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Safety technical specification for batteries used in electric wheelchairs

电动轮椅车用电池安全技术规范

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5 General safety requirements

5.1 General security considerations The safety of batteries and battery packs is considered from two application conditions.

a) Intended use;

b) Reasonably foreseeable misuse, abuse, and malfunction conditions.

5.2 Safe Operating Parameters To ensure the safe use of batteries and battery packs under different conditions, their safe operating conditions should be specified, including temperature range and voltage range. Parameters such as current range. Due to differences in battery material systems and structures, their safe operating parameter values may vary.

6 Battery electrical safety requirements

6.1 High-Temperature External Short Circuit After fully charging the battery according to the test method specified in 4.5.1, place it in an environment of 57 °C ± 4 °C until the battery temperature reaches... After being heated to 57°C±4°C, leave it for another 6 hours. Then connect the positive and negative terminals of the battery with wires, ensuring that the total external resistance is 20 mOmega±5 mOmega. During the test, the battery temperature

was monitored. The test was terminated when the battery surface temperature dropped to 57 °C±4 °C and was maintained for another 1 hour. The surface temperature of the battery should not exceed 170 °C. The battery should not disintegrate, crack, or catch fire.

6.2 Overcharging After fully charging the battery according to the test method specified in 4.5.1, charge it with the maximum charging current (Icm) specified by the manufacturer. The battery temperature will be monitored during the test, and the test will be terminated if any of the following conditions are met.

1.5 times the charging limit voltage for 1 hour, then continue constant voltage charging.

b) The total charging time reaches

1.5 hours. The battery should not catch fire or explode.

6.3 Forced Discharge After discharging the battery according to the test method specified in 4.5.2, reverse charge it with a current of 1It until the negative upper limit of the charging voltage. The total charging time is 90 minutes. If the voltage reaches the negative upper limit of battery charging within 90 minutes of reverse charging, the voltage should be maintained by reducing the current to continue charging. The experiment was terminated after reverse charging for a total of 90 minutes, as shown in Case 1 of Figure 1. If the voltage does not reach the negative battery charging upper limit voltage within 90 minutes of reverse charging, the reverse charging test will be terminated after a total of 90 minutes. The test is shown in Figure 1, Case 2.

7 Battery Environmental Safety Requirements

7.1 Low pressure After fully charging the battery according to the test method specified in 4.5.1, place the battery in a vacuum chamber at 20 °C ± 5 °C, and evacuate the chamber. The pressure was reduced to less than or equal to

11.6 kPa (simulated altitude 15,240

m) and maintained for at least 6 hours. The battery should not catch fire, leak gas, disintegrate, crack, or leak liquid. After the test, the open circuit voltage should not be lower than 90% of that before the test.

7.2 Temperature Cycling After fully charging the battery according to the test method specified in 4.5.1, place it in a temperature-controlled chamber at a temperature of 20 °C ± 5 °C for testing. The next step (as shown in Figure 2).

a) Raise the temperature of the test chamber to 72 °C±2 °C and maintain it for 6 h;

b) Reduce the temperature of the test chamber to -40 °C ± 2 °C and maintain this temperature for 6 h;

b) for a total of 10 cycles;

d) Store at room temperature (20 °C ± 5 °C) for at least 24 h. During the experiment, the transition time between any two temperatures shall not exceed 30 minutes. For large batteries, the holding time in

b) should be 12 h.

7.3 Vibration After fully charging the battery according to the test method specified in 4.5.1, secure the battery to the vibration test bench and perform the test according to the parameters in Table 6. String vibration test.

7.10 Lithium plating After repeated charge and discharge cycles, lithium-ion batteries should not release lithium metal that could compromise safety. The following tests are used for detection.

7.11 Thermal runaway

7.11.1 Requirements The batteries in the battery pack shall undergo thermal runaway tests in accordance with

7.11.2 and 7.11.3.The batteries shall not catch fire or explode.

7.11.2 Test Subjects The test subject was a battery.

7.11.3 Test Methods

7.11.3.1 The test environment temperature is 25 °C±5 °C, the relative humidity is 15%~90%, and the atmospheric pressure is 86 kPa~106 kPa.

7.11.3.2 A planar or rod-shaped heating device shall be used, and its surface shall be covered with a ceramic, metal, or insulating layer. The power requirements for the heating device are as follows: See Table

7.Complete the assembly of the test object and the heating device. The heating device should be in direct contact with the battery, and the size of the heating device should not be large. The temperature monitoring device is installed on the heated surface of the test object, with the temperature sensor positioned away from heat conduction, as shown in Figure 5. The location is shown. The sampling interval for temperature data should be less than 1 second, the accuracy requirement is ±2 °C, and the diameter of the temperature sensor tip should be less than 1 mm.

8 Environmental safety requirements for battery packs

Note. This chapter applies to battery packs, as well as the overall sample consisting of a non-user-replaceable battery pack and its electric wheelchair.

8.1 Low pressure After fully charging the sample according to the test method specified in 4.5.1, conduct a low-pressure test, the test method of which is described in 7.1. The sample

should not ignite, leak gas, disintegrate, crack, or leak liquid, and the open circuit voltage after the test should not be lower than 90% of that before the test.

8.2 Temperature Cycling After fully charging the sample according to the test method specified in 4.5.1, conduct a temperature cycling test, the test method of which is described in 7.2. For large battery packs weighing more than 12 kg, the holding time specified in 7.2a) and

b) shall be 12 h. The sample should not ignite, leak gas, disintegrate, crack, or leak liquid, and the open circuit voltage after the test should not be lower than 90% of that before the test.

8.3 Vibration After fully charging the sample according to the test method specified in 4.5.1, secure the sample to the vibration test bench with a mass not exceeding 12 kg. The test method for battery packs is given in 7.3; the test method for battery packs with a mass greater than 12 kg is to perform sinusoidal vibration testing according to the parameters in Table 8.

8.5 drop After fully charging the sample according to the test method specified in 4.5.1, it was subjected to free fall dropping from a height of 1 m and in the manner specified in the test method, into a mixed environment. On the concrete slab, the square battery pack has six surface directions, while the cylindrical battery pack has an axial direction and two perpendicular radial directions (both positive and negative). Each test was performed once, for a total of six tests. The time interval between each test was 5 min ± 1 min. After the test, the test was left to stand for 4 hours.

8.6 Stress Relief The structure of a molded or injection-molded thermoplastic shell should ensure that the shell material releases the internal stress generated by the molding or injection molding process. Under stress, any shrinkage or deformation of the outer shell material will not expose the internal components. After fully charging the sample according to the test method specified in 4.5.1, place it in a forced-air constant temperature chamber at 70 °C±2 °C for 7 h, and then remove the sample. The product was then brought back to room temperature.

8.7 Water immersion The sample was fully charged according to the test method specified in 4.5.1. The test sample should be immersed in a saline solution (3.5% NaCl aqueous solution) at room temperature for at least 30 minutes. The water depth should be at least... It did not exceed the highest point of the test sample by 1 cm.

8.8 Flame retardant requirements

8.8.1 General Requirements For battery pack systems, the materials used for encapsulation should limit the spread of flame, and their flame retardancy rating should meet the requirements of