PRODUCT SPECIFICATION
规格书

Product design Preparation	Product design approval	Approval of sales	Project engineering approval	Quality assurance approval	Product manager approval
Yang Meng	**Wang GuoBao**	**Wang Hui**	**Zhang YuBao**	**Zhao Chao**	**Chan LiBing**

Client Information 客户确认	签名Signature	日期 Date
	客户代码Client Code:	
	公司印章Corporate Seal:	

客户要求Clients’ Requirement

型号Modul: MHH3L7

版本Version: 1.0

要求客户写出他们的需求信息并提前与 CATL 沟通。 如果客户有一些特别的应用或者操作条件不同于此文件中所描述的，CATL 可以根据客户的特别要求进行产品的设计和生产。Ask customers to write out their requirements and communicate with CATL in advance. If the customer has some special applications or operating conditions different from those described in this document, CATL can design and produce products according to the customer's special requirements.

	特殊要求Specific requirements	标准Standard
1		
2		
3		
4		
5		

客户代码: _____ 签字: _____ 日期: __
Client code Signature Date

修改记录Amendment Record

Version	ECN	Effective Date	Author	Revised description/recognition status
1.0			Yang Meng/EVC	New release

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术语定义 Term Definition

术语Term	定义Definition
产品Product	The term "Product" in this specification refers to the 230Ah 3.22V rechargeable lithium iron phosphate power battery manufactured by CATL.
客户 Client	Means the Buyer in the CATL EV Product Sales Contract.
CATL	Means the Seller in the CATL EV Product Sales Contract.
PN	CATL is the material number defined for a 230Ah 3.22V rechargeable lithium battery in order to distinguish the batter y for different use areas or different application conditions.
Ambient temperature	Ambient temperature of the battery.
（BMS）	An effective tracking and control system used by the customer to monitor and record the operational parameters of the product throughout the service life. The 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 operating environment and conditions of the product conform to the provisions of this specification.
Temperature of cell	The temperature of the cell is measured by the temperature sensor connected to the battery. The selection of the temperature sensor and measurement circuit is agreed by CATL and the customer.
New Battery status	It refers to the state of the battery within 7 days from the manufacturing date of the product.
C-Rate	The ratio of the charging current to the battery capacity measured multiple times by the battery management system. For example, if the battery capacity is 230Ah and the charging current is 45.6A, the charging ratio is 0.2C. When the battery capacity drops to 200Ah and the charging current is 40A, the charging ratio is 0.2C.
Cycle	The battery is charged and discharged in one cycle according to the specified charging and discharging standard. A cycle consists of a short period of normal charging or a combination of regenerative charging and discharging, sometimes with normal charging and no regenerative charging. Discharges can be formed by a number of partial discharges combined together.
Date of manufacture	The date of manufacture of the battery, as specified by the date code on the sticker at the top of each associated battery.
Open-circuit voltage （OCV）	The voltage of the battery measured when no load or circuit is connected.
Product Supply Agreer	Terms of trade for the products of this Specification signed by CATL and Customer.
Standard charge	The charging mode described in Section 2.2.4 of this specification.
Standard Discharge	Discharge current of 114A as described in Clause 2.3.1 of this specification and discharge mode of minimum voltage of 2.5V as described in Clause 2.3.5 of this specification.
充电状态(SOC)	All linear relationships of the state of the battery's charging capacity in ampere-hours or watt-hours at no load. For example, if the capacity of 230Ah is considered as 100%SOC, the capacity of 0Ah is 0%SOC.
Increase of temperature	An increase in the temperature of the cell during charging or discharging specified in this specification.
Measurement Unit	“V” (Volt)伏特(V)，电压单位 “A” (Ampere)安培(A)，电流单位 “Ah” (Ampere-Hour)安培-小时(Ah)，负荷单位 “Wh” (Watt-Hour)瓦特-小时(Wh)，能量单位 “Ω” (Ohm) 欧姆(Ω)，电阻单位 “mΩ” (MilliOhm) 毫欧姆(mΩ)，电阻单位

	“℃” (degree Celsius) 摄氏度(℃)，温度单位 “mm” (millimetre) 毫米(mm)，长度单位 “s” (second) 秒(s)，时间单位 “Hz” (Hertz)赫兹(Hz)，频率单位

1 适用范围 Scope of application

This specification describes in detail the product performance indicators, service conditions and risk warnings of the 3.22V 230 Ah rechargeable lithium iron phosphate power battery produced by CATL

2 产品电性能指标Product electrical performance indicators

2.1 概要 summary

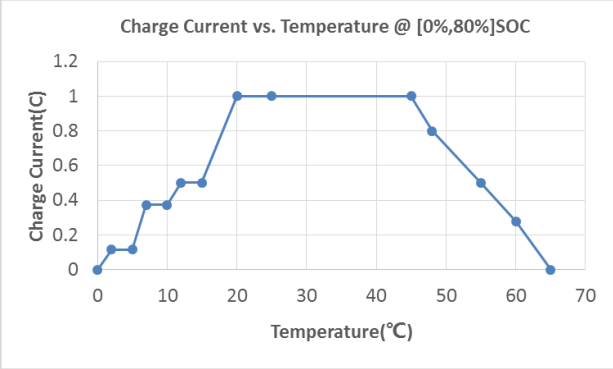
No.	参数 Parameter	产品规格 Specification	条件 Condition
2.1.1	标准容量 Standard Capacity	230 Ah	25±2℃，1C，New Battery status
2.1.2	最小容量 Minimum capacity	228 Ah	25±2℃，1C，New Battery status
2.1.3	工作电压 Working voltage	2.5~3.65V 2.0~3.65V	Temperature T>0℃ T≤0℃
2.1.4	Internal Resistant(1KHz)	0.22±0.05mΩ	40%SOC New Battery status
2.1.5	Capacity of shipment	87~93Ah	40% SOC New Battery status
2.1.6	Monthly self discharge	≤3.5%	25℃，50%SOC，new battery stored > 3 months
2.1.7	Operating temperature (charging)	0~65℃	Refer to Section 2.2
2.1.8	Operating temperature (discharge)	-35~65℃	Refer to Section 2.3
2.1.9	Weight	≤4.22Kg	N.A.
2.1.10	Dimensions	Please refer to Clause 8	300Kgf under pressure
2.1.11	Cell cycle life	⩾6000cycles	Initial clamping force 300Kgf, standard charge-discharge test

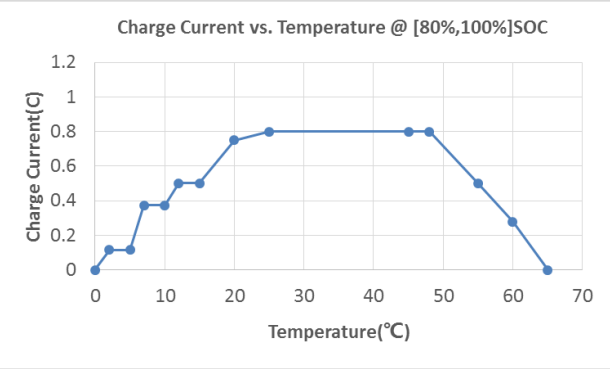
2.2 充电模式/参数 Charging mode/parameters

No.	Parameter	Product Specification	Condition
2.2.1	Standard charging current	0.5C	25±2℃
2.2.2	Maximum charge Continuous current current	1C	25±2℃
2.2.3	Standard charge Voltage	3.65V	/
2.2.4	Standard charging mode	0.5C constant current continuous charging to the maximum 3.65V of single battery, and then continuous charging at constant voltage 3.65V at normal voltage until the current lower limit of 0.05C	
2.2.5	Standard charging temperature	25±2℃	Temperature of cell
2.2.6	Absolute charging temperature (Cell temperature)	0~65℃	No matter what charging mode the cell is in, it will stop charging once the temperature of the cell is found to exceed the absolute charging temperature range
2.2.7	Absolute charging voltage	Max. 3.65V	No matter what charging mode the cell is in, it stops charging once the voltage of the cell is found to exceed the absolute charging voltage range

2.2.8：Other charging condition (mode) unitC-Rate

Temperature/℃		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





2.3 Discharge Mode

No.	Parameter	Specification	Condition
2.3.1	Standard Discharge Current	0.5C	25±2℃
2.3.2	Max. Con. Dis. current	1C	N.A.
2.3.3	End-off voltage	2.5V 2.0V	Temperature T>0℃ T≤0℃
2.3.4	Standard discharge temperature	25±2℃	
2.3.5	Absolute discharge temperature	-35~65℃	Whether the cell is in continuous discharge mode or pulse discharge mode, the discharge stops if the cell temperature exceeds the absolute discharge temperature

2.4 Pulse discharge & recharge mode

2.4.1 Pulse discharge mode Unit: C-Rate

30s Pulse discharge rate/C-cell level													
SoC/T	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	100%
-35℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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℃	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

2.4.2 Pulse charging mode Unit: C-Rate

30s Pulse recharging rate													
SoC/T	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	100%
0℃	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℃	-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℃	-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℃	-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℃	-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℃	-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℃	-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℃	-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℃	-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℃	-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℃	-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℃	-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℃	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

2.5 Low temperature capacity

No.	Parameter	Specification	Condition
2.5.1	Capacity of 0℃	≥80%	0℃，1C，2.0V~3.65V, benchmark 230Ah,New Batter y status
2.5.2	Capacity of -20℃	≥70%	-20℃，1C，2.0V~3.65V, benchmark 230Ah

2.6 Safety and Reliability（All tests are in line with GB/T 31485-2015, GB/T 31486-2015 standards)

No.	Parameter	Specification	Test condition
2.6.1	Over charge test	No fire, no explosion	1. Test the ambient temperature of 25℃; 2. Single battery charging; 3. Charge with 1.0C constant current until the voltage reaches 1.5 times of the termination voltage specified in the technical conditions of the enterprise or the charging time reaches Stop charging after 1h; 4. Observe 1h to monitor the voltage, current and temperature during the experiment.
2.6.2	Vibration test	No discharge current sharpening, abnormal voltage, battery shell deformation, electrolyte overflow and other phenomena occur, and keep connected Reliable, sound structure.	1. Test the ambient temperature of 25±2℃ 2. Charge the battery module 3. Fasten the battery module to the vibration test bench, and perform linear sweep vibration test according to the following conditions; -- Discharge current: 1/3C; -- Vibration direction: upper and lower single vibration; -- Vibration frequency: 10Hz ~ 55Hz -- Maximum acceleration: 30m/s2; -- Frequency sweep cycle: 10 times; -- Vibration time: 3h; 4. Observe whether there are abnormal phenomena in the process of vibration test. Do not allow the discharge current sharp, abnormal voltage, battery shell deformation, electrolyte overflow and other phenomena , and keep the connection reliable, good structure.

Remarks: The overcharge test requires testing with fixtures. Before conducting other tests or referring to other standard tests, the specific test process and precautions should be confirmed with CATL.

3 Product life termination management

Batteries have a finite life. The customer shall establish an effective tracking system to monitor and record the internal resistance and capacity of the battery during each life period. The measurement method and calculation method of internal resistance and capacity need to be discussed and agreed by 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℃), the battery should be stopped. Failure to comply with this requirement will release CATL from its responsibility for product quality assurance under the Product Sales Agreement and this Specification.

4 Application condition

The customer shall ensure that the following battery related application conditions are strictly observed:

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 the detailed design scheme, system features, 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

4.3 Without the consent of CATL, the Customer shall not modify or change the design and framework of the battery management system to avoid affecting the performance of the battery.

4.4 Customer shall keep complete battery operation monitoring data for reference in product quality responsibility division. CATL shall not be responsible for product quality assurance in the absence of complete battery system lifetime monitoring data.

4.5 The battery management system must meet the following basic detection and control requirements

No.	Parameter	Specification	Protective action
4.5.1	Termination of charge	3.65V	Stop charging when the battery voltage reaches 3.65V
4.5.2	First level overcharge protection	⩾ 3.8V	Stop charging when the battery voltage reaches 3.8V
4.5.3	Second level overcharge protection	> 4.0V	Stop charging when the battery voltage reaches 4. 0V and lock the battery management system until the technician fixes the problem
4.5.4	Discharge off	< 2.5V	When the battery voltage reaches 2.5V, the current is minimized
4.5.5	First level overdischarge protection	< 2.0V	When the battery voltage reaches 2.0V, the current is minimized

4.5.6	Second level overdischarge protection	< 1.8V	When the battery voltage is below 1.8V, lock the battery management system until the technician fixes the problem
4.5.7	Short circuit protection	Short circuit is not allowed	In case of short circuit, the overcurrent disconnects the battery
4.5.8	Overcurrent protection	Refer to section 2.3	The battery management system controls the discharge current to meet specifications
4.5.9	Overheating protection	Refer to clauses 2.2 and 2.3	When the temperature exceeds the specification, the charge/discharge shall be terminated
4.5.10	Long charging time protection	Charging time is within 8 hours	If the charging time is longer than 8 hours, the charging will be terminated

Note: No.4.5.2, 4.5.3, 4.5.5 and 4.5.6 above are warning clauses, please note to customers: When the battery reaches the indicators and parameter states described in any of the above clauses, it means that the battery has exceeded the service conditions specified in this Specification, and the Customer shall take protective measures for the battery in accordance with the "Protection Action" and other relevant provisions of this Specification. Meanwhile, CATL declares that it is not responsible for the quality of the battery in the above service conditions. And no compensation for any loss caused by the customer and the third party.

4.6 Avoid the battery reaching the overdischarge state. When the battery voltage is lower than 1.8V, permanent damage may occur inside the battery, at which point CATL's product quality assurance liability expires. According to Clause 2.3.5 of this specification, when the discharge cutoff voltage is below 2.5V, the internal energy consumption of the system is minimized and the hibernation time is extended before recharging. The customer needs to train the user to recharge the battery in the shortest possible time to prevent the battery from entering the overdischarge 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 Batteries should not be charged at low temperatures prohibited by this specification (including standard charge, quick charge, emergency charge and regenerative charge), otherwise unexpected capacity reduction may occur. The battery management system shall be controlled in accordance with minimum charging and regenerative charging temperatures. Charging at temperatures lower than those specified in this specification is prohibited, otherwise, CATL will not be responsible for quality assurance.

4.9 The heat dissipation of the battery cell should be fully considered in the design of the electric box. CATL does not assume the responsibility for quality assurance if the battery cell or battery is damaged due to the heat dissipation design of the electric box

4.10 In the design of electric box, the waterproofing and dust-proof of the cell should be fully considered. The electric box must meet the waterproofing and dust-proof grades stipulated by the relevant national standards. CATL does not guarantee the quality of cells or batteries due to water and dust problems (corrosion, rust, etc.) responsibility.

4.11 It is forbidden to use cells with different P/N numbers in the same battery system (or vehicle), otherwise, CATL will not be responsible for quality assurance.

5 Safety protection

*Do not immerse the battery in water.
*Do not put the battery into fire or expose it to high temperature conditions beyond the temperature conditions specified in clauses 2.1.7 and 2.1.8 of this specification for a long time, otherwise it may cause fire. Under normal conditions, the battery cell temperature should not exceed 65 ° C. If the battery cell temperature exceeds 65 ° C, the battery management system needs to shut down the battery.
*Do not short circuit the positive and negative electrodes of the battery. Otherwise, the strong current and high temperature may cause personal injury or fire. Since the positive and negative electrodes of the battery are exposed to plastic protective covers, adequate safety protection should be provided to avoid short circuit when the battery system is assembled and connected.
Strictly follow the labels and instructions to connect the positive and negative battery terminals. Do not reverse charge.
*Do not overcharge the battery. Otherwise, the battery may overheat and fire. During battery installation and use, hardware and software must be protected against multiple overcharge failures. The minimum protection requirements are described in sections 4.5.3 and 5.11 of this specification.
*Normal charging shall be finished after charging according to Article 4.5.9 of this specification. When a charge lasts longer than a reasonable time limit, the battery will overheat and may cause thermal runaway and fire. A timer should be installed for protection. Once the charging current reaches the overshoot state and cannot be terminated, the timer will act to terminate the charging, see article 5.11 of this specification.
*The customer shall secure the battery to a solid plane and securely bind the power cord in place to avoid arcing and sparks caused by friction.
*Do not use plastic to encapsulate batteries or use plastic for electrical connections. Incorrect electrical connections may cause the battery to overheat during use.
*When the electrolyte leaks, keep skin and eyes away from the electrolyte. If exposed, wash the area with plenty of water and seek medical help. No person or animal is allowed to ingest any part of the battery or any substance contained in the battery.

The tests described in Section 2.5 of this specification may cause battery fire or explosion if not performed properly. The test should only be carried out in a professional laboratory by professionals equipped with appropriate protective equipment. Otherwise, serious personal injury and property damage may occur lost.

6 Disclaimer

CATL will hold the product demand unit responsible for any social impact caused by the non-use of the product in accordance with the provisions of this specification and the impact on the reputation of CATL. According to the degree of impact on CATL, the product demand unit shall provide compensation to CATL.

7 Risk Warning

7.1 Warning Statement

Warning

Batteries are potentially dangerous. Proper protective measures must be taken during operation and maintenance.

Incorrect operation of the test experiments described in Section 2.5 of this specification may result in serious personal injury and property damage!

You must use the correct tools and protective equipment to operate the battery.

Battery maintenance must be performed by personnel with specialized battery knowledge and safety training.

Failure to comply with these warnings could result in multiple disasters.

7.2 Type of risk:

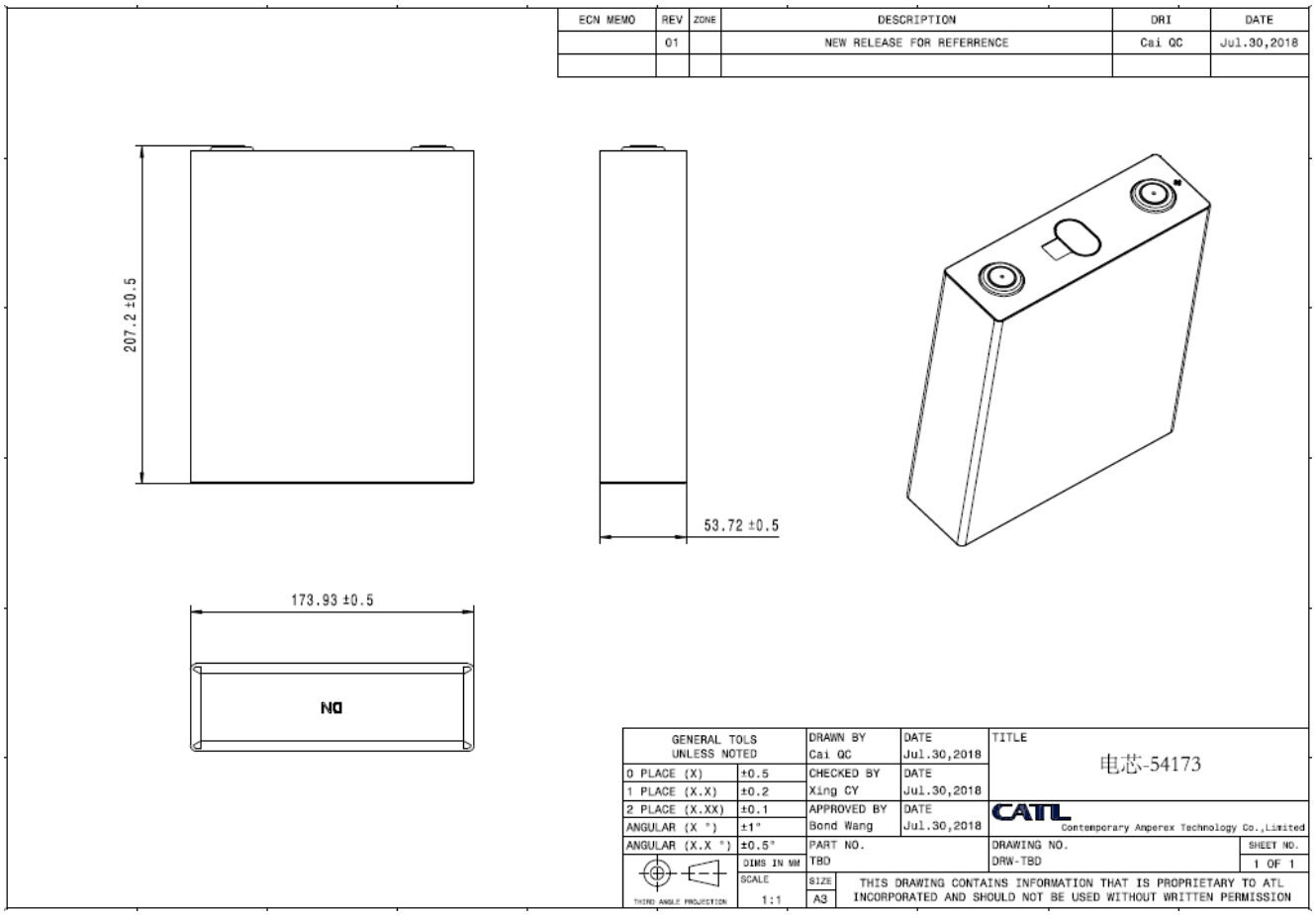
The customer is aware of the following potential hazards during battery use and operation:

7.2.1 The operator may be exposed to chemicals, electric shocks, or electric arcs during operation. Although the human body reacts differently to DC and AC, DC voltage higher than 50V is just as harmful to the human body as AC, so the customer must operate adopt a conservative posture to avoid electrical damage.

7.2.2 There are chemical risks from the electrolyte in the battery.

7.2.3 When operating batteries and selecting personal protective equipment, the Customer and its employees must take into account the above potential risks to prevent accidental short circuit, resulting in electric arc, explosion or thermal runaway.

8 Battery (cell) drawing


ECN MEMO | REV | ZONE | DESCRIPTION | DRI | DATE
01 | NEW RELEASE FOR REFERRENCE | Cai QC | Jul.30,2018
207.2 ±0.5
53.72 ±0.5
173.93 ±0.5
NO
GENERAL TOLS UNLESS NOTED
0 PLACE (X) ±0.5
1 PLACE (X.X) ±0.2
2 PLACE (X.XX) ±0.1
ANGULAR (X °) ±1°
ANGULAR (X.X °) ±0.5°
THIRD ANGLE PROJECTION
DIMS IN MM
SCALE 1:1
DRAWN BY Cai QC DATE Jul.30,2018
CHECKED BY Xing CY DATE Jul.30,2018
APPROVED BY Bond Wang DATE Jul.30,2018
PART NO. TBD
TITLE 电芯-54173
CATL Contemporary Amperex Technology Co.,Limited
DRAWING NO. DRW-TBD
SHEET NO. 1 OF 1
SIZE A3
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