302Ah C A T L

Product Specification of 302Ah Cell

Cell Model：LEP71H3L7-01

Cell Capacity：302Ah

Product Design Standard	Product design approval	Sales approval	Project approval	Quality Assurance Approval	Product Manager Approval
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	Sign	Date
	Customer #:	
	Stamp:	

AMENDMENT RECORDS

Rev.	ECN No.	Effective Date	Author	Description of Revision
1.1			Yang Meng/EVC	New release

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Content

Definitions

Terms	Definition
Product	Means the 302Ah 3.2V rechargeable lithium ion cells produced by CATL
Customer	Means the customer in the 《CATL product sales contract》
CATL	Means Contemporary Amperex Technology Co. Limited
PN	Means the unique part number provided by CATL to identify the Product supplied by CATL;.
Ambient Temperature	Means the ambient temperature of the environment which the Products are exposed to;
Battery Management System(BMS)	Means an active tracking and control system to be developed and implemented by CATL to monitor and record the operating parameters, including but not limited to voltage, current and temperature, of each Product in its entire service life, and to control the operation of each Product to ensure a safe operation of Product.
Cell Temperature	Means the temperature of the cell measured by the temperature sensor connected to the cell， the selection of temperature sensors and measurement lines is determined by CATL and the customer.
Fresh State	Means the state within 7 days after customer received the product（domestic only）.
C-Rate	The ratio of charging current to the capacity of batteries measured repeatedly by BMS. For example, when the battery capacity is 302Ah and the charging current is 60.4A, the charging rate is 0.2C; when the battery capacity fades to 161.6Ah and the charging current is 54A, the charging rate is 0.2C.
D-Rate	The ratio of discharging current to the capacity of batteries measured repeatedly by BMS. For example, when the battery capacity is 302Ah and the discharging current is 101A, the discharging rate is 0.5C.
Cycle	Means a state when a total of charge and discharge according to rules from a cell as recorded by BMS and it may consist of a summation of a few segments of partial charge and discharges.
Production date	Means the production date of the cell marking on the top of the cell by date code.
Open Circuit Voltage: (OCV)	Means the voltage of battery in an open circuit without any electronic loading components.

Terms	Definition
Standard Charge	Means the default charging method set out in paragraph 2.2.3 titled “Standard Charging method”.
Standard Discharge	Means the default discharging method as set out in paragraph 2.3.1 of 151A with a discharge cut-off voltage of 2.5 V as set out in paragraph 2.3.5;
State of Charge	Means the ratio of the actual battery charge to the full charge, characterizing the state of charge of the battery. The state of charge of 100% SOC indicates that the battery is fully charged to 3.65V, and the state of charge of 0% SOC indicates that the battery is completely discharged to 2.5V.
Units of Measure	“V” (Volt)， “A” (Ampere)， “W”(Watt) “Ah” (Ampere-Hour)， “Wh” (Watt-Hour) “Ω” (Ohm) “mΩ” (MilliOhm) “℃” (degree Celsius) “mm” (Millimeter) “s” (Second) “Hz” (Hertz)

1. Scope of application

The purpose of this document is to specify the specifications of 302Ah 3.2V lithium iron cells for energy storage system with CATL (“Product”) to be supplied by CATL.

2. Electrical specification

2.1 General

No.	Parameter	Specification	Condition
2.1.1	Typical capacity	302 Ah	25±2 °C ， 1C， 25±2 °C , 1C discharge, fresh cell,
2.1.2	Operating voltage	2.5~3.65V 2.0~3.65V	Cell temperature T>0℃ Cell temperature T≤0℃
2.1.3	Impedance (1KHz)	0.18±0.05m Ω	Fresh cell (40%SOC)
2.1.4	Shipping capacity	117~123Ah	40% SOC
2.1.5	Residual capacity loss	Per month ≤3.5%	Fresh cell after 3month, 50%SOC, 25±2 °C storage

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No.	Parameter	Specification	Condition
2.1.6	Operating temperature (charging)	0~65℃	Reference to paragraph 2.2
2.1.7	Operating temperature (discharge)	-35~65℃	Reference to paragraph 2.3
2.1.8	Cell Weight	≤5.51Kg	N.A.
2.1.9	Storage Temp.	-20~+45℃	Storage ambient humidity < 85% ROH, no condensation
2.1.10	Typical dimension	Reference to par agraph 8	Thickness with compression force (300±20 Kgf), Height with Terminal, BOL(Reference to item 8)
2.1.11	Rest SOC	≥5%	SOC interval without load or charging
2.1.12	Altitude	≤2000m	N.A.
2.1.13	Cycle life	⩾4000cycles	25±2℃, cycle test by the standard charge and discharge method under 300±20Kgf preload., capacity fading to 161.6Ah.

2.2. Charging/Parameter

No.	Parameter	Specification	Condition
2.2.1	Standard charge current	0.5C	25±2 ℃
2.2.2	Standard charge voltage	Cell max voltage 3.65V	N.A.
2.2.3	Standard charge method	0.5 C constant current charge to 3.65 V for cell, then switch to constant voltage charge until charge current declines to ⩽0.05C	
2.2.4	Standard charge temperature	25±2°C	Cell Temperature
2.2.5	Absolute charging temperature （Cell Temperature）	0~65℃	No matter what charge mode the battery is in, stop charging once the cell temperature exceeds absolute charge temperature range.
2.2.6	Absolute charging voltage	Max 3.65V	No matter what charge mode the battery is in, it stop charging once the cell voltage exceeds absolute charge voltage.

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2.2.7 C-Rate Other charge Condition (C-Rate)

temperature		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	1.0	1.0	1.0	0.8	0.5	0.279
SOC	＞80%	0	0.116	0.116	0.372	0.372	0.5	0.5	0.75	0.8	0.8	0.8	0.5	0.279

2.3. Discharging

No.	Parameter	Specification	Condition
2.3.1	Standard discharge current	0.5C	25±2 ℃
2.3.2	Maximum discharge current (continuous)	1.0 C	N.A.
2.3.3	Discharge cut-off voltage	2.5V 2.0V	(Temp.) T>0℃ (Temp.) T≤0℃
2.3.4	Standard discharge temperature	25±2 °C	Cell temperature
2.3.5	Absolute discharge temperature	-30~65°C	Stop discharging once cell temperature is outside this range regardless of whether continuous or pulse current is adopted.

2.4. Low Temperature Capacity

No.	Parameter	Specification	Condition
2.4.1	Capacity@0°C	≥80%	Fresh cell，0°C，1C，2.0V~3.65V, 302Ah as benchmark
2.4.2	Capacity@-20°C	≥70%	Fresh cell，-20°C，1C，2.0V~3.65V, 302Ah as benchmark

2.5. Safety and Reliability

(Safety and Reliability (All tests is in full compliance with requirements of GB/T 31485-2015 and GB/T 31486-2015)

No.	Parameter	Specification	Condition

2.5.1	Overcharge test	No fire; No explosion	1. Testing ambient temperature is 25±2℃; 2. Charge of the individual cell; 3. At constant current 1.0C till the voltage reaches 1.5 times as much charge cutoff voltage as specified in the technical condition of enterprises or charge time reaches 1h; 4. During observation of 1h, monitoring the voltage, current and temperature during the testing process.
2.5.2	Vibration test	No sharp change of discharge current; No abnormal voltage; No battery shell deformation; No leakage of electrolyte; etc. Connection retains reliable and structure is still well.	1. Testing ambient temperature is 25±2℃; 2. Charge of the cell module; 3. The cell module is fasten to the vibration test table, and then the linear sweep vibration test is carried out according to the following conditions: --discharge current: 1/3C; --vibration direction: upper and lower single vibration; --vibration frequency: 10Hz～55Hz; --maximum acceleration: 30m/s^2; -- sweep cycle: 10 times; -- vibration time: 3h; 4. During the vibration test, observing whether there is any abnormal condition. No permit of sharp change of discharge, abnormal voltage, battery shell deformation, leakage of electrolyte, etc. Make sure connection reliable and structure well.

Remarks: Overcharge test requires fixtures for testing, other tests or other standard tests to confirm the specific test procedures and precautions with CATL.

3. Product End of Life Management

This cell is designed to service with a finite life time. The customer shall develop and implement an active tracking system to monitor and record impedance of each Product in its entire service life. CATL and its customer shall come into agreement about internal resistance and capacity measurement methods, CATL and/or its customer shall stop using any of the Products when its resistance exceeds 150% of its internal resistance or it capacity fading to 70% of typical capacity @25℃ . Failure to comply with this requirement shall render CATL's warranties under the contract inapplicable, thereby releasing CATL from any liability in connection therewith.

4. Application Conditions

Customer shall ensure that the following application conditions in connection with the products are strictly observed:

4.1

Customer shall procure that each Product shall be used under the strict monitor, control and protection by the BMS to be incorporated by CATL.

4.2

Customer shall provide detailed information of the BMS, including but not limited to its design, features, setting, and data file format to CATL for design review and record keeping.

4.3

Once the detailed information of the BMS has been reviewed and agreed by CATL, customer shall not modify or change the design, features, setting or data file format of the BMS without the prior written agreement by CATL.

4.4

Customer shall keep relevant records of the BMS monitoring data throughout the entire service life of each Product, including keeping record of number of occurrence of Rush Charge, which will be used in the determination and judgment of any product warranty and liability claim entitlement. No warranty or liability claim will be considered without BMS diagnosis records (at a regular basis, esp. during maintenance) of the relevant Product

4.5

The BMS shall include the following monitoring and control features as a minimum requirement.

No.	Parameter	Specifiation	Action
4.5.1	Stop charging	3.65V	Stop charging when cell voltage reaches 3.65 V
4.5.2	First overcharge protection	≥3.8V	Stop charging when cell voltage reaches 3.8 V

4.5.3	Second overcharge protection	≥4.0V	When the battery voltage reaches 4.0V, the BMS is forced to terminate charging, and the BMS should be locked until technicians solve the problem.
4.5.4	Stop discharge	Minimum 2.5V	Minimize the discharging current when cell voltage reaches 2.5V.
4.5.5	First over discharge protection	Minimum 2.0V	Stop discharging when cell voltage reaches 2.0V
4.5.6	Second over discharge protection	Minimum 1.8 V	When the battery voltage is less than 1.8 V, the BMS should be charged back to 50% at 0.1C in time, and the BMS should be locked until technicians solve the problem.
4.5.7	Short circuit protection	No short circuit allowed	When a short circuit occurs, the battery (battery) is disconnected by the overcurrent protection device.
4.5.8	Over current protection	See paragraph 2.2&2.3	Control discharge current by BMS to values within specification
4.5.9	Over temperature protection	See paragraph 2.2&2.3	Stop charging and discharging when temperature exceeds specification
4.5.10	Charging time out limit	Charging completes within 8 hours	Stop charging if changing time exceeds specification

Note: The above No. 4.5.2, 4.5.3, 4.5.5, 4.5.6 are the warning clause, draw the attention of customers: When the battery reaches any of the terms described in the above, means that the battery has been used beyond the specifications, the customer shall take protective measures on the battery in accordance with the "protection action" and other relevant provisions of this specification. At the same time, the CATL shall not take any responsibility for the damage in connection therewith.

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4.6.

Prevent draining any Product down to over discharge state. A Product may be permanently damaged internally when the cell voltage is lower than 1.8 V and therefore shall be strictly prohibited, failing what CATL's warranties under the Contract shall cease to apply, thereby releasing the CATL from any liability in connection therewith. After discharge cut-off in accordance with paragraph 2.3.4, internal power consumption of the system should be reduced to a minimum to prolong the idle time before recharge. Customer undertakes to educate the users of the Products or other parties who may come to handle the Products to recharge the cells at minimum time intervals to prevent reaching the over-discharge state.

4.7.

When the Products are intended to be stored for a prolonged period of time (more than one month), the SOC of cells should be adjusted to around 50% periodically(every three months is recommended).

4.8.

Batteries should avoid charging at low temperatures prohibited by this Technical Agreement (including standard charging, fast charging and emergency charging), otherwise accidental capacity reduction may occur. Battery management system should be controlled according to the minimum charging temperature. It is forbidden to charge under the temperature stipulated in this technical agreement. Otherwise, CATL will not undertake the responsibility of quality assurance.

4.9.

The design of the electric box must fully consider the heat dissipation problem of the cell. CATL does not take the responsibility due to the overheating of the cell or batteries caused by the thermal design problem of the electric box.

4.10

The design of the electric box must fully consider the waterproof and dustproof problems of the cells. The electric box must meet the waterproof and dustproof grade stipulated by the relevant national standards. The CATL does not take the responsibility due to damage to the cell or batteries (such as corrosion, rust, etc.) caused by water and dust.

4.11

It is forbidden to mix different P/N batteries in the same battery system, otherwise, CATL will not be responsible for quality assurance.

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5. Safety Precautions

5.1

Do not immerse cells into water.

5.2

Do not drop cells into fire or expose them to any high temperature environment exceeding operation temperature as set out in paragraphs 2.1.7、2.1.8 & 2.1.10, otherwise it may cause fire. At all use time, cell temperature should not exceed 60 °C, shut down system by BMS when it occurs.

5.3

Do not short circuit cell terminals, otherwise high current and temperature may cause body injury or fire hazards. Metallic cell terminals are exposed from plastic packaging and ample safety precautions should be implemented to avoid short circuiting them during system integration or connections.

5.4

Always connect cell terminals according to its label(s) in right polarity. Reverse charging is strictly prohibited.

5.5

It is extremely dangerous to overcharge a cell which may cause overheating and fire hazards. Multiple level of fail-safe overcharge protection should be implemented by hardware and software. See paragraph 4.5.1、4.5.2、4.5.3、4.5.9 for minimum requirement to be adopted by the BMS for protection.

5.6 al 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 implemented in the charger circuit and set up properly. In case charging does not terminate normally within charging time out limit, ensure that the timer will intervene and stop the charging. See also paragraph 5.11.

5.7

Products should be securely fixed to solid platform, and power cables should be securely attached by fastener to avoid intermittent contact which may cause arcing and sparks.

5.8

Do not service cells and electrical connections within plastic package of cell. Improper electrical connection within a cell may cause overheating in service.

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5.9

When the electrolyte leaks, skin and eye contact with the electrolyte should be avoided. In case of contact, a large amount of clean water should be used to clean the contact area and seek help from the doctor. It is forbidden for any person or animal to swallow any part or substance contained in the battery.

5.10 Protect cells from mechanical shock, impact and pressure.

Internal electrical circuit may short circuit to generate high temperature and fire hazards.

5.11

When cells charging is terminated improperly for reasons such as exceeding allowable charging time, cut-off due to exceeding charging voltage or cut-off due to exceeding charging current, all these events are defined as “improper charge termination”. Such event may indicate that there is current leaking within a cell system or some components have started to malfunction and subsequent charging of such cell system without finding and fixing root cause of problem may cause potential overheat or fire hazards. When such event occurs, the BMS should lock itself up to prevent subsequent charging and notice should be given to the user to return the vehicle to dealer for servicing. Subsequent charging should only be resumed after the system has been thoroughly checked by qualified technician who can identify and fix root cause attributed to the “improper charge termination”.

5.12

Battery fire or explosion may be caused by improper operation during abuse test. The test can only be carried out in a professional laboratory by professionals equipped with appropriate protective equipment. Otherwise, it may lead to serious personal injury and property loss.

6. Disclaimer

6.1

If the product demand unit does not use the product according to the provisions of this specification, causing social impact and affecting the reputation of CATL, CATL will investigate the responsibility of the product demand unit. According to the degree of impact on CATL, the product demander should provide compensation to CATL.

6.2

CATL reserves the right to modify the specifications and performance parameters of the product.

Before ordering

CATL products, the buyer needs to confirm the latest status of the products in advance with CATL.

English specifications are for reference only. Please refer to the technical specifications of the Chinese version.

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7. Risk Warning

7.1 Waring statement

警 告

电池存在潜在的危险，在操作和维护时必须采取适当的防护措施!

不正确地滥用测试实验，可能导致严重的人身伤害和财产损失!

必须使用正确的工具和防护装备操作电池。

电池的维护必须由具有电池专业知识并经过安全培训的人士执行。

不遵守上述警告可能造成多种灾难。

CELLS ARE POTENTIALLY DANGEROUS AND PROPER PRECAUTIONS MUST BE OBSERVED IN HANDLING AND MAINTENANCE.

RUNNING TESTS ON THE CELLS IMPROPERLY MAY RESULT IN SEVERE PERSONAL BODY INJURY OR PROPERTY DAMAGES.

WORK ON CELLS MUST BE PERFORMED ONLY WITH PROPER TOOLS AND PROTECTIVE EQUIPMENT MUST BE USED.

CELL MAINTENANCE MUST BE CARRIED OUT BY PERSONNEL KNOWLEDGEABLE OF CELLS AND TRAINED IN THE SAFETY PRECAUTIONS INVOLVED.

FAILURE TO OBSERVE THE ABOVE MAY CAUSE VARIOUS HAZARDS.

7.2 Types of Hazards

Customer acknowledges the following potential hazards in connection with the usage and handling of the Products:

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7.2.1

Working with battery can expose the handler to chemical, shock and/or arcing hazards. Although a person's body might react to contact with direct current voltage differently than from contact with alternate current voltage, Customer shall take a conservative position and consider the risk of shock or electrocution to be the same for both alternate current and direct current exposures greater than 50 volts.

7.2.2

Cells expose its handler to chemical hazards associated with the electrolyte used in the cell.

7.2.3

When selecting work practices and personal protective equipment, Customer and its employees shall consider potential exposure to these hazards and therefore prevent accidental short-circuit that can result in electrical arcing, explosion, and/or "thermal runaway" of the cells.

8. Mechanical Drawing