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The safety requirements for bus construction

客车结构安全要求

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The safety requirements for bus construction

1 Scope

This standard specifies the safety requirements for bus constructions.

This standard applies to category M₂ and M₃ buses, including trolleybuses.

This standard does not apply to sleeper buses, special school buses, special buses and non-road buses.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this standard.

GB/T 2408-2008 Plastics - Determination of burning characteristics - Horizontal and vertical test

GB/T 3730.2-1996 Road vehicle - Masses - Vocabulary and codes

GB/T 4780-2000 Terms for motor vehicle body

GB 8410-2006 Flammability of automotive interior materials

GB/T 12428-2005 Laden mass calculating method for buses

GB 14166 Safety-belts, restraint systems, child restraint systems and ISOFIX child restraint systems for occupants of power-driven vehicles

GB 14167 Safety-belt anchorages, ISOFIX anchorages systems and ISOFIX top tether anchorages for vehicles

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

GB 30678 Safety signs and information symbols for the use of bus

3 Terms and definitions

The terms and definitions as defined in GB/T 3730.2-1996, GB/T 4780-2000, GB/T 15089 as well as the following terms and definitions apply to this

crew member (if there is a seat for the crew) (75 kg/person).

3.33

"Front" and "rear"

In front of or behind the vehicle in the normal driving direction.

4 Requirements

4.1 General requirements

4.1.1 If the bus belongs to more than one class of class A, class B, class I, Class II, and class III at the same time, the bus shall comply with the corresponding provisions of this standard according to each class to which it belongs.

4.1.2 If no special provisions are made, the measurement in this standard shall performed on the bus at the mass of vehicle in running order (the crew members are seated or with corresponding counterweight) which is parked on a flat level. The adjustable backrest angle of the passenger seat and the driver's seat as well as the other adjustments shall be at the design reference position as specified by the manufacturer. If it is equipped with a kneeling system, it shall be set at the normal height when the bus is traveling.

4.1.3 The provisions of this standard require that a certain surface in the bus shall be horizontal or at a certain angle at the mass of vehicle in running order. For buses that use mechanical suspension, as long as the bus can meet the requirements under the loading conditions declared by the manufacturer, the surface can be inclined or exceed the specified angle at the mass of vehicle in running order. If the bus is equipped with a kneeling system, the system shall not be in working condition.

4.1.4 Buses that provide convenient facilities for wheelchair users shall comply with the provisions of Appendix A.

4.2 Axle load and passenger area

4.2.1 Axle load

When the bus is at the mass of vehicle in running order and the maximum design total mass state, the percentage of the load on the front axle and the mass of the vehicle under the corresponding load state shall be greater than or equal to the provisions in Table 1.

- The projected area of the space reserved for wheelchair users only.

4.2.2.3 Minimum number of seats

For class I, class II and class A buses, the number of passenger seats on each floor shall be at least equal to the floor area (in square meters) for passengers and crew member (if any) on this floor, after rounding off to the nearest integer. In class I vehicles (excluding the upper deck of double-deck buses), the number of passenger seats shall not be less than 90% of this integer.

4.3 Roll stability

4.3.1 The test platform for the parking of buses shall be inclined to the left and right by 28° from the horizontal position, the bus shall not roll over.

4.3.2 When carrying out the stability test, the bus shall be at the mass of the bus in running order, meanwhile the load shall be configured as follows:

- a) The load on each seat (for double-deck buses, only on the seats at upper deck) is 65 kg (68 kg for class B, class II or class III buses and 75 kg for crew members). For class I, II or class A single-deck buses, the corresponding load of 65 kg for standing passengers (68 kg for passengers of class II buses) shall be evenly distributed in the corresponding standing area, meanwhile the height of center of mass is 875 mm above the floor. If the bus is equipped with an outer roof rack, it shall be uniformly loaded according to the mass specified by the manufacturer (the value is greater than or equal to $R \times V_x$) and fixed firmly. There shall be no luggage in the luggage rack and luggage compartment.

Among them, the values of R and V_x are checked according to GB/T 12428-2005.

- b) If the bus is designed to carry one or more wheelchairs, the wheelchair area shall be loaded as follows:

- 1) For the area reserved for wheelchair users in accordance with A.7.4, the sum of the mass of the wheelchair and its users is 250 kg, meanwhile the center of mass is located 500 mm above the center floor of each wheelchair space;
- 2) For class III and class B vehicles, if seats are installed in the area, the seats are loaded according to the passenger mass of the corresponding class of seat;
- 3) For class A, class I and class II buses, if seats are installed in the area, the seats are loaded according to the mass of seat passengers of the

4.4.2 Fuel tank

4.4.2.1 The fuel tank shall be fixed firmly. Its installation position shall be protected by the body structure in the event of a front or rear collision of the bus. At the same time, any part of the fuel tank shall be greater than or equal to 600 mm from the front end of the bus, greater than or equal to 300 mm from the rear end of the bus. For the class III bus which has rear positioned engine, the front-end face of the fuel tank shall be behind the front axle.

4.4.2.2 No part of the fuel tank shall protrude beyond the total bus width.

4.4.2.3 The filling port of the fuel tank shall only be used from outside the vehicle; it shall not be located where fuel may splash onto the engine or exhaust system when refueling. For buses longer than 7 m, the distance from the filling port and to the service door or emergency door shall be greater than or equal to 500 mm (for gasoline tank) or 250 mm (for diesel tank). The filling port and vent of the fuel tank of a bus with a length greater than 6 m shall be more than 300 mm away from any part of the exhaust pipe.

4.4.2.4 If the fuel filling port is located on the side of the bus, when the filling port's cap is applied, it shall not protrude beyond the adjacent body surface.

4.4.2.5 The filler cap shall not be opened accidentally.

4.4.3 Fuel supply system

4.4.3.1 The fuel supply system shall not be installed in the driving area or passenger area.

4.4.3.2 The fuel pipes and other components of the fuel supply system shall be reasonably arranged and reliably protected.

4.4.3.3 The torsion, bending and vibration of the body structure or power assembly shall not put the oil supply pipeline in an abnormally stressed state.

4.4.3.4 When the rigid parts of the fuel supply system are combined with flexible piping, it shall be ensured that there will be no leakage under various operating conditions of the bus.

4.4.3.5 Once any part of the fuel supply system has a fuel leak, it shall flow smoothly to the ground; it shall not drip onto the exhaust system or high-voltage electrical equipment.

4.4.4 Electrical equipment and conductors

4.4.4.1 The conductor shall have good insulation properties. Electrical equipment and conductors shall be able to withstand the ambient temperature and humidity, especially the temperature in the engine compartment and the

4.4.6.1 The materials within 100 mm around the exhaust system, high-voltage electrical equipment and other obvious heat sources shall be able to withstand the high temperatures that may be encountered, otherwise they shall be effectively shielded, to prevent grease or other combustible materials from coming into contact with them.

4.4.6.2 The flame-retardancy of the interior decoration materials of the bus is tested according to the method of GB 8410-2006; its horizontal burning speed shall be less than or equal to 70 mm/min.

4.4.6.3 The engine compartment shall use sound insulation and thermal insulation materials with flame retardant performance that meets the requirements of class A as specified in 4.6 of GB 8410-2006. It shall not use easily immersed fuel, lubricating oil or other flammable materials without impervious covers.

4.4.7 Fire monitoring and fire extinguishing facilities

4.4.7.1 Buses shall be equipped with an alarm system that can monitor the high temperature or smoke in the compartment.

4.4.7.2 If the engine compartment is located behind the driving area, a temperature alarm system shall be configured, to issue an alarm when the temperature is too high in the engine compartment and other cabins equipped with gas/fuel heaters. The monitoring area shall include components that may come into contact with leaking flammable fluids (including liquids or gases) and whose operating temperature (including temperature at failure) is higher than the ignition point of the fluid.

4.4.7.3 The alarm system as specified in 4.4.7.1 and 4.4.7.2 shall provide the driver with an audible or visual alarm signal in the driving area.

4.4.7.4 Once the engine is started, the alarm system shall be in working condition.

4.4.7.5 The space for one or more fire extinguishers shall be provided, one of which is placed close to the driving seat. On class A or class B buses, the space for each required fire extinguisher shall not be less than $8 \times 10^6 \text{ mm}^3$; for class I, class II or class III buses, the required space shall not be less than $15 \times 10^6 \text{ mm}^3$. For double-deck buses, additional space for fire extinguishers shall be provided on the upper deck.

4.4.7.6 The fire extinguisher shall be easily accessible in emergency situations; its installation location shall be clearly visible or clearly marked.

service door). It shall meet the following requirements:

- a) On class I and class II double-deck buses, if there are more than 50 passengers on the upper deck, there shall be at least 2 intercommunication staircases or 1 intercommunication staircases and 1 half staircase;
- b) On a class III double-deck bus, if there are more than 30 passengers on the upper deck, there shall be at least 2 intercommunication staircases or 1 intercommunication staircases and 1 half staircase.

4.5.2 Exit location

4.5.2.1 The service door shall be located on the right side of the bus, at least one of the service doors shall be located on the front half of the bus. However, the following doors can be set:

- a) A door (non-service door) for wheelchair passengers is provided in the rear or side wall;
- b) A service door is set in the rear wall, which can be used by passengers when special needs;
- c) For buses designed for passengers to get on/off from left side, such as those that only need to get on/off from left side due to the location of the platform, service doors can be provided only on the left. For buses designed for passengers to get on/off from both sides, such as the buses that need to run not only along the dedicated lane for public bus as provided along the central lane of the road but also along the ordinary road, it may set one or more service doors at the left side; however, it shall ensure that when the service door at one side is opened, the service door at the other side shall be reliably locked simultaneously;
- d) A service door is provided in the back of the class A or class B bus.

4.5.2.2 If the passenger area S_0 is greater than or equal to 10 m², the two service doors specified in 4.5.1.1 shall be provided separately. For single-deck buses (except for class A, class I, and class II buses whose service doors are on the left), the distance between the horizontal vertical planes passing through the center of the area of the two doors shall be greater than or equal to 40% of the total length of the passenger area. For double-deck buses, if the two doors are on the same side, the distance shall be greater than or equal to 40% of the total length of the passenger area at lower deck or 25% of the total length of the bus. If they are not on the same side, it does not need to meet this requirement. If there are double doors in the two doors, it shall be measured between the two farthest doors. For articulated buses, if the distance between two doors of different rigid sections is greater than or equal to 40% of the total

it can still be opened from inside the vehicle.

4.5.4.2 The height of the door opening device outside the vehicle to the horizontal ground (at no load) shall be less than or equal to 1800 mm; the distance from the outer edge of the door shall be less than or equal to 500 mm or on the door.

4.5.4.3 For hinged or pivoted single-leaf hand-operated service door, when the bus moves forward, the opened door shall tend to close when it touches a stationary object.

4.5.4.4 If the spring-loaded lock is used for the manually controlled service door, it shall be of two-stage type.

4.5.4.5 When the service door is closed, there shall be no mechanism on the inside of the door to cover the step. The door operating mechanism and other devices installed on the inside of the door can invade the concave part of the step, but the intrusive part shall not become an additional floor that the passenger may stand on; meanwhile the mechanism and device shall not be hazardous to passengers.

4.5.4.6 The driver shall be able to observe the situation of passengers near the inside and outside of each non-automatically controlled service door on the seat. For class I double-deck buses, this requirement also applies to the inside of all service doors and the vicinity of each intercommunication staircase on the upper decks. For service doors on the rear wall of class A and class B buses, if the driver can observe a person of 1.3 m tall at a point 1 m behind the bus, it meets this requirement. For the service door on the articulated bus behind the hinge, it shall not be observed only with the mirror. If it is not directly observable, optical or other auxiliary devices shall be installed.

4.5.4.7 Under the conditions of normal use, when the service door is opened inwards, its structure shall ensure that the opening movement will not harm the passengers. When necessary, appropriate protective devices shall be installed.

4.5.4.8 If the service door is adjacent to the toilet or other inner doors, it shall be able to prevent misuse. This requirement does not apply to service doors that can be automatically locked when the vehicle speed exceeds 5 km/h.

4.5.4.9 The service door located in the back wall of class A and class B buses shall have an opening angle of greater than or equal to 85° and be automatically kept in the open position.

4.5.4.10 Any open state of service doors shall not prevent passengers from reaching or using emergency exits, except for buses with a length of less than 7 m and sliding doors.

4.5.5.3 For each driver operated service door, the driver shall be able to operate it with manipulators on the seat. The manipulators (excluding manipulators operated with feet) shall be clearly marked and distinct from other signs.

4.5.5.4 Each power-controlled service door shall be able to activate a visual warning device. The driver shall be able to clearly see this warning in the normal driving position and in any lighting environment, to remind that the door is not completely closed. This warning device shall give a signal between the fully open position of the rigid structure of the door and 30 mm from the fully closed position. Multiple doors can share a warning device. However, the front service door that does not meet the requirements of 4.5.5.6a) and 4.5.5.6b) may not be equipped with such warning device.

4.5.5.5 The control part for the driver to open and close the power-operated service door shall be able to enable the driver to move the service door at any time during the door closing or opening process.

4.5.5.6 The structure and control system of the power operated service door shall ensure that the passengers are not injured or pinched by the door when closing the door. If the following two requirements are met, this provision is met:

- a) At any of the measurement points as described in Appendix C, the clamping force when the door is closed shall not exceed 150 N, otherwise the door shall be automatically fully opened again (except for automatically operated service door), meanwhile kept in the open position until the door closing control is operated. See Appendix C for the test method. The peak force can be higher than 150 N for a short time, but shall not exceed 300 N. Re-opening system can be checked by a test bar which has a cross-section height of 60 mm, a width of 30 mm, a radius of 5 mm.
- b) When the passenger's wrist or finger is caught by the door, one of the following conditions shall be met:
 - 1) The door shall be automatically reopened to fully open (except for automatically operated service door) and kept open until the door closing control is operated.
 - 2) The passenger's wrist and fingers can be easily extracted without injury. This requirement can be checked by hand or test bar (section height 60 mm, width 30 mm, fillet radius 5 mm). The thickness of the test bar is gradually reduced from 30 mm to 5 mm in the length of 300 mm, meanwhile it shall not be polished or lubricated. If the door clamps the test rod, it shall be easily pulled out.
 - 3) The door is kept at a position where the test bar which has a section height of 60 mm, a width of 20 mm, a radius of 5 mm can pass freely.

shall also be an out-of-vehicle display. The display (such as light-emitting buttons and light-emitting signals) shall be on or near the corresponding door;

- d) When it is directly activated with a switch, the functional status of the system shall be clearly displayed to the driver through the switch position, indicator light or light display switch. The switch shall be specially marked; it shall not be mixed with other control parts.

4.5.6.2 Opening of automatically operated service door

4.5.6.2.1 After the driver activates the door opening control, the passenger shall be able to open the door as follows:

- a) Operation from inside the bus, for example, pressing a button or passing a light grid;
- b) Operation from outside the bus (except for doors marked for exit only), for example, it can press the light-display button, the button below the light-display signal, or a similar device marked accordingly.

4.5.6.2.2 After pressing the button mentioned in 4.5.6.2.1a) and adopting the contact method with the driver as described in 4.6.9.1, a storage signal may be issued, and the door opened after the driver activates the door opening control.

4.5.6.3 Closing of automatically operated service door

The closing of the automatically operated service doors shall comply with the following requirements:

- a) After automatically operated service door is opened, it shall be automatically closed after a time interval. If passengers enter and exit the door during this time interval, the safety device (i.e. step contactor, grating or one-way valve, etc.) shall ensure that there is sufficient door closing delay time;
- b) If passengers enter or exit when the door is closing, the closing process shall be automatically terminated, the door shall return to the open position; the return action is initiated by one of the safety devices described in 4.5.6.3a) or other devices;
- c) When the driver activates the door opening control, the service door that has been automatically closed according to 4.5.6.3a) shall be able to be opened by the passenger in the manner of 4.5.6.2;
- d) After the activation of the opening of automatically operated service door opening is released by the driver, the opened door shall be closed according to 4.5.6.3a) and 4.5.6.3b).

be satisfied:

- Maintain an opening angle of at least 100° (limiting bands, chains or other restraining devices may be used);
- The access passage gauge for the emergency door can freely pass through the door to the outside of the bus.

4.5.7.6 If the emergency door is located near the toilet or other inner doors, it shall be able to prevent misuse. This requirement does not apply to emergency doors that can be automatically locked when the vehicle speed exceeds 5 km/h.

4.5.7.7 All emergency doors shall provide sound devices to alert the driver when the emergency doors are not fully closed. The warning device shall be activated by the movement of the door locking device (for example, the latch or handle), rather than the movement of the door itself.

4.5.8 Technical requirements for emergency windows

4.5.8.1 The push-out emergency window shall be opened outwards.

4.5.8.2 The opening of emergency windows shall meet one of the following conditions:

- Easy to open quickly from inside and outside the bus;
- Use safety glass easily to be broken (instead of laminated glass or plastic) and provide a convenient device for breaking the emergency window glass on or near each emergency window in the bus. The breaking device of the emergency window behind the bus shall be located in the middle position above or below the emergency window, or the glass breaking device shall be placed on both the left and right sides.

4.5.8.3 Emergency windows that can be locked from the outside of the vehicle shall be structurally guaranteed to always open from the inside of the vehicle.

4.5.8.4 Emergency windows hinged horizontally at the upper end shall have an appropriate mechanism to keep them fully open. The opening of the hinged emergency window shall ensure the unimpeded entry and exit of the bus.

4.5.8.5 The height of the lower edge of the side window of the bus (the upper edge of the metal lower frame of the sliding window) from the floor plane of the foot pedal below it (without any local changes, such as local deformation caused by wheels, transmission devices or toilets, etc.) shall be less than or equal to 1200 mm, meanwhile greater than or equal to 500 mm. For push-pull and push-out side windows, if the lower edge of the openable part is less than 650 mm, a protective device shall be provided at a height of 650 mm to 700 mm from the floor to prevent passengers from falling outside the vehicle. If the side

4.5.10 Technical requirements for telescopic step

4.5.10.1 The telescopic step shall work synchronously with the corresponding service door or emergency door.

4.5.10.2 When the door is closed, the telescopic step shall not protrude 10 mm from the adjacent bus surface. For class A and B buses, the vertical projection of the surface above the step shall not protrude by 10 mm.

4.5.10.3 When the door is opened, the telescopic step shall be in the extended position; its area shall meet the requirements of 4.6.7.6.

4.5.10.4 When the power-operated telescopic step is in the extended position, an audible or visual alarm prompt shall be issued to the driver; if the bus cannot start on its own power at this time, the alarm prompt may not be provided.

4.5.10.5 The power-operated telescopic step shall not extend when the bus is running. If the control device fails, the step shall be retracted and kept in the stowed position. When the control device fails or the step is damaged, it shall not hinder the operation of the corresponding door.

4.5.10.6 When a passenger stands on a power-operated telescopic step, the corresponding door shall not be closed; a 15 kg weight can be placed in the center of the step to check it. This rule does not apply to doors in the driver's field of vision and non-power operated doors.

4.5.10.7 The movement of the telescopic step shall not cause harm to the body of people inside or outside the vehicle. There shall be yellow and black warnings around the upper surface of the telescopic step.

4.5.10.8 The outer corner of the telescopic step shall adopt a round corner transition with a radius greater than or equal to 5 mm; its upper and lower edges shall adopt a round corner transition with a radius greater than or equal to 2.5 mm.

4.5.10.9 When the service door is opened, the telescopic step shall be reliably maintained in the extended position. When the weight of 136 kg is placed in the center of the telescopic step of the single access door or the weight of 272 kg is placed in the center of the telescopic step of the double access door, the deformation at any point of the step shall not exceed 10 mm.

4.5.11 Exit signs

4.5.11.1 Each emergency exit shall be marked, its safety signs and location shall comply with the provisions of GB 30678 and can be seen in the bus.

4.5.11.2 The service door and emergency controllers of all emergency exits shall be marked with clearly visible symbols or text.

4.6.6 Gangway slope

4.6.6.1 The longitudinal slope of the gangway shall not exceed:

- Class I, class II, class A buses: 8%;
- Class III and class B buses: 12.5%.

4.6.6.2 The lateral slope of the gangway shall not exceed (in a plane perpendicular to the longitudinal axis of the bus) 5%.

4.6.7 Step

4.6.7.1 The maximum height, minimum height, minimum depth of steps of the service door and the steps in the bus are as shown in Figure 11 and Table 8. For the steps at the double door, each half shall meet this requirement, respectively.

4.6.7.2 The transition between the recessed gangway and the seating area shall not be used as a step, whilst the vertical distance between the gangway surface and the seating area's floor shall not exceed 350 mm.

4.6.7.3 The step height shall be measured at the center of the width of its outer edge; the step depth shall be measured at the center of the width of the gangway (or access passage).

4.6.7.4 The height of the first step from the ground shall be measured when the bus is at the mass of vehicle in running order as parked on the horizontal ground. The tire configuration and air pressure during the measurement shall meet the manufacturer's requirements for the maximum designed loading mass.

4.6.7.5 Except for the first step, the other steps may extend into the vertical projection area of the upper step by not more than 100 mm, meanwhile the projection of the lower step shall retain at least a free surface with a depth of 200 mm (see Table 8 and Figure 11). The outer edges of all steps shall be designed to minimize the risk of passengers tripping and be clearly marked with color.

communication device shall form a clear visual contrast with the surroundings. When these manipulators are activated, there shall be one or more light-emitting signals to remind passengers such as "parking" and/or corresponding graphic symbols, until the service door is opened. Each rigid section of the articulated bus and each deck of the double-deck bus shall have this prompt signal.

4.6.9.2 Liaison between crew member compartment and driver

If the bus is provided with a crew member compartment, meanwhile there is no gangway between the crew member compartment and the driving area or passenger area, it shall provide communication equipment between the driving area and the crew member compartment.

4.6.9.3 Liaison between toilet and driver

The toilet shall be equipped with call equipment in an emergency.

4.6.10 Hot beverage machine and cooking equipment

4.6.10.1 The hot beverage machine and cooking equipment shall have protective facilities, to prevent hot food or beverages from spilling onto passengers during emergency braking or steering.

4.6.10.2 On buses equipped with hot beverage machines or cooking equipment, all passenger seats shall have appropriate devices for passengers to place hot food or hot drinks while the bus is running.

4.6.11 Inner door

Each door leading to a toilet or other interior compartment shall meet the following requirements:

- a) If the opening will hinder the evacuation of passengers in an emergency, it shall be able to close automatically, meanwhile no device shall be installed to keep it open.
- b) When opening, it shall not cover any service door, emergency exit, opening handle of fire extinguisher or first aid kit, control piece or necessary signs.
- c) Means shall be provided to open the door from outside the cabin in an emergency.
- d) It shall be ensured that it can always be opened from the inside, otherwise it cannot be locked from the outside.

4.6.12 Intercommunication staircases

mm wide.

4.6.14.6 The longitudinal position, height and backrest angle of the driver's seat shall be adjustable and can be automatically locked in the selected position. If equipped with a slewing mechanism, it shall be automatically locked in the driving position. For class A or class B buses, the height adjustment function is not necessary.

4.7 Interior lighting

4.7.1 The interior lighting shall cover the following areas:

- a) All passenger areas, crew member compartment, toilets and articulated sections of articulated buses;
- b) All steps;
- c) The access passages of all exits and the areas closed to service doors, including auxiliary boarding devices in use;
- d) The internal signs and internal controls of all exits;
- e) Where there are obstacles.

4.7.2 As long as the proper lighting can be provided for the above locations during normal use, there is no need to provide separate lighting at each location.

4.7.3 Buses shall have at least two internal lighting circuits. When one circuit fails, it shall not affect the lighting of the other circuit. A circuit that is only used for conventional lighting at the entrance and exit can be used as one of them (for example: a circuit that controls the lighting of the gangway and a circuit that controls the lighting of the service door's step).

4.7.4 The above internal lighting shall be controlled by an automatic switch or a manual switch under the control of the driver.

4.8 Articulated section of articulated bus

4.8.1 The articulated sections connecting the rigid sections of articulated buses shall be structurally rotated about at least one horizontal axis and at least one vertical axis.

4.8.2 When the articulated buses is still on a horizontal surface at the mass of vehicle in running order, the width of the uncovered gap between the floor of the rigid section and the floor of the rotating part (or its replacement) shall not exceed:

4.10.1.4 The gap between the grip of the armrests or handles and the adjacent parts or side walls of the bus shall be greater than or equal to 40 mm. For the handles on the doors and seats and the armrests in the access passage of class II, class III or class B buses, the minimum gap shall be greater than or equal to 35 mm.

4.10.1.5 The surface of each armrest, handle or post forms a sharp visual contrast with their surrounding environment and has a non-slip function.

4.10.2 Additional requirements for handrails and handles of standing passengers

4.10.2.1 Corresponding to each position of the passenger standing area, there shall be a sufficient number of handrails or handles. If a sling or lifting ring is used, it can be regarded as a handle, but there shall be an appropriate method to maintain it in its position. Place the measuring device as shown in Figure 18 (the movable arm can freely rotate around its hinge axis) at each position of the passenger's standing area. If the movable arm can touch at least two armrests or handles, this requirement is met.

4.10.2.2 The height of the two handrails or handles required in 4.10.2.1 from the floor shall be greater than or equal to 800 mm, meanwhile shall be less than or equal to 1950 mm.

4.10.2.3 At least one of the above two handrails or handles shall be less than or equal to 1600 mm above the floor. For the area adjacent to the door, if the door or door mechanism in the open position will hinder the use of armrests or handles, this requirement may not be met. The middle position of a larger standing area may not meet this requirement, but the standing area that does not meet the requirements shall not exceed 20% of the total standing area.

4.10.2.4 In the passenger standing area with no seat separation between the side or rear wall of the bus, it shall provide horizontal armrests parallel to the side or rear wall, which has a height of 800 mm to 1600 mm above the floor.

4.10.3 Armrests and handles at service doors

4.10.3.1 Handrails or handles shall be installed at the service door. The single access door shall be installed on at least one side; the double doors shall be installed on each side, or one side can be replaced by adding a central post or handrail.

4.10.4.2 Handrails and/or handles shall provide gripping points for passengers standing on adjacent floors or each step; these gripping points shall be between 700 mm and 1200 mm above the vertical surface of the floor or each step; horizontally:

- For the convenience of passengers standing on the floor, the outer edge of the first step shall not exceed 400 mm inward;
- For the convenience of passengers on the step, the position of the grip point shall not exceed the outer edge of the step, meanwhile it shall not exceed 600 mm inwardly.

4.11 Protection of stepping area

4.11.1 In order to prevent seated passengers from falling into the stepping area at the service door due to emergency braking, a baffle or seat belt shall be installed; if the seats immediately behind the service door's stepping area of class III and B buses are not equipped with safety belts, it shall be provided with restraining partitions. If the seats immediately behind the step area have seat belts installed, baffles may also be provided. The minimum height of the baffle or restraining partition is 800 mm upward from the floor of the passenger's footrest; it extends inwardly from the inner wall of the bus to at least 100 mm beyond the longitudinal centerline of the seat, or to the edge of the innermost step (take the smaller of the two).

4.11.2 The staircase opening of the upper-deck of the double-deck buses shall be provided with a closed guardrail which has a minimum height of 800 mm from the floor; the height of the lower edge from the floor shall be less than or equal to 150 mm.

4.11.3 The front row of the upper deck of the double-deck bus and the glass in front of the passengers on the seats above the driving area of the single-deck bus shall be provided with a padded guard rail; the height of the upper edge from the floor shall be 800 mm ~ 900 mm.

4.11.4 The elevation of each step of the intercommunication staircases shall be closed.

4.12 Crew member protection

4.12.1 If there is a luggage rack in the bus, reasonable design and protective measures shall be taken, to prevent the luggage from falling and injuring the passenger. If the bus is equipped with a luggage compartment, it shall be ensured that the luggage will not fall during emergency braking.

A.8.3 Combination test of forward-facing wheelchair

A.8.3.1 A wheelchair restraint system suitable for general wheelchairs shall be installed in the wheelchair space; it is allowed to load one wheelchair and one wheelchair user facing the front of the bus.

A.8.3.2 A wheelchair user's restraint system shall be installed in the wheelchair space. The restraint system shall include at least two fixing points and a hip restraint belt (waist belt). The design and component composition of the restraint system shall be similar with the seat belts as specified in GB 14166.

A.8.3.3 Any restraint system installed in the wheelchair space shall be able to be easily opened in an emergency.

A.8.3.4 Any wheelchair restraint system shall meet one of the following conditions:

- It meets the dynamic test requirements as described in A.8.3.8, and firmly adheres to the vehicle fixing parts that meet the static test requirements of A.8.3.6;
- It is firmly attached to the vehicle fixing parts that meet the requirements of the combination test of restraint device and fixing parts in A.8.3.8.

A.8.3.5 Any wheelchair user's restraint system shall meet one of the following conditions:

- It meets the dynamic test requirements as described in A.8.3.9, meanwhile firmly adheres to the vehicle fixing parts that meet the static test requirements of A.8.3.6;
- It is firmly attached to the vehicle fixing parts that meet the dynamic test requirements of the combination of restraint devices and fixing parts in A.8.3.9. The restraint devices and fixing parts are conducted for test, by being attached to the fixing parts that are described in A.8.3.6 g).

A.8.3.6 The static test of the fixed points of the wheelchair restraint system and wheelchair user's restraint system shall be completed according to the following requirements:

- a) The force specified in A.8.3.7 shall be applied to a device that can simulate the geometry of the wheelchair restraint system;
- b) When applying the force as specified in A.8.3.7b), it shall use the tensioning device as specified in GB 14167 and the device that can simulate the geometric structure of the wheelchair user's restraint system;
- c) The forward forces specified in A.8.3.6a) and A.8.3.6b) shall be applied to

- The period exceeds 0.075 s;
- It does not exceed 28 g and the time is not more than 0.08 s;
- The period does not exceed 0.12 s.

2) For backward-mounted wheelchairs:

- The cumulative time over 5 g shall exceed 0.015 s;
- The time not exceeding 8 g does not exceed 0.02 s.

b) If the same restraint device is used in the forward and backward directions, or if an equivalent test has been conducted, then only the forward deceleration test in a) is performed.

c) In the above tests, the wheelchair restraint system shall be attached to any of the following fixings:

- 1) Fixings that are installed on the test device which represent the geometric structure of the restraint system fixings on the bus;
- 2) Restriction system fixings on representative sections of buses as described in A.8.3.6d).

A.8.3.9 The wheelchair user's restraint device shall meet the test requirements of GB 14166; or meet the requirements of A.8.3.8a) for corresponding deceleration-time equivalent test. Seat belts approved and marked according to GB 14166 meet this requirement.

A.8.3.10 If the tests in A.8.3.6, A.8.3.8 or A.8.3.9 meet the following conditions, they are deemed to meet the requirements:

- During the test, no part of the system fails, or does not come out of the restraint system fixings or buses;
- After the test is completed, the mechanism for releasing wheelchairs and wheelchair users shall be able to complete the release action;
- For the test of A.8.3.8, during the test, the movement of the wheelchair in the longitudinal plane of the bus shall not exceed 200 mm;
- After the test is completed, no deformation of any part of the system shall cause sharp edges or other protrusions that may cause injury.

A.8.3.11 The operating instructions for wheelchairs shall be clearly marked in the vicinity.

A.10.1.3 If both of the following conditions are met from the inside and outside of the bus, the auxiliary boarding device can penetrate into the access passage of one of the service doors or emergency doors:

- The auxiliary boarding device does not obstruct the door handle or other devices;
- In an emergency, the auxiliary boarding device shall be removable at any time to restore the passability of the access passage.

A.10.2 Kneeling system

A.10.2.1 Buses shall be provided with a switch for controlling the operation of the kneeling system.

A.10.2.2 The control switch of the kneeling system (making part or whole of the bus lower or rise relative to the road surface) shall be clearly marked and shall be directly controlled by the driver.

A.10.2.3 The bus descent process shall be able to stop immediately and run in reverse. The control switch shall be located within the reach of the driver on his seat and close to other controls that operate the kneeling system.

A.10.2.4 When the bus is below the normal driving height and the driving speed exceeds 15 km/h, the kneeling system shall be able to automatically restore the normal driving height.

A.10.3 Lift

A.10.3.1 General

A.10.3.1.1 The lift shall only be operable when the bus is stationary. Before any movement of the platform, the protective device used to prevent the wheelchair from tipping over shall have been activated or have automatically entered the working state.

A.10.3.1.2 The platform width of the lift shall be greater than or equal to 800 mm, the length shall be greater than or equal to 1200 mm, the bearing capacity shall be greater than or equal to 300 kg.

A.10.3.2 Additional requirements for power operated lift

A.10.3.2.1 During the movement of the power lift, when the manipulator is released, the movement shall be stopped immediately, meanwhile the movement in any direction can be started again.

A.10.3.2.2 In areas where the movement of the lift will be restricted or it will collide with objects and cannot be seen by the operator, it shall install a safety

A.10.4.1.7 The portable ramp shall be fixed firmly when in use. An appropriate position shall be provided for the portable ramp, so that it can be safely stored and quickly taken out for use.

A.10.4.2 Operation mode

The ramp can be deployed and retracted manually or powered.

A.10.4.3 Additional technical requirements for power operated ramp

A.10.4.3.1 When the ramp is deployed and retracted, it shall be indicated by a flashing yellow light and an audible signal.

A.10.4.3.2 The ramp that may cause injury shall be deployed and retracted under the protection by safety devices.

A.10.4.3.3 When the ramp encounters a resistance not exceeding 150 N, the safety device shall stop the movement of the ramp. The peak value of resistance in a short time can be higher than 150 N but shall not exceed 300 N. Resistance can be measured by any method approved by an authority. See Appendix C for guidelines on measuring reaction forces.

A.10.4.3.4 When the weight of 15 kg is placed on the ramp, its horizontal movement shall be interrupted.

A.10.4.4 Control of power operated ramp

A.10.4.4.1 When the driver has sufficient vision to observe the deployment and use of the ramp to ensure passenger safety, the ramp can be operated by the driver on his seat. This requirement can be met by means of appropriate indirect vision devices.

A.10.4.4.2 For other situations, the manipulator shall be close to the ramp. The operation and release of the control switch shall only be controlled by the driver in the seat.

A.10.4.5 Operation of manual operated ramp

The design of the ramp shall ensure that the ramp is easy to operate.

Appendix D

(Normative)

Additional technical requirements for trolleybuses

D.1 Terms and definitions applicable to this Appendix

D.1.1

Line voltage

The voltage supplied by the external power supply to the trolleybus. The design line voltage rating of trolleybus can choose one of the following voltage values:

- 600 V(DC) (working voltage range 400 V ~ 720 V);
- 750 V(DC) (working voltage range 500 V ~ 900 V).

D.1.2

Electrical circuits of trolleybus

Trolleybus's circuits are divided into the following types:

- High voltage circuit: A circuit driven by line voltage and vehicle power supply voltage;
- Low voltage circuit: A circuit driven by 24 V(DC) voltage;
- Three-phase circuit: A circuit driven by a voltage not exceeding 400 V(AC).

D.1.3

Rated climatic conditions

Trolleybuses shall work reliably under the following environmental conditions:

- Temperature range: -40 °C ~ +45 °C;
- Relative humidity: When the temperature is 25 °C, the relative humidity is 98%;
- Atmospheric pressure range: 866 kPa ~ 1066 kPa;
- Height range: From sea level to the maximum altitude of 1100 m.

When the current collector's rotating lifting mechanism fails, there shall be a limit device at the lowest position 2.5 m above the ground where the current collector rod (lowest point) freely lowers.

D.2.5 The trolleybus shall be equipped with an off-line alarm device. When the collector head is disconnected from the contact transmission line, it shall emit an audible signal; its alarm sound shall be distinguishable from other alarm sounds on the bus.

D.2.6 The collector shall have the function of preventing scratching the wire mesh. When the trolleybus is running, if the collector head is detached from the normal position on the collector rod, it shall be able to maintain the connection with the collector rod and shall not fall.

D.2.7 The current collector shall be installed on the trolleybus with a water-resistant insulation structure. The insulation position is: the electrical conductor on the collector head and the collector rod against the rotating lifting mechanism (basic insulation); the rotating lifting mechanism against the current collector's mounting frame (additional insulation 1); current collector's mounting frame against the bus (additional insulation 2). Use a 1000 V megohmmeter to separately measure the total insulation resistance between the collector head and the bus. When the relative humidity of the surrounding air is less than 90%, it shall be greater than or equal to 10 M Ω ; when the relative humidity of the surrounding air is more than 90%, it shall be greater than or equal to 1 M Ω .

D.2.8 It shall set a remote-control device for the current collector that can be operated in the cab. At a minimum, it shall set a remote-control device for lowering the current collector rod.

D.3 Traction and auxiliary equipment

D.3.1 For the electrical components installed on the trolleybus, it shall take measures to prevent or protect overvoltage, undervoltage, overcurrent, short circuit and overtemperature. The protective measures can be reset by automatic, remote control or manual methods.

D.3.2 For the electric system of trolleybus, it shall take measures to prevent transitional overvoltage and lightning protection measures.

D.3.3 The circuit breaker shall have the ability to damage or interrupt special circuits.

D.3.4 If a single-pole circuit breaker is designed in the high-voltage circuit, it shall be installed on the positive line of the circuit.

D.3.5 All high-voltage circuits and three-phase circuits shall be connected by wires. It is only allowed for the trolleybus to be used as a current ground loop

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