QC

AUTOMOBILE INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 43.140

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QC/T 792-2022

Replacing QC/T 792-2007

Motors and controllers for electric motorcycles and electric mopeds

电动摩托车和电动轻便摩托车驱动用电机及其控制器

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Announcement of Ministry of Industry and Information Technology of PRC

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The Ministry of Industry and Information Technology approved 555 industry standards, such as the "Regulations on mechanical design of chemical plant pipelines" (see Annex 1). Among them, it includes 4 chemical industry standards, 8 petrochemical industry standards, 5 non-ferrous metal industry standards, 3 building materials industry standards, 156 machinery industry standards (including pharmaceutical equipment), 45 automobile industry standards, 6 shipping industry standards, 48 aviation industry standards, 68 light industry standards, 103 textile industry standards, 6 packaging industry standards, 18 electronics industry standards, 85 communication industry standards. It has approved the amendment of one automobile industry standard of "Tail lifting lifts for vehicles" (see Annex 2). It has approved the foreign language versions of 11 industry standards, such as "Travel luggage and bags" (see Annex 3), including 8 light industry standards, 2 textile industry standards, 1 electronics industry standard. It has approved 79 industry standard samples including "Standard sample of Sorbitite content in high carbon steel wire rod" (see Annex 4), including 78 metallurgical industry standards and 1 non-ferrous metal industry. They are all hereby announced. The industry standard amendment list and industry standard samples will be implemented from the date of release.

The above chemical industry standards (engineering construction) and automobile industry standards are published by Beijing Science and Technology Press. The petrochemical industry standards are published by Sinopec Press. The non-ferrous metal industry standards (engineering construction) are published by China Planning Press. The building material standards are published by China Building Materials Industry Press. The machinery industry standards are published by Machinery Industry Press. The machinery (pharmaceutical equipment) industry standards, textile industry standards (including foreign language versions) and packaging industry standards are published by China Standard Publishing House. The ship industry standards are published under the organization by China Shipbuilding Industry Comprehensive Technical and Economic Research Institute. The aviation industry standards are published under the organization of the China Aviation Comprehensive Technology Research Institute. The light industry standard (including the foreign language version) is published by the China Light Industry Publishing House. The electronics industry standard (including the foreign language version) is published, under the organization of the China Electronics Institute of Technical Standardization. The communication industry standard is published by the People's Posts and Telecommunications Press.

Attachment: Number, standard name and implementation dates of 45 automotive industry standards

Ministry of Industry and Information Technology of the People's Republic of China

April 8, 2022

Annex:

Number, standard name and implementation dates of 45 automotive industry standards

No.	Standard No.	Standard name	Replaced standard No.	Date of implementation
177	QC/T 1157-2022	Method of calculating comprehensive energy consumption for unit output of automobile products		2022-10-01
178	QC/T 1158-2022	Method of calculating comprehensive water consumption for unit output of automobile products		2022-10-01
179	QC/T 1159-2022	Guidelines on evaluation of automobile industry green supply chain management		2022-10-01
180	QC/T 1160-2022	Guidelines on evaluation of whole vehicle manufacturing green factory in automobile industry		2022-10-01
181	QC/T 1161-2022	Technical specifications for green-design product assessment - Automobile		2022-10-01
182	QC/T 1162-2022	Honeycomb sandwich structure product for automobile exterior decoration parts		2022-10-01
183	QC/T 1163-2022	Automotive diesel engines - Reduction agent filter for selective catalytic reduction (SCR) system		2022-10-01
184	QC/T 1164-2022	Natural gas filter for road vehicle		2022-10-01
185	QC/T 1165-2022	Carbon canister air filter for gasoline passenger car		2022-10-01
186	QC/T 1166-2022	Streaming mirror view mirror for vehicle		2022-10-01
187	QC/T 1167-2022	Service brake dynamometer squeal noise test methods for passenger cars		2022-10-01
188	QC/T 1168-2022	Performance requirements and bench test methods for vehicle electric air compressor		2022-10-01
189	QC/T 463-2022	Technical requirements and bench test methods for automotive hydrodynamic torque converter assembly	QC/T 29033-1991 QC/T 557-1999 QC/T463-1999	2022-10-01
190	QC/T 792-2022	Motors and controllers for electric motorcycles and electric mopeds	QC/T 792-2007	2022-10-01
191	QC/T 1169-2022	Liquid crystal instrument for automobile		2022-10-01
192	QC/T 1170-2022	Performance film for automotive glass		2022-10-01
193	QC/T 1171-2022	Automotive paint protection film		2022-10-01
194	QC/T 804-2022	Instrument panel assembly and Console assembly for passenger cars	QC/T 804-2014	2022-10-01
195	QC/T 1016-2022	Door trim panel assembly for passenger cars	QC/T 1016-2015	2022-10-01
196	QC/T 768-2022	Toilet of passenger car	QC/T 768-2006	2022-10-01
197	QC/T 580-2022	Mounting dimensions of automobile transmission assembly	QC/T 580-1999	2022-10-01
198	QC/T 1172-2022	Performance requirements and test methods of exhaust muffler for vehicles air brake equipment		2022-10-01
199	QC/T 237-2022	Bench test methods for the performance of automobile parking brake	QC/T 237-1997	2022-10-01

No.	Standard No.	Standard name	Replaced standard No.	Date of implementation
200	QC/T 1173-2022	Road vehicles - Spark-plugs application test methods		2022-10-01
201	QC/T 1174-2022	High voltage fuse of electric vehicles		2022-10-01
202	QC/T 1175-2022	High voltage contactor for electric vehicles		2022-10-01
203	QC/T 1176-2022	Evaporator for automotive air conditioning		2022-10-01
204	QC/T 1177-2022	Condenser for automotive air conditioning		2022-10-01
205	QC/T 633-2022	The seats of passenger vehicles	QC/T 633-2009	2022-10-01
206	QC/T 80-2022	Road vehicles - Polyamide (PA) tubing for air braking systems	QC/T 80-2011	2022-10-01
207	QC/T 1178-2022	Motor vehicle and towed vehicle Pneumatic braking system - Tapped and male fitting		2022-10-01
208	QC/T 1179-2022	Specification for wheel bolts of automobile		2022-10-01
209	QC/T 869-2022	Short-cycle drawn arc welding stud	QC/T 869-2011	2022-10-01
210	QC/T 870-2022	Double end studs bm = 1.25d	QC/T 870-2011	2022-10-01
211	QC/T 871-2022	Double end studs bm = 2d	QC/T 871-2011	2022-10-01
212	QC/T 598-2022	Bolt-for projection welding on the bearing face	QC/T 598-1999	2022-10-01
213	QC/T 599-2022	Overhead projection weld bolts	QC/T 599-2013	2022-10-01
214	QC/T 624-2022	Rubber plugs	QC/T 624-2013	2022-10-01
215	QC/T 603-2022	Clips - Type A	QC/T 603-1999	2022-10-01
216	QC/T 604-2022	Clips - Type B	QC/T 604-1999	2022-10-01
217	QC/T 605-2022	Clips - Type C	QC/T 605-1999	2022-10-01
218	QC/T 606-2022	Clips - Type H	QC/T 606-1999	2022-10-01
219	QC/T 618-2022	Specification for plastic expansion nut	QC/T 618-2013	2022-10-01
220	QC/T 928-2022	Plastic cable and tubing clips with inter-fix hole	QC/T 928-2013	2022-10-01
221	QC/T 929-2022	Plastic cable and tubing clips with side-fix hole	QC/T 929-2013	2022-10-01

Motors and controllers for electric motorcycles and electric mopeds

1 Scope

This document specifies the product model compilation, requirements, test methods, inspection rules for motors (including motors including reducers) and controllers for electric motorcycles and electric mopeds.

This document applies to the motors for electric motorcycles and electric mopeds (hereinafter referred to as motors) and controllers.

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text. Among them, for dated reference documents, only the version corresponding to the H issue is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to this document.

GB/T 755 Rotating electrical machines - Rating and performance

GB/T 1184-1996 Geometrical tolerancing - Geometrical tolerance for features without individual tolerance indications

GB/T 2423.5-2019 Environmental testing - Part 2: Test methods - Test Ea and guidance: Shock (IEC 60068-2-27:2008; IDT)

GB/T 2423.17-2008 Environmental testing for electric and electronic products - Part 2: Test method - Test Ka: Salt mist (IEC 60068-2-11:1981, IDT)

GB/T 4208-2017 Degrees of protection provided by enclosure (IP code)

GB/T 4942-2021 Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification

GB/T 5171.21-2016 Small power motors - Part 21: General test methods

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 (ISO 1680:1999, MOD)

GB/T 10069.3-2008 Measurement of airborne noise emitted by rotating electrical machines and the noise limits - Part 3: Noise limits

GB/T 13202-2015 Series of motorcycle rims (ISO 4249-3:2010, ISO 5995-2:1988, ISO 6054-2:1990, MOD)

GB/T 18387 Limits and test method of magnetic and electric field strength from electric vehicles

GB/T 18488.1-2015 Drive motor system for electric vehicles - Part 1: Specification

GB/T 18488.2-2015 Drive motor system for electric vehicles - Part 2: Test methods

GB 34660 Road vehicles - Requirements and test methods of electromagnetic compatibility

ISO 11898.1 Road vehicle - Controller Area Network (CAN) - Part 1: Data link layer and physical signaling

ISO 11898.2 Road vehicle - Controller Area Network (CAN) - Part 2: High-speed medium access unit

ISO 14229.2 Road vehicles - Unified Diagnostic Services (UDS) - Part2 : Session layer services

ISO 15765.2 Road vehicles - Diagnostics on Controller Area Networks (CAN) - Part 2: Network layer services

ISO 16845.1 Road vehicles - Controller Area Network (CAN) conformance test plan - Part 1: Data link layer and physical signaling

3 Terms and definitions

The following terms and definitions apply to this document.

3.1

Wheel with the outer shell of motor integrated

The motorcycle driving wheel, whose wheel hub and motor casing are made into an integral part.

3.2

Continuous torque

The specified maximum torque that can work continuously for 30 minutes.

ZK - Brushed DC motor controller;

ZWK- Brushless DC motor controller;

YCK - Permanent magnet synchronous motor controller;

JYK - AC asynchronous motor controller;

KCK - Switched reluctance motor controller.

4.2.2 Voltage level

The controller adopts DC voltage input. The voltage level is indicated by the nominal voltage value of the DC bus of the controller. If it is less than three digits, add a 0 in front.

4.2.3 Current level code

The current level of the controller is indicated by the integer value (three Arabic numerals) of the maximum DC input current of the controller. If there are less than three digits, add a 0 in front.

4.2.4 Derivative code

The derivative codes are A, B...

Note: The letters I, N, O, Y are not used.

5 Requirements

5.1 General requirements

The motor shall be idling flexibly, without fixed-rotor friction or abnormal noises (such as periodic abnormal noises, abnormal noises caused by damaged bearings, or abnormal noises caused by foreign objects stuck in the rotating parts, etc.). The controller shall have safety management functions, such as communication, fault diagnosis, calibration and program refresh, which meet the whole vehicle requirements.

5.2 Environmental conditions for use

The motor and controller shall be able to work normally under the following conditions:

- Ambient temperature: -25 °C ~ 60 °C;

- Relative humidity: 0% ~ 100%.

5.3 Rated voltage

The rated voltage shall be the nominal voltage of the DC bus of the controller.

5.4 Appearance

The surface of the motor and controller shall be free of rust, bruises, cracks, peeling of the coating. The fasteners shall be firmly connected. The lead wires shall be intact. The contents of nameplate of the motor and controller shall be correct; the words shall be clear; the background color shall not fade.

5.5 External dimensions and installation dimensions

The external dimensions and installation dimensions of the motor and controller shall comply with the provisions of the technical documents of the enterprise.

5.6 Assembly requirements

5.6.1 Motor's axial clearance

The axial clearance of the power output end of the direct drive motor, non-direct drive independent motor, motor and reducer integrated machine shall not be greater than 0.3 mm.

5.6.2 Radial circular runout

The radial circular runout of the output shaft of the inner rotor motors, such as direct drive motors and non-direct drive independent motors, shall meet the tolerance requirements of level 6 in GB/T 1184-1996. For the motor and reducer integrated machine, the radial circular runout of the output shaft of the reducer shall meet the tolerance requirements of level 6 in GB/T 1184-1996 standard.

5.6.3 End face runout

The end face runout of the outer edge of the integrated wheel-mounted motor wheel shall not exceed 1 mm.

5.7 Sealing performance of cooling circuit in liquid cooling system

For liquid-cooled motors and controllers, there shall be no leakage, when subjected to a pressure not lower than 200 kPa.

5.8 Lead wires and connectors

5.8.1 Color of lead wire

Among the three-phase main winding wires of brushless DC motors, permanent magnet synchronous motors, switched reluctance motors, the U phase wires shall have obvious blue marks; the V phase wires shall have obvious green marks; the W phase wires shall have obvious yellow marks.

5.14 Direction of rotation of the motor rotor

The direction of rotation of the motor rotor shall comply with the provisions of the product technical documentation.

5.15 No-load current

The motor runs at the rated voltage and at the speed specified in the technical documents of the enterprise, for 5 minutes without load. The bus current shall not be greater than the limit value, which is specified in the technical documents of the enterprise.

5.16 Motor performance parameters and efficiency

5.16.1 Operating voltage range

The operating voltage range of the motor system shall comply with the provisions of the product technical documentation.

5.16.2 Continuous torque, continuous power

The continuous torque and continuous power of the motor shall be able to work continuously, at the rated speed for 30 minutes.

5.16.3 Peak torque, peak power, maximum operating speed

The peak torque and peak power of the motor shall comply with the provisions of the product technical documents, among which the electric motorcycle's drive motor shall be able to operate normally for 60 s, under the peak torque and peak power conditions, meanwhile the electric moped's drive motor shall be able to operate normally for 30 s, under the peak torque and peak power conditions. Under the rated voltage, the maximum operating speed of the motor and the size of the load running at the maximum operating speed shall comply with the product technical documents.

5.16.4 Efficiency

Under rated voltage and continuous torque conditions, the maximum efficiency of the motor and controller system shall not be lower than 75%. Under rated voltage, 50% and 160% continuous torque operating conditions, the maximum efficiency of the motor and controller system shall not be lower than 70%.

For the motor and reducer integrated machine, under the rated voltage and continuous torque conditions, the maximum system efficiency of the motor, controller, reducer shall not be lower than 70%. Under rated voltage, 50% and 160% continuous torque conditions, the highest system efficiency of the motor, controller, reducer shall not be lower than 65%.

5.17 Speed control accuracy, torque control accuracy

For the motor system, which has speed control function and torque control function, the control accuracy of speed and torque shall meet the requirements of product technical documents.

5.18 Response time of speed and torque

For the motor system, which has speed control function and torque control function, the response time of speed and torque shall meet the requirements of product technical documents.

5.19 Motor overspeed

Run the motor at 1.2 times the maximum operating speed, for 2 minutes without load; it shall not have mechanical deformation or abnormal noise.

5.20 Maximum input current of controller

The maximum input current of the controller shall be within the range, which is stipulated in the technical documents of the enterprise.

5.21 Rated input current of controller

Under the rated input current condition of the controller, which is specified in the technical documents of the enterprise, the controller shall be able to operate normally for 2 hours continuously.

5.22 Controller efficiency

The maximum efficiency of the controller, under rated voltage and rated input current conditions, shall not be less than 95%.

5.23 Short-term overload of controller

When the motor is running at the peak torque, corresponding to the overload condition of the controller, the controller's overload duration of the electric motorcycle is 60 s; the controller's overload duration of the electric moped is 30 s. After the short-term overload is completed, the controller shall work normally.

5.24 Controller's adjustment function

The controller for open-loop control shall have the function of motor terminal voltage regulation. The controller, whose outer loop is speed closed-loop control, shall have the function of speed regulation. The controller, whose outer loop is torque closed-loop control, shall have the function of torque regulation.

5.25 Controller's overvoltage and undervoltage protection function

The controller shall have over-voltage and under-voltage protection functions. The

the temperature rise limit, which is specified in GB/T 755.

5.32 Low temperature

After placed in cold power-off state at the ambient temperature range of -25 °C ± 1 °C for 2 hours, the insulation resistance of the motor and controller shall meet the low temperature requirements, which are specified in Clause 5.9. The motor and controller shall be able to start in cold state without load. The performance of the motor and controller, after standing still to room temperature, shall meet the requirements of 5.16.2.

5.33 High temperature

Within the ambient temperature range of 60 °C ± 2 °C, after the motor and controller have been running without load for 2 hours, the insulation resistance shall meet the high temperature requirements of 5.9. The performance of the motor and controller, after stand still to room temperature, shall meet the provisions of 5.16.2.

5.34 Temperature cycle test

The motor and the controller shall be able to withstand the alternating temperature cycle test of high temperature 60 °C ± 2 °C and low temperature - 25 °C ± 1 °C; the number of cycles shall be 100; the maintenance time of high temperature and low temperature in each cycle shall be 30 minutes, respectively. The switching time between high temperature and low temperature shall be less than 3 minutes. After the test is completed and allowed to stand to reach room temperature, the insulation resistance of the motor and controller shall meet the requirements in 5.9; the performance shall meet the requirements in 5.16.2.

5.35 Constant damp heat

The motor and controller shall be able to withstand the constant damp heat test, at 40 °C ± 2 °C, relative humidity 90% ~ 95%, for a duration of 48 hours. After the test, the no-load current shall meet the requirements of 5.15; the insulation resistance shall meet the constant damp heat test requirements of 5.9. The appearance rust shall not affect the normal operation; the performance of the motor and the controller shall meet the requirements of 5.16.2, after the motor is allowed to stand still to reach room temperature.

5.36 Electromagnetic compatibility

5.36.1 Electromagnetic radiation

The electromagnetic radiation, which is generated by the motor and controller during operation, shall comply with the provisions of GB/T 18387 and GB 34660.

5.36.2 Immunity to interference

controller reaches the rated input current of the controller, which is specified in the technical documents of the enterprise, for a duration of 2 hours. Visually inspect the controller for normal operation.

6.20 Controller efficiency

Fix the motor on the torque tester. Connect the controller and the motor correctly. Apply the rated voltage to the controller. Adjust the adjustment command, to make the motor run at the rated speed without load. After the operation is stable, the steering torque tester gradually increases the motor torque, until the input current of the DC bus of the controller reaches the rated input current of the controller, which is specified in the technical documents of the enterprise. Read out the controller's input voltage, input current, controller's output power, from the power analyzer. The input power of the controller is the product of the DC bus voltage of the controller and the DC bus current. The efficiency of the controller is the ratio -- of the output power of the controller TO the input power of the controller.

6.21 Short-term overload of controller

Fix the motor on the torque tester. Connect the controller and the motor correctly. Apply the rated voltage to the controller. Adjust the adjustment command, to make the motor run without load in the speed range, which is corresponding to the peak torque. After the operation is stable, the steering torque tester gradually increases the motor torque, until it reaches the peak torque, which is specified in the technical documents of the enterprise. The overload duration of the controller of the electric motorcycle's drive motor is 60 s. The overload duration of the controller of the electric moped's drive motor is 30 s. The controller shall be able to work normally, after the short-time overload is completed.

6.22 Main functions of controller

6.22.1 Adjustment function of controller

Fix the motor on the torque tester. Connect the controller and the motor correctly. Apply the rated voltage to the controller.

Controller of open loop control: Under no-load conditions, adjust the voltage regulation command evenly. Use a voltmeter, to monitor the effective value of the output voltage of the controller, under different voltage regulation commands. Confirm that the effective value of the output voltage of the controller changes with the change of the voltage regulation command.

The controller whose outer loop is the speed closed-loop: Under no-load conditions, apply rated voltage to the controller. Adjust the speed regulation command evenly. Use the tachometer, to measure the motor speed, under different speed regulation commands. Confirm that the motor speed changes with the change of the speed regulation command.

The controller whose outer loop is the torque closed-loop: Evenly adjust the torque regulation command. Use the torque measuring instrument, to measure the motor torque, under different torque regulation commands. Confirm that the motor output torque changes with the change of the torque regulation command.

6.22.2 Overvoltage and undervoltage protection function of controller

Fix the motor on the torque tester. Connect the controller and the motor correctly. Apply the rated voltage to the controller. Adjust the adjustment command, to make the motor run at the rated speed without load. Then increase/decrease the input voltage of the controller to the protection value, which is stipulated in the technical documents of the enterprise. The controller shall be able to stop working automatically.

6.22.3 Over-temperature protection function of controller

Place the controller in the temperature box. Connect the controller and motor correctly. Apply the rated voltage to the controller. Adjust the adjustment command, to make the motor run at the rated speed and continuous torque. Then adjust the temperature of the temperature box, so that the temperature of the controller reaches the limit value, which is specified in the technical documents of the enterprise. The controller shall have the protection function of automatically reducing the output power, stopping the drive motor or cutting off its own power.

Place the motor in the temperature box. Connect the controller and the motor correctly. Apply the rated voltage to the controller. Adjust the adjustment command, to make the motor run at the rated speed and continuous torque. Then adjust the temperature of the temperature box, to make the motor temperature reach the limit value, which is specified in the technical documents of the enterprise. The controller shall have the protection function of automatically reducing the output power, stopping driving the motor or cutting off its own power.

6.22.4 Overcurrent protection function of controller

Fix the motor on the torque tester. Connect the controller and the motor correctly. Apply the rated voltage to the controller. Adjust the adjustment command, to make the motor run at the rated speed without load. After the operation is stable, the steering torque tester gradually increases the motor torque, until the current reaches the maximum input current of the controller, which is specified in the technical documents of the enterprise, or when the phase current output of the controller reaches the maximum output current condition, THEN, continue to increase the motor torque by operating the torque tester. The controller shall have the function of maintaining the work within the current limit range. If a short circuit occurs, the controller shall have the protection function of stopping the output of the current or cutting off the power itself.

6.22.5 Braking energy recovery function of controller

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