements of para 5.3.1 shall be verified for all positions of the seat. In the case of seats fitted with an adjustable head restraint, the test shall be conducted with the head restraints placed in the most unfavourable position (generally the highest position) allowed by its adjusting system. During the test, the seat shall be so positioned that no external factor shall prevent the release of the locking systems.
- 5.3.2.2 These conditions shall be considered to be met if the seat is tested after being adjusted in the following positions :
 - 5.3.2.2.1 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);
 - 5.3.2.2.2 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, where appropriate, in accordance with the requirements of para 5.3.2.3.
 - 5.3.2.3 In cases where the arrangement of the locking system is such that, in a seat position other than those defined in para 5.3.2.2, the distribution of the forces on the locking devices and seat anchorages would be less favourable than either of the configurations defined in para 5.3.2.2, the tests shall be conducted for the least favourable seating position.

5.3.3 Test Procedure for Resistance to Inertia Effects

- 5.3.3.1 The seats to be tested shall be mounted on the vehicle body for which they are designed. This vehicle body shall be firmly anchored on a test trolley as prescribed in the following para.
- 5.3.3.2 The method used for anchoring the vehicle body on the test trolley shall not result in a reinforcement of the seat anchorages.
- 5.3.3.3 The seats and their parts shall be adjusted and locked as prescribed in para 4.1.1. and in one of the positions described in para 5.3.2.

- 5.3.3.4 If the seats of a group do not present essential differences in the sense of para 3.2, the tests prescribed in para 5.3.1 may be carried out with one seat adjusted to its foremost position and the other seat adjusted to its rearmost position.
- 5.3.3.5 The trolley deceleration is measured with data channels of frequency class CFC 60 corresponding to the characteristics of International Standard ISO:6487-1980.
- 5.3.4 The test conditions of para 5.3.1 shall be considered to be satisfied if, at the request of the manufacturer, they are replaced by a collision test of the complete vehicle in running order against a rigid barrier as laid down in para 5.3.5. In this case, the seat shall be adjusted for the least favourable conditions of distribution of stresses in the anchorages system as provided for in para 5.1.1 and 5.3.2.
- 5.3.5 Collision Test of the Complete Vehicle Against a Rigid Barrier
- 5.3.5.1 The barrier shall consist of a block of reinforced concrete of not less than 3 m width, not less than 1.5 m height and not less than 0.6 m thickness. The front face shall be perpendicular to the final part of the run-up track and shall be covered with plywood boards 19 ± 1 mm thick. At least 90 tons of earth shall be compressed behind the block of reinforced concrete. The barrier of reinforced concrete and earth may be replaced by obstacles having the same front surface, provided that they give equivalent results.
- 5.3.5.2 At the moment of impact the vehicle shall run free. It shall reach the obstacle on a course perpendicular to the collision wall; the maximum lateral misalignment allowed between the vertical median line of the front of the vehicle and the vertical median line of the collision wall shall be ± 30 cm; at the moment of impact the vehicle shall no longer be subjected to the action of any additional steering or propelling device. The speed on impact shall be between 48 km/h and 53 km/h.
- 5.3.5.3 The fuel feed system shall be filled to at least 90% of its capacity with fuel or an equivalent liquid.
- 5.4 Test of the Performance of the Head Restraint
- 5.4.1 Test Set-up
- 5.4.1.1 If the head restraint is adjustable, it shall be placed in the most unfavourable position (generally the highest position) allowed by its adjustment system.
- 5.4.1.2 In the case of a bench seat, where part or all of the supporting frame (including that of the head restraints) is common to more than one seating position, the test shall be conducted simultaneously for all those seating positions.

5.4.2 Test Procedure

- 5.4.2.1 All lines including the projections of the reference line, shall be drawn in the vertical median plane of the seat or seating position concerned (see Fig.1).
- 5.4.2.2 The displaced reference line is determined by applying to the part simulating the back of the manikin referred to in IS:13749-1993, an initial force producing a rearward moment of 373 Nm about the R point.
- 5.4.2.3 By means of a spherical head form 165 mm in diameter, an initial force producing a moment of 373 Nm about the R point is applied at right angles to the displaced reference line at a distance of 65 mm below the top of the head restraint, the reference line being kept in its displaced position in accordance with para 5.4.2.2.
- 5.4.2.4 If the presence of the gaps prevents the application of the force prescribed in para 5.4.2.3 at 65 mm from the top of the head restraint, the distance may be reduced so that the axis of the force passes through the center line of the frame element nearest to the gap.
- 5.4.2.5 In the cases described in para 4.6 and 4.7 above, the test shall be repeated by applying to each gap, using a sphere of 165 mm in diameter, a force passing through the center of gravity of the smallest of the sections of the gap, along transversal plane parallel to the reference line, and reproducing a moment of 373 Nm about the R point.
- 5.4.2.6 The tangent Y to the spherical head form, parallel to the displaced reference line is determined.
- 5.4.2.7 The distance X, provided for in para 4.7 above, between the tangent Y and the displaced reference line is measured.
- 5.4.2.8 To check the strength of the head restraint, the initial load specified in para 5.4.2.3 and 5.4.2.5 are increased to 890 Nm unless the breakage of the seat or seat-back occurs earlier.

5.5 Determination of the Height of the Head Restraint (see Fig.5)

- 5.5.1 All lines, including the projection of the reference line, shall be drawn in the vertical median plane of the seat or seating position concerned, the intersection of such plane with the seat determining the contour of the head restraint and of the seat back (see Fig.5).
- 5.5.2 The manikin referred to in IS:13749-1993 shall be placed in a normal position on the seat.
- 5.5.3 The projection of the reference line of the manikin shown in IS:13749-1993 is then, in the seat concerned, drawn in the plane specified in para 5.4.2.1.

- 5.5.4 The tangent S to the top most point of the head restraint is drawn perpendicular to the reference line.
- 5.5.5 The distance “h” from the R point to the tangent S is the height to be taken into consideration in implementing the requirements of para 4.4.
- 5.6 Determination of the Width of the Head Restraint (see Fig.6)
- 5.6.1 The plane S perpendicular to the reference line and situated 65 mm below the tangent S defined in para 5.5.4 determines a section in the head restraint bounded by the section C.
- 5.6.2 The width of the head restraint to be taken into consideration in implementing the requirements of para 4.5, is the distance “L” measured in the plane S between the vertical longitudinal planes P and P’.
- 5.6.3 The width of the head restraint shall if necessary also be determined in the plane perpendicular to the reference line 635 mm above the R point of the seat, this distance being measured along the reference line.
- 5.7 Determination of Distance “a” of Head Restraint Gaps (see Fig.2 and Fig.3)
- 5.7.1 The distance “a” shall be determined for each gap and in relation to the front face of the head restraint, by means of a sphere having a diameter of 165 mm.
- 5.7.2 The sphere shall be put into contact with the gap in a point of the gap area which allows the maximum sphere intrusion, considering no load is to be applied;
- 5.7.3 The distance between the two points of contact of the sphere with the gap will constitute the distance “a” to be considered for the evaluation of the provisions under para 4.6.
- 5.8 Tests for Checking Energy Dissipation on the Seat-back and Head Restraint
- 5.8.1 The surfaces of the rear parts of seats to be checked are those situated in the areas defined below which can be contacted by a 165 mm diameter sphere when the seat is mounted in the vehicle.
- 5.8.2 Area 1
- 5.8.2.1 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 center line, and above a plane perpendicular to the reference line 100 mm below the top of the seat-back.

5.8.2.2 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.

5.8.2.3 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.

5.8.3 Area 2

5.8.3.1 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 distance from the top of the seat back, other than parts of area 1.

5.8.3.2 In the case of the seats or bench seats with integrated head restraints, area 2 shall extend above a plane perpendicular to the reference line 440 mm distance from the R point of the seat or of the seating position concerned, other than parts of area 1.

5.8.4 Area 3

Area 3 is defined as the part of the back of the seat or the bench seats situated above the horizontal planes defined in para 4.1.6.3, excluding parts situated in area 1 and area 2.

5.8.5 Test Procedure for Checking Energy Dissipation

The test should be carried out as described below :

5.8.6 Test Set-up

5.8.6.1 The seat, as mounted in the vehicle, shall be firmly secured to the test bench with the attachment parts provided by the manufacturer, so as to remain stationary when the impact is applied.

5.8.6.2 The seat-back, if adjustable, shall be locked in the position specified in para 4.1.1.

5.8.6.3 If the seat is fitted with a head restraint, the head restraint shall be mounted on the seat-back as in the vehicle. Where the head restraint is separate, it shall be secured to the part of the vehicle structure to which it is normally attached.

5.8.6.4 If the head restraint is adjustable, it shall be placed in the most unfavourable position allowed by its adjusting systems.

5.8.7 Test Apparatus

This apparatus consists of a pendulum whose pivot is supported by a ball-bearing and whose reduced mass at its center of percussion is 6.8 kg. The lower extremity of the pendulum consists of a rigid head form 165 mm in diameter whose center is identical with the center of percussion of the pendulum. The relationship of the reduced mass "m_r" of the pendulum to the total mass "m" of the pendulum at a distance "a" between the center of percussion and the axis of rotation and at a distance "l" between the center of gravity and the axis of rotation is given by the formula :

$$m_r = (m) \times (l/a).$$

5.8.8 Test Instrumentation

5.8.8.1 The head form shall be fitted with two accelerometers and a speed-measuring device, all capable of measuring values in the direction of impact.

5.8.8.2 The recording instruments used shall be such that the measurements can be made with the following degrees of accuracy.

5.8.8.2.1 Acceleration

Accuracy : $\pm 5\%$ of the actual value.

Frequency class of data channel : class 600 corresponding to ISO Standard 6487-1987.

Cross axis sensitivity : $< 5\%$ of the lowest point on the scale.

5.8.8.2.2 Speed

Accuracy : $\pm 2.5\%$ of the actual value.

Sensitivity : 0.5 km/h.

5.8.8.2.3 Time Recording

The instrumentation shall enable the action to be recorded throughout its duration and readings to be made within one-thousandth of a second.

The beginning of the impact at the moment of first contact between the head form and the item being tested shall be detected on the recording used for analysing the test.

5.8.9 Test Procedure

5.8.9.1 Tests on the Seatback

With the seat installed as indicated in para 5.8.6, the direction of impact from the rear towards the front shall be situated in a longitudinal plane at an angle of 45° from the vertical. The impact points shall be selected by the test agency in area 1 as defined in para 5.8.2, or if necessary, in area 2 as defined in para 5.8.3 on surfaces exhibiting radii of curvature less than 5 mm.

5.8.9.2 Tests on the Head Restraint

The head restraint shall be fitted and adjusted as indicated in para 5.8.6. Impacts shall be performed on points selected by the test agency in area 1 as defined in para 5.8.2 and possibly in area 2 as defined in para 5.8.3 on surfaces exhibiting radii of curvature less than 5 mm as given below :

For the rear face, the direction of impact from the rear towards the front shall be in a longitudinal plane at an angle of 45° from the vertical.

For the front face, the direction of impact from the front towards the rear shall be horizontal in a longitudinal plane.

The front and rear zones are respectively bounded by the horizontal plane tangential to the top of the head restraint as determined in para 5.5.

5.8.9.3 The head form shall strike the test item at a speed of 24 km/h. This speed shall be achieved either by the mere energy of propulsion or by using an additional impelling device.

5.8.10 Results

The deceleration rate shall be taken as the average of the readings on the two decelerometers.

5.9 Test Procedure for Devices Intended to Protect the Occupants against Displacement of Luggage

5.9.1 Test Blocks

Rigid blocks, with the centre of inertia in the geometric centre.

Type 1

Dimensions : 300 mm x 300 mm x 300 mm with all edges and corners rounded to 20 mm

Mass : 18 kg

Type 2

Dimensions : 500 mm x 350 mm x 125 mm with all edges and corners rounded to 20 mm

Mass : 10 kg

5.9.2 Test Preparation

The details of test preparation and set-ups for various configurations are explained below.

5.9.3 Test of Seat Backs (see Fig.7)

5.9.3.1 General Requirements

Two numbers of Type 1 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 centre has transversed 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.

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.

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

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.

Seats behind which the Type 1 blocks cannot be installed are exempted from this test.

5.9.3.2 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, in this case, the test agency, after consultation with the manufacturer, 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. When there is a gap, allowing sliding of one Type 1 block past the seats, then the test loads (two numbers of Type 1 blocks) shall be installed behind the seats after agreement between the test agency and the manufacturer. The exact test configuration shall be noted in the test report.

5.9.3.4 Test of Partitioning Systems

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 centre of gravity of the test block centrally between the top edge of the bordering seat back (without taking into account the headrests) 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 mm x 350 mm, centrally in relation to the longitudinal axis of the vehicle and with its surface 500 mm x 125 mm to the front. Partitioning systems behind which the Type 2 test block cannot be installed are exempted from this test. The test block is placed directly in contact with the partitioning system. In addition, two numbers of Type 1 test blocks are positioned in accordance with para 5.9.3.1 in order to perform a simultaneous test on the seat backs (see Fig.8).

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

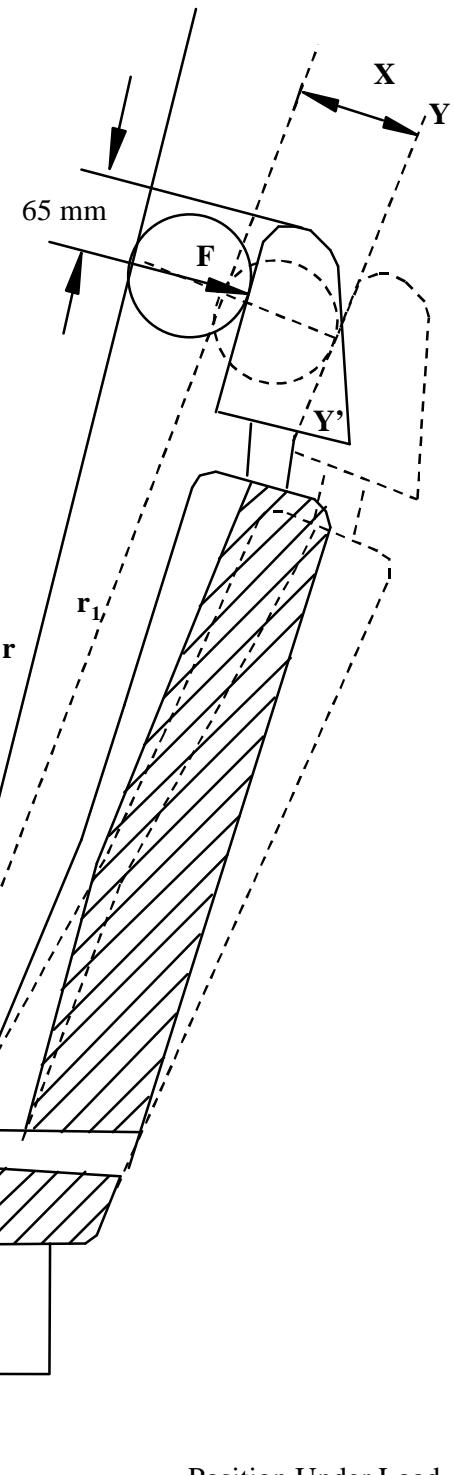
5.9.4 Dynamic Testing of Seatbacks and Partitioning Systems used as Luggage Restraint Systems

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. After the installation of the test blocks as described in para 5.9.3.1 or 5.9.3.2, the passenger car body shall be accelerated as shown in Fig.8. With the agreement of the manufacturer, the above described test pulse corridor can be used alternatively to fulfil the test of the seat strength according to para 5.3.1.

5.10 If a test method other than those specified in para 5.2 to 5.9 above is used, its equivalence shall be proved.

6. EXPLANATORY NOTE

This is based on ECE R 17-07 "Approval of Seats, Anchorages and Head Restraints" and 74/408/EEC as amended by 96/37 "Strength of Seats and Their Anchorages".



R = Reference Point.

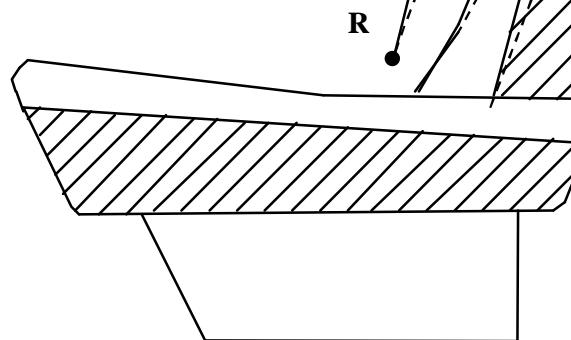
r = Reference Line.

r_1 = Displaced Reference Line.

Y-Y' = Plane parallel to Displaced
Torso passing through the point
of contact of the headrest and
head form.

X = Displacement of headrest from
displaced torso line.

F = Moment of F in relation to
R = 373 Nm



— Initial Position - - - - Position Under Load

FIG 1 DETAILS OF LINES AND MEASUREMENT TAKEN DURING PERFORMANCE TEST OF HEAD RESTRAINT(Para 3.13,3.14&4.7.1)

DETERMINATION OF DIMENSION 'a' OF HEAD RESTRAINT GAPS

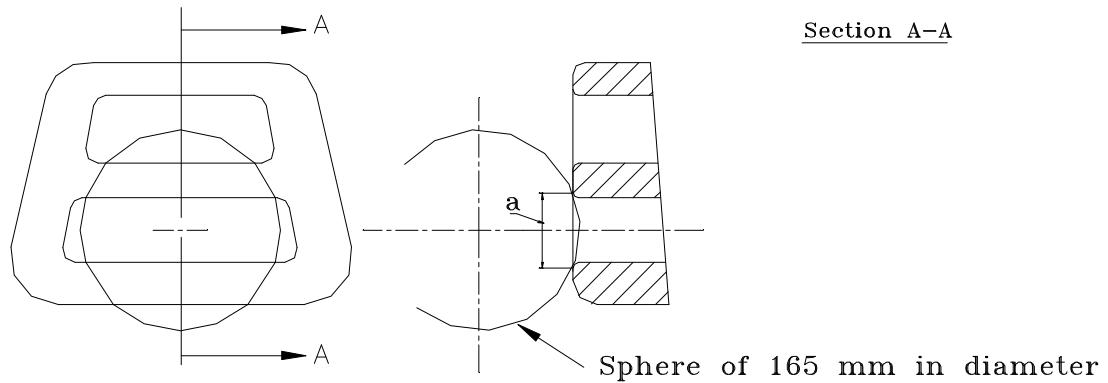


Fig 2 Example of Horizontal Gaps(Para 4.6.2)

Note : Section A-A is to be made in a point of the gap area which allows the maximum sphere intrusion, without exerting any load.

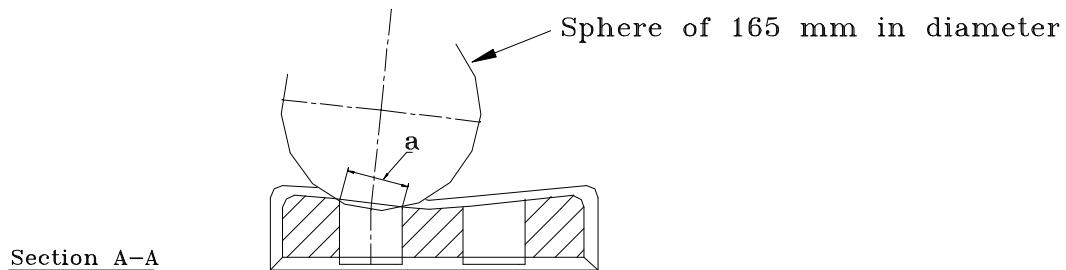
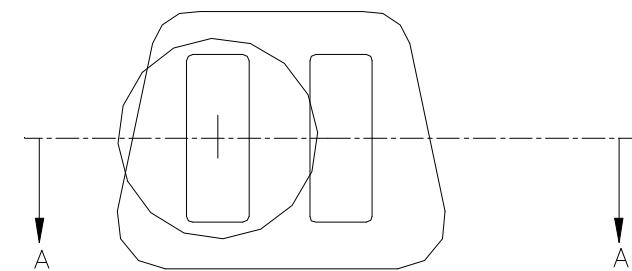
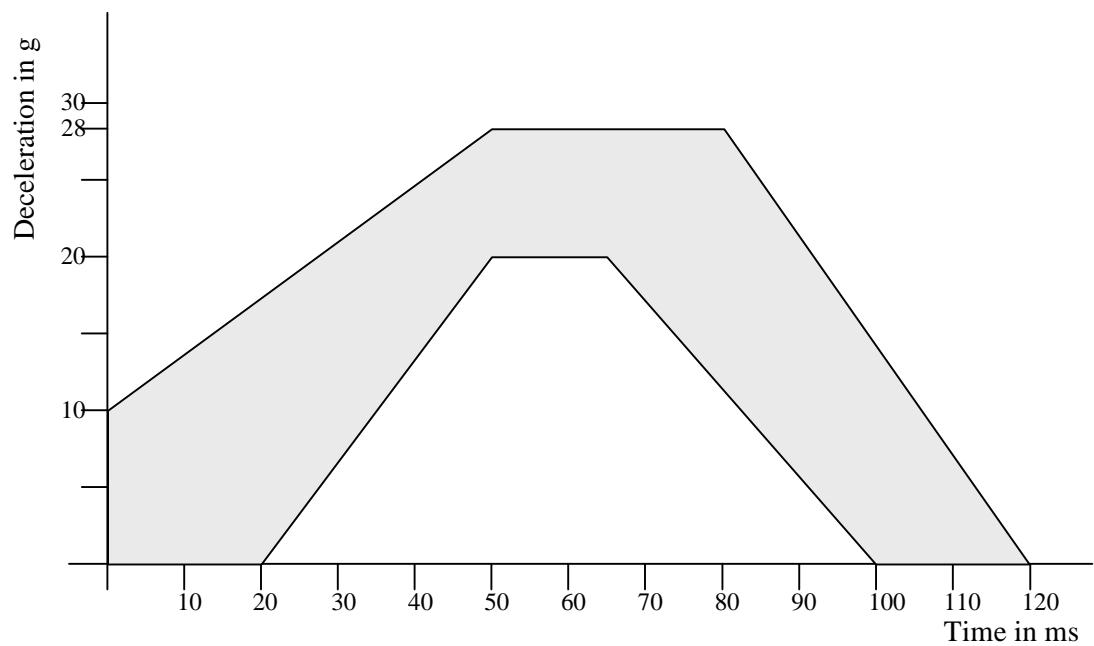


Fig 3 Example of Vertical Gaps(Para 4.6.2)

Note : Section A-A is to be made in a point of the gap area which allows the maximum sphere intrusion, without exerting any load.



**FIG 4 SLED DECELERATION AS A FUNCTION OF TIME (Para 5.3.1)
(Frontal Impact)**

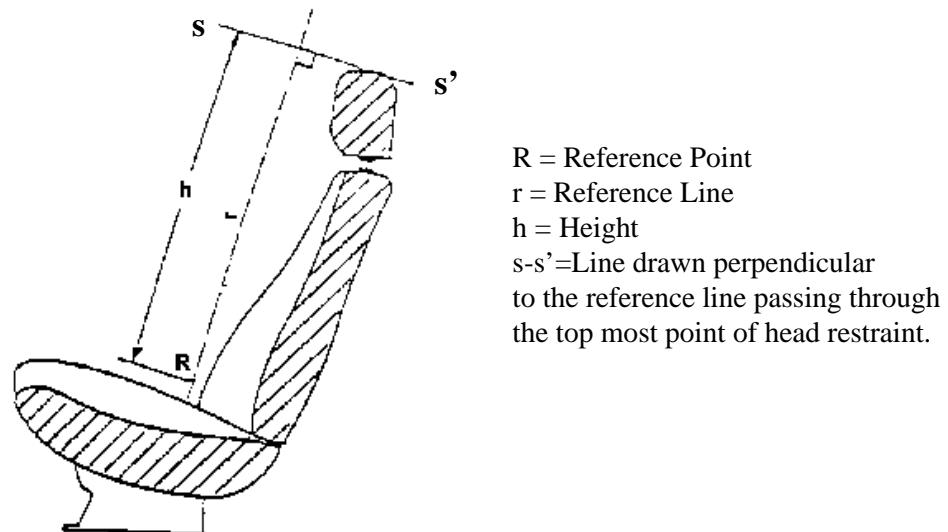


FIG 5 DETERMINATION OF HEIGHT OF HEAD RESTRAINT (Para 5.5)

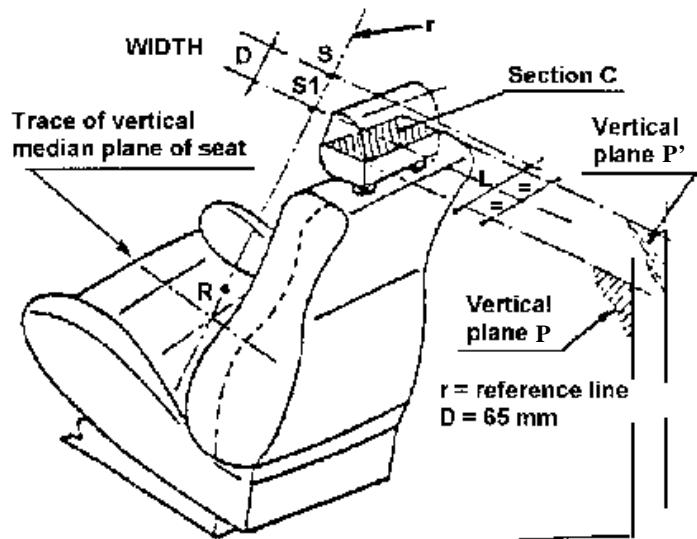


FIG 6 DETERMINATION OF THE WIDTH OF HEAD RESTRAINT (Para 5.6)

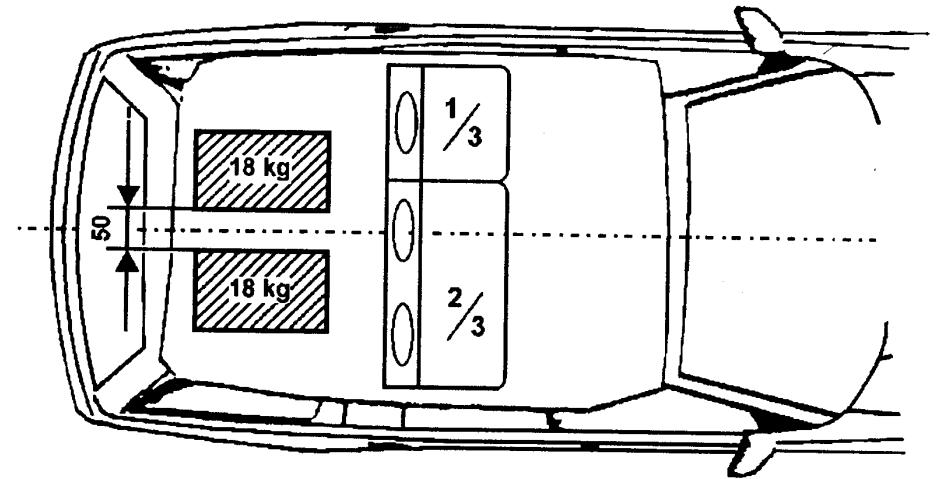


FIG 7 POSITION OF TEST BLOCKS BEFORE TEST OF REAR SEAT BACK
(Para 5.9.3)

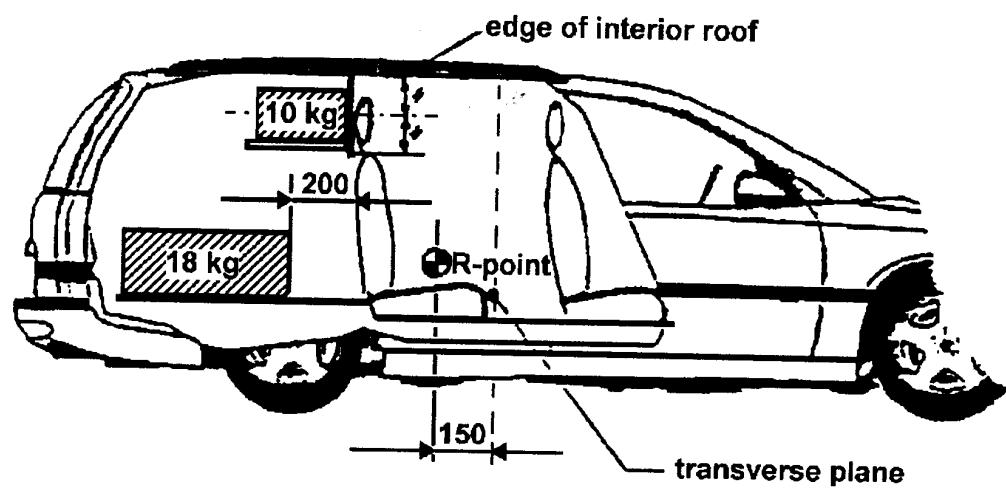


FIG 8 TESTING OF A PARTITIONING SYSTEM ABOVE THE BACK REST
(Para 5.9.3)

ANNEXURE-I
AUTOMOTIVE VEHICLES :
SEATS, THEIR ANCHORAGES AND HEAD RESTRAINTS
FOR CATEGORY M1 : SPECIFICATIONS

Technical Specifications Required to be Provided by Vehicle Manufacturer at the Time of Type of Evaluation Relevant to the Requirements of this Standard

1. Trade name or mark of the motor vehicle
.....
2. Vehicle type
.....
3. Manufacturer's name and address
.....
4. If applicable, name and address of the manufacturer's representative.....
5. Description of seats Make
.....
6. Number of seats fitted or capable of being fitted with head restraints, adjustable or not adjustable
.....
7. Description of the adjustment, displacement and locking systems of the seat or of its parts and a description of occupant protection system against displacement of luggage.....
8. Description of seat anchorage
.....
9. Longitudinal position of the seats during the tests.....
10. Documents to be furnished along with test request :
 - 10.1 Drawings, diagrams and plans of the seats, their anchorages on the vehicle, the adjustment and displacement systems of the seats and their parts, and their locking devices.
 - 10.2 Photographs of the seats, their anchorages, the adjustment and displacement systems of the seats and their parts, and their locking devices and of additional occupant protection system against displacement of luggage.
 - 10.3 In the case of seats fitted with head restraints, the head restraint shall be shown on all drawings, diagrams and photographs.

ANNEXURE-II

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Annexure: III
 (See Introduction)

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Automotive Industry Standards Committee

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