GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 45.060.20

S 50

GB/T 7928-2003

Replacing GB/T 7928-1987

General technical specification for metro vehicles

地铁车辆通用技术条件

Issued on: December 05, 2003 **Implemented on: July 01, 2004**

Issued by: General Administration of Quality Supervision, Inspection and Quarantine

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General technical specification for metro vehicles

1 Scope

This Standard specifies conditions for use, vehicle types, technical requirements, safety facilities, test and acceptance, marks, transportation and guarantee period for metro vehicle.

This Standard is applicable to metro vehicle (hereinafter referred to as the vehicle).

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB 4208-1993, *Degrees of protection provided by enclosure (IP code)* (eqv IEC 529: 1989)

GB/T 9963-1998, *Tempered glass*

GB/T 10411, *D.C. traction power supply system for urban rail transit*

GB/T 11944-2002, *Sealed insulating glass unit*

GB 14892, *Limit and measurement for train of urban rail transit*

GB/T 14894, *Rules for inspecting and testing of urban rail transit vehicles after completion of construction*

GB 50157-2003, *Code for design of subway*

TB/T 449-2003, *Wheel profile for locomotive and car*

TB/T 1333.1-2002, *Railway applications - Electric equipment for rolling stock - Part 1: General service conditions and general rules* (idt IEC 60077-1:1999)

TB/T 1333.2-2002, *Railway applications - Electric equipment for rolling stock - Part 2: Electrotechnical components - General rules* (idt IEC 60077-2:1999)

a single car that can be incorporated into a train on the subway line; metro vehicle can be powered train and unpowered trailer

3.2 metro train, train

a complete combination of several metro vehicles that can carry passengers normally

3.3 deadman switch

control button to confirm that the vehicle is under the control of the driver

3.4 train communication network

data communication network that connects the on-board programmable electronic equipment of each vehicle

4 Conditions for use

4.1 Environmental conditions

4.1.1 Normal working altitude does not exceed 1200m.

4.1.2 The ambient temperature is between -25°C and 40°C.

4.1.3 The average maximum relative humidity of the wettest month is not more than 90% (the average minimum temperature of the month is 25°C).

4.1.4 The vehicle shall be able to withstand the attack of wind, sand, rain, and snow and the action of the cleaning agent when the vehicle is washed.

4.1.5 Because there are differences in climatic conditions due to the different regions in which cities are located, user and manufacturer can additionally specify the environmental conditions for use in the contract.

4.2 Line conditions

4.2.1 The track gauge is 1435mm.

4.2.2 The minimum plane curve radius shall meet the relevant regulations of GB 50157.

4.2.3 The minimum vertical curve radius: 2000m.

4.2.4 Maximum slope: if there are no special regulations, the maximum slope of the main line shall not be greater than 30‰. 35‰ can be used in difficult areas. The maximum slope of tie line and access line shall not be greater than

6 Basic requirements and general provisions

6.1 The vehicle shall comply with the regulations of the relevant subway vehicle boundary.

6.2 The various equipment of the vehicle shall be manufactured in accordance with the drawings and technical documents approved by the prescribed procedures and comply with the provisions of relevant standards.

6.3 The wheel diameter is 840^{+3}_{0}mm. The difference between the diameters of the two coaxial wheels of the new vehicle does not exceed 1mm. The wheel diameter difference of the same motor vehicle bogie does not exceed 2mm.

6.4 Wheelset inner distance is 1353mm ± 2mm.

6.5 The weight of the vehicle in the servicing state shall not be 3% greater than the value specified in the contract.

6.6 The difference between the measured axle load on each dynamic axle of the same motor vehicle and the actual average axle load of each dynamic axle of the vehicle shall not exceed 2% of the actual average axle load.

6.7 The difference between the actual wheel weight of each wheel and the average wheel weight of the axle shall not exceed ±4% of the average wheel weight of the axle.

6.8 The height of the floor of the passenger compartment of the vehicle from the track surface shall be coordinated with the station platform. The height adjustment device for empty and heavy vehicles shall be able to effectively keep the height of the vehicle floor surface from being significantly changed due to changes in passenger capacity. The floor height shall not be lower than the platform surface under any use.

6.9 The train shall be able to safely pass the minimum radius curve section at the specified speed and carry out normal train pick-up and hang-up operations on the specified small radius curve.

6.10 The traction-speed characteristics and braking force-speed characteristics of the train shall meet the requirements of the design documents agreed between the user and the manufacturer.

6.11 The maximum operating speed of the vehicle is not less than 80km/h.

6.12 In the case of occupancy, the wheels are in a semi-wear state on a flat and dry track. At rated supply voltage, if there is no special requirement, the average

6.21 Parts of the same model shall have good interchangeability.

6.22 The structural materials and parts of the vehicle shall be made of high flame retardant or flame-retardant materials. The flame retardancy of the material, the harmful gas volatilized when the material is burned and thermally decomposed, and the smoke density index shall meet the relevant safety and fire protection standards. Otherwise, it shall be subjected to flame-retardant treatment or sealed with flame-retardant and non-combustible materials. The cables used on the vehicle shall meet the requirements of TB/T 1484.1.

6.23 The surface treatment and protective coating requirements of the vehicle before painting shall meet the requirements of TB/T 289.3 and TB/T 2879.5.

6.24 When the vehicle needs to be transported by rail, it shall be able to meet the requirements of unpowered return.

7 Vehicle types and train marshalling

7.1 Vehicle types

- Motor vehicle: motor vehicle with driver's cab (Mc), motor vehicle without driver's cab (M).

- Trailer: trailer with driver's cab (Tc), trailer without driver's cab (T).

7.2 Train marshalling

7.2.1 There may be many forms for train marshalling: mixed marshalling of motor vehicle and trailer or marshalling of full motor vehicles.

7.2.2 Different equipment can be installed on motor vehicles and trailers.

The train marshalling form (ratio and configuration of motor vehicle, trailer) shall be determined according to the principle of power distribution and weight balance of the lifting equipment.

7.3 Coupling device

7.3.1 Coupler type: Semi-permanent traction rods or close-fitting semi-automatic couplers are installed between each vehicle of fixed marshalling in trains. Close-fitting automatic coupler or close-fitting semi-automatic coupler is set at the front of the cab.

7.3.2 There shall be a buffer device in the coupling device. Its characteristics shall be able to effectively absorb the impact energy and ease the impact. The maximum impact speed that the device can bear to be fully restored is 5km/h.

excluding the seat and front edge of 100mm. Per capita weight is calculated at 60 kg.

NOTE: Rated standing space is calculated as 6 persons/m^2.

8.1.7 The design life of the vehicle structure is 30 years.

8.1.8 Vehicle sealing performance shall meet the requirements of IEC 61133. The casing of the vehicle body and various equipment installed outside the vehicle body and all openings, doors and windows, and hole covers can prevent rain and snow from intruding. Closed boxes and cabinets shall be well sealed. No water seepage or gushing during mechanical cleaning.

8.1.9 Heat and sound insulation materials with low moisture absorption, low expansion rate and stable performance shall be laid between the inner and outer wall panels of the vehicle body structure and between the underframe and the floor.

8.1.10 The vehicle shall be equipped with a vehicle support and a vehicle body hoisting seat. Mark the position where the truck is allowed to be erected and hoisted to facilitate disassembly, lifting and rescue.

8.1.11 Adjustable troubleshooter shall be installed at both ends of the train running on the ground. The shape shall be conducive to eliminating track obstacles.

8.1.12 Vehicles at both ends of the train can be equipped with impact energy absorption areas to prevent accidental collisions, so as to protect the safety of drivers and passengers. Anti-climbing devices can be installed at both ends of the train running on the ground or overhead.

8.2 Driver's cab

8.2.1 The cab shall have a wide view. It shall be possible for the driver to clearly and conveniently look at the front signal, line contact network (contact rail), tunnel and platform during operation.

8.2.2 The front window glass of the driver's cab shall adopt safety glass that will not collapse when it is penetrated or knocked on any part. The front window shall be equipped with a wiper and sunshade. Electric heating glass that meets TB/T 1451 conditions shall be used in cold areas. The penetration and impact resistance of the front window glass shall comply with the relevant regulations of TB/T 1451.

8.2.3 Set driver’s cab side door at the side of driver’s cab. Emergency evacuation doors shall be provided at both ends of trains running on lines without safe passages. There shall be a connecting door between the driver's

be installed on the upper part of some vehicle windows. Safety glass of which once damaged, its fragments will not cause serious harm to people, shall be adopted for door and window glass. In an emergency, it can be crushed with force or sharp objects. Its performance meets the requirements of GB/T 9963. When hollow glass is used in the window, it shall meet the requirements of GB/T 11944.

8.3.4 Appropriate number of passenger seats are set in the passenger compartment. The shape of the seat shall meet ergonomic requirements.

8.3.5 The interior wall panels shall be made of easy-to-clean and decorative flame-retardant materials. The floor shall have abrasion resistance, non-slip, waterproof, anti-static and flame-retardant properties. Non-flammable or high flame-retardant materials shall be used in the production of seats, decorations and advertisements in the passenger compartment.

8.3.6 There shall be enough, strong and beautiful columns and handrails in the passenger compartment. Appropriate number of hand rings can be added according to needs.

8.3.7 The passenger compartment shall have adequate lighting. The average illuminance at a height of 800mm from the floor surface is not less than 200 lx. The minimum value is not less than 150 lx (when there is no light outside the vehicle). When the normal power supply is interrupted, emergency lighting is provided, and the illuminance shall not be less than 10 lx.

8.3.8 A through passage shall be provided between the two connected vehicles. The through passage shall be sealed, fireproof, waterproof, heat trapped, and soundproof. The through passage crossing plates shall be wear-resistant, smooth, non-slip, and anti-pinch. The sealing material for the through passage shall have sufficient tensile strength, be safe and reliable, and not easy to age.

8.3.9 Each train shall have at least one dedicated wheelchair location and shall have a gripping or fixing device suitable for wheelchair passengers.

9 Bogie

9.1 The performance and main dimensions of the vehicle running mechanism shall be coordinated with the track. Ensure that its related components are within the allowable wear limit and still ensure that the train runs safely and smoothly at the highest allowable speed. Even when the suspension or damping system is damaged, it shall be able to ensure that the vehicle runs safely to the end on the track.

9.2 The structural strength test of the bogie frame can be carried out in

10.6 The train shall be equipped with a parking brake device. Ensure that the train with the parking brake will not slip away under the maximum slope and maximum load of the line. Its braking force shall only be generated and transmitted mechanically.

10.7 The train shall have two or more independent electric air compressor units. When one unit fails, the performance, displacement, air supply quality and air storage cylinder volume of the remaining compressor units shall all meet the air supply requirements of the entire train. The compressor unit shall be equipped with a dryer and automatic drainage device. The pressure regulator and safety valve action value shall be accurate and reliable. The volume of the air storage cylinder shall also meet the air volume for the three emergency braking of the train after the compressor stops running.

10.8 The compressed air pipeline shall be made of stainless steel or copper. Piping and air storage cylinders shall be rust-proof, anti-corrosion and cleanly treated before installation to facilitate the smooth flow of the wind road.

10.9 The air tightness of the air system shall meet the requirements of IEC 61133. The pressure value of the system (main air cylinder, brake pipeline, air valve, air suspension, electro-pneumatic device) shall not drop more than 20kPa within 5min after closing the air circuit. The pressure of brake cylinder and auxiliary air cylinder shall not decrease by more than 10kPa after 3min.

10.10 The actual value of the brake shoe pressure of the vehicle's basic braking device shall not exceed ±5% of the design value.

10.11 When the train is accidentally separated, emergency braking shall be applied immediately. Ensure that the separated train brakes automatically and shall be easy for the driver to identify.

11 Electrical system

11.1 Electric traction shall adopt AC drive system with frequency conversion and voltage regulation.

11.2 Traction motor shall comply with TB/T 3001. Traction electrical appliances shall comply with TB/T 1333. Electronic equipment shall comply with TB/T 3021. The power converter shall meet the requirements of IEC 61287-1.

11.3 The electromagnetic compatibility of electrical equipment shall comply with TB/T 3034.

11.4 The electrical system shall have good insulation protection. Each circuit shall be able to withstand the withstand voltage test. The test voltage value is

storage battery. The auxiliary converter shall comply with the requirements of IEC 61287-1. Its capacity shall be able to meet the usage requirements of the vehicle under various working conditions.

11.13 The floating charge performance of the storage battery is good. Its capacity shall be able to meet the emergency lighting, external lighting, on-board safety equipment, broadcasting, communications, emergency ventilation and other systems of the vehicle in the event of a failure. It shall not be less than 45min, not less than 30min for ground and elevated lines.

11.14 The electrical equipment box installed outside the vehicle body that needs to be kept clean inside shall have a protection performance not lower than the IP54 level specified in GB 4208.

11.15 Multi-strand copper core cables shall be used for connecting wires of electrical equipment of each circuit. The electrical withstand voltage rating, electrical conductivity, and flame-retardant performance shall all meet the requirements of TB/T 1484.1. The material used in the cable shall not produce harmful and dangerous fumes during combustion and thermal decomposition. The use of optical cables and communication cables shall meet the requirements of product technical conditions.

11.16 The laying of wires and cables should be arranged reasonably. The wires and cables of the main, auxiliary, and control circuits shall be routed separately. Meet the requirements of electromagnetic compatibility. Put into the dedicated wire duct. Use wire clips, cable ties to bind firmly. When it is necessary to cross, the contact part of the high-voltage cable shall be reinforced with additional insulation. The cable passing through the electrical box shall be clamped firmly by a clamp. A sheath shall be added to the area adjacent to the box shell. Wire ducts shall be installed firmly to prevent damage caused by vehicle operation. Conduit and trunk shall prevent the intrusion of oil, water and other pollutants. Vehicle wiring rules can refer to the provisions of TB/T 1507.

11.17 The crimping of wire and cable ends and connectors shall be firm and conductive. The wires between the two terminals are not allowed to have joints. Both ends of each wire and cable shall have clear and durable wire number marks.

11.18 The accuracy of the various measuring and indicating instruments on the vehicle shall not be lower than level 2.5.

12 Air conditioning and heating device

12.1 The air conditioning and refrigeration capacity of the vehicle shall be able to meet the requirements when the ambient temperature is 33°C, the

and closing state of the side door of the passenger compartment and a vehicle-mounted signal display device and shall be easy for the driver to observe.

13.3 The vehicle shall have automatic train protection system (ATP) or automatic train protection system (ATP) and automatic driving system (ATO), as well as communication devices that can ensure driving safety.

13.4 The front end of the driver's cab shall be equipped with a headlamp capable of changing far and near light. The illuminance of the headlights at the emergency stop distance at the front of the vehicle shall not be less than 2 lx. The outer wall of the rear end of the train shall be provided with a red protective light with sufficient visible distance. The side wall of the vehicle can be equipped with indicator lights showing the opening and closing of the door and the relief of the brake cylinder as required.

13.5 The train shall be equipped with a whistle device.

13.6 There shall be various warning signs in the vehicle, including emergency braking devices, live high-voltage equipment, fire-fighting equipment and operation warning signs in the electrical box marked in the driver's cab.

13.7 The passenger compartment and driver's cab shall be equipped with fire extinguishers suitable for electrical installations and grease. The placement location shall be clearly marked and easy to access. The gas produced by the fire extinguishing material shall not be harmful to the human body.

13.8 The train shall have the ability to evacuate passengers urgently under special circumstances.

14 Control diagnosis system

14.1 The train shall be controlled through the train communication network. In addition to the operation and safety-related control carried out by the train communication network, other forms of redundancy measures shall be taken if necessary.

14.2 Data communication shall have the following basic functions:

- Train control, diagnosis system and train subsystem communicate through train communication network and intelligent terminal;

- Download the fault information of the networked subsystem through the standard service interface on the train communication network;

- The main microcomputer control subsystem can be tested online through the standard service interface on the train communication network.

maximum operating speed and the use of new equipment and new technologies. In principle, series products can be shorter than new products, and low-speed ones are shorter than high-speed ones. For vehicles undergoing type test, when there is no specified value in the contract, the maximum test running mileage of the vehicle shall be set at 5000km.

16.3 Type test shall be carried out when the vehicle is in one of the following situations:

- Newly designed and manufactured vehicle;
- Mass-produced vehicles undergoing major technological transformations, with major changes in their performance, structure, materials, and components;
- After a certain number of mass-produced vehicles are manufactured, when it is necessary to reconfirm their performance, take samples for testing;
- The manufacturer produces this model for the first time;
- Vehicles produced after plant transfer.

16.4 The supporting equipment and main components of the vehicle shall be installed after passing the inspection.

16.5 All vehicles put into mass production shall undergo routine tests. Routine test results shall be consistent with the type test of this type of product.

16.6 Vehicles formally submitted for acceptance shall have product qualification certificates, type test reports, routine test reports, operation and maintenance instructions and vehicle history books.

16.7 When the vehicle is handed over, the manufacturer shall provide the user with relevant technical documents, maintenance drawings, tools and spare parts.

16.8 Research tests are only carried out when there are provisions in the contract between the user and the manufacturer.

17 Marks

The relevant information of the vehicle shall be marked on the obvious position of the vehicle. The marking method shall comply with the relevant standards. The manufacturer shall provide complete information. The content of the mark shall not be less than the following requirements:

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