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**Motors and Controllers for
Electric Motorcycles and Electric Mopeds**

电动摩托车和电动轻便摩托车用电机及控制器技术条件

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Announcement

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The National Development and Reform Commission approves 139 industry standards (see Schedule I for the standard numbers, names, start and implementation dates) including *Polyester Filament Embroidery Threads*; these 139 standards contain 12 textile industry standards, 15 petrochemical industry standards, 70 non-ferrous metal industry standards, 12 pharmaceutical equipment industry standards, 30 automotive industry standards; the commission also approves the amendment (see Schedule II) of 1 non-ferrous metal industry standard of YS/T 318-2007 *Copper Concentrate*; it is announced thereby, and shall be implemented since the date of promulgation. All industry standards mentioned above shall be implemented since May 1, 2008.

The above textile industry standards are published by Textile Industry Publishing House; the petrochemical industry standards are published by China Petrochemical Press; the non-ferrous metal industry standards are published by Standards Press of China; the pharmaceutical equipment & automotive industry standards are published by China Planning Press.

Schedule: numbers and names of 30 automotive industry standards.

National Development and Reform Commission of the PRC

November 14, 2007

Schedule:

Numbers and Names of 30 Automotive Industry Standards

SN	Standard Numbers	Standard Names	Replaced Standards
110	QC/T 476-2007	Rain Proof Performance Limit and Test Method for Bus	GB/T 12480-1990 QC/T 476-1999
111	QC/T 780-2007	Water Radiator Used in Motorcycles	
112	QC/T 688-2007	General Specifications of Motorcycles and Mopeds	QC/T 688-2002
113	QC/T 781-2007	Braking disc for motorcycles and mopeds	
114	QC/T 634-2007	Vehicle Water - Heating Air Heater Mechanism	QC/T 634-2000
115	QC/T 518-2007	Tightening Torque for Automotive Threaded Fasteners	QC/T 518-1999
116	QC/T 323-2007	Motor Vehicles - Door Locks and Door Retention Components	QC/T 323-1999 QC/T 586-1999
117	QC/T 782-2007	Dump Cover-Specifications	
118	QC/T 673-2007	Solenoid Valve of LPG Vehicles	QC/T 673-2000
119	QC/T 674-2007	Solenoid Valve of CNG Vehicles	QC/T 674-2000
120	QC/T 208-2007	Temperature Alarms for Automobile	QC/T 208-1996
121	QC/T 783-2007	Speedometer Sensor for Automobile and Motorcycle	
122	QC/T 727-2007	Instrument for Automobile and Motorcycle	QC/T 727-2004
123	QC/T 213-2007	Automobile and Motorcycle Instrument Terminology	QC/T 213-1996
124	QC/T 784-2007	Electroluminescent Screen for Automobile and Motorcycle Instrument	
125	QC/T 217-2007	Pressure Alarms for Automobile	QC/T 217-1996
126	QC/T 215-2007	Type Methodology for Automobile and Motorcycle Instrument	QC/T 215-1996
127	QC/T 209-2007	Flexible Shaft for Automobile and Motorcycle	QC/T 209-1996
128	QC/T 785-2007	Road Vehicles - Two-Stage Fuel Filters for Compression-Ignition Engines-Mounting and Connecting Dimensions	
129	QC/T 786-2007	Diesel Engines-Heads for Fuel Filters with Vertical Flange-Mounting and Connecting Dimensions	
130	QC/T 787-2007	Diesel Engines - Heads for Fuel Filters with Horizontal Flange-Mounting and Connecting Dimensions	
131	QC/T 788-2007	Performance Requirements and Bench Test Methods of Automobile Pedal Device	
132	QC/T 789-2007	Performance Requirements and Bench Test	

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		Methods of Automobile Electric Vortex Retarder Assembly	
133	QC/T 790-2007	Performance Requirements and Bench Test Methods for Brake Chamber	
134	QC/T 791-2007	Electric Motorcycles and Electric Mopeds-Engineering Approval Evaluation Program	
135	QC/T 792-2007	Motors and Controllers for Electric Motorcycles and Electric Mopeds	
136	QC/T 793-2007	Specifications and Test Methods of Air Filters for Motorcycles and Scooters	
137	QC/T 794-2007	Internal-Combustion Engine Industry Filter Paper	
138	QC/T 795.1-2007	Road Vehicles - Air Filters for Passenger Compartment Part 1: Test for Particulate Filtration	
139	QC/T 795.2-2007	Road Vehicles - Air Filters for Passenger Compartment Part 2: Test for Gaseous Filtration	

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Foreword

The purpose of preparing this Standard is to guide and regulate the manufacture of the motors and controllers for the electric motorcycles and electric mopeds; and promote the quality improvements of the motors and controllers for the electric motorcycles and electric mopeds.

This Standard was proposed shall be under the under the jurisdiction of National Technical Committee for Standardization of Automotive.

Drafting organizations of this Standard: National Center of Supervision and Inspection on Motor Vehicle Quality (Shanghai), China Automotive Technology & Research Center.

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Motors and Controllers for Electric Motorcycles and Electric Mopeds

1 Scope

This Standard specifies the preparation of product model, requirements, test methods, inspection rules and requirements for mark, package, transportation and storage of the drive motors (including motor with reducer) and controller for the electric motorcycles and electric mopeds.

This Standard is applicable to the drive motors (hereinafter referred to as motors) and controllers for electric motorcycles and electric mopeds.

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/T 191-2000 Packaging - Pictorial Marking for Handling of Goods

GB 14023-2006 Vehicles, Boats and Internal Combustion Engine Driving Device – Radio Disturbance Characteristics – Limits and Methods of Measurement

GB/T 2423.5 Environmental Testing for Electric and Electronic Products Part 2: Test Methods Test Ea and Guidance: Shock

GB/T 2423.10 Environmental Testing for Electric and Electronic Products - Part 2: Tests Methods - Test Fc: Vibration (Sinusoidal)

GB/T 4942.1-2001 Classification of Degrees of Protection Provided by Enclosures of Rotating Electrical Machines (IP Code)

GB/T 4942.2-1993 Low Voltage Electrical Enclosure Protection Class

GB/T 5171-2002 General Technical Requirements for Small Power Motors

GB/T 10069.1-2006 Measurement of Airborne Noise Emitted by Rotating Electrical Machines and the Noise Limits Part 1: Method for the Measurement of Airborne Noise Emitted by Rotating Electrical Machines

GB/T 13202-1997 Series of Motorcycle Rims

- c) The motor with rated voltage below 48V (including 48V), and independent power supply, its test voltage (effective value) is 500V; the test voltage (effective value) of other motors is $1000V+2U_N$ (U_N is rated voltage); if the test voltage is below 1500 V, then 1500V shall be subject to.
- d) The test lasts for 1min.

During the test period, the trip current shall be no greater than 5mA. During the test period, no breakdown or arcover phenomena shall occur.

Generally, such test shall not be repeated for the same motor. If it is necessary to repeat this test, then the test voltage for the second test shall be 80% of the specified one above.

When performing the insulation dielectric strength test against the mass-produced motors, the test voltage shall use 120% of the specified one above; test time shall be shortened to 1s.

5.9 Stator resistance

The resistance of stator windings on each phase of motor shall be within the range specified in the enterprise technical document.

5.10 Stator inductance

The inductance of stator windings on each phase of motor, under Frequency 1000Hz, shall be within the range specified in the enterprise technical document.

5.11 Rotation direction of motor rotor

The counterclockwise of one-way outlet motor (one wheel hub motor shall be observed from line end; while the inner rotor motor shall be observed from shaft extension end) is the positive direction.

The rotation direction of two-way outlet one wheel hub motor shall conform to the provision of enterprise technical document.

5.12 No-load current

The motor is run, at rated voltage, for 5 min at no-load, after that maintain the no-load status; the input current of the winding shall be no greater than the limit specified in the enterprise technical document.

5.13 Rated parameters and efficiency of motor

5.13.1 Rated torque, rated speed, and rated output power. Under the working conditions of rated voltage and rated torque, the speed and output power of motor shall be within the scope of deviation specified in the enterprise technical document.

5.13.2 Efficiency. Under the working conditions of ratted voltage and rated torque, the motor efficiency shall be no less than 75%. Under the working conditions of rated voltage, 50% and 160% rated torque, the motor efficiency shall be no less than 70%.

5.14 Motor overspeed

When motor (except the Permanent Magnet Synchronous Motor) is run, under 1.2 times of rated voltage, at no-load and overspeed conditions, for 2min; the mechanical deformation or abnormal noise shall not be occurred.

5.15 Short-term overload of motor

The motor can withstand, under rated voltage, 2.5 times of rated torque (the duration time is 1min); after restart, the motor can run normally.

5.16 Maximum input current of controller

The maximum input current of controller shall be within the scope specified in the enterprise technical document.

5.17 Rated input current of controller

Under the working condition of rated input current of controller stipulated in the enterprise technical document, the controller can run normally for 2h continuously.

5.18 Controller efficiency

The efficiency of controller shall, under the working condition of rated voltage, rated input current, be no greater than 95%.

5.19 Short-term overload of controller

The controller can maintain, under 2.5 times of rated input current, 1min of short-term overload.

5.20 Adjustment function of controller

The open-loop control controller shall have the function to adjust the voltage; the controller with outer loop as the speed close-loop control shall have the function to adjust the speed; while the controller with outer loop as the torque close-loop control shall have the function to adjust the torque.

5.21 Under-voltage protection function of controller

The controller shall have the under-voltage protection function. The under-voltage value shall be specified in the enterprise technical document; when the controller voltage is reduced to the specified under-voltage value, the controller can automatically power-off and stops working.

6.4 Assembly quality

6.4.1 Axial clearance. Install the motor in the horizontally axial direction; place the measuring head of micrometer gauge on the shaft extension top end surface. Exert 100N thrust on the axis along the axial direction back and forth in succession; the difference between two readings of the micrometer gauge is the axial clearance

6.4.2 Radial runout. Fix the motor shell, slowly rotate the motor shaft. Measure the radial runout with a micrometer at the matching position of the shaft extension.

6.4.3 End-face runout. Fix the one wheel hub motor shaft, slowly rotate motor shell. Use micrometer gauge to read the axial runout of rotating circle near the outer edge of the shell end face.

6.5 Leading-out wire and connector assembly

6.5.1 The color of leading-out wire: observed visually.

6.5.2 The strength of leading-out wire of motor: place the shaft of the motor that have the axial (radial) leading-out wires into the vertical (horizontal) position; the leading end of the leading-out wire shall be downward; pull the end of the leading-out wire, gradually increase to the value specified in 5.6.2; when increase the force, the lead wirer core and insulation layer shall withstand uniform force. After that, rotate the motor for 90°, so that the shaft is within the horizontal (vertical) position; repeat the above loading process. Then rotate the motor stator around the axis of the leading-out wire hole clockwise and counterclockwise for 360°, respectively. Finally, check whether the leading-out wire is damaged.

6.5.3 Connector assembly: inspect as per the method specified in the enterprise technical document.

6.6 Insulation resistance

Measured with megger.

6.7 Insulation dielectric strength

Perform insulation dielectric strength test with voltage withstanding tester.

6.8 Stator resistance

Use DC bridge or other instruments that meet the precision requirements to measure the resistance of each phase stator winding of the motor.

6.9 Stator inductance

Use inductance bridge to measure the inductance of each phase stator windings of motor under Frequency 1000Hz.

the test, there is no abnormal sound; after test, no abnormal deformation can be observed visually.

6.14 Short-term overload of motor

Fix the motor onto the torque tester; correctly connect the motor with the controller. Exert rated voltage to the controller, take adjustment command, so that the motor can perform no-load running at idling speed. After running stably, operate the torque tester to gradually increase the motor torque, till the 2.5 times of rated torque specified in the enterprise technical document can be obtained, then run for 1min continuously. After test, visually observe whether the motor has harmful deformation, whether it can re-start, whether it can run normally after start.

6.15 Maximum input current of controller

Fix the motor onto the torque tester; correctly connect the motor with the controller. Exert rated voltage to the controller, take adjustment command, so that the motor can perform no-load running at idling speed. After running stably, operate the torque tester to gradually increase the motor torque, till the input current of controller DC bus reaches the maximum value, then measure the current.

6.16 Rated input current of controller

Fix the motor onto the torque tester; correctly connect the motor with the controller. Exert rated voltage to the controller, take adjustment command, so that the motor can perform no-load running at idling speed. After running stably, operate the torque tester to gradually increase the motor torque, till the input current of controller DC bus reaches rated input current of controller specified in the enterprise technical document, then run for 2h. Visually observe whether the controller can run normally.

6.17 Efficiency of controller

Fix the motor onto the torque tester; correctly connect the motor with the controller. Exert rated voltage to the controller, take adjustment command, so that the motor can perform no-load running at idling speed. After running stably, operate the torque tester to gradually increase the motor torque, till the input current of controller DC bus reaches the rated input current of controller specified in the enterprise technical document. The input power of controller is the product of DC bus voltage of controller and the DC bus current. The controller efficiency is the ratio between controller output power and controller input power.

6.18 Short-term overload of controller

Fix the motor onto the torque tester; correctly connect the motor with the controller. Exert rated voltage to the controller, take adjustment command, so that the motor can perform no-load running at idling speed. After running stably, operate the torque tester to gradually increase the motor torque, till the input current of controller DC bus

6.25.1 The electromagnetic radiation shall be tested as per the method specified in GB/T 18387, GB 14023-2006.

6.25.2 The interference immunity shall be tested as per the measurement method specified in Chapter 9 of GB/T 17619-1998.

6.26 Water-spray resistance

The motor shall be inspected according to the water-spray resistance test condition (during the test, motor is in non-energized state, the leading-out wire is downward) for IP03 products stipulated in GB/T 4942.1-2001, and the qualified assessment method.

The controller shall be inspected according to the water-spray resistance test condition (during the test, controller is in non-energized state, the leading-out wire is downward) for IP03 products stipulated in GB/T 4942.2-1993, and the qualified assessment method.

6.27 Vibration

Fix the motor and controller onto the vibration test bench, and place them into the normal installation position; meanwhile install and fix the hose connecting the motor with controller and other accessories, perform the test as per the provisions of GB/T 2423.10. During the test, motor and controller are in non-working state.

After the completion of test, check the no-load current as per the method specified in 6.11.

6.28 Shock

Fix the motor and controller onto the test bench, respectively; the perform the test as per the method specified in GB/T 2423.5. The peak acceleration, pulse duration, waveform, and the number of shock shall conform to the provisions of Table 4. During the test, motor and controller perform no-load running under rated voltage.

During the test, check, at any time, whether the parts are loose or damaged. After the completion of the test, check the no-load current as per the method specified in 6.11.

6.29 Noise

Hang the motor onto the elastic element, and the motor perform no-loading running under rated voltage; perform the noise test as per the method specified in GB/T 10069.1-2006.

6.30 Service life

The motor shaft shall be place horizontally. Exert 60% rated torque, run at 100% rated speed. Test time shall be the one specified in 5.35, it can be calculated accumulatively; however, each time running duration shall be no less than 2h. During the test, no parts

manufacturer one by one, and attach the certificates, then can they leave the factory.

7.3 Type inspection

7.3.1 The type inspection shall be carried out under one of the following conditions:

- a) When new products are designed and finalized;
- b) When replacing the materials and processes, the performance is affected;
- c) Normal production for 2 years.

7.3.2 Sampling rules: the type inspection shall be carried out among the products sampling from the qualified products in the exit-factory inspection. Totally sampling 6 sets, thereof, 2 sets for service life test, 2 sets for other item tests, 2 sets reserving for re-inspection.

7.3.3 Judgment rules: if one item of 1 set of product is disqualified in the type inspection, then double number of samples are required for such item re-inspection; after that, if there is still 1 set disqualified, then the type inspection is judged disqualified.

8 Mark, Package, Transportation and Storage

8.1 Mark

8.1.1 The motor and controller shall have firm and clear nameplates; the contents of which include:

- a) Model, specification;
- b) Exit-factory number;
- c) Exit-factory date;
- d) Manufacturer name.

8.1.2 The outer surface of the package box shall be marked with the following contents:

- a) Product name, model specification, quantity;
- b) Product implementation standard number;
- c) Net mass and gross mass per box;
- d) Marks of "fragile object", "upward", "fear of rain" shall conform to the provisions