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Frontal airbag - Technical requirements of protection for out of position occupant

正面安全气囊 离位乘员保护技术要求

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1 Scope

This Standard specifies test methods and technical requirements of protection for out of position occupant of frontal airbag.

This Standard is applicable to frontal airbag system with function of protecting out of position occupants.

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 4094, *Motor vehicles - Symbols for controls，indicators and tell-tales*

GB 27887, *Restraining devices for child occupants of power-driven vehicles*

3 Terms and definitions

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

3.1 out of position occupant

an occupant in an abnormally designed riding posture

3.2 point A

the point 114mm ± 3mm down from the top along the midline of the front of the chest of the 3-year-old child's dummy

3.3 point B

the point 139mm ± 3mm down from the top along the midline of the front of the chest of the 6-year-old child's dummy

3.4 point C

the geometric center of the front airbag module of the front row outer occupant is connected to the geometric center of the static fully deployed airbag; point C refers to the intersection of the connection and the instrument panel

3.5 plane A

a vertical plane passing through the longitudinal centerline of the child restraint system

3.6 plane B

for a single seat, it is a vertical plane that passes through the longitudinal centerline of the right front outer seat cushion and is parallel to the longitudinal centerline of the vehicle; for bench seats, it is a vertical plane parallel to the longitudinal centerline of the vehicle that passes the right front seat and has the same distance from the centerline of the steering wheel to the longitudinal centerline of the vehicle

3.7 plane C

a horizontal plane passing point C

3.8 plane D

a vertical plane passing through point C and parallel to the longitudinal center plane of the vehicle

3.9 plane E

a vertical plane that passes the geometric center of the fully deployed state of the driver's frontal airbag and is parallel to the longitudinal center plane of the vehicle

4 Technical requirements

4.1 Protection provided to infants in child restraint systems or portable cots after use

4.1.1 General requirements

Carry out the test in accordance with the test method specified in 5.1 and meet the requirements of 4.1.2 or 4.1.3.

4.1.2 Automatic suppression function

4.1.2.1 The vehicle is equipped with a front passenger side airbag system with automatic suppression function. In each static test specified in 5.1.2, prevent

force and neck torque are both filtered using CFC600.

4.2 Protection of mixed type III 3-year-old child dummy

4.2.1 General requirements

The test is carried out in accordance with the test method specified in 5.2 and shall meet the requirements of 4.2.2 or 4.2.3.

4.2.2 Automatic suppression function

4.2.2.1 The vehicle is equipped with a front passenger side airbag system with automatic suppression function. In each static test specified in 5.2.2, prevent the front passenger side airbag system from being activated. In each static test specified in 5.2.3, the front passenger side airbag system is activated.

4.2.2.2 The vehicle is equipped with at least one luminous signal device. The signal device meets the requirements of 4.1.2.2.

4.2.2.3 Regardless of whether the front outer passenger seat is occupied or not, the vehicle needs to have the function of indicating whether the airbag system is suppressed. In addition to the signal device described in 4.2.2.2, the device does not need to be located in the passenger compartment.

4.2.3 Low-risk deployment of front passenger side airbags

4.2.3.1 All parts of the dummy and child restraint system are contained in the passenger compartment of the vehicle.

4.2.3.2 For the dummy head injury evaluation index, the calculated maximum value of HIC_{15} is not more than 570. For any two moments t_1 and t_2, the time interval between the two in the collision is not more than 15ms and t_1 is less than t_2, the head injury evaluation index (HIC_{15}) is determined by the acceleration a measured at the center of gravity of the dummy's head, expressed by g. Use formula (1) to calculate.

4.2.3.3 The time when the synthetic acceleration of the dummy's chest is greater than 55g shall not exceed 3ms.

4.2.3.4 The compression of the dummy's chest is not more than 34mm.

4.2.3.5 For the upper neck injury index of the dummy, during the collision, the axial force (F_z) may be the tensile force or the compressive force. At the same time, the bending moment (M_{ocy}) of the occipital condyle may be bending or extension. This makes N_{ij} [see formula (3)] produce four possible load conditions: tension-extension (N_{te}), tension-bending (N_{tf}), compression-extension (N_{ce}), or compression-bending (N_{cf}). At any time during the collision,

5 Test methods

5.1 Test method for infant protection of child restraint system or portable bed after use

5.1.1 General test conditions

5.1.1.1 The child restraint system used in the test shall meet the requirements of GB 27887.

5.1.1.2 The outer front passenger seat is tested separately in the last position, middle position, and most front position in the front and rear direction. If the child restraint system or dummy comes into contact with the vehicle interior parts, move the seat back to a fixed position from the contact position. If it is an electric seat, move the seat backward to a position where there is a maximum clearance of 5mm.

5.1.1.3 If the rear-facing child restraint system or portable bed is equipped with a handle, the handle is located in the position recommended by the manufacturer of the child restraint system and the handle is in an upright position for testing.

5.1.1.4 If the rear-facing child restraint system or the portable bed is equipped with an awning, the awning is in a fully open position and a fully closed position for testing.

5.1.1.5 The rearward child restraint system or the portable bed is not covered and the 1.0kg towel or blanket is tested separately. The towel or blanket is placed in a way to cover the child restraint system or from the top of the seat back to the frontmost position of the restraint system.

5.1.1.6 If the rear-facing child restraint system or the portable bed has an ISOFIX fixing system and the vehicle's front outer passenger seat is equipped with ISOFIX fixing points, then in the test of securing with a seat belt, under the condition of using the child restraint system ISOFIX fixing system and not using the vehicle seat belt, as well as under the condition of using the vehicle seat belt without using the child restraint system ISOFIX fixing system, carry the test separately. In the test without the use of seat belts, neither the child restraint system ISOFIX system nor the vehicle seat belt is used, carry out the test.

5.1.1.7 If the rear-facing child restraint system or portable bed is equipped with a detachable base, then the case where the child restraint system is connected to the base and the case where the child restraint system is not connected to the base are tested separately.

5.1.1.8 No pull strap attached.

5.1.1.9 If the seat lumbar support is adjustable, adjust to the position designed by the manufacturer or fully retracted position. For other seat adjustment devices, adjust the adjustable part of the seat to provide additional support. Adjust it to the lowest seat or convenient position. If the cushion is adjustable back and forth, adjust to the final position. For the seat height that can be adjusted, it can be adjusted to the middle height position in the last position, middle position, and most front position of the front and rear stroke of the seat. The backrest of the seat can be adjusted to the angle designed by the manufacturer or to a position inclined at an angle of 25° backward from the vertical surface. If the headrest is adjustable, place it in the lowest and most forward position.

5.1.1.10 Determine the longitudinal centerline of the seat cushion and the longitudinal centerline of the vehicle.

5.1.2 Static test method for the automatic suppression function of the front passenger side airbag not being activated

5.1.2.1 Rearward child restraint system secured with seat belt

5.1.2.1.1 Do not connect to ISOFIX fixed point. Ensure that plane A and plane B of the child restraint system coincide. Fix according to the installation instructions of the child restraint system manufacturer. The belt tension of the vehicle seat belt for fixing the child restraint system is not more than 134N (measured on the belt away from the buckle end). Place the 12-month-old CRABI child dummy according to the instructions of the child restraint system manufacturer. Start the vehicle engine or turn the ignition switch to the "ON" position. The suppression system is turned on. Close all doors. Wait 10s. Then check whether the airbag is not activated.

5.1.2.1.2 Connect ISOFIX fixed point. Do not use vehicle seat belts. Fix according to the installation instructions of the child restraint system manufacturer. Place the 12-month-old CRABI child dummy according to the instructions of the child restraint system manufacturer. Start the vehicle engine or turn the ignition switch to the "ON" position. The suppression system is turned on. Close all doors. Wait 10s. Then check whether the airbag is not activated.

5.1.2.2 Rearward child restraint system that does not use seat belts

5.1.2.2.1 Ensure that plane A and plane B of the child restraint system coincide. The child restraint system is in contact with the seat back.

5.1.2.2.2 Place the 12-month-old CRABI child dummy according to the instructions of the child restraint system manufacturer.

5.1.2.2.3 Start the vehicle engine or turn the ignition switch to the "ON" position.

5.1.4.4 Fix according to the installation instructions of the child restraint system manufacturer. The belt tension of the vehicle seat belt for fixing the child restraint system is not more than 134N (measured on the belt away from the buckle end). Place the 12-month-old CRABI child dummy according to the instructions of the child restraint system manufacturer.

5.1.4.5 When deploying the front airbag system of the front outer occupants, if the airbag system contains multi-stage gas generators, the test is carried out when the gas generator is started at any one or several levels of mixed start and multi-level continuous delay start. The activation state of the airbag is determined by the activation state during the rigid barrier collision test at a speed of not less than 50km/h.

5.2 Test method using mixed type III 3-year-old child dummy

5.2.1 General test conditions

5.2.1.1 The outer front passenger seat is tested separately in the last position, middle position, and most front position in the front and rear direction. If the child restraint system or dummy comes into contact with the vehicle interior parts, then move the seat back to a fixed position from the contact position. If it is an electric seat, move the seat backward to a position where there is a maximum clearance of 5mm.

5.2.1.2 If the child restraint system has an ISOFIX fixing system and the vehicle's front outer passenger seat is equipped with ISOFIX fixing points, then in the test of using seat belts, under the condition of using the child restraint system ISOFIX fixing system and not using the vehicle seat belt, as well as under the condition of using the vehicle seat belt without using the child restraint system ISOFIX fixing system, carry out the test separately.

5.2.1.3 The pull-up strap is not connected.

5.2.1.4 Dummy calf and thigh angle measurement, thigh angle measurement part: The upper surface of the skin between the thigh-pelvic connecting bolt and the thigh-knee connecting bolt. Calf angle measurement part: The front surface of the skin between the calf-ankle connecting bolt and the calf-knee connecting bolt.

5.2.1.5 If the seat lumbar support is adjustable, adjust it to the position designed by the manufacturer or fully retracted. For other seat adjustments, adjust the adjustable part of the seat to provide additional support. Adjust it to the lowest seat or convenient position. If the cushion is adjustable back and forth, adjust to the final position. If the seat height can be adjusted, adjust to the middle height position in the last position, middle position, and frontmost position of the front and rear stroke of the seat. If the seat back is adjustable, adjust it to the

angle designed by the manufacturer or to a position that is tilted back at an angle of 25° from the vertical. If the headrest is adjustable, place it in the lowest and most forward position.

5.2.2 Static test method for the automatic suppression function of the front passenger side airbag not being activated

5.2.2.1 Test of forward child restraint system or booster mat secured with seat belt

5.2.2.1.1 Fix the child restraint system to the front outer passenger seat according to the installation instructions of the child restraint system **manufacturer.**

5.2.2.1.2 The vehicle meets the following two states: Do not use ISOFIX fixing points, use vehicle seat belts to ensure that plane A and plane B of the child restraint system coincide; Connect the ISOFIX fixed point without using the vehicle seat belt.

5.2.2.1.3 For forward child restraint system, the belt tension of the vehicle seat belt for fixing the child restraint system is not more than 134N (measured on the belt away from the buckle end). Place the dummy according to the instructions of the child restraint system manufacturer. Make the back of the dummy close to the backrest of the child restraint system. Place the dummy's hands on both sides. Use the safety belt on the child restraint system to restrain the dummy.

5.2.2.1.4 For the heightening pad, the belt tension of the vehicle seat belt that fixes the child restraint system is not more than 134N (measured on the belt away from the buckle end). Place the dummy according to the instructions of the child restraint system manufacturer. For booster cushions with a backrest, the back of the dummy is parallel and in contact with the backrest of the booster cushion. For booster cushions without a backrest, the back of the dummy is parallel and in contact with the backrest of the vehicle seat. The dummy's hands are placed on both sides. Use the safety belt on the child restraint system to restrain the dummy. If applicable, wrap the three-point safety belt around the test dummy and lock the buckle. Eliminate all slack from the waist belt. Pull the upper shoulder strap out of the retractor and let it retract automatically. Repeat this operation four times. Apply a pulling force of 9N~18N on the waist belt to retract the excess shoulder belt of the upper shoulder belt.

5.2.2.1.5 Start the vehicle engine or set the ignition switch to the "ON" position. The suppression system is turned on. Close all the vehicle doors. Wait 10s. Check if the airbag is not activated.

5.2.2.2 Test of dummy without seat belt

positioning posture of the dummy in this position, a material with a maximum destructive force of 311N can be used to fix the dummy.

5.2.2.2.3.3 The dummy's thigh rests on the seat cushion.

5.2.2.2.3.4 The lower legs of the dummy are stretched out on the seat surface.

5.2.2.2.3.5 The upper arm of the dummy is placed parallel to the spine. Rotate the lower arm of the dummy until the dummy's hand touches the seat cushion.

5.2.2.2.3.6 Start the vehicle engine or place the ignition switch in the "ON" position. The suppression system is turned on. Close all the vehicle doors. Wait 10s. Check whether the airbag is not activated.

5.2.2.2.4 Test with dummy sitting on the edge of the seat

5.2.2.2.4.1 For single seats, position the symmetry plane of the dummy in a vertical position so that it coincides with the vertical longitudinal plane passing through the longitudinal centerline of the seat cushion. For bench seats, position the symmetry plane of the dummy in a vertical position and parallel to the longitudinal centerline of the vehicle and the distance to the longitudinal centerline of the vehicle is the same as the distance from the center of the steering wheel to the line.

5.2.2.2.4.2 With the dummy's chest and spine vertical, position the dummy in a forward seated position, so as to make the calf vertical and leaning against the front of the seat. If the dummy's feet touch the floor, rotate the calf forward until the dummy is in a state where the feet are flat on the floor and the thoracic spine is vertical. In this state, the dummy is supported on the seat. In order to maintain the positioning posture of the dummy in this position, a material with a maximum destructive force of 311N can be used to fix the dummy.

5.2.2.2.4.3 The upper arm of the dummy is placed parallel to the spine.

5.2.2.2.4.4 Lower the lower arm of the dummy so that it touches the seat cushion. Place hands on both sides.

5.2.2.2.4.5 Start the vehicle engine or place the ignition switch in the "ON" position. The suppression system is turned on. Close all the vehicle doors. Wait 10s. Check whether the airbag is not activated.

5.2.2.2.5 Test of dummy standing on the seat facing forward

5.2.2.2.5.1 For single seats, position the symmetry plane of the dummy in a vertical position so that it coincides with the vertical longitudinal plane passing through the longitudinal centerline of the seat cushion. For bench seats, position the symmetry plane of the dummy in a vertical position and parallel to

the longitudinal centerline of the car and the distance to the longitudinal centerline of the car is the same as the distance from the center of the steering wheel to the line. When the heel of the dummy is in contact with the seat back, position the dummy in a standing position on the seat cushion of the front outer passenger seat toward the front of the vehicle.

5.2.2.2.5.2 When the arms of the dummy are parallel to the spine, the dummy is leaned on the back of the seat.

5.2.2.2.5.3 If the dummy's head touches the vehicle roof, tilt the seat so that the head does not touch the vehicle roof. However, a gap of no more than 5mm between the head and the ceiling is allowed. If the seat does not have a sufficient angle of inclination to ensure the gap, the test is cancelled.

5.2.2.2.5.4 If necessary, it can use materials or pads with a maximum destructive force of 311N to fix the dummy in the required position.

5.2.2.2.5.5 Start the vehicle engine or place the ignition switch in the "ON" position. The suppression system is turned on. Close all the vehicle doors. Wait 10s. Check whether the airbag is not activated.

5.2.2.2.6 Test of dummy kneeling forward on the seat

5.2.2.2.6.1 For single seats, position the symmetry plane of the dummy in a vertical position so that it coincides with the vertical longitudinal plane passing through the longitudinal centerline of the seat cushion. For bench seats, position the symmetry plane of the dummy in a vertical position and parallel to the longitudinal centerline of the car, and the distance to the longitudinal centerline of the car is the same as the distance from the center of the steering wheel to the line.

5.2.2.2.6.2 Place the kneeling dummy on the outer front passenger seat so that the dummy faces the front of the vehicle. At the same time, its toes are located on the intersection of the seat back and the seat cushion. Position the dummy so that its chest and spine are vertical. Press the calf down so that it touches the seat as much as possible and then release. Place the arm parallel to the spine.

5.2.2.2.6.3 If necessary, it can use materials or pads with a maximum destructive force of 311N to fix the dummy in the required position.

5.2.2.2.6.4 Start the vehicle engine or place the ignition switch in the "ON" position. The suppression system is turned on. Close all the vehicle doors. Wait 10s. Check whether the airbag is not activated.

5.2.2.2.7 Test of dummy kneeling on the seat facing backwards

5.2.3.1 The outer front passenger seat is tested separately in the last position, middle position, and most front position in the front and rear direction. If the seat height can be adjusted, adjust to the middle height position in the last position, middle position, and frontmost position of the seat back and forth stroke.

5.2.3.2 Place the mixed type III 5th percentile adult female dummy on the front passenger seat of the vehicle. Do not wear seat belts.

5.2.3.3 Start the vehicle engine or place the ignition switch in the "ON" position. The suppression system is turned on. Close all the vehicle doors. Wait 10s. Check whether the airbag is not activated.

5.2.4 Low-risk deployment test of front passenger side airbag

5.2.4.1 Test of 3-year-old child's dummy chest on the dashboard

5.2.4.1.1 Adjust the front and rear travel of the front outer passenger seat to the final position. If the height can be adjusted, adjust to the lowest position. If the cushion is adjustable back and forth, adjust to the final position. If the inclination angle of the cushion is adjustable, adjust it to the middle position. If the seat back is adjustable, adjust it to the angle designed by the manufacturer or to a position that is tilted back at an angle of 25° from the vertical. For other seat adjustments, adjust the adjustable part of the seat to provide additional support. Adjust it to the lowest seat or convenient position. If the headrest is adjustable, place it in the lowest position.

5.2.4.1.2 Place the dummy on the front passenger seat. The plane of symmetry of the dummy coincides with plane D.

5.2.4.1.3 The lower leg of the dummy is perpendicular to the floor. Adjust the position of the lower leg and thigh. Make the head or torso into contact with the dashboard.

5.2.4.1.4 The upper arms of the dummy are parallel to the torso. The dummy's hands touch the thighs.

5.2.4.1.5 Do not change the seat position and the vertical position of the back surface of the dummy's chest spine (as shown in Figure 1). Move the dummy forward until the dummy's head/torso touches the dashboard. If the dummy cannot touch the cushion due to forward movement, keep the height of the dummy and the angle of the thighs to the torso. Once the dummy is in contact with the dashboard, lift the dummy vertically until point A is on plane C. If the dummy's head is in contact with the front windshield and keep point A in plane C, lower the dummy until the gap between the head and the front windshield is no more than 5mm. (Raising or lowering the dummy will change the front and rear position of the dummy, but keep the dummy in contact with the dashboard).

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