

	PRODUCT SPECIFICATION 产品规格确认书		Form No.: <u>xxxxxxx</u>
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	型号: Sample product Specification of 173Ah Cell 173Ah 电芯产品规格确认书		
	Confidential: () Level 3 隐私 () Level 2 高密 (V) Level 1 低密		

Product Specification

Definition of Terms

The term	definition
product	The "product" in this specification refers to the 173Ah 3.22V rechargeable lithium iron phosphate power battery produced by CATL.
client	Refers to the buyer in the "CATL EV Product Sales Contract".
CATL	Refers to the seller in the "CATL EV Product Sales Contract".
PN	In order to distinguish the battery used in different areas of use or under different application conditions, CATL is the material number defined for 173Ah 3.22V rechargeable lithium batteries.
Ambient temperature	The ambient temperature where the battery is located.
电池管理系统 (BMS)	An effective tracking and control system used by customers to monitor and record the operating parameters of the product throughout the service period. Its tracking and recording parameters include but are not limited to voltage, current, temperature, etc., to control the operation of the product and ensure that the product's operating environment and operating conditions meet the requirements of this specification.
Cell temperature	The temperature of the battery cell is measured by the temperature sensor connected to the battery. The selection of the temperature sensor and the measurement circuit is determined by CATL Agree with the customer
New battery status	It refers to the state of the battery within 7 days from the date of manufacture of the product.
C-Rate Charge rate	The ratio of the charging current to the battery's capacity value measured multiple times by the battery management system. For example: when the battery capacity is 173Ah and the charging current is 34.6A, the charging rate is 0.2C; when the battery capacity drops to 155Ah and the charging current is 31A, the charging rate is 0.2C.
Cycle 循环	The battery is charged and discharged in a cycle according to the prescribed charging and discharging standards. The cycle includes short-term normal charging or a combination of regenerative charging and discharging processes. In the charging process, sometimes there is only normal charging and no regenerative charging. The discharge can be formed by combining some partial discharges.
Production Date	The date of manufacture of the battery, the clear date code marked on the top sticker of each relevant battery is the date of manufacture.
Open circuit voltage (OCV)	The voltage of the battery measured when no load or circuit is connected.
Product Supply Agreement	The terms of the transaction concerning the products in this specification signed jointly by CATL and the customer.
Standard charging	The charging mode described in section 2.2.4 of this specification.
Standard discharge	It conforms to the discharge current of 101A described in Article 2.3.1 of this specification and the discharge mode of the minimum voltage of 2.5V described in Article 2.3.5 of this specification.
State of Charge (SOC)	In the case of no load, all linear relationships of the state of battery charge capacity measured in ampere-hours or watt-hours. For example, if the capacity of 173Ah is regarded as 100% SOC, when the capacity is 0Ah, the SOC is 0%
The temperature rises	Under the conditions specified in this specification, such as the increase in cell temperature during charging or discharging.

Units of measurement	V (Volt) Volt (V), the unit of voltage
	A (Ampere) Ampere (A), the unit of current
	Ah (Ampere-Hour) Ampere-hour (Ah), load unit
	Wh (Watt-Hour) Watt-hour (Wh), energy unit
	Ω (Ohm) ohm (Ω), resistance unit
	M Ω (MilliOhm) Milliohm (m Ω), resistance unit
	$^{\circ}\text{C}$ (degree Celsius) Celsius ($^{\circ}\text{C}$), temperature unit
	Mm (millimetre) Millimeter (mm), the unit of length
	S (second) second (s), time unit
	Hz (Hertz) Hertz (Hz), frequency unit

1 Scope of application

This specification describes in detail the product performance indicators, product usage conditions and risk warnings of the 3.22V 173Ah rechargeable lithium iron phosphate power battery produced by CATL; this specification is only applicable to sample shipments in the C sample stage, and product specifications in the mass production stage Redefine and provide formal product specifications.

2 Product electrical performance indicators

2.1 Summary

No.	parameter	Product specifications	condition
2.1.1	Standard capacity	173 Ah	25±2 °C, 1C, new battery status
2.1.2	Minimum capacity	173 Ah	25±2 °C, 1C, new battery status
2.1.3	Operating Voltage	2.5~3.65V 2.0~3.65V	Temperature T>0°C Temperature T≤0°C
2.1.4	Battery internal resistance (1KHz)	0.16±0.05m Ω	New battery status (30~40%SOC)
2.1.5	Shipping capacity	69.2±1Ah	40%SOC
2.1.6	Monthly self-discharge	≤3.5%	25°C, 50% SOC, 3 months after new battery
2.1.7	Working temperature (charging)	0~60°C	Refer to section 2.2
2.1.8	Working temperature (discharge)	-30~60°C	Refer to section 2.3
2.1.9	Battery weight	≤3.2Kg	N.A.
2.1.10	Battery size	Please refer to Article 8 of this specification	Under 300Kgf pressure
2.1.11	Cell cycle	≥4000cycles	Initial clamping force 300Kgf, standard charge and discharge test

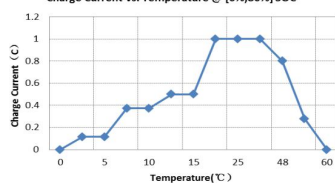
2.2 Charging mode/parameters

No.	parameter	Product	condition
2.2.1	Standard charging current	0.5C	25±2 °C
2.2.2	Maximum continuous charging current	1C	25±2 °C
2.2.3	Standard charging voltage	Single battery max 3.65V	/
2.2.4	Standard charging mode	0.5C constant current continues to charge to the maximum of the single battery 3.65V, and then constant voltage continues to be charged at normal pressure 3.65V until the current lower limit is 0.05C	
2.2.5	Standard charging temperature	25±2 °C	Cell temperature
2.2.6	Absolute charging temperature (cell temperature)	0~65°C	Regardless of the charging mode of the battery cell, once the battery cell temperature is found to exceed the absolute charging temperature range, the charging will stop.
2.2.7	Absolute charging voltage	Max 3.65V	No matter what charging mode the battery cell is in, once the battery cell voltage is found to exceed the absolute charging voltage range, the charging will stop.

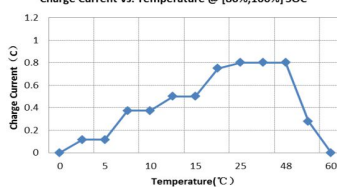
2.2.8 Other charging conditions (modes) Unit: C-Rate

Cell temperature/°C	0	2	5	7	10	12	15	20	25	45	48	55	60
SOC 0%~<80%	0	0.116	0.116	0.372	0.372	0.5	0.5	1	1	1	0.8	0.279	0
SOC >80%	0	0.116	0.116	0.372	0.372	0.5	0.5	0.75	0.8	0.8	0.8	0.279	0

Charge Current vs. Temperature @ [0%,80%] SOC



Charge Current vs. Temperature @ [80%,100%] SOC



2.3 Discharge mode

No.	parameter	Product specifications	condition
2.3.1	Standard discharge current	0.5C	25±2 °C
2.3.2	Maximum continuous discharge current	1C	N.A.
2.3.3	Maximum pulse discharge current (short pulse)	3C	The cell temperature is lower than 50°C, and the longest discharge time is 60s when SOC>40%, and the longest discharge time is 10s when SOC<40%
2.3.4	Discharge cut-off voltage	2.5V 2.0V	Temperature T>0°C Temperature T≤0°C
2.3.5	Standard discharge temperature	25±2 °C	Cell temperature
2.3.6	Absolute discharge temperature	-35~65°C	Regardless of whether the cell is in continuous discharge mode or pulse discharge mode, if the cell temperature exceeds the absolute discharge temperature, the discharge will stop

2.4 Low temperature capacity

No.	Parameter	Product specifications	Condition
2.4.1	0°C capacity	≥80%	New battery status, 0°C, 1C, 2.0V~3.65V, the benchmark is 173Ah
2.4.2	-20°C capacity	≥70%	New battery status, -20°C, 1C, 2.0V~3.65V, the benchmark is 173Ah

2.5 Safety and reliability (all tests meet the national standard GB/T 31485-2015, GB/T 31486-2015 standard)

No.	Parameter	Product specifications	Test Conditions
2.5.1	Overcharge test	No fire, no explosion	1. Test environment temperature 25°C; 2. Single battery charging; 3. Charge with 1.0C current and constant current until the voltage reaches the company's technical specifications 1.5 times the charge termination voltage specified in the document or stop charging after the charging time reaches 1h; 4. Observe for 1 hour and monitor the voltage, current and temperature during the experiment.
2.5.2	Vibration test	There is no sharp change in discharge current, abnormal voltage, deformation of the battery shell, and electrolyte overflow, etc., and the connection is reliable and the structure is intact.	1. Test environment temperature 25±2°C 2. Charging the battery module 3. Fasten the battery module to the vibration test bench according to the following conditions Carry out linear sweep frequency vibration test; --Discharge current: 1/3C; --Vibration direction: up and down single vibration; --Vibration frequency: 10Hz~55Hz --Maximum acceleration: 30m/s ² ; --Sweep frequency cycle: 10 times; --Vibration time: 3h; 4. During the vibration test, observe whether there are any abnormal phenomena. Do not allow the discharge current to change sharply, the voltage is abnormal, the battery shell is deformed, the electrolyte overflows, etc., and the connection is reliable and the structure is intact.

3 End-of-life management of products

The battery life is limited. Customers should establish an effective tracking system to monitor and record the internal resistance and capacity of the battery during each service life. The measurement method and calculation method of internal resistance and capacity require mutual discussion and mutual agreement between the customer and CATL. When the internal resistance of the battery in use exceeds 150% of the initial internal resistance of the battery or the capacity is less than or equal to 70% (25°C), the battery should be stopped. Violation of this requirement will exempt CATL from its responsibility for product quality assurance in accordance with the product sales agreement and this specification.

4 Application conditions

Customers should ensure that the following battery-related application conditions are strictly adhered to:

4.1 The customer should configure a battery management system to closely monitor, manage and protect each battery.

4.2 The customer shall provide CATL with detailed design plan, system features, framework, system data, format and other related information of the battery management system for CATL to evaluate the system design and establish battery management files

4.3 Without the consent of CATL, customers are not allowed to modify or change the design and framework of the battery management system, so as not to affect the performance of the battery.

4.4 The customer shall keep complete monitoring data of battery operation as a reference for the division of product quality responsibilities. If there is no complete battery system monitoring data within the service life, CATL does not assume the responsibility of product quality assurance.

4.5 The battery management system needs to meet the following most basic testing and control requirements

No.	Parameter	Product specifications	Protection action
4.5.1	Charge termination	3.65V	Stop charging when the battery voltage reaches 3.65V
4.5.2	The first level of overcharge protection	≥3.8V	Stop charging when the battery voltage reaches 3.8V
4.5.3	Second level overcharge protection	>4.0V	When the battery voltage reaches 4.0V, the charging is terminated and the battery management system is locked until the technician solves the problem
4.5.4	Discharge termination	2.5V minimum	Terminate the discharge when the battery voltage reaches 2.5V, reduce the current to a minimum
4.5.5	The first level of over-discharge protection	2.0V minimum	Terminate the discharge when the battery voltage reaches 2.0V, reduce the current to a minimum
4.5.6	Second-level over-discharge protection	1.8V minimum	When the battery voltage is lower than 1.8V, lock the battery management system until the technician solves the problem
4.5.7	Short circuit protection	Short circuit is not allowed	When a short circuit occurs, disconnect the battery by the overcurrent device
4.5.8	Overcurrent protection	Refer to section 2.3 discharge requirements	The battery management system controls the discharge current to meet specifications
4.5.9	Overheating protection	Refer to Section 2.2 and Section 2.3	When the temperature exceeds this specification, the charge/discharge will be terminated
4.5.10	Long charging time protection	Charging time within 8 hours	If the charging time is longer than 8 hours, the charging will be terminated

Remarks: The above No.4.5.2, 4.5.3, 4.5.5, and 4.5.6 are warning clauses. Customers are reminded: When the battery reaches the indicator and parameter status described in any of the above clauses, it means that the battery has exceeded the limit. For the use conditions specified in the specification, customers need to take protective measures for the battery in accordance with the "protection action" and other relevant provisions of this specification. At the same time, CATL declares that it does not assume any guarantee responsibility for the battery quality in the above-mentioned use state, and will Any loss of customers and third parties will not be compensated.

4.6 Prevent the battery from reaching an over-discharged state. When the battery voltage is lower than 1.8V, the inside of the battery may be permanently damaged. At this time, CATL's product quality assurance responsibility becomes invalid. According to Article 2.3.5 of this specification, when the discharge cut-off voltage is lower than 2.5V, the internal energy consumption of the system is reduced to a minimum, and the sleep time is extended before recharging. Customers need to train users to recharge in the shortest possible time to prevent the battery from entering an over-discharged state.

4.7 If the battery is expected to be stored for more than 30 days, the SOC should be adjusted to about 50%.

4.8 Avoid charging the battery under low temperature conditions prohibited by this specification (including standard charging, fast charging, emergency charging and regenerative charging), otherwise unexpected capacity reduction may occur. The battery management system should be controlled according to the minimum charging and regenerative charging temperature. It is forbidden to charge at a temperature lower than the temperature specified in this specification, otherwise, CATL will not assume the responsibility of quality assurance.

4.9 The heat dissipation of the cells should be fully considered in the design of the electric box. CATL shall not be responsible for quality assurance if the cells or batteries are overheated and damaged due to the heat dissipation design of the electric box.

4.10 In the design of the electric box, the water-proof and dust-proof problems of the electric core shall be fully considered, and the electric box must meet the waterproof and dust-proof grades stipulated by the relevant national standards. CATL does not assume responsibility for quality assurance due to damage to cells or batteries (corrosion, rust, etc.) caused by waterproof and dustproof issues.

4.11 It is forbidden to mix batteries of different P/N material numbers in the same battery system (or the whole vehicle). Otherwise, CATL will not bear the responsibility for quality assurance.

5 Safety precautions

5.1 It is forbidden to immerse the battery in water.

5.2 It is forbidden to throw the battery into a fire or expose it to a high temperature environment exceeding the temperature conditions specified in Article 2.1.7 and Article 2.1.8 of this specification for a long time, otherwise it may cause a fire. In any normal use, the temperature of the battery cells should not exceed 60°C. If the temperature of the cells in the battery exceeds 60°C, the battery management system needs to shut down the battery and stop the battery operation.

5.3 It is forbidden to short-circuit the positive and negative electrodes of the battery, otherwise the high current and high temperature may cause personal injury or fire. Since the positive and negative electrodes of the battery are exposed in the plastic protective sleeve, there should be sufficient safety protection to avoid short circuits when the battery system is assembled and connected.

5.4 Strictly follow the signs and instructions to connect the positive and negative poles of the battery, and reverse charging is prohibited.

5.5 It is forbidden to overcharge the battery, otherwise, it may cause overheating of the battery and fire accidents. In the battery installation and use, the hardware and software need to implement multiple overcharge failure safety protections. For minimum protection requirements, see Article 4.5.3 and Article 5.11 of this specification.

5.6 After charging according to Article 4.5.9 of this specification, normal charging shall be terminated. When the continuous charging time exceeds the reasonable time limit, the battery will overheat, which may cause thermal runaway and fire. A timer should be installed to protect it. Once the charging current reaches the overshoot state and cannot be terminated, the timer will take effect to terminate the charging, see section 5.11 of this specification.

5.7 The customer should securely fix the battery on a solid surface, and securely tie the power cord in a suitable position to avoid friction and sparks and sparks.

5.8 It is strictly forbidden to use plastic to encapsulate the battery or use plastic for electrical connection. Incorrect electrical connection may cause overheating during

5.9 When the electrolyte leaks, avoid contact of the skin and eyes with the electrolyte. If there is contact, use a lot of clean water to wash the touched area and seek help from a doctor. It is forbidden for any person or animal to swallow any part of the battery or the substance contained in the battery.

5.10 Do your best to protect the battery from mechanical shock, collision and pressure shock, otherwise the battery may be short-circuited, resulting in high temperature and fire.

5.11 Inappropriate termination of charging may occur during battery charging. Such as: charging beyond the allowable charging time, the charging voltage is too high and the charging is terminated, or the charging current is too strong and the charging is terminated. The above phenomenon is defined as "inappropriate termination of charging". When the above phenomenon occurs, it may mean that the battery system is leaking or some parts are malfunctioning. Continuing to charge the battery before the root cause is found and completely resolved may cause the battery to overheat or cause a fire. When the above phenomenon occurs, the battery management system should use the automatic lock function to prohibit subsequent charging, and remind the user to return the vehicle loaded with the battery to the dealer for system maintenance. The battery can only be recharged after being fully inspected by a certified technician, the root cause has been determined, and the solution has been thoroughly solved and improved.

5.12 Improper operation of the test experiment described in Article 2.5 of this specification may cause the battery to catch fire or explode. This test experiment can only be carried out in a professional laboratory by professionals equipped with appropriate protective equipment. Otherwise, it may cause serious personal injury and property damage

6 Disclaimer

If the product demanding unit does not use it in accordance with the provisions of this manual, which causes social impact and affects the reputation of CATL, CATL will pursue the product demanding unit's responsibility. According to the degree of impact on CATL, the product demanding unit needs to provide compensation to CATL.

7 Risk warning

7.1 Warning statement

Warning

The battery is potentially dangerous, and proper protective measures must be taken during operation and maintenance!

Improper operation of the test experiment described in Article 2.5 of this specification may cause serious personal injury and property damage!

The correct tools and protective equipment must be used to operate the battery.

The maintenance of the battery must be performed by a person who has battery expertise and has received safety training.

Failure to comply with the above warnings can cause a variety of disasters.

7.2 Type of danger:

The customer is aware of the following potential hazards during battery use and operation:

7.2.1 The operator may be injured by chemicals, electric shocks or electric arcs during operation. Although the human body responds differently to direct current and alternating current, DC voltage higher than 50V and alternating current are equally harmful to the human body. Therefore, customers must take a conservative posture during operation to avoid current damage.

7.2.2 There is a chemical risk from the electrolyte in the battery.

7.2.3 When operating batteries and selecting personal protective equipment, customers and their employees must consider the above potential risks to prevent accidental short circuits that may cause arcs, explosions or thermal runaway.

8 Batteries (cells) drawings

