	PRODUCT SPECIFICATION 产品规格确认书		Form No : xxxxxx
	Author/Dept. : Yang Meng/EVC	Document #: CTPS-MHH3L7-01	Rev: 1.0
	Model : 228 Ah Cell Technical Specification		
	Confidential: () Level 3 () Level 2 (V) Level 1		

Product Specifications

Product design preparation	Product design approval	Sales approval	Project approval	Quality assurance approval	Product manager approval
Yang Meng	Wang GuoBao	Wang Hui	Zhang YuBao	Zhao Chao	Chan LiBing

Client Confirmation	Signature	Date
	Client code:	
	Company seal:	

Client Request

Model: MHH3L7

Version: 1.0

Need clients to write down their demand information and communicate with CATL in advance. If clients have some special applications or operating conditions different from those described in this document, CATL will following clients' special requirements to do product design and production.

	Special requirements	Standard
1		
2		
3		
4		
5		

Client code: _____ Sign: _____ Date: _____

修改记录

Version	ECN number	Effective date	Author	Revision description/ Recognition Status
1.0			Yang Meng /EVC	New release

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Definition of terms

Term	Def
Product	CATL 228Ah 3.22V Rechargeable LiFePo4 Battery
Customer	A buyer in the CATL EV Product Sales Contract.
CATL	A seller in a contract for the sale of CATL EV products.
PN	To distinguish between battery applications in different areas of use or under different application conditions, CATL the material number defined Ah 3.22V 228 rechargeable lithium batteries.
ambient temperature	The ambient temperature of the battery.
Battery Management System (BMS)	An effective tracking and control system used by customers to monitor and record the operating parameters of a product throughout its service life Unified. The parameters tracked and recorded include, but are not limited to, voltage, current, temperature, etc. to control the operation of the product and ensure that the operating environment and operating conditions of the product comply with the provisions of this specification.
Core temperature	Core temperature, temperature sensor and measurement line selected by CATL temperature sensor connected to battery 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 capacity value of the battery measured many times by the battery management system. When the battery capacity is 228Ah, the charging current is 45.6A, the charging rate is 0.2 C; When the battery capacity drops to 200 Ah, the charging current is 40 A, the charging rate is 0.2C
Cycle	The battery is charged and discharged as a cycle according to the prescribed charging and discharging standard. The cycle includes short-term normal or regenerative charging And the combination of discharge process, in the charging process sometimes only normal charging without regenerative charging. The discharge can be formed by some partial discharge combinations.
date of manufacture	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 without access to any load and circuit.
Product Supply Agreement	CATL and customer signed the terms of this specification products.
Standard charge	The charging mode described in Article 2.2.4 of this specification.
Standard discharge	Discharge current of 112 A as specified in Article 2.3.1 of this Specification and minimum as specified in Article 2.3.5 of this Specification 2.5V Discharge mode of voltage.

Charging status (SOC)	All linear relationships of battery charging capacity states measured in amperes or watt hours without load. Such as: if the capacity of 228 Ah is regarded as 100% SOC, then the capacity of 0 Ah ,SOC is 0%.
Temp	Conditions specified in this specification such as charging process or discharge process of the core temperature rise.
Diameter	“V” (Volt) “A” (Ampere) “Ah” (Ampere-Hour) “Wh” (Watt-Hour)

	"Ω"(Ohm) ohm (Ω), resistance unit "mΩ"(Milliohm) millim (mΩ), unit of resistance "°C"(degree Celsius) degrees Celsius (°C), unit of temperature mm" mm (mm), unit of length "s"(s second) seconds (s), unit of time "Hz"(Hertz) Hertz (Hz), unit of frequency
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1.Scope of application

This specification describes in detail the product performance index, product usage conditions and risk warning of 3.22 V 228Ah rechargeable lithium iron phosphate power battery produced by the CATL. This specification is only applicable to shipment in C sample stage. Product specifications for mass production need to be redefined to provide formal product specifications.

1 Product performance index

1.1 Resume

No.	parameter	specifications	condition
2.1.1	standard capacity	228 Ah	25±2 °C, 1C, New battery status
2.1.2	minimum capacity	228 Ah	25±2 °C, 1C, New battery status
2.1.3	working voltage	2.5~3.65V 2.0~3.65V	TemperatureT>0°C TemperatureT≤0°C
2.1.4	internal resistance (1KHz)	0.22±0.05m Ω	New battery status 40%SOC
2.1.5	Shipment capacity	87~93Ah	New battery status 40% SOC
2.1.6	Monthly self-discharge	≤3.5%	25°C, 50%SOC, Three months
2.1.7	Operating temperature (charging)	0~65°C	Refer to Section 2.2
2.1.8	Operating	-35~65°C	Refer to Section 2.3

	temperature (discharge)		
2.1.9	Battery weight	≤4.22Kg	N.A.
2.1.10	Battery size	Please refer to article 8 of this specification	300Kgf pressure
2.1.11	Core cycle	≥4000cycles	Initial clamping force 300 Kgf, standard charge-discharge test

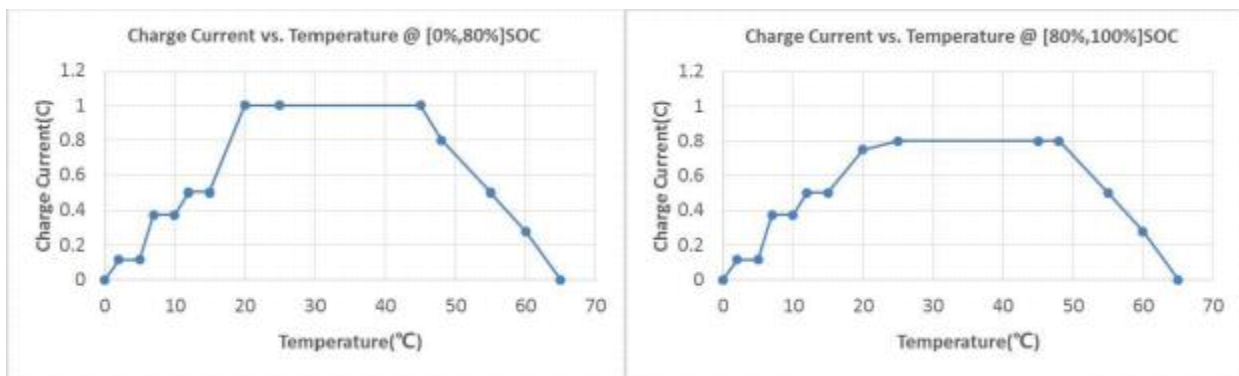
1.2 Charging mode

No.	parameter	specification	condition
2.2.1	Standard charging current	0.5C	25±2 °C
2.2.2	Maximum charge sustainable current	1C	25±2 °C
2.2.3	Standard Charge Voltage	Maximum 3.65 V for single cell	/
2.2.4	Standard Charging Mode	The constant current of 0.5 C is continuously charged to the maximum 3.65 V, of the single cell, then the constant voltage is continuously charged normal pressure 3.65 V until the lower atmospheric pressure until the lower limit of the current is 0.05 C	
2.2.5	Standard charging temperature	25±2 °C	Core temperature
2.2.6	Absolute charging temperature (Core temperature)	0~65°C	No matter what charging mode the core is in, once Stop charging when the core temperature exceeds the absolute charging temperature range

2.2.7	Absolute charging voltage	3.65V max	No matter what charging mode the core is in, once Stop charging when the core voltage exceeds the absolute charging voltage range
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2.2.8 Additional charging condition (mode) unit: C-Rate

Core temperature/°C	0	2	5	7	10	12	15	20	25	45	48	55	60	65
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	0
SOC >80%	0	0.116	0.116	0.372	0.372	0.5	0.5	0.75	0.8	0.8	0.8	0.5	0.279	0



1.3 Discharge mode

No.	parameter	Specificat ion	condtion
2.3.1	Standard discharge current	0.5C	25±2 °C
2.3.2	Maximum continuous discharge current	1C	N.A.
2.3.3	Discharge cutoff voltage	2.5V 2.0V	Temp T>0°C Temp T≤0°C
2.3.4	Standard discharge temperature	25±2 °C	Core temperature
2.3.5	Absolute discharge temperature	-35~65°C	Whether the core is in continuous discharge mode or pulse discharge mode, if the core temperature exceeds the absolute discharge temperature, the discharge is stopped

1.4 Pulse discharge and recharge mod

1.4.1 Pulse discharge mode unit: C-Rate

30s Pulse discharge rate/ C level													
SoC/T	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	100%
-35°C	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
-30°C	0.00	0.03	0.06	0.13	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
-25°C	0.00	0.06	0.13	0.25	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
-15°C	0.00	0.06	0.13	0.25	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
-10°C	0.00	0.19	0.38	0.63	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
-5°C	0.00	0.25	0.50	1.00	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13
0°C	0.00	0.28	0.56	1.06	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18
5°C	0.00	0.31	0.63	1.13	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
10°C	0.00	0.33	0.66	1.22	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43
15°C	0.00	0.34	0.68	1.32	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
20°C	0.00	0.36	0.72	1.41	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82
25°C	0.00	0.38	0.75	1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
30°C	0.00	0.38	0.75	1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
35°C	0.00	0.38	0.75	1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
40°C	0.00	0.38	0.75	1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
45°C	0.00	0.38	0.75	1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
50°C	0.00	0.38	0.75	1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
55°C	0.00	0.38	0.75	1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
60°C	0.00	0.38	0.75	1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
65°C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1.4.2 Pulse recharge mode unit: C-Rate

Pulse recharge rate s C- core level													
SoC/T	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	100%
0°C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5°C	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	0.00
10°C	-0.81	-0.81	-0.81	-0.81	-0.81	-0.81	-0.81	-0.81	-0.81	-0.81	-0.81	-0.81	0.00
15°C	-1.22	-1.22	-1.22	-1.22	-1.22	-1.22	-1.22	-1.22	-1.22	-1.22	-1.22	-1.22	0.00
20°C	-1.61	-1.61	-1.61	-1.61	-1.61	-1.61	-1.61	-1.61	-1.61	-1.61	-1.61	-1.22	0.00
25°C	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-1.33	0.00
30°C	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-1.33	0.00
35°C	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-1.33	0.00
40°C	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-1.33	0.00
45°C	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-1.33	0.00
50°C	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-1.33	0.00
55°C	-1.60	-1.60	-1.60	-1.60	-1.60	-1.60	-1.60	-1.60	-1.60	-1.60	-1.60	-1.07	0.00
60°C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1.5 Low temperature capacity

No.	parameter	spec	condition
2.5.1	Capacity °C0	≥80%	New battery status ,0°C, 1 C,2.0V~3.65 V, benchmark 228
2.5.2	-20°C capacity	≥70%	New battery status ,-20°C, 1 C,2.0V~3.65 V, benchmark 228

2.6 Safety and reliability (all tests comply with national standards GB/T 31485-2015,GB/T 31486-2015 standards)

No.	parameter	Spec	Condition
2.6.1	Overcharge testing	No fire, no explosion	1. Test ambient temperature 25°C; 2. Single battery charging; 3. With 1.0 C current constant current charge to the voltage to the enterprise technical conditions specified in the charging termination voltage 1.5 times or charging time up to 1 h after stopping charging; 4. Observation 1 h, Monitor voltage, current and temperature during experiment.
2.6.2	Vibration test	There are no sharp discharge current, abnormal voltage, battery shell deformation, electrolyte overflow and so on.	Test ambient temperature $25 \pm 2^\circ\text{C}$ Battery module charging Fasten the battery module to the vibration test table and carry out the linear sweep vibration test according to the following conditions; -- discharge current: C;1/3 -- vibration direction: up and down single vibration; -- vibration frequency :10 Hz~55 Hz Maximum -- acceleration :30 m/s ² ; -- sweep cycle :10 times; -- vibration time :3 h; During the vibration test, observe whether there are abnormal phenomena. Do not allow sharp discharge current, abnormal voltage, battery case deformation. Solution overflow and other phenomena, and maintain reliable connection, good structure.

Remarks: Overcharge testing requires testing with fixture, other testing or reference to other standard testing before you need to confirm with CATL the specific test process and precautions.

2 Product life termination management

The battery life is limited. Customers should establish an effective tracking system to monitor and record the internal resistance and capacity of the battery for each lifetime. Internal resistance and capacity measurement and calculation methods need to be discussed and agreed by customers and CATL. If 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 shall be discontinued. Failure to comply with this requirement shall exempt the CATL from product quality assurance in accordance with the product sales agreement and this specification.

3 Application conditions

Customers should ensure strict compliance with the following battery-related application conditions:

- 3.1 Customers should configure battery management system to closely monitor, manage and protect each battery.
- 3.2 The customer shall provide the CATL with detailed design scheme, system characteristics, framework, system data, format and other relevant information of the battery management system for CATL to evaluate the design of the system and establish the battery management file
- 3.3 Customers may not modify or change the design and framework of the

battery management system without CATL consent,so as not to affect the performance of the battery.

- 3.4 Customers should keep complete battery operation monitoring data as a reference for product quality responsibility division. If the monitoring data of the battery system is not complete, the CATL shall not bear the responsibility of product quality assurance.
- 3.5 The battery management system needs to meet the following basic testing and control requirements

No.	parameter	Spec	Condition
4.5.1	Charge termination	3.65V	Discontinue charging when battery voltage reaches V 3.65
4.5.2	Level 1 overcharge protection	<=3.8V	Discharging when battery voltage reaches 3.8 V
4.5.3	Secondary Overcharge Protection	< 4.0V	Discontinue charging when battery voltage reaches 4.0 V and lock battery Manage the system until the technician solves the problem
4.5.4	discharge off	Min 2.5V	Discontinue discharge When the battery voltage reaches 2.5 V, current To a minimum
4.5.5	Level 1 overprotection	min 2.0V	Discontinue discharge When the battery voltage reaches 2.0 V, minimize current

4.5.6	Secondary protection	min 1.8V	Lock the battery management system when the battery voltage is less than V 1.8 Until technicians solve problems
4.5.7	short-circuit protection	No short circuit	In the event of a short circuit, the battery (battery) is disconnected by the overcurrent (battery)
4.5.8	overcurrent protection	Refer to section 2.3 discharge requirements	Battery management system controls discharge current to specification
4.5.9	Overheat protection	Reference to articles 2.2 and 2.3 Article 12	Termination of charge/discharge when temperature exceeds the specification Electricity
4.5.10	Over-charge protection	Charge time within 8 hours	If the charging time is longer than 8 hours, the charging is terminated

Note: the above No.4.5.2,4.5.3,4.5.5,4.5.6 are warning clauses, drawing customer's attention: when the battery reaches the target and parameter status described in any of the above terms, it means that the battery has exceeded the operating conditions stipulated in this specification. The customer shall take protective measures against the battery in accordance with the "protective action" and other relevant provisions of this specification. At the same time, CATL declare that it is not liable for any warranty on the quality of the battery in the above use state and shall not compensate for any loss caused to the customer and third party.

- 3.6 Avoid the battery reaching over-discharge state. When the battery voltage is less than 1.8 V, the battery interior may be permanently damaged, CATL this time
The product quality assurance responsibility is invalid. According to Article 2.3.5 of this specification, when the discharge cutoff voltage is less than 2.5 V, the internal energy consumption of the system is reduced to a minimum and the dormancy time is prolonged before recharging. Customers need to train users to recharge in the shortest possible time to prevent the battery from entering overdischarge.
- 3.7 If the battery is expected to be stored for more than 30 days, the SOC should be adjusted to about 50%.
- 3.8 Batteries avoid charging at low temperatures prohibited by this specification (including standard charging, fast charging, emergency charging and regenerative charging), otherwise unexpected capacity reductions may occur. The battery management system shall be controlled according to the minimum charging and regenerative charging temperature. Charging below the temperature specified in this specification is prohibited, otherwise, CATL shall not be liable for quality assurance.
- 3.9 The heat dissipation problem of electric core should be fully considered in the design of electric box, and the overheating damage of electric core or battery caused by the heat dissipation design problem of electric box,
CATL is not responsible for quality assurance.
- 3.10 The waterproof and dustproof problems of electric core should be fully considered in the design of electric box, and the electric box must meet the waterproof and dustproof grade stipulated by the relevant national standards. Damage to electric core or battery (e.g. corrosion, rust, etc.) due to waterproof and dustproof problems, CATL shall not be liable for quality assurance
- 3.11 No different P/N number cores are mixed in the same battery system (or vehicle), otherwise, CATL do not assume responsibility for quality assurance.

4 Security precautions

- 4.1 It is forbidden to immerse the battery in water.
- 4.2 It is prohibited to put the battery into fire or expose it for a long time to a high temperature environment exceeding the temperature conditions specified in articles 2.1.7 and 2.1.8 of this specification, otherwise it may lead to fire. Under any normal condition, the battery core temperature should not exceed 65 °C . If the battery core temperature exceeds 65 °C , the battery management system should close the battery and stop the battery operation.
- 4.3 Battery positive and negative short circuit is prohibited, otherwise strong current and high temperature may lead to personal injury or fire. Because the positive and negative electrodes of the battery are exposed to the plastic protective sleeve, there should be sufficient safety protection when the battery system is assembled and connected to avoid short circuit.
- 4.4 Connect battery positive and negative electrodes strictly in accordance with marking and instructions, prohibit reverse charging.
- 4.5 Do not overcharge the battery, otherwise, may cause battery overheating and fire accident. In battery installation and use, hardware and software need to implement multiple overcharge failure safety protection. Minimum protection requirements are provided in Articles 4.5.3 and 5.1.1 of this specification.
- 4.6 After charging according to Article 4.5.9 of this specification ,.9 of this specification. When the continuous charging time exceeds the reasonable time limit, the overheating of the battery may cause heat runaway and fire. A timer should be installed to protect it. Once the charging current is overcharged and can not be terminated, the timer will function to terminate the charge, see Article 5.1.1 of this Specification.
- 4.7 The customer shall secure the battery to the solid plane and securely bind the power cord to the right position to avoid friction and cause arcs and sparks.
- 4.8 It is strictly forbidden to use plastic to encapsulate batteries or to use plastic for electrical connection. Incorrect electrical connection may cause overheating during battery use.
- 4.9 When the electrolyte leaks, the skin and eyes should be avoided contact with the electrolyte. If in contact, use plenty of water to clean the area and ask the doctor for help. It is prohibited for any person or animal to swallow any part of the battery or the substance contained in the battery.
- 4.10 Try to protect the battery from mechanical vibration, collision and pressure impact, otherwise the battery may be short circuit, high temperature and fire.
- 4.11 Improper termination of charging may occur during battery charging. For example: charging beyond the allowable charging time, charging voltage is too high to stop charging or charging current is too strong to stop charging. the above phenomenon is defined as "improper termination charging ". When the above phenomenon occurs, it may mean leakage of electricity or failure of some components in the battery system. Continue to address

Battery charging may cause battery overheating or fire. When the above phenomenon occurs, the battery management system should prohibit subsequent charging through automatic locking function, and remind the user to return the vehicle loaded with the battery to the dealer for system maintenance. The battery can only be fully checked by certified technical personnel, determine the root cause and completely solve, improve before resuming charging.

- 4.12 Improper operation of the test experiments described in Article 2.5 of this specification may cause the battery to catch fire or explode. The test can only be matched Professionals with appropriate protective equipment are carried out in professional laboratories. Otherwise, it may lead to serious personal injury and property loss.

5 disclaimer

If the product demand unit does not use according to the provisions of this specification, causing social impact, and affecting the reputation of the CATL, the CATL will be held responsible for the product demand unit. The product demand unit shall provide compensation to the CATL according to the degree of impact on the CATL.

6 Risk warning

6.1 Warning statements

Warning

The battery is potentially dangerous and must be properly protected during operation and maintenance!

Improper operation of the test experiments described in Article 2.5 of this specification may lead to serious personal injury and property loss!

The battery must be operated using the correct tools and protective equipment.

Battery maintenance must be performed by a person with battery expertise and safety training. Failure to comply with the warning may cause multiple disasters.

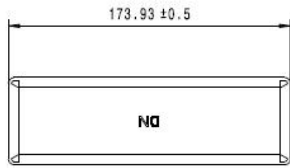
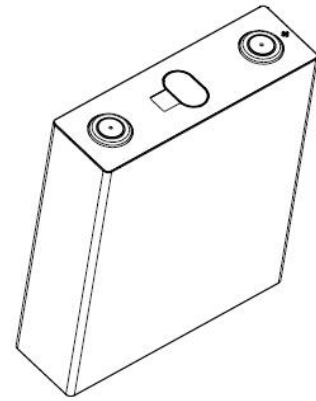
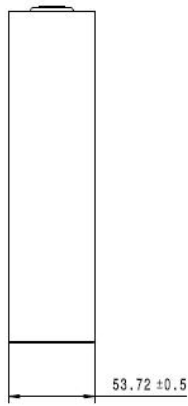
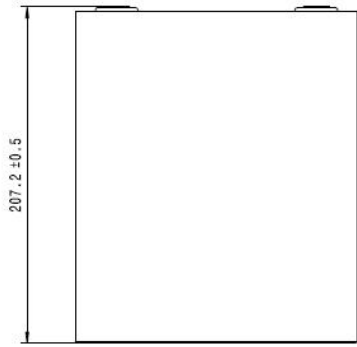
6.2 Type of risk:

Customers are aware of the following potential hazards in battery use and operation:

- 6.2.1 Operators may be exposed to chemicals, electric shocks or electric arcs during operation. Although the reaction of human body to suffer DC and AC is different, the DC voltage above 50 V is as serious as that of AC to human body, so the customer must take a conservative posture in operation to avoid the damage of current.
- 6.2.2 There is a chemical risk from the electrolyte in the battery.
- 6.2.3 When operating batteries and selecting personal protective equipment, customers and their employees must take into account the above potential risks to prevent accidental short circuit and cause arc, explosion or thermal runaway.

7 Battery (core) drawings

ECN MEMO	REV	ZDWE	DESCRIPTION	DRI	DATE
	01		NEW RELEASE FOR REFERENCE	CaI QC	Jul.30,2018



GENERAL TOLS UNLESS NOTED		DRAWN BY CaI QC	DATE Jul.30,2018	TITLE 电芯-54173
0 PLACE (X)	+0.5	CHECKED BY Xing CY	DATE Jul.30,2018	
1 PLACE (X.X)	+0.2	APPROVED BY Bond Wang	DATE Jul.30,2018	CATL Contemporary Apex Technology Co., Limited
2 PLACE (X.XX)	+0.1	PART NO.	DRAWING NO. DRW-TBD	
ANGULAR (X °)	±1°			SHEET NO. 1 OF 1
ANGULAR (X.X °)	±0.5°			
DIMS IN MM SCALE 1:1		THIS DRAWING CONTAINS INFORMATION THAT IS PROPRIETARY TO ATL INCORPORATED AND SHOULD NOT BE USED WITHOUT WRITTEN PERMISSION		