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Safety technical specification for electric bicycle

电动自行车安全技术规范

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Safety technical specification for electric bicycle

1 Scope

This document specifies the technical requirements for electric bicycles, such as bicycle marking, bicycle safety, mechanical safety, electrical safety, fire retardancy, plastic ratio, Beidou positioning function, communication and dynamic safety monitoring, anti-tampering, instruction manual, enterprise quality assurance capability, product consistency; describes the corresponding test methods.

This document applies to electric bicycles.

2 Normative references

The contents of the following documents constitute the essential terms of this document through normative references in the text. Among them, for dated references, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies to this document.

GB/T 755-2019 Rotating electrical machines - Rating and performance

GB 811 Helmets for motorcycle and electric bicycle users

GB/T 3565.1-2022 Safety requirements for bicycles - Part 1: Terms and definitions

GB 3565.2-2022 Safety requirements for bicycles - Part 2: Requirements for city and trekking, young adult, mountain and racing bicycles

GB/T 3565.4-2022 Safety requirements for bicycles - Part 4: Braking test methods

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

GB/T 5169.16 Fire hazard testing for electric and electronic products - Part 16: Test flames - 50 W horizontal and vertical flame test methods

GB/T 5296.1 Instructions for use of products of consumer interest - Part 1: General principles

GB/T 5454 Textiles - Burning behavior - Oxygen index method

GB/T 5455 Textile - Burning behavior - Determination of damaged length, afterglow time and after-flame time of vertically oriented specimens

functions.

3.2 Abbreviations

The following abbreviations apply to this document.

PDOP: Position Dilution of Precision

4G: the 4th Generation mobile communication technology

5G: the 5th Generation mobile communication technology

4 General requirements

4.1 Electric bicycles shall not be dangerous in normal use, reasonably foreseeable misuse, malfunction. Dangers include but are not limited to the following situations:

- a) The heat generated causes material deterioration, fire or burns;
- b) Burning, explosion, electric shock, etc. during charging, driving, parking, etc.;
- c) Personal injury caused by the breakage, loosening, deformation, motion interference of the whole bicycle or parts.

4.2 The software and hardware of electric bicycles shall have anti-tampering design, to prevent unauthorized modification or change of the maximum speed, motor power, voltage, etc.

4.3 Unless otherwise specified, the testing equipment and instruments used in this document shall comply with the provisions of relevant standards such as GB/T 12742.

The accuracy level of the instrument used to test electrical devices (except for withstand voltage testers and insulation resistance testers) shall not be lower than level 1; the ripple factor of the DC power supply shall not be greater than 5%.

During the test, the capacity of the on-board battery pack shall not be less than 90% of its rated capacity.

If riding-related tests are involved, such as 6.1.1, 6.1.2, 6.1.8, etc., the test conditions are:

- a) Road test environment: Temperature is $-5\text{ }^{\circ}\text{C} \sim 35\text{ }^{\circ}\text{C}$; wind speed is not more than 3 m/s; the test shall not be carried out in rainy or snowy weather;
- b) Test road surface: Flat asphalt or concrete road surface, the road surface shall be hard, without soft dust or gravel; the minimum friction coefficient between the

dry road surface and the tire is 0.5;

- c) Bicycle speed detection equipment: Accuracy $\pm 2\%$, resolution 0.1 km/h;
- d) The mass of the rider is 75 kg; the weight is increased to 75 kg if it is insufficient;
- e) The test bicycle is a fully assembled electric bicycle;
- f) The tire shall be fully inflated according to the maximum recommended pressure marked on the outer tire; the pressure deviation is ± 10 kPa.

5 Bicycle marking

5.1 Nameplate

The nameplate shall indicate the following information in Chinese: Product name, model, manufacturer name or trademark, production date/manufacturing date, battery type, etc.

Note 1: Product name, such as electric bicycle, electric-assisted bicycle, etc.

Note 2: Battery type, such as lead-acid battery, lithium manganese oxide battery, lithium iron manganese phosphate battery, lithium iron phosphate battery, sodium ion battery, etc.

The nameplate shall also indicate the recommended service life, in the format of "The recommended service life of this bicycle is $\times$ years".

Note 3: The recommended service life of electric bicycles is determined by the manufacturer, based on a comprehensive consideration of various factors such as the service life and aging rate of the main components and electrical circuits of the bicycle.

Electric bicycles used for commercial activities such as urban logistics and commercial leasing shall be marked with "commercial" or the character "商" on the nameplate.

The content indicated on the nameplate shall be standardized, clear, durable, easy to identify.

Use a cotton cloth dipped in water to wipe the nameplate for 15 s; then use a cotton cloth dipped in 75% (volume fraction) alcohol to wipe it for 15 s. After the test, the information shall be complete and clear; there shall be no curling.

5.2 Bicycle coding

The unique bicycle coding of each electric bicycle shall be permanently marked on the

The parts engraved with the bicycle code shall not be processed by grinding, patching, gasketing, etc. When observed from the top or front, there shall be no covering on the surface of a large enough area around the engraving area; if there is a covering, the surface of the covering shall be clearly marked with the words "bicycle code", meanwhile the covering can be directly removed, uncovered and restored without using any special tools, so that a large enough surface including the engraving area can be easily observed.

If paint, coating, plating and other materials are used in the bicycle code engraving area, the height of the engraved font shall be greater than or equal to 4 mm before and after engraving, which shall be clearly visible.

The bicycle code shall be marked with high temperature resistant permanent marking. Put the sample of the engraved area into a heating furnace at $(950 \pm 10) ^\circ\text{C}$; keep it at this test temperature for 0.5 h. Then take out the specimen and cool it naturally to room temperature in the air. After the test, the bicycle code shall be clearly visible.

If the bicycle frame is made of materials that are not resistant to high temperatures, such as aluminum alloy, magnesium alloy, etc., the code shall be engraved on the frame of the whole bicycle; the same code shall be engraved with high-temperature resistant materials within 5 cm from the edge of the code and fixed on the frame.

5.3 Motor code

The motor code shall at least include information on the motor power and rated voltage; it shall be permanently engraved on the motor housing and shall be easy to observe and read.

5.4 License plate installation position

The rear of the electric bicycle shall have a convenient location for installing the license plate, which shall have 2 mounting holes and the center spacing shall be 80 mm.

5.5 Product certificate

The product certificate shall clearly indicate the product name, model, manufacturer or trademark, manufacturer and address, production date/manufacturing date, bicycle code, motor code, drive mode (electric drive and/or electric power), maximum design speed, bicycle mass, motor power and rated voltage, battery type, length/width/height, front and rear wheel center distance, nameplate fixing position, bicycle code position, recommended service life, other information, whether it is used for business activities such as urban logistics or commercial leasing, as well as bicycle photos, etc.

Note: Other information such as China Compulsory Certification (CCC) certificate number, etc.

The above information shall be indicated in the product certificate using a QR code, where the QR code shall comply with the provisions of GB/T 18284.

6 Safety requirements and test methods

6.1 Bicycle safety

6.1.1 Speed limit

6.1.1.1 Speed limit requirements

The speed limit of electric bicycles shall comply with the following requirements.

- a) When driving with the electric drive function, the maximum speed shall not exceed the maximum design speed; the maximum design speed shall not exceed 25 km/h. If the speed exceeds 25 km/h, the motor shall not provide power output.

Note: In the case of continuous downhill driving, the speed may exceed 25 km/h.

- b) When driving with the electric power assist function, if the speed exceeds 25 km/h, the motor shall not provide power output.

6.1.1.2 Speed limit test method

The test shall be carried out in accordance with the following provisions.

- a) Speed limit test of electric bicycles with electric drive function: Check the instruction manual to confirm whether the maximum design speed exceeds 25 km/h; the test bicycle starts to accelerate from rest, the speed control handle shall be kept at the maximum opening. The test bicycle reaches the maximum speed and maintains the maximum speed. Pass the 2 m test section and record the speed value passing the test section; the test is carried out twice, the average value is taken to compare whether the average value is less than the maximum design speed specified in the manual. The speed control handle shall be kept at the maximum opening; the power device shall be used to assist the bicycle under test to reach and maintain a speed of 24.5 km/h ~ 25.5 km/h. Measure whether the motor drive current drops to 0 A.
- b) Speed limit test of electric bicycles with electric power assist function: The driving wheel of the test bicycle is in contact with the drum; the ammeter is connected in series to the circuit of the battery pack output end. Use the electric power assist function to adjust the driving wheel speed of the test bicycle to 25 km/h; record the working current at this time to see whether it is less than or equal

The size limits of electric bicycles shall meet the following requirements.

- a) The height of the whole bicycle (excluding the rearview mirror and the rearview mirror connecting rod) is less than or equal to 1100 mm; the width of the bicycle body (excluding the handlebars, pedals, rearview mirrors and the rearview mirror connecting rod) is less than or equal to 400 mm; the center distance between the front and rear wheels is less than or equal to 1250 mm; the saddle height is greater than or equal to 635 mm. The requirements for the height and center distance of the front and rear wheels of electric bicycles with only electric power assist function are not applicable.

Note: To ensure driving safety, electric bicycles are encouraged to install rearview mirrors.

- b) The length of the saddle is less than or equal to 350 mm.
- c) The maximum width of the flat part of the hanger above the rear wheel is less than or equal to 175 mm. The rear hanger shall be a flat or nearly flat structure made of metal bars, tubes, etc., with a thickness not exceeding 40 mm. Metal bars can be used to strengthen the fixation with the bicycle body, but the rear hanger itself and the metal reinforcement bars shall not be covered by the exterior parts; the height of the flat part of the rear hanger shall be significantly lower than the height of the bottom of the saddle. If the taillights are attached to the rear hanger, they shall not block the main metal structure on both sides of the rear hanger.

6.1.5.2 Dimension limit test method

Dimension limits are measured according to the following provisions.

- a) Dimensions:
 - 1) Bicycle height: The front and rear wheels of the test bicycle are on the ground; the bicycle body is perpendicular to the support surface; the distance between the support surface and the highest point of the handlebar of the test bicycle is measured (excluding the rearview mirror and the rearview mirror connecting rod);
 - 2) Bicycle width: Use length measuring tools to measure (excluding the handlebar, pedals, rearview mirror and rearview mirror connecting rod);
 - 3) Front and rear wheel center distance: Adjust the front and rear wheel center planes to be parallel; use length measuring tools to measure the distance between the front axle center and the rear axle center;
 - 4) Saddle height: The front and rear wheels of the test bicycle are on the ground; the bicycle body is perpendicular to the support surface; the maximum vertical height between the saddle and the support surface is measured with a measuring tool. If the saddle tube is adjustable, adjust the saddle tube to the

minimum insertion depth before measuring.

b) Saddle length:

- 1) The front and rear wheels of the test bicycle are on the ground; the bicycle body is perpendicular to the support surface. On the longitudinal centerline of the test bicycle, select the intersection of the saddle where the front and rear edges of the saddle are 30° with the horizontal plane as the front and rear ends of the saddle (see Figure 2); mark them. Along the surface of the seat cushion, use a measuring tool to measure the distance between the front and rear ends of the seat cushion;
- 2) For models with two or more saddles installed, the length of each saddle shall be tested; the total saddle length after accumulation shall be less than or equal to 350 mm;
- 3) Except for the rear hanger, the length of the flat or nearly flat structure at the rear of the electric bicycle saddle in the longitudinal direction of the bicycle body is included in the total length of the saddle;
- 4) For models with a rear hanger installed, if there is a flat or nearly flat structure after the rear hanger is removed, its length in the longitudinal direction of the bicycle body shall also be included in the total length of the saddle;
- 5) The length of the bicycle body base for installing the saddle in the longitudinal direction of the bicycle body shall not exceed 400 mm; it shall not extend forward and backward (the bicycle body base for installing the saddle refers to the basically complete bicycle body outline located below the saddle, which is covered or spliced with exterior parts. The starting position is approximately behind the footrest or the middle axis; it extends backward to the rear of the bicycle. When measuring, it shall be measured from the front end of the bicycle body base for installing the saddle to the rear end of the bicycle. The frame, lights, fenders and other parts designed as an integral part of the bicycle body shall also be included in the length of the bicycle body base, but the rear hanger, flat fork, wheel parts are not included. For those which are difficult to determine the front end of the bicycle body base, the front end of the saddle shall be used as the measurement starting point).

c) Hanger width:

Measure and check with length measuring tools.

6.1.6 Structure

6.1.6.1 Pedal clearance

The pedal clearance of electric bicycles with pedal riding function shall comply with

D - Driving wheel diameter, in meters (m);

n - Driving wheel speed, in revolutions per minute (r/min).

6.1.7.2.2 Prompt sound pressure level

The prompt sound pressure level shall be measured in accordance with the following provisions.

a) Test environment:

- 1) The test site is a flat ground with a dry surface made of concrete, asphalt or hard materials with high reflectivity (excluding compacted soil or other natural materials). A rectangular test area is marked in the site; the four sides of the rectangle are at least 3 m away from the outer contour of the test bicycle (excluding the handlebars). There are no obstacles that affect the sound level meter reading within this range; the distance between the sound level meter microphone and the edge of the road shall be no less than 1 m;
- 2) During the test, except for the test personnel and the rider, no other personnel shall be in the test area; the position of the test personnel and the rider shall not affect the instrument reading;
- 3) The test is carried out indoors or outdoors. When it is carried out outdoors, there must be no rain or snow and the wind speed is not more than 3 m/s; the influence of gusts on the sound level meter reading is eliminated during the test;
- 4) During the test, the background noise (A-weighted sound level) is not higher than 50 dB(A).

b) Test method:

- 1) Acoustic measuring instrument: The sound pressure level is measured using a sound level meter with first-level accuracy;
- 2) Place the test bicycle on the test site and lift the driving wheels off the ground. Place sound level meters on both sides of the bicycle at a distance of 2 m from the center of the bicycle body and a height of 1.2 m, for measurement;
- 3) Turn on the circuit and adjust the bicycle speed to the prompt sound; read the maximum reading of the sound level meter respectively; calculate the average reading of the sound level meter on the left and right sides (keep the integer).

6.1.8 Water splashing and wading

6.1.8.1 Water splashing and wading requirements

The test is carried out according to the water splashing and wading test method specified in 6.1.8.2. After the test, the electric bicycle shall be able to ride normally; all electrical components shall function normally; the insulation resistance value shall be greater than or equal to 1 MΩ.

6.1.8.2 Water spraying and wading test method

6.1.8.2.1 Water spraying

The water spraying test is carried out according to the following provisions:

- a) The test bicycle body is perpendicular to the support surface, the driving wheel is off the ground, the circuit is turned on before the test;
- b) Use a sprinkler device that meets the IPX3 requirements of GB/T 4208-2017, with a flow rate of 10 L/min $\pm$ 0.5 L/min and a duration of 10 min, to spray the test bicycle with water (tap water) in all directions.

Note that after the water spraying test, the wading test shall be carried out within 5 min.

6.1.8.2.2 Water wading

This test is carried out in a pool with a water depth of 100 mm; the electric bicycle is driven at a speed of 15 km/h for 500 m. If the length of the pool cannot meet the specified continuous driving time, it can be carried out back and forth, but the total driving time (including the time outside the pool) shall be less than 10 min.

6.1.8.2.3 Post-test measurement

After the wading test, check whether the electric bicycle can be ridden normally and whether the functions of the electrical components are normal; at the same time, measure the insulation resistance of the test bicycle within 5 minutes. Disconnect the battery circuit; connect one end of the 500 V insulation resistance tester to the positive or negative pole of the test bicycle circuit; connect the other end to the frame, handlebars and motor housing in turn; measure the insulation resistance of the test bicycle.

6.1.9 Data storage function

Electric bicycles used for commercial activities such as urban logistics and commercial leasing shall store the position and driving speed information of the last 20 stops within 1 minute before each second. The driving speed is the speed converted from the electric bicycle motor speed.

Check and verify compliance through enterprise-specific software or host computer.

6.2.1.3.1 Requirements

After testing according to the test method specified in 6.2.1.3.2, the assembly shall have no visible cracks or damage; no separation of the assembly and any part of the shock-absorbing system shall occur.

6.2.1.3.2 Test method

This test shall be carried out on the frame/front fork and roller assembly used in 6.2.1.2.

The assembly shall be supported on the rear axle, so that it can rotate freely in a vertical plane around the rear axle. The front fork shall be placed on a flat steel anvil so that the frame is in its normal use position. A weight of 70 kg shall be fastened to the seat tube and its center of gravity shall be placed on the axis of the seat tube 75 mm from the upper end of the seat tube. The assembly shall be rotated around the rear axle, so that the center of gravity of the 70 kg weight is vertically placed above the rear axle; then the assembly shall be allowed to fall freely and impact on the steel anvil (see Figure A.2 in Appendix A).

This test shall be repeated twice.

For test bicycles with the battery pack installed on the frame, this component shall be included in the test. If this affects the normal progress of the test, the battery pack may be removed and the corresponding weight may be added to the corresponding position.

If the frame is equipped with a shock-absorbing front fork, the assembly shall be tested so that the front fork is in a free length in a no-load state. If the shock-absorbing spring can be locked, it shall be locked at no-load length. For frames equipped with rear shock absorbers, tighten the shock absorber in the same way as if a 75 kg rider were sitting on the test bike; if the shock absorber is not allowed to be locked, a solid connection of the same size may be used instead of the spring and shock absorber; the connection method at both ends shall be the same as the spring and shock absorber.

6.2.2 Stem and saddle tube (when applicable)

6.2.2.1 Stem safety line

There shall be a permanent mark on the stem tube, to clearly indicate the minimum depth of the stem tube inserted into the front fork stem, or a reliable permanent device to ensure its minimum insertion depth. The insertion mark or insertion depth shall be no less than 2.5 times the tube diameter measured from the end of the stem tube; there shall be at least one tube diameter length of tube material without a groove below the mark. The insertion mark shall not damage the strength of the stem tube.

Visually inspect the stem tube for safety line marks or devices; measure the safety line position.

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