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Strength requirement and test method of automobile seats, their anchorages and any head restraints

汽车座椅、座椅固定装置及头枕强度要求和试验方法

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Strength requirement and test method of automobile seats, their anchorages and any head restraints

1 Scope

This Standard specifies terms and definitions, technical requirements and test methods for automobile seats, their anchorages and any head restraints.

This Standard is applicable to:

a) Types M_1 and N automobile seats, their anchorages and any head restraints;

b) Types M_2 and M_3 automobile seats, their anchorages and any head restraints not involved in GB 13057;

c) Design of seat backrest parts of type M_1 automobile as well as design of the device that is to prevent occupant from causing injury due to movement of luggage in frontal collision.

This Standard is not applicable to rearward-facing seats as well as the head restraints that are mounted on them.

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.

GB/T 3730.1, *Motor vehicles and trailers - Types - Terms and definitions*

GB 11551-2014, *The protection of the occupants in the event of a frontal collision for motor vehicle*

GB 11552, *The interior fittings of passenger car*

GB 13057, *Strength of the seats and their anchorages of passenger vehicles*

GB/T 15089, *Classification of power-driven vehicles and trailers*

ISO 6487, *Road vehicles - Measurement techniques in impact tests -*

angle between the symmetrical vertical plane of the seat and the symmetrical vertical plane of the vehicle is 90°±10°.

3.3 bench seat

A ride facility that is for more than one adult occupants, that has complete skin.

3.4 folding seat

A backup seat that is designed for an adult occupant to use occasionally, that is easy to operate and be able to self-lock during use. Usually, it is in a folded state.

3.5 walk-in seat

A seat that its backrest, cushion or overall is reversible, unloaded; that provides convenience for passenger behind the seat to enter and leave the vehicle or convenience for luggage placement.

3.6 anchorage

A device that fixes seat assembly on vehicle structure. It includes the components that are affected on vehicle structure.

3.7 adjustment system

A device that can adjust the position of the seat or its components to suit the occupant's seating posture. This device may have (but not limit to) the following functions:

- longitudinal displacement;

- vertical displacement;

- angular displacement.

3.8 displacement system

The device that is easy for occupants to enter and exit behind the seat and makes the seat or a part of it rotate or/and move. There is no fixation position during the process when the seat or a part of it rotates or/and moves.

3.9 locking system

The device that keeps the seat and components in the position of use.

3.10 transverse plane

A vertical plane that is orthogonal to the longitudinal center plane of vehicle.

This requirement is not applicable to:

a) the components that the height of the convex surrounding surface is less than 3.2mm, the protruding height is not more than half of its width, and the edges are smooth;

b) the last row of seats, back-to-back seats or seats that comply with GB 11552;

c) the seat back components that are located below the horizontal plane passing through the lowest 'R' point of each row of seats (if the height of each row of seats is different, it shall start from the rear seats. This level shall pass through the 'R' point of the front seat. A step shall be formed in the vertical direction, high or low);

d) the components such as flexible net.

The surface within area 2 of 5.8.2, if it meets the energy absorption test in Annex A, its radius of curvature is allowed to be less than 5mm, but not less than 2.5mm. The surface shall be padded to avoid direct contact between the occupant's head and the seat skeleton.

For the components within the above areas, if the surface material Shore A hardness is less than 50, except the requirements related to the energy absorption test specified in Annex A, all requirements only apply to the rigid components.

4.2.5 During the process of the test performed according to the provisions of 5.2 and 5.3 or after the test, the seat skeleton, the anchorage, the adjustment system, the displacement system as well as its locking system shall not fail. It is allowed to have permanent deformation (including cracks) that does not increase the degree of damage during a collision. And it can withstand the specified load.

4.2.6 During the process of the tests specified in 5.3 and B.2.1 in Annex B, the locking system must not loosen.

4.2.7 After the test, the displacement system that allows or facilitates the occupant to pass shall be in working condition. And it shall at least ensure to unlock once. It shall move the seat or a part of the seat as needed.

Other displacement system, adjustment system and its locking system are allowed to have deformation, crack but not failure. It shall remain at the original locking position.

For the seat with head restraint, during the test process of 5.4.3.6 or after the test, if the seat or the seat backrest does not have cracks, the strengths of the

b) There shall be no “position of use” in a height less than 750mm;

c) The head restraints of other seats excluding the front row of seats can be adjusted to a position less than 750mm; but it needs to clearly indicate to the occupants that this position is not the position of use of the head restraint;

d) For the front row of seats, if the head restraints can automatically go back to the position of use during riding, it shall allow the head restraint, when there is no occupant, to automatically lower to a position below 750mm.

4.6.4 To ensure sufficient clearance between the head restraint and the roof trim surface, between the window and the structural components of the vehicle, for the front row of seats, the size specified in 4.6.2 and 4.6.3 a) can be less than 800mm, less than 750mm for other seats; but this clearance shall not exceed 25mm. For the seats that are equipped with the displacement system and/or the adjustment system, this provision is applicable to all seating positions. In addition, reduce the height specified in 4.6.3 b). When it is lower than 700mm, there shall be no “position of use”.

4.6.5 For the head restraints of other rows of seats or seating positions other than the front row, it can reduce the height specified in 4.6.2 and 4.6.3 a), but it shall not be less than 700mm.

4.6.6 The seats that are equipped with the head restraints shall comply with the provisions of 4.2.3 and 4.5.2. For the head restraints that the height is adjustable, when the height of the restraint part is measured according to the method specified in 5.5, it shall not be less than 100mm.

4.7 Spacing between head restraint and seat backrest

For the head restraint that its height is nonadjustable, the spacing between it and seat backrest shall not exceed 60mm. For the head restraint that its height is adjustable, when the head restraint is adjusted to the lowest position of use, the spacing between it and seat backrest top shall not exceed 25mm. For the seats or bench seats that are equipped with separate head restraints and the height is adjustable, all positions where they are shall all comply with the provisions of this sub-clause.

4.8 Clearance

4.8.1 For integrated head restraint, the area that shall be considered is: at the position 540mm from the ‘R’ point and above the plane that reference lines are perpendicular to each other, within the area enclosed between two longitudinal vertical planes of 85mm on either side of the torso reference line. Within this area, if this head restraint, after the additional test specified in 5.4.3.3, still complies with the provisions of 4.10.1, one or more clearances are allowed to

All the measurements shall be performed on the longitudinal center plane of each seat or seating position that constitutes the front boundary of the luggage compartment.

After the test, it is not allowed to have sharp corners and edges that are easy to increase the degree of injury or danger to the occupant.

4.11.3 Others

The requirements referred by 4.11.1, 4.11.2 do not apply to the luggage holding system that automatically acts due to impact. The manufacturer shall demonstrate that the protection provided by this system is equivalent to the requirements of 4.11.1 and 4.11.2.

5 Test methods

5.1 Test conditions

5.1.1 For adjustable seat backrest, except as otherwise specified by the manufacturer, it shall be locked in the back-tilt position as close as possible to 25° of the three-dimensional H-point system trunk reference line as described in Appendix A of GB 11551-2014 and the vertical direction.

5.1.2 When the locking system and installation method of a certain seat is same or symmetric with the corresponding seat, the testing facility can test only one of the seats.

5.1.3 For the seat that the head restraint height is adjustable, when testing, the head restraint shall be placed in the most unfavorable position within its adjustment range (usually the highest position).

5.1.4 The folding seat shall be tested at the position of use of occupant.

5.2 Strength test of seat backrest and its adjustment system

Though stimulating the human pseudo-back model described in Annex A of GB 11551-2014, apply a load of 530Nm to the seat 'R' point in the longitudinal direction of the upper part of the seat back skeleton. For bench seat, if part or all of the supporting skeleton (including the head restraint part) is shared by more than one seat, these seats shall be tested simultaneously.

5.3 Strength test of seat anchorage, adjustment system, locking system and displacement system

5.3.1 According to the provisions of C.1 in Annex C, apply a longitudinal horizontal deceleration or acceleration of not less than 20g to the entire vehicle

11551-2014 on the normal seating position of the seat.

5.5.3 Draw the projection of the three-dimensional H-point system reference line shown in Annex A of GB 11551-2014 on the plane specified in 5.4.3.1. Make a tangent S perpendicular to the reference line and tangent to the top of the head restraint.

5.5.4 The distance "h" from the 'R' point to the tangent S is the height of the head restraint specified in 4.6.

5.6 Determination of head restraint width (see Figure E.2 of Annex E)

5.6.1 Use the plane S1 that is located 65mm below the tangent S specified in 5.5.3 and perpendicular to the reference line to determine the head restraint profile that is defined by the outline C.

5.6.2 According to the corresponding provisions of 4.9, the width of the head restraint to be considered is the distance L between the vertical longitudinal planes P and P' and the two intersections of the section S1.

5.6.3 If necessary, the width of the head restraint can also be determined in a plane 635mm from the 'R' point along the reference line and perpendicular to the reference line.

5.7 Determination of clearance distance of head restraint "a" (see Annex F)

5.7.1 Use a sphere of which the diameter is 165mm to determine the distance of each clearance "a" on the front surface of head restraint.

5.7.2 Without applying any acting force, place the sphere within the clearance at the maximum degree and contact with this area point.

5.7.3 The distance between the two points where the sphere is in contact with the clearance is the distance "a" specified in 4.8.

5.8 Energy absorption test of seat backrest and head restraint (applicable to that when the seat is installed on the vehicle, it can be contacted by a sphere of which the diameter is 165mm and is located on the area surface defined in 5.8)

5.8.1 Area 1

5.8.1.1 For the independent seat without head restraint, this area refers to the area behind the backrest that is located between the longitudinal vertical planes 100mm at the left, right sides of the seat's longitudinal center, and is above the plane perpendicular to the reference line from the apex of the backrest 100mm down the reference line.

Annex A

(normative)

Energy absorption test procedures

A.1 Sample installation, test equipment, recording instrument and test procedures

A.1.1 Sample installation

Use the anchorage provided by manufacturer to firmly fix on the test bench according to the installation mode of real vehicle, so as to make it stable during the test.

If the seat backrest is adjustable, it shall be locked on the position specified in 5.1.1.

For the seat equipped with head restraint, in shall install the head restraint on the seat backrest according to the installation mode of real vehicle. The separate head restraint shall be installed on the vehicle structural component according to the normal installation position.

For the adjustable head restraint, it shall be adjusted to the most unfavorable position within the adjustable range.

A.1.2 Test equipment

A.1.2.1 The test equipment consists of a pendulum. The pendulum rotating shaft is supported by a ball bearing. Its conversion mass[1] at the impact center is 6.8kg. At the lower end of the pendulum, there is a rigid head type of which the diameter is 165mm. Its center coincides with the pendulum impact center.

A.1.2.2 Two accelerometers and one speed measuring device are installed on the head type, so as to determine all data in the direction of impact.

A.1.3 Recording instrument

A.1.3.1 Acceleration

Accuracy: ±5% of the measured value.

Frequency level of data channel: (CFC) 600 (corresponding to ISO 6487).

[1] "a" is the distance between the center of impact and the rotation. "l" is the distance between the center of gravity and the axis of rotation. "m_r" is the conversion mass of the pendulum. “m” is the total mass of the pendulum. The relative relationship between "m_r" and "m" at distance "a" and distance "l" can be given by the following formula: $m_r = ml/a$.

Annex B

(normative)

Test method for luggage displacement passenger protection device

B.1 Test piece

B.1.1 General requirements

For rigid test piece, its inertial center coincides with the geometric center.

B.1.2 Type 1

Size: 300mm × 300mm × 300mm.

All edge fillets shall be 20mm.

Mass: 18kg.

Moment of inertia: (0.3±0.05) kg·m^2 (around all three inertia spindles of the simulated luggage sample).

B.1.3 Type 2

Size: 500mm × 350mm × 125mm.

All edge fillets shall be 20mm.

Mass: 10kg.

B.2 Test preparation

B.2.1 Seat backrest test (see Figure B.1)

B.2.1.1 General provisions

B.2.1.1.1 Under the choice of the vehicle manufacturer, during the test, the components of which the Shore A hardness is less than 50 can be removed from the tested seat and head restraint.

B.2.1.1.2 Place two type-1 test pieces on the floor of the luggage compartment. In order to determine the longitudinal placement of the test sample, it shall place the test piece at the bottom of the luggage compartment. At first, the front end is in contact with the vehicle components that form the front boundary of the luggage compartment and the lower side of the test piece is placed on the floor of the luggage compartment. Then, move it backwards parallel to the

B.2.1.2 Vehicle with more than two rows of seats

B.2.1.2.1 If user can, according to the instruction manual of manufacture, remove and/or fold down the last row of seats, so as to increase the space of luggage compartment. Otherwise, it shall test the penultimate row of seats directly.

B.2.1.2.2 Under the above circumstances, if the designs of the seat and its anchorage are similar and can meet the requirements of 200mm displacement, after consultation between the inspection agency and the manufacturer, it shall select one of the seats of rear row to test.

B.2.1.3 Others

If the clearance between the seats may make type-1 test piece slip over. After negotiation between testing agency and manufacturer, it may place type-1 test pieces (2 pieces) behind the seat backrest.

In the test report, an accurate test loading diagram shall be attached.

B.2.2 Partitioning system test

B.2.2.1 For the partitioning system test above the seat backrest, on the test vehicle, it shall equip a fixed test plate that can be raised with a load bearing plane. The position of the plate shall be such that the center of gravity of the test piece placed on it passes through right in the middle of the top of the seat backrest (excluding the seat head restraint) and the lower edge of the inner ceiling of the vehicle. The type-2 test piece is placed on the rising test plate. The bottom surface has a maximum size of 500mm × 350mm. Its center is located on the longitudinal axis of the vehicle. And its front surface size is 500mm × 125mm. If type-2 test piece cannot be placed behind the partitioning system, this test may not be carried out. During the test, the test piece shall be directly contacted with the partitioning system. In addition, it shall place two type-1 test pieces according to the provisions of B.2.1. Meanwhile, perform the test to the seat backrest.

B.2.2.2 If the seat is installed with the head restraint of which the height is adjustable, it shall adjust the seat head restraint to the highest position.

Annex C

(normative)

Test methods for seat anchorage, adjustment system, locking system and displacement system

C.1 Anti-inertial test

C.1.1 Install the test seat on the vehicle body according to the design position. Firmly install this vehicle body on the test pulley according to the following provisions.

C.1.2 The connection mode that installs the vehicle body on the test pulley shall not play a strengthening role to the seat anchorage.

C.1.3 It shall adjust the seat and its components according to the provisions of 5.1.1 and lock at one of the positions specified in 5.3.3 and 5.3.4.

C.1.4 If a group of seats has no major differences in the aspects specified in 3.1, it shall, according to the methods specified in 5.3.1 and 5.3.2, adjust one seat to the most front position while another seat to the last position to test.

C.1.5 The measurement of pulley deceleration or acceleration uses the data channel of frequency class (CFC) 60 that conforms to ISO 6487 characteristics.

C.2 Rigid barrier collision test of real vehicle

C.2.1 The barrier is composed of reinforced concrete structures. Barrier length is not less than 3m. Height is not less than 1.5m. Thickness is not less than 0.6m. The front surface shall be perpendicular to the last segment of the runway of the test vehicle. And it shall be covered by plywood that its thickness is (19 ± 1) mm. At least 90t of soil shall be piled up behind the reinforced concrete structure. The barrier that consists of a reinforced concrete structure and a soil structure can also be replaced by other barriers with the same effect on the front surface.

C.2.2 The test vehicle shall slide freely at the moment of collision. The vehicle travel route shall be perpendicular to the barrier collision surface. The maximum lateral deviation of the vertical centerline of the front of the vehicle from the vertical centerline of the collision barrier surface shall be ±300mm. At the moment of the collision, it shall not apply steering or pushing action to the vehicle. The collision speed is in the range of 48.3km/h~53.1km/h.

C.2.3 The fuel supply system shall be fitted with at least 90% of rated fuel or

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