

Contents

Foreword	(III)
1 Scope	(1)
2 Normative references	(1)
3 Terms and definitions	(1)
4 Working conditions	(2)
5 Composition of electrical system equipment	(2)
6 Requirements	(2)
7 Test methods	(6)
8 Inspection rules	(7)
9 Marking, packaging, transportation and storage	(11)

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Foreword

This standard was drafted in accordance with the rules given in the GB/T 1.1-2009.

This standard was proposed by Research Institute of Standards and Norms, Ministry of Housing and Urban-Rural Development of the People's Republic of China.

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Technical specification for the electrical system of medium and low speed maglev vehicle

1 Scope

This standard specifies the working conditions, composition, requirements, test methods, inspection rules, marking, packaging, transportation and storage of the electrical system of medium and low speed maglev vehicle.

This standard is applicable to the design, commissioning and acceptance of the electrical system and equipment of medium and low speed maglev vehicle.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- GB/T 2900.36 *Electrotechnical Terminology—Electric Traction*
- GB/T 21413.1-2008 *Railway Applications—Electric Equipment for Rolling Stock—Part 1: General Service Conditions and General Rules*
- GB/T 21413.2-2008 *Railway Applications—Electric Equipment for Rolling Stock—Part 2: Electrotechnical Components—General Rules*
- GB/T 21414-2008 *Railway Applications—Rolling Stock—Protective Provisions Against Electrical Hazards*
- GB/T 21563 *Railway Applications—Rolling Stock Equipment—Shock and Vibration Tests*
- GB/T 24338.4 *Railway Applications—Electromagnetic Compatibility—Part 3-2: Rolling Stock—Apparatus*
- GB/T 25122.1-2010 *Railway Applications—Power Converters Installed on Board Rolling Stock—Part 1: Characteristics and Test Methods*
- GB/T 25119-2010 *Railway Applications—Electronic Equipments Used on Rail Vehicles*
- GB/T 28029.1 *Electronic Railway Equipment—Train Communication Network (TCN) —Part 1: General Architecture*
- CJ/T 311-2009 *Technical Specification of Linear Induction Traction Motors for Urban Mass Transit*
- CJ/T 375 *General Technical Specification for Medium and Low Speed Maglev Vehicles*
- TB/T 1507 *Routing Rules for Locomotive Electrical Equipment*
- TB/T 1508 *Technical Specification for Locomotive Electrical Cubicles*
- TB/T 1484 *(All Parts) Specification for Cables on Board Rolling Stock*
- TB/T 3116 *Information Transmission over Trainbus*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in GB/T 2900.36, GB/T 21413.1, GB/T 21413.2, GB/T 25119, GB/T 25122.1 and CJ/T 375 apply.

4 Working conditions

- 4.1 Altitude: $\leq 1\,400\text{m}$.
- 4.2 The ambient temperature: -25°C to $+40^{\circ}\text{C}$.
- 4.3 The monthly average maximum relative humidity of the month with maximum relative humidity is not more than 90% (the monthly average minimum temperature of this month is 25°C).
- 4.4 Biological conditions shall meet the requirements given in GB/T 21413.1-2008, Subclause 7.5.
- 4.5 The chemical active substances shall meet the requirements given in GB/T 21413.1-2008, Subclause 7.6.
- 4.6 The mechanical active substance shall meet the requirements given in GB/T 21413.1-2008, Subclause 7.7.
- 4.7 The temperature of low temperature storage is not lower than -40°C .
- 4.8 Vibration and shock shall meet the requirements given in GB/T 21563.
- 4.9 When the working conditions of electrical system equipment exceed the above conditions, it shall be agreed by the supplier and the customer upon consultation.

5 Composition of electrical system equipment

The electrical system of medium and low speed maglev vehicles is composed of following subsystems:

- High voltage system;
- Traction system;
- Levitation system;
- Auxiliary power system;
- Passenger information system;
- Control and diagnosis system;
- On-board operation control system (including location and velocity detecting system).

6 Requirements

6.1 High voltage system

- 6.1.1 High voltage system includes all pieces of equipment from the current collectors to converters, which is generally composed of current collector, high-voltage box and reactor.
- 6.1.2 The power supply system may be DC1 500V (Variations of voltage supply: 1 000V to 1 800V) or DC750V (Variations of voltage supply: 500V to 900V).
- 6.1.3 Contact rail-current collector shall be adopted for the current-collecting mode. The contact rail is composed of current collecting rail (positive pole) and return current rail (negative pole).
- 6.1.4 The current collector shall be reliable, and there shall be no damage or abnormal abrasion to the current receiver or power supply facilities when collecting current.
- 6.1.5 All receiving currents on the train shall be provided with current collection detection function. When one

current fails, it shall be able to cut off effectively to prevent future fault.

6.1.6 A high speed circuit breaker shall be provided for traction system as overcurrent protection.

6.1.7 Overvoltage surge absorbers and other lightning protection measures shall be provided.

6.1.8 Noise of reactor shall be less than 65dB(A).

6.2 Traction system

6.2.1 Rated power for traction

The rated power shall meet the requirements in CJ/T 375.

6.2.2 Traction converter

6.2.2.1 The traction converter includes inverter, overvoltage chopper, chopper resistor, drive control unit (DCU) and related voltage and current sensors, etc..

6.2.2.2 Vehicle control should be adopted as the traction mode of the train. Each traction converter drives all traction motors in a vehicle.

6.2.2.3 The traction converter shall have the following functions:

—When the vehicle is in traction condition, the input direct current voltage is converted into variable voltage variable frequency (VVVF) three-phase voltage to drive the traction motor.

—When the vehicle is in braking condition, the three-phase alternating current voltage output by the linear motor is converted into direct current voltage to feed back to the grid or supply brake resistor.

6.2.2.4 The traction converter shall have such protective functions as DC overvoltage, DC undervoltage, input overcurrent, output overload, short circuit, grounding, phase-failure, three-phase current unbalance and overheating. All faults may be identified by network.

6.2.2.5 The traction converter should be insulated gate bipolar transistor (IGBT) power components, forced-air cooling.

6.2.2.6 The rated efficiency of traction converter shall be greater than or equal to 98%, and its noise shall be less than 75dB (A).

6.2.2.7 The drive control unit implements the control of traction converter and linear induction traction motor, and communicates with the central control unit through the train communication network to complete the vehicle control and protection functions as well as the emergency driving control. The communication between the train communication network and the central control unit shall meet the requirements given in GB/T 28029.1.

6.2.3 Traction motor

6.2.3.1 Traction motor should use three-phase linear induction traction motor.

6.2.3.2 The characteristics and power of traction motor shall meet the requirements of traction and braking of maglev vehicles. The minimum efficiency shall be 70% under rated operating conditions.

6.2.3.3 The primary winding of the traction motor is mounted on the bogie, and the secondary winding of traction motor (induction plate) is fixed on the track. The primary and secondary electrical parameters shall match each other.

6.2.3.4 Traction motor shall be natural air cooled or forced-air cooling.

6.2.3.5 In the case of normal operation and maintenance, the motor design shall meet its overhaul period of not less than 600 000km or four years. During this period, the motor may not be disassembled for maintenance.

6.2.3.6 The type and structure of the secondary winding of traction motor (induction plate) shall be suitable for the traction requirements of vehicles in different operation sections. The plate-type induction plate should be used.

6.3 Auxiliary power system

6.3.1 Auxiliary power supply

6.3.1.1 The alternating voltage output of the auxiliary power supply shall be three-phase AC380V and 50Hz sine wave. The total harmonic distortion (THD) of output voltage waveform shall be less than 10%, frequency stability shall be $\pm 1\text{Hz}$.

6.3.1.2 Under rated working conditions, the efficiency of the auxiliary power supply shall be greater than or equal to 90%, the load power factor shall not be less than 0.85, and the noise shall be less than 75dB(A).

6.3.1.3 Lighting shall be powered by an auxiliary power source and the illumination shall meet the requirements in CJ/T 375.

6.3.1.4 The auxiliary power supply shall have the protection functions of short circuit, input overvoltage, undervoltage, overcurrent, radiator overheating, phase-failure, three-phase unbalance and so on.

6.3.2 Control power supply

6.3.2.1 The nominal voltage of the control power supply is DC 110V, and the basic operation function of the train shall be guaranteed in the case of failure.

6.3.2.2 The control power supply shall meet the specified output characteristics in the entire input voltage range, the relative peak-peak ripple factor of output voltage shall be less than 10%, and the steady state adjustment frequency shall not be greater than $\pm 1\%$.

6.3.2.3 The control power supply shall be able to float charge the control storage battery.

6.3.2.4 When the control battery is undervoltage, the control power supply shall be capable of emergency start.

6.3.2.5 Under rated working conditions, the efficiency of the control power supply shall be greater than or equal to 90%, and the noise shall be less than 75dB(A).

6.3.2.6 The control power supply shall have the protection functions of short circuit, input overvoltage, undervoltage, overcurrent and radiator overheating.

6.3.3 Emergency power supply

6.3.3.1 Emergency power supply shall be composed of emergency inverter and storage battery.

6.3.3.2 The storage battery capacity shall meet the requirements of working at least 30min under the condition of emergency ventilation and emergency lighting.

6.3.3.3 The output voltage waveform THD of the emergency inverter shall be less than or equal to 10%, rated efficiency shall be greater than 85%, load power factor shall be greater than or equal to 0.75, noise shall be less than 75dB(A).

6.3.3.4 Emergency inverters shall have such protective functions as short circuit, input overvoltage, undervoltage, overcurrent, radiator overheating, phase-failure, three-phase unbalance, etc..

6.4 Passenger information system

6.4.1 Train passenger information system shall provide two-way communication between driver and traffic control and dispatching center, and realize the communication function between the front and rear driver's cab.

6.4.2 Passenger information system of the train shall have the device for the driver to broadcast stops and have automatic station reporting device. The passenger compartment shall be equipped with loudspeakers to report the coming station and important emergency notices.

6.4.3 The redundancy of the train broadcasting system shall be considered. Once the passenger broadcasting

controller at the driver's end fails, the driver may manually switch to the broadcasting controller in the driver's cab at the other end.

6.4.4 The passenger information display system may regularly communicate with the train control and diagnosis system, and status and fault information of the passenger information display system shall be able to be transmitted to the display screen of the driver's cab through train communications network.

6.4.5 The passenger information system of the train shall be equipped with passenger information facilities in the passenger compartment, offering information on lines, stations and guide signs, etc., and shall be equipped with a display screen to show information of the next arrival and destination.

6.4.6 Passenger manual alarm and intercom device shall be provided in the passenger compartment. In case of emergency, passengers may be able to send alarm to the driver, and the driver shall be able to immediately identify the alarmed vehicle when the passenger sends the alarm.

6.4.7 The running section display device should be set at both ends of the train.

6.5 Control and diagnosis system

6.5.1 The control and diagnosis system shall control, monitor, diagnose and record the faults of the high voltage system, traction system, auxiliary power supply system, braking system, levitation system, vehicle-mounted operation control system, doors, air conditioning and lighting of the maglev train.

6.5.2 Train control, monitoring and diagnosis shall be realized through train communication network. The train communication network should be distributed with the central control unit (nodes) as the core. The microcomputer unit responsible for the management of train bus is dual redundant.

6.5.3 The train communication network shall meet the requirements given in GB/T 28029.1.

6.5.4 The information transmitted on the train bus shall meet the requirements given in TB/T 3116, in which the customized data shall be prepared by the manufacturer and submitted to the user for approval.

6.5.5 The train shall be capable of emergency driving in case of communication network failure.

6.5.6 Fault diagnosis system shall be able to detect fault and find out the causes to facilitate maintenance and repair. Each node and critical component shall have the ability to collect and store fault tracking data and an interface to dump fault information.

6.5.7 The control and diagnosis system shall comprehensively evaluate the fault according to the fault situation of the whole train and the influences each component exerting on the train operation, output the fault grades, and provide appropriate emergency guidance.

6.6 Other requirements

6.6.1 Electronic devices of vehicles not specified in this standard shall meet the requirements given in GB/T 25119.

6.6.2 Electric converters of vehicles not specified in this standard shall meet the requirements given in GB/T 25122.

6.6.3 Electrotechnical components of vehicles not specified in this standard shall meet the requirements given in GB/T 21413.1 and GB/T 21413.2.

6.6.4 Safety protection of each electrical subsystem and equipment not specified in this standard shall meet the requirements given in GB/T 21414.

6.7 Wiring requirements

6.7.1 The wiring of the electrical screen cabinet inside vehicles shall meet the requirements given in TB/T 1508,

and the wiring of vehicle electrical equipment shall meet the requirements given in TB/T 1507.

6.7.2 Halogen-free, low-smoke and flame-retardant conductors shall be used on vehicles and it shall meet the requirements given in TB/T 1484.

6.7.3 The connection wire of electrical equipment of each circuit shall adopt multi-strand copper core cable. The electrical voltage resistance grade, electrical conductivity and flame-retardant performance shall meet the requirements given in TB/T 1484. The materials used for cables shall not produce harmful and dangerous smoke during combustion and thermal decomposition.

6.7.4 The electric wires and cables shall be reasonably arranged, and the electric wires and cables of collecting, main, auxiliary and control circuits as well as the sensitive signal lines for communication shall be wired separately and installed in the special electric wire tubes and trunking, and fixed with wire clips and cable tie. The cable passing through the electrical box shell shall be fixed firmly with wire clips, the part of cable close to the box shell shall be sheathed, and the wire trunking shall be installed firmly to prevent damage caused by vehicle operation.

6.7.5 The bending radius of the communication sensitive signal line shall not be less than 5 times of the cable diameter; the communication line shall be kept 0.5m away from the power line and at least 0.1m away from the DC110V control line, and shall not be laid in the same tube with wires above 60V. When the communication line crosses other cables, the right-angle shall be used as far as possible. If the space cannot meet the above requirements, measures shall be taken to strengthen the shielding. The isolator shall be grounded separately and the grounding wire shall be shorter than 1m. The two ends of the communication line shall be connected to an end connector whose resistance shall match the characteristic impedance of the communication line.

6.7.6 The ends and joints of wire and cable shall be firm and conductive. There shall be no joints on the wire between two terminals. Both ends of each wire and cable shall be marked with clear durable wire number.

6.7.7 Insulation materials shall be anticorrosive, odorless, non-hygroscopic.

6.8 Anti-shock and vibration performance

The vibration and shock resistance of the electrical equipment installed on the maglev vehicles shall meet the requirements given in GB/T 21563.

6.9 Electromagnetic compatibility

For the electrical equipment installed on the maglev vehicles, the emission disturbance and immunity of each port shall meet the requirements given in GB/T 24338.4.

6.10 System requirements

The system shall meet the requirements of reliability, availability, maintainability and security.

7 Test methods

7.1 Test conditions

The test conditions shall meet following requirements:

- a) The equipment to be tested shall be installed in accordance with the technical conditions prescribed by the manufacturer or in anticipated environmental conditions for locomotives and vehicles;

- b) The test shall be carried out under the environmental conditions of the test site;
- c) The test shall be carried out on clean and new equipment.

7.2 Inspection items and methods for electronic devices of vehicle

The items and methods for inspecting electronic devices of vehicles shall meet the requirements given in GB/T 25119.

7.3 Inspection items and methods for vehicle electric converters

The items and methods for inspecting electric converters of vehicles shall meet the requirements given in GB/T 25122.1.

7.4 Items and methods for inspecting electrotechnical components of vehicle

The items and methods for inspecting electrotechnical components of vehicle shall meet the following requirements:

- a) The items and methods of type test and routine test for electrotechnical components of vehicle shall meet the requirements given in GB/T 21413.2;
- b) The items and methods for inspecting linear induction traction motor shall meet the requirements given in CJ/T 311.

8 Inspection rules

8.1 Types of Inspection

The equipment shall pass the inspection to prove that it meets the requirements of this standard and relevant product standards. The types of inspection classification is as follows:

- a) Type test: It is used to examine the design of the designated products to make sure it is in accordance with this standard and relevant product standards;
- b) Routine test: It is used to detect material and process faults and confirm the normal function of equipment;
- c) Research test: It is a selective test to evaluate the special performance and characteristics of equipment.

8.2 Type test

Under one of the following conditions, type tests shall be carried out:

- a) A new product is designed for trial formulation;
- b) Changes in product structure, material or process may affect product performance;
- c) The product is produced again after it is out for production for more than 3 years;
- d) The trial production of the products is completed after the products are transferred to a new factory;
- e) The national quality supervision agency puts forward the requirements of type test.

8.3 Routine test

8.3.1 The manufacturer shall carry out routine test on every piece of product before it leaves the factory.

8.3.2 In the course of routine test, if any single item fails, the product shall be deemed as unqualified.

8.3.3 Upon negotiation between the user and the manufacturer, the user may conduct sampling tests on the delivered products to verify the routine test results.

8.4 Research test

8.4.1 The test shall be carried out only when the manufacturer and the user require further understanding of the design or certain performance. The test items may be customized by the manufacturer or based on the negotiation with the user.

8.4.2 The results of the research test shall not be taken as the criterion of whether the product performance is qualified or not.

8.5 Inspection items

8.5.1 Inspection items of vehicle electronic devices

The inspection items of vehicle electronic devices are shown in Table 1.

Table 1 Inspection items of vehicle electronic devices

No.	Inspection or test item	Type	Routine	Provision
1	Appearance inspection	√	√	Subclause 12.2.1 in GB/T 25119-2010
2	Performance test	√	√	Subclause 12.2.2 in GB/T 25119-2010
3	Low temperature test	√	-	Subclause 12.2.3 in GB/T 25119-2010
4	High temperature test	√	-	Subclause 12.2.4 in GB/T 25119-2010
5	Damp heat test	√	-	Subclause 12.2.5 in GB/T 25119-2010
6	Power over voltage, surge and electrostatic discharge test	√	-	Subclause 12.2.6 in GB/T 25119-2010
7	Electrical fast transient pulse group immunity test	√	-	Subclause 12.2.7 in GB/T 25119-2010
8	Radio-frequency interference test	√	-	Subclause 12.2.8 in GB/T 25119-2010
9	Insulation test	√	√	Subclause 12.2.9 in GB/T 25119-2010
10	Salt fog test	-	-	Subclause 12.2.10 in GB/T 25119-2010
11	Vibration and shock test	√	-	Subclause 12.2.11 in GB/T 25119-2010
12	Water-tight test	-	-	Subclause 12.2.12 in GB/T 25119-2010
13	Enhanced screening test	-	-	Subclause 12.2.13 in GB/T 25119-2010
14	Low-temperature storage test	√	-	Subclause 12.2.14 in GB/T 25119-2010

Note 1: Tests marked with "√" are compulsory test.
Note 2: Tests marked with "-" are subject to contractual requirements between the user and the manufacturer.
Note 3: The ambient temperature for above tests is 25°C ± 10°C .

8.5.2 Inspection items of vehicle electric converter

The inspection items of vehicle electric converter are shown in Table 2.

Table 2 Inspection items of vehicle electric converter

Inspection and test items	Place	Type test	Routine test	Provision
Appearance inspection	In factory	√	√	Subclause 4.5.3.1 in GB /T 25122.1-2010
Dimensions and tolerances	In factory	√	√	Subclause 4.5.3.2 in GB/T 25122.1-2010
Weigh	In factory	√		Subclause 4.5.3.3 in GB/T 25122.1-2010
Mark inspection	In factory	√	√	Subclause 4.5.3.4 in GB/T 25122.1-2010
Cooling test	In factory/ on train	√		Subclause 4.5.3.5 in GB/T 25122.1-2010
Filter effectiveness	In factory/ on train	-		Subclause 4.5.3.5.4 in GB/T 25122.1-2010
Leakage test	In factory/ on train		√	Subclause 4.5.3.5.5 in GB/T 25122.1-2010
Testing on protective and measuring devices	In factory	√	√	Subclause 4.5.3.6 in GB/T 25122.1-2010
Light-load test	In factory	√	√	Subclause 4.5.3.7 in GB/T 25122.1-2010
Inspection on protection level	In factory	√		Subclause 4.5.3.8 in GB/T 25122.1-2010
Converter test	In factory/ on train	√		Subclause 4.5.3.9 in GB/T 25122.1-2010
Noise measurement	In factory	√		Subclause 4.5.3.10 in GB/T 25122.1-2010
Temperature rise test	In factory	√		Subclause 4.5.3.11 in GB/T 25122.1-2010
Power loss measurement	In factory	√		Subclause 4.5.3.12 in GB/T 25122.1-2010
Power supply overvoltage and transient energy test	In factory	√		Subclause 4.5.3.13 in GB/T 25122.1-2010
Load sudden change test	In factory/ on train	-		Subclause 4.5.3.14 in GB/T 25122.1-2010
Insulation resistance test	In factory	√	√	Subclause 4.5.3.15 in GB/T 25122.1-2010
Dielectric test	In factory	√	√	Subclause 4.5.3.16 in GB/T 25122.1-2010
Partial discharge test	In factory	-		Subclause 4.5.3.17 in GB/T 25122.1-2010
Safety requirements inspection	In factory	√	√	Subclause 4.5.3.18 in GB/T 25122.1-2010
Vibration and shock test	In factory	√		Subclause 4.5.3.19 in GB/T 25122.1-2010
Electromagnetic compatibility test	In factory/ on train	√		Subclause 4.5.3.20 in GB/T 25122.1-2010
Grid voltage jump test	In factory/ on train	√		Subclause 4.5.3.21 in GB/T 25122.1-2010
Short interruption test of power supply	In factory/ on train	√		Subclause 4.5.3.22 in GB/T 25122.1-2010
Uniform current test	In factory/ on train	-		Subclause 4.5.3.23 in GB/T 25122.1-2010

Note 1: Tests marked with "√" are compulsory test.

Note 2: Tests marked "-" are subject to contractual requirements between the user and the manufacturer.

8.5.3 Vehicle electrotechnical components inspection items

8.5.3.1 The routine test items of vehicle electrotechnical components are shown in Table 3.

Table 3 Routine test items of vehicle electrotechnical components

No.	Test Item	Provision
1	Mechanical property	Subclause 9.4.2 in GB/T 21413.2-2008
2	Resistance or impedance measurement	Subclause 9.4.3 in GB/T 21413.2-2008
3	(Air-operated electrical equipment) gas tightness	Subclause 9.4.4 in GB/T 21413.2-2008
4	Insulating property	Subclause 9.4.5 in GB/T 21413.2-2008
5	Check the rating and operation of protective devices and relays	Subclause 9.4.6 in GB/T 21413.2-2008

8.5.3.2 The type test items of vehicle electrotechnical components are shown in Table 4.

Table 4 Type test items of vehicle electrotechnical components

Test procedures	Test item	Provision
I General performance	Operating limit	Subclause 9.3.3.1 in GB/T 21413.2-2008
	Temperature rise	Subclause 9.3.3.2 in GB/T 21413.2-2008
	Insulating property	Subclause 9.3.3.3 in GB/T 21413.2-2008
	Working performance	Subclause 9.3.3.4 in GB/T 21413.2-2008
	Insulating property verification	Subclause 9.3.3.5 in GB/T 21413.2-2008
	Temperature rise verification	Subclause 9.3.3.6 in GB/T 21413.2-2008
II Vibration and shock resistance	Vibration	Subclause 9.3.4.1 in GB/T 21413.2-2008
	shock	Subclause 9.3.4.2 in GB/T 21413.2-2008
	Mechanical property verification	Subclause 9.3.4.3 in GB/T 21413.2-2008
	Insulating property	Subclause 9.3.4.4 in GB/T 21413.2-2008
III Critical current (if any)	Determine the critical current	Subclause 9.3.5 in GB/T 21413.2-2008
IV Climate conditions	Low temperature	Subclause 9.3.6 in GB/T 21413.2-2008
	Low-temperature storage	
	High temperature	
	Damp heat	
	Mechanical property verification	
	Insulating Property verification	
	Salt fog	
V Other Test (if required)	Electromagnetic compatibility (EMC)	Subclause 9.3.7 in GB/T 21413.2-2008
	Noise	
	Short-circuit making capacity	
	Short-time withstand current	

Note: Test procedures shall be tested under clean, new (or reconditioned) conditions.

8.5.4 Inspection items of linear induction traction motors

Inspection items of linear induction traction motors are shown in Table 5.

Table 5 Type test items of vehicle electrotechnical components

No.	Item	Type test	Delivery test	Subclause in standard
1	Inspection on appearance and dimension	√	√	Subclause 7.1 in CJ/T 311-2009
2	Measurement on insulation resistance to iron core by primary winding	√	√	Subclause 7.2 in CJ/T 311-2009
3	Measurement on primary winding DC resistance in cold state	√	√	Subclause 7.3 in CJ/T 311-2009
4	Ventilation test(for forced-air cooling)	√		Subclause 7.4 in CJ/T 311-2009
5	Temperature-rise test	One-hour rating	√	Subclause 7.5.1 in CJ/T 311-2009
		Continuous rating		Subclause 7.5.2 in CJ/T 311-2009
6	Measurement of static characteristics	√		Subclause 7.6 in CJ/T 311-2009
7	Dynamic characteristic test	*		Subclause 7.7 in CJ/T 311-2009
8	Shock resistance test	*		Subclause 7.8 in CJ/T 311-2009
9	Primary winding interturn dielectric strength test	√	√	Subclause 7.9 in CJ/T 311-2009
10	Dielectric strength test of primary winding on iron core and winding interphase	√	√	Subclause 7.10 in CJ/T 311-2009
11	Primary winding reactance measurement	√	√	Subclause 7.11 in CJ/T 311-2009
12	Weigh	√		Subclause 7.12 in CJ/T 311-2009
13	Submerging test	√	**	Subclause 7.13 in CJ/T 311-2009

Note 1: Tests marked with "√" are compulsory.
Note 2: Tests marked with "*" may be conducted during truck loading.
Note 3: Tests marked with "**" are not routine inspection for all linear motors. Please refer to Subclause 7.13 for details.

9 Marking, packaging, transportation and storage

9.1 Marking

The product shall have a nameplate indicating at least the following information:

- Model identification;
- Main technical parameters;
- Factory serial number;

- d) Manufacture date;
- e) Manufacturer name.

9.2 Packaging

The packaging shall meet the following requirements:

- a) Product packaging shall prevent moisture, dust and damage caused during transportation;
- b) Packaging of electronic products shall also be anti-static;
- c) The products shall be delivered with manufacturer certificates, and each user shall be provided with at least one copy of installation and maintenance instructions;
- d) Spare parts and special tools shall be provided as per agreements between the supplier and the customer.

9.3 Transportation

During product transportation, there shall be no violent vibration, impact or inversion. When some parts have special requirements for transportation, they shall be noted so that relative measures can be taken during transportation.

9.4 Storage

In addition to the special storage requirements, products shall be stored in a dry and clean place with no acid, alkali or corrosive gas as per manufacture instruction, and the storage temperature shall not be lower than -40°C . Long-term storage requires maintenance as per product technical conditions.
