ICS 29.220.99
CCS K 82

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 42729-2023

Guidelines for safety use of lithium ion cells and batteries

锂离子电池和电池组安全使用指南

Issued on: August 6, 2023 **Implemented on: March 1, 2024**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

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1 Scope

GB/T 42729-2023 gives safety guidance for using lithium-ion cells and battery packs. The cell is safe within a window of voltage, current and temperature and dangerous outside it,

and almost every fire traces back to the same few causes: charging above the upper voltage, drawing current the cell cannot deliver, using it hot or cold, or physical damage that shorts it internally. Most of those are decided by the equipment the cell is put into rather than by the cell, which is why the standard is addressed largely to equipment manufacturers. It sets out the possible hazards - leakage, overheating, electric shock, fire and explosion - then the recommendations to equipment manufacturers on protection function management and on voltage, current and temperature management, followed by the guidance to users on charging, storage, transport and disposal. It took effect on 1 March 2024.

This document provides safety guidance and suggestions during the use of lithium-ion cells and battery packs; provides relevant information about possible dangers that lithium-ion cells and battery pack manufacturers provide to users. This document applies to the use of lithium-ion cells and battery packs.

2 Normative references

This document does not have normative references.

3 Terms and definitions

The following terms and definitions are applicable to this document.

3.1 Lithium ion cell A device, that relies on the movement of lithium ions between the positive and negative electrodes, to convert chemical energy into electrical energy; it is designed to be rechargeable.

Note: The device includes electrodes, separators, electrolytes, containers, terminals, etc.

3.2 Module Configurations with multiple cells connected in series or parallel, which may or may not have protective devices [such as fuses or positive temperature coefficient thermistors (PTC)] and monitoring circuits. [Source: IEC 62619: 2017, 3.9]

3.3 Battery pack An energy storage device, which is electrically connected by one or more batteries or modules.

Note 1: It may include protection and monitoring devices, that provide information (such as battery voltage) to the battery system.

Note 2: It may include a protective cover, which is provided by the terminal or other interconnection device. [Source: IEC 62619: 2017, 3.10]

3.4 Battery protection circuit module; PCM Battery management unit; BMU Battery management system; BMS A circuit board, circuit module or electronic system, which has the core function of controlling the charging and discharging behavior of the battery pack, to protect battery safety.

Note 1: Usually in simple portable product applications, a separate battery protection circuit module is used to protect the battery. In the component modules in complex battery pack systems, the battery management unit is used to manage the batteries in the module. In complex battery pack systems such as new energy vehicle power battery packs, the battery management system is used to manage and protect the batteries.

Note 2: A complex battery management system may include battery voltage, temperature and current measurement, energy balance, power (SOC) calculation and display, abnormal alarm, charge and discharge management, communication, etc.

3.5 Battery Battery system A system consisting of one or more cells, modules or battery packs. It has a battery management system. If overcharge, overcurrent, over-discharge or overheat occur, the battery management system will take action.

Note 1: If the battery manufacturer and the user reach an agreement, over-discharge cut-off is not mandatory.

Note 2: It can include cooling or heating devices; some even include charge and discharge modules and inverter modules. - Leakage of electrolyte inside the cell due to bulging, deflation, etc.; - Leakage of electrolyte inside the cell due to extrusion, wear, etc.

4.3 Overheat

4.3.1 Overview Overheat may directly cause burns to the human body, OR cause the insulation level of equipment to decrease and the performance of safety components to decrease, OR ignite flammable liquids.

4.3.2 Causes Including but not limited to the following situations: - The cooling and heat dissipation functions of the cell fail; - Increased current due to cell failure; - The ambient temperature of the cell is too high; - Failure of the protection function causes the cell to heat up abnormally.

4.4 Electric shock

4.4.1 Overview The physiological response, which is caused by electric shock, depends on the size and duration of the current value, as well as its path through the human body, which directly harms the human body. Voltages exceeding a DC value of 60 V are considered hazardous voltages.

Note: For products with inverter function that can output AC voltage, see GB 4943.1 for the electric shock hazard.

4.4.2 Causes Including but not limited to the following situations: - Contact with exposed parts, that normally carry hazardous voltages; - The insulation -- between parts with dangerous voltages under normal circumstances and accessible conductive parts -- is broken down; - Contact current flowing from parts carrying hazardous voltages to

accessible parts.

4.5 Fire

4.5.1 Overview A fire may directly burn the human body, OR cause a fire hazard to the equipment, AND may produce harmful gases that affect human health.

4.5.2 Causes Including but not limited to the following situations: - Too much heat energy accumulates inside the cell, meanwhile the temperature reaches the ignition point of internal flammable materials; - Combustible gas accumulates inside the cell, meanwhile the temperature reaches its ignition point; - Burning of external parts of the cell may ignite the cell or battery pack.

4.6 Explosion

4.6.1 Overview When an explosion occurs, the components or parts are ejected, which may directly harm the human body or damage the equipment.

4.6.2 Causes Including but not limited to the following situations: - Excessive heat energy and gas accumulation inside the cell, meanwhile the internal pressure exceeds the endurance of the casing; - Overheat of the outside of the cell and other factors cause a large amount of heat or gas to be generated inside the cell, meanwhile the internal pressure exceeds the capacity of the casing.

5 Recommendations for equipment manufacturers

5.1 Protection function management It should use a battery pack, which is equipped with PCM/BMU/BMS. When using batteries and battery packs, which are not equipped with battery protection Where: I1 - Maximum charging current of cell, in Ampere (A); I2 - Over current for charge protection of battery pack, in Ampere (A); I3 - Maximum charging current of battery pack, in Ampere (A); I4 - The equipment's continuous charging input current to the cell/battery pack, in Amperes (A); I5 - Continuous discharge load current of the cell/battery pack to the equipment, in Amperes (A); I6 - Maximum discharge current of battery pack, in Ampere (A); I7 - Over current for discharge protection of battery pack, in Ampere (A); I8 - Maximum discharge current of cell, in Ampere (A). Generally, the maximum charging current and maximum discharge current capabilities of lithium-ion cells are closely related to the ambient temperature. The equipment should be able to adjust the charge and discharge current of the cell or battery pack, according to the ambient temperature, to ensure that the cell or battery pack in the equipment does not exceed its maximum charge and discharge current, at the current ambient temperature. If the charge/discharge current exceeds the normal operating current range of the cell or battery pack, the equipment should take protective action immediately.

5.4 Temperature management The equipment should have a cell or battery pack