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Strength of Student Seat and Their Anchorages of Special School Bus

专用校车学生座椅及其车辆固定件的强度

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Strength of Student Seat and Their Anchorages of Special School Bus

1 Scope

This document specifies the requirements and test methods for the strength of student seats and their anchorages of special school buses.

This document applies to student seats on special school buses and anchorages used to install such seats. It also applies to restraining barriers installed in front of student seats on special school buses.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB 14166 Safety-belts, Restraint Systems, Child Restraint Systems and ISOFIX Child Restraint Systems for Occupants of Power-driven Vehicles

GB 24407 The Safety Technique Specifications of Special School

ISO 6487:2015 Road Vehicles - Measurement Techniques in Impact Tests - Instrumentation

3 Terms and Definitions

The terms and definitions defined in GB 24407, and the following are applicable to this document.

3.1 student seat

Seat used for preschool children aged 3 years and above or students in the 9-year compulsory education stage on special school buses.

NOTE: in accordance with the applicable occupants, they are divided into infant seats, primary school student seats, and primary and secondary school student seats.

3.2 adjustment system

A device that can adjust the position of a seat or its components to suit the sitting posture of the occupant.

intersection of the vertical line tangent to the backrest surface and the upper surface of the seat cushion. For a semi-back seat, it is the point of intersection of the extended line of the backrest surface and the upper surface of the seat cushion.

[source: GB/T 13053-2008, 3.4.14, modified]

4 Requirements

4.1 Requirements for Seats

4.1.1 General

All student seats shall be installed forward-facing. Each adjustment system and displacement system provided shall be equipped with an automatic locking system. After the test, the adjustment system, displacement system and locking system of the seat are allowed to be deformed and partially broken, but the locking system shall remain in the locked state. If a head restraint is provided, then, during the tests of evaluating the performance requirements in 4.1.2 and 4.1.3, it shall not completely detach from the seat.

4.1.2 Frontal collision performance requirements

4.1.2.1 In the test of 5.1.2, the dummy shall be restrained by the seat in front of it (or restraining barrier) and satisfy the following requirements:

---For the seats (or restraining barriers) of special school buses for infants and primary school students, the forward displacement of any part of the dummy's torso and head shall not exceed the transverse vertical plane located 1.1 m in front of the G point of the seat where the dummy sits;

---For the seats (or restraining barriers) of special school buses for primary and secondary school students, the forward displacement of any part of the dummy's torso and head shall not exceed the transverse vertical plane located 1.2 m in front of the G point of the seat where the dummy sits.

4.1.2.2 In the test of 5.1.3, the dummy injury criterion determined in accordance with Appendix A and Appendix B shall satisfy the following requirements:

a) The head injury criterion (HIC_{15}) is less than 500;

b) The neck injury criterion (Nij) is less than 1.0;

c) The thoracic injury criterion (ThAC) is less than 30*g* (except for cumulative duration less than 3 ms) (g = 9.81 m/s^2);

d) When hybrid type III 5th percentile dummy is used for testing, the foot injury criterion (FAC) is less than 6.8 kN.

4.1.2.3 The seat belt restraining the dummy in the test of 5.1.3 shall be able to restrain the dummy on the seat without failure. After the test, the buckle unlocking force shall not exceed 60 N.

4.1.2.4 When tested in accordance with 5.1.2 and 5.1.3, the student seats (or restraining barrier) and their attachments shall satisfy the following requirements:

a) During the test, the seats (or restraining barrier) and their attachments or fittings are not completely separated;

b) During the test, even if one or more anchorages are partially separated or the surrounding area is permanently deformed, the seats (or restraining barrier) can still be fixed, and all locking systems remain locked;

c) After the test, the structural parts of the seats (or restraining barrier) and their accessories shall have no fractures or sharp corners or edges that may cause human injury. A sphere with a diameter of 165 mm on the back of the seat can contact any part with Shore A hardness greater than 50, and its curvature radius is greater than 5 mm, then, it is deemed to satisfy the requirements.

4.1.2.5 When the rear of the seat will not be hit by an unrestrained passenger (i.e. there is no forward-facing seat at the rear), the test specified in 5.1.2 may be omitted. At this time, the strength of the anchorage shall be tested in accordance with the test condition of the second row of seats in 5.1.3 and satisfy the requirements of 4.1.2.3 and 4.1.2.4. During the test, the first row of seats may not be placed. For the second row of seats, the test dummy shall be selected in accordance with the following requirements, and it is unnecessary to measure the dummy injuries:

---For the seats of special school buses for infants, the test shall be carried out using Q series 6-year-old or P series 6-year-old child dummy;

---For the seats of special school buses for primary school students and the seats of special school buses for primary and secondary school students, only the hybrid type III 5th percentile dummy is used for testing.

4.1.3 Rear collision performance requirements

4.1.3.1 When testing in accordance with 5.2, the dummy injury criterion determined in accordance with Appendix A and Appendix B shall satisfy the following requirements:

a) Head injury criterion (HIC_{15}) is less than 500;

b) Neck injury criterion (Nij) is less than 1.0;

c) Thoracic injury criterion (ThAC) is less than 30*g* (except for cumulative duration less than 3 ms) (g = 9.81 m/s^2).

4.1.3.2 When tested in accordance with 5.2, the maximum rearward tilt angle change of the seat

19 °C ~ 26 °C.

5.1.2 Unrestrained test

5.1.2.1 Dummy

5.1.2.1.1 Based on the seat type corresponding to the rear seat, in accordance with the following requirements, use dummy[1)] to conduct the test:

a) For the seats of special school buses for infants, use child dummy (P series 6-year-old or Q series 6-year-old) for testing;

b) For the seats of special school buses for primary school students and the seats of special school buses for primary and secondary school students, use child dummy (P series 6-year-old or Q series 6-year-old) and hybrid type III 5th percentile dummy to conduct one test each;

c) For the attendant seat / position, use TNO-10 dummy or hybrid type III 50th percentile dummy[2)] to conduct the test.

5.1.2.1.2 The dummy shall be unrestrainedly placed on the second row of seats, so that its mid-vertical plane coincides with the mid-vertical plane of the seating position.

5.1.2.1.3 Each test dummy is positioned on the seat in accordance with the following steps.

a) Place the dummy on the seat.

b) Place a 76 mm × 76 mm rigid plane as low as possible in front of the dummy's torso.

c) Use a horizontal force of 250 N ~ 350 N to press this plane toward the dummy's torso; pull the dummy's shoulders to pull the torso forward to a vertical position, and then, put it back on the backrest, and perform this action twice; keep the mid-vertical plane of the head parallel to the longitudinal vertical plane of the vehicle.

d) Remove the rigid plane.

e) Move the dummy on the seat forward and repeat step b) ~ step d).

f) Adjust the limbs of the dummy. For the hybrid type III 5th percentile dummy, the elbows shall touch the backrest, the hands shall be placed on the thighs, the legs shall be as parallel as possible and stretched forward as far as possible, and the heels shall touch the floor. For the child dummy, the upper arms shall be aligned with the breastbone, the hands shall be placed on the thighs, the legs shall be as parallel as possible and stretched forward as far as possible, and the heels shall be kept as close

[1)] It is unnecessary to measure the dummy for injury value.
[2)] The dummy on the attendant seat / position is positioned with reference to the positioning method of the hybrid type III 5th percentile dummy. If the dummy interferes with the dummy on the adjacent student seat, then, the positioning of the dummy on the student seat shall be given priority.

requirements, use dummy to conduct the test:

a) For the seats of special school buses for infants, use Q series 6-year-old child dummy for testing;

b) For the seats of special school buses for primary school students and the seats of special school buses for primary and secondary school students, use Q series 6-year-old child dummy and hybrid type III 5th percentile dummy to conduct one test each;

c) For the attendant seat / position, use TNO-10 dummy or hybrid type III 50th percentile dummy.

NOTE: It is unnecessary to measure the dummy on the attendant seat / position for injury value. The dummy is positioned with reference to the positioning method of the hybrid type III 5th percentile dummy. If the dummy interferes with the dummy on the adjacent student seat, then, the positioning of the dummy on the student seat shall be given priority.

5.1.3.1.2 Place the dummy on each seat of the second row and wear the safety belt, so that its mid-vertical plane coincides with the mid-vertical plane of the seating position.

5.1.3.1.3 In accordance with the requirements of 5.1.2.1.3 ~ 5.1.2.1.5, adjust the dummy.

5.1.3.1.4 Place three fingers (index finger, middle finger and ring finger) together between the seat belt and the dummy, tighten the seat belt, and then, remove the fingers. If there are special instructions in the vehicle operation manual, in accordance with the vehicle operation manual, adjust the seat belt.

5.1.3.2 Collision simulation

In accordance with the provisions of 5.1.2.2, carry out collision simulation.

5.2 Rear Collision Dynamic Test

5.2.1 Test preparation

5.2.1.1 When evaluating seats and their anchorages, the seats shall be installed on a test platform that represents the vehicle body. The anchorages provided for the seats on the test platform shall be the same as the anchorages for the installation of the seats. When evaluating only the seats, they are allowed to be installed on a rigid test platform.

5.2.1.2 The test platform shall be securely fixed to the test trolley in a direction that can simulate a rear collision. The fixing mode shall not generate a reinforcing effect on the connection between the seat and the test platform.

5.2.1.3 The decorative parts and accessories of the seats shall be complete. If the seats are equipped with accessories, such as: small tables and armrests, etc., then, they shall be in a stowed position.

5.2.1.4 For seats that can be laterally adjusted, they shall be adjusted to the widest lateral position.

5.2.1.5 For seats with adjustable seat backs, adjust them to a position as close as possible to the normal use value recommended by the manufacturer. If the manufacturer has no recommended value, then, adjust them to a position as close as possible to a position tilted 25° backward from the vertical plane.

5.2.1.6 For seats equipped with height-adjustable headrests, the headrests shall be adjusted to the highest position.

5.2.1.7 The seat belts installed on the seats shall be consistent with the actual vehicle status and comply with the provisions of GB 14166.

5.2.1.8 The test environment temperature shall be stable and maintained within the range of 19 °C ~ 26 °C.

5.2.2 Dummy

5.2.2.1 Based on the seat type, in accordance with the following requirements, use dummy to conduct the test:

a) For the seats of special school buses for infants, use Q series 6-year-old child dummy for testing;

b) For the seats of special school buses for primary school students and the seats of special school buses for primary and secondary school students, use hybrid type III 5^{th} percentile dummy for testing;

c) For the attendant seat / position, if it shares the seat frame or attachment with the student seats, then, a TNO-10 dummy or a hybrid Type III 50^{th} percentile dummy shall be placed on the attendant seat / position and the dummy is to be tested wearing a safety belt.

NOTE: It is unnecessary to measure the dummy on the attendant seat / position for injury value. The dummy is positioned with reference to the positioning method of the hybrid type III 5^{th} percentile dummy. If the dummy interferes with the dummy on the adjacent student seat, then, the positioning of the dummy on the student seat shall be given priority.

5.2.2.2 The dummy shall be placed on each seat and wear a safety belt, so that its mid-vertical plane coincides with the mid-vertical plane of the seating position.

5.2.2.3 In accordance with the requirements of 5.1.2.1.3 ~ 5.1.2.1.5, adjust the dummy.

5.2.2.4 Place three fingers (index finger, middle finger and ring finger) together between the seat belt and the dummy, tighten the seat belt, and then, remove the fingers. If there are special instructions in the vehicle operation manual, in accordance with the vehicle operation manual, adjust the seat belt.

c) The structural types of the adjustment system, locking system and displacement system of the seats are the same;

d) The structure, material and size of seat attachments and accessories are the same;

e) The configuration, type, fixing mode and manufacturer of the seat belts on the seats are the same;

f) The G point height of the seats immediately behind them is the same, or is reduced or increased by no more than 72 mm.

6.2 Restraining barriers that comply with the following requirements are determined to be of the same type:

a) The structural type, connection mode, material and manufacturer of the restraining barriers are the same;

b) The G point height of the seats immediately behind them is the same, or is reduced or increased by no more than 72 mm;

c) The number of seats immediately behind them is the same or is decreased.

6.3 Anchorages that comply with the following requirements are determined to be of the same type:

a) The structure and material are the same, and the material thickness is the same or enhanced;

b) The specifications and grades of the connecting bolts are the same or enhanced;

c) The connection mode is the same (for example: bolt + threaded hole, bolt + through hole + nut, etc.).

7 Implementation of the Standard

For new vehicle models applying for type approval, implementation will begin from the date of implementation of this document. For vehicle models that have obtained type approval, implementation will begin on the 13th month from the date of implementation of this document.

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