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Traction batteries for electric earth-moving machinery - Part 1: Safety requirements

电动土方机械用动力电池 第1部分：安全要求

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1 Scope

Part 1 of China's national standard for the traction batteries of electric earth-moving machinery, covering safety. A construction machine's battery faces a duty that a road vehicle's does not. It is charged and discharged at high rates continuously through a shift rather than once a day; it is subjected to shock and vibration far beyond automotive levels; it sits in a machine that works in dust, mud and water and that may be operated on a slope or in a confined space underground. It is also large - hundreds of kilowatt hours in a machine of any size - which makes the consequences of a thermal event correspondingly larger, in a location where there may be no way to move the machine and no water. The safety

requirements therefore address the mechanical protection of the pack, the detection and containment of a cell failure, and the isolation and rescue provisions for a machine that cannot be driven away.

This document specifies the safety requirements for power battery cells, battery packs or battery systems for electric earthmoving machinery; describes the relevant test methods. This document is applicable to the manufacture of power lithium-ion batteries for electric earthmoving machinery; the manufacture of other types of power batteries is implemented with reference to it.

2 Normative references

The contents of the following documents constitute essential clauses of this document through normative references in the text. Among them, for referenced documents with dates, only the version corresponding to that date applies to this document; for referenced documents without dates, the latest version (including all amendments) applies to this document.

GB/T 2423.4 Environmental testing for electric and electronic products - Part

4.1 Symbols The following symbols apply to this document. I

1.1 h rate discharge current (A), whose value is equal to the rated capacity value. I

3.3 h rate discharge current (A), whose value is equal to 1/3 of the rated capacity value.

5.1 Safety requirements for battery cells

5.1.1 Battery cells shall not catch fire or explode, when subjected to over-discharge test in accordance with 8.1.2.

5.1.6 The battery cell shall be subjected to extrusion test in accordance with

8.1.7 and shall not catch fire or explode.

5.2 Safety requirements for battery packs or battery systems

5.2.1 The battery pack or battery system shall be subjected to vibration test in accordance with

8.2.1 and shall not have leakage, shell rupture, fire or explosion; it shall not trigger the voltage and temperature sharp change thresholds specified by the manufacturer. The insulation resistance after the test shall not be less than 100 Omega/V.

5.2.7 The battery pack or battery system shall be subjected to the external fire test in accordance with

8.2.7 and shall not explode.

5.2.8 The battery pack or battery system shall be subjected to the temperature shock test in accordance with 8.2.8; it shall not have leakage, shell rupture, fire or explosion. The insulation resistance after the test shall not be less than 100 Omega/V.

5.2.9 The battery pack or battery system shall be subjected to salt spray test in accordance with 8.2.9; there shall be no leakage, shell rupture, fire or explosion. The insulation resistance after the test shall not be less than 100 Omega/V.

6.1.5 The battery pack or battery system shall be tested for insulation resistance before all tests and after some tests. The test location is between the two terminals and the electrical platform. It is required that the measured insulation resistance value divided by the maximum operating voltage of the battery pack or battery system is not less than 100 Omega/V. The test method shall be in accordance with the provisions of Appendix C.

6.1.6 If the battery pack or battery system is not suitable for certain tests due to some reasons (such as size or mass), the manufacturer and the testing agency may use the subsystem of the battery pack or battery system as the test object for all or part of the test after consultation;

6.1.7 Method for adjusting SOC to the test target value n. fully charge the battery pack or battery system according to the charging method provided by the manufacturer; let it stand for 1 hour; discharge it at a constant current of 1 I3.

6.1.8 The charge and discharge rate, charge and discharge method, charge and discharge cut-off conditions during the test shall be provided by the manufacturer.

6.1.9 The rated capacity of a battery cell, battery pack or battery system shall comply with the product technical conditions provided by the manufacturer.

6.2 Accuracy of measuring instruments and meters The accuracy of measuring instruments and meters shall not be less than the following requirements.

6.3 Test process error The error requirements between the control value (actual value) and the target value are as follows:

6.4 Data recording and recording interval Unless otherwise specified, the recording interval of test data (such as time, temperature, current, voltage, etc.) shall not be greater than 15 s.

7.1 Battery cell test preparation

7.1.1 Standard charging The battery cell is first discharged with a current specified by the manufacturer and not less than 1I3 to the discharge termination voltage specified in the manufacturer's technical conditions.

7.2.2.3 Unless otherwise specified in the specific test items, the test shall be started within 24 hours after the pretreatment cycle is completed and fully charged; otherwise, a standard charge shall be performed again.

8.1 Test method for battery cell safety

8.1.1 General requirements All safety tests are carried out under environmental conditions with sufficient safety protection. If the test object has additional active protection circuits or devices, they shall be removed.

8.1.3 Over-charge

8.1.3.1 The test object is a battery cell.

8.1.3.4 After completing the above test steps, observe at the test environment temperature for 1 hour.

8.2.6.1 Dustproof

8.2.6.2 Waterproof 8.2.6.2.1 The test object is a battery pack or battery system that has passed the dustproof test in 8.2.6.1. 8.2.6.2.3 Take the test object out of the water. Observe it at the test environment temperature for 2 hours.

8.2.7 External fire

8.2.7.1 The test object is a battery pack or battery system. The body structure that protects the battery pack or battery system can participate in the fire test.

8.2.7.2 The test environment temperature is above 0 °C and the wind speed is not more than

2.5 km/h. system manufacturer, until the test is completed.

8.2.12 Overcurrent protection

8.2.12.1 The test object is a battery system that can be powered by an external DC power supply.

8.2.12.2 The test conditions are as follows:

8.2.12.3 Perform overcurrent test in accordance with the battery system manufacturer's data.

8.2.12.4 The test ends when any of the following conditions are met.

8.2.12.5 After completing the above test steps, observe at the test environment temperature for 1 h.

8.2.13 External short-circuit protection

8.2.13.1 The test object is a battery system.