



**PRODUCT
SPECIFICATION**

DOC NO.: CTPS-S5E891-15

REV. : 1.0

SHEET : 1 of 15

ECN NO.:

Product Specification Confirmation

Model:S5E891 P/N: FC-N50-S5E891-5AEL

Product Design Preparation	Product Design Approval	Sales Approval	Project engineering approval	Quality Assurance Approval	Product Manager Approval
JQ Cao	CM Yan	F Yin	Davei Wang	XG Lu	CL Xing

Customer confirmation	Sign one's name	Date
	Customer code :	
	Corporate seal :	

Confidential: () Level 3 Private () Level 2 High Confidentiality (V) Level 1 Low Confidentiality

--- CATL Confidential ---



**PRODUCT
SPECIFICATION**

DOC NO.: CTPS-S5E891-13

REV. : 1.0

SHEET : 2 of 15

Update Log

Edition	Description	Date	Acknowledgment state
1.0	New release	2017.03.15	



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13

REV. : 1.0

SHEET : 3 of 15

Customer Requirements

Model: S5E891

Version: 1.0

Customers are required to submit their requirement documentation and coordinate with CATL in advance. For applications or operational conditions differing from those specified in this document, CATL may customize product design and production to meet specific client requirements.

	Special requirements	Standard
1		
2		
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4		
5		

Customer code :

Sign :

Date : _____



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13

REV. : 1.0

SHEET : 4 of 15

Catalogue

Terminology	5
1. scope of application	6
2. Product Electrical Performance Specifications	6
2.1 essentials	6
2.2 Charging mode/parameters	6
2.3 Discharge mode/parameter	7
2.4 Pulse discharge mode	7
2.5 renewal pulse pattern	8
2.6 high and low temperature discharge capacity	8
2.7 self-discharge performance	9
3. product temperature rise performance	9
4. Safety and Reliability	9
5. Product Life Termination Management	9
6. Application conditions	9
7. Security Protection	10
8. Risk Warning	11
9. product size	12



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13REV. : 1.0SHEET : 5 of 15

Terminology

Term	Definition
Product	In this specification, 'product' refers to the 48Ah rechargeable ternary battery produced by CATL.
Client	The term 'Customer' refers to any company, enterprise, or individual that purchases the products specified in this specification.
CATL	It refers to CATL New Energy Technology Co., Ltd.
PN	To differentiate batteries for various application scenarios or conditions, CATL assigns a material code to its 48Ah rechargeable lithium batteries.
Ambient temperature	The ambient temperature of the battery. The temperature tolerance is $\pm 2^{\circ}\text{C}$.
Battery Management System (BMS)	An effective tracking and control system for customers to monitor and record the operational parameters of products throughout their service life. The parameters tracked and recorded include, but are not limited to, voltage, current, temperature, etc., to control product operation and ensure that the operating environment and conditions comply with the specifications outlined in this manual.
Cell temperature	The cell temperature is measured by a temperature sensor connected to the battery, with the sensor and measurement circuitry jointly approved by CATL and the customer.
Charge Rate (C-Rate)	The ratio of the charging current to the battery capacity value measured by the battery management system. For example, if the battery capacity is 48Ah and the charging current is 48A, the charging rate is 1C. If the battery capacity drops to 45Ah and the charging current is 45A, the charging rate is 1C.
Recurrence (Cycle)	A battery cycle is defined as a complete charge-discharge process according to the specified standards. A cycle includes a brief normal charging or regenerative charging and discharging process. During charging, only normal charging may occur without regenerative charging. Discharging can be composed of partial discharges.
Date of manufacture	The manufacturing date of the battery. The date code on the top sticker of each battery indicates the manufacturing date.
Open Circuit Voltage (OCV)	The voltage of the battery is measured when no load or circuit is connected.
Recoverable capacity	The battery capacity is determined after storage, with the maximum value among three measurements taken under the standard charge-discharge conditions specified in Sections 2.2 and 2.4 of this specification.
Product Supply Agreement	The transaction terms for products specified in this specification, jointly agreed upon by CATL and its customers.
Standard charging	The charging mode specified in Section 2.2 of this specification.
Standard discharge	The discharge mode specified in Section 2.4 of this specification.
Standard shelf life	The warranty period for CATL products is generally 60 months from the manufacturing date or 1,500 cycles, whichever comes first.
SOC (State of Charge)	The ratio of actual charge to full charge indicates the battery's state of charge. A 100% SOC means the battery is fully charged to 4.2V, while a 0% SOC means it is completely discharged to 2.8V.
Product usage area	This product is used in the Chinese mainland.
Battery temperature rise	Under the conditions specified in this specification, such as the rise in cell temperature during charging or discharging.



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13REV. : 1.0SHEET : 6 of 15

Measurement unit	"V" (Volt), a unit of voltage A "(Ampere) A, current unit" Ah "(Ampere-Hour) Ah, load unit" Wh" (Watt-Hour) Wh, energy unit Ω (ohm), unit of resistance "m Ω " (milliohm) is a unit of resistance. °C (degree Celsius), a temperature unit "mm" (millimeter), a unit of length "s" (second), time unit Hz (Hertz), a unit of frequency
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Scope of Application

This specification document outlines the performance parameters, operating conditions, and risk warnings for CATL's 3.65V 48Ah rechargeable ternary battery system (CATLPN: FC-N48-S5E891-5AEL).

Product Electrical Performance Specifications

2.1 Essentials

No.	Parameter	Size of product	Condition
2.1.1	Standard capacity	$\geq 50\text{Ah}$ $\geq 48\text{Ah}$	16A (0.33C) current discharge current; 48A (1.0C) current discharge
2.1.2	Discharge energy	$\geq 182.5\text{ Wh}$ $\geq 172.8\text{ Wh}$	16A (0.33C) current discharge; 48A (1.0C) current discharge
2.1.3	Rated voltage	3.65V 3.60V	16A (0.33C) current discharge; 48A (1.0C) current discharge
2.1.4	Operating voltage range	2.8–4.2V 2.5–4.2V 2.1–4.2V	Temperature $T > -5^{\circ}\text{C}$ $-25^{\circ}\text{C} \leq \text{temperature } T \leq 5^{\circ}\text{C}$ Temperature $T \leq -25^{\circ}\text{C}$
2.1.5	Battery internal resistance (1KHz)	$\leq 1.0\text{m}\Omega$	New battery at 70% SOC
2.1.6	Average battery resistance (1KHz)	$\sim 0.65\text{m}\Omega$	New battery at 70% SOC
2.1.7	Ship capacity	About 70% charge level	3.78~3.84V
2.1.8	Working temperature (charging)	-20 – 55°C	Refer to Section 2.2
2.1.9	Working temperature (discharge)	-30 – 55°C	Refer to Section 2.3
2.1.10	Storage temperature	-40 – 55°C	
2.1.11	Cycle life	≥ 1500 recurrence	25±2°C, 24A charging/48A discharging, capacity decay



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13REV. : 1.0SHEET : 7 of 15

			Reduced to 80%
2.1.12	Room temperature discharge power	> 1400 W	25±2°C, 50% SOC, 184A, 10s pulse discharge
2.1.13	Recommended SOC usage scope	5% - 95%	
2.1.14	Battery weight	≤ 860 grams	N.A.
2.1.15	Cell size	Refer to Section 10 of this specification	N.A
2.1.16	Cell weight energy density	212 Wh/Kg 200 Wh/Kg	16A (0.33C) current discharge current; 48A (1.0C) current discharge
2.1.17	Volume energy density of cell	521 Wh/L 490 Wh/L	16A (0.33C) current discharge current; 48A (1.0C) current discharge

2.2 Charging mode/parameters

2.2.1 Standard charging conditions (mode)

No.	Parameter	Size of product	Condition
2.2.1.1	Standard charging current	16A	25°C
2.2.1.2	Standard charging voltage	The maximum voltage of a single cell is 4.2 volts.	
2.2.1.3	Standard charging mode	16A constant current charging continues until the individual battery reaches a maximum voltage of 4.2 V, followed by constant voltage charging at 4.2 V under normal pressure until the current limit is ≤ 2.4±0.3 A.	
2.2.1.4	Standard charging temperature	25 ± 2°C	Cell temperature

2.2.2 Other charging conditions (modes)

Cell temperature	Standard charging	Quick charge
< -20°C	Charging is not allowed	Charging is not allowed
-20°C ≤ T < -10°C	Charge at a constant current of 0.05C to 4.2V	Charge 0.05C to 4.2V
-10°C ≤ T < 0°C	Charge at a constant current of 0.1C to 4.2V, then charge at a constant voltage of 4.2V to 0.05C	Charge from 0.1C to 4.2V, then charge at a constant voltage of 4.2V to 0.05C
0°C ≤ T < 5°C	Charge at a constant current of 0.2C to 4.2V, then charge at a constant voltage of 4.2V to 0.05C	Charge from 0.2C to 4.2V, then charge at a constant voltage of 4.2V to 0.05C
5°C ≤ T < 15°C	Constant current charge from 0.2C to 4.2V, then constant voltage charge from 4.2V to 0.05C	Charge at 0.3C to 3.84V; charge at 0.2C to 4.2V, then charge at constant voltage from 4.2V to 0.05C
15°C ≤ T < 25°C	Constant current charge from 0.33C to 4.2V, then constant voltage charge from 4.2V to 0.05C	Charge at 0.5C to 3.84V; charge at 0.33C to 4.2V, then charge at constant voltage from 4.2V to 0.05C
25°C ≤ T < 45°C	Constant current charge from 0.33C to 4.2V, then constant voltage charge from 4.2V to 0.05C	1.3C constant current charging to 3.71V, then linearly decreasing current to 1C charging to 3.85V, followed by linear current reduction



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13REV. : 1.0SHEET : 8 of 15

		Charge at 0.33C to 4.02V, charge at 0.33C constant current to 4.2V, charge at 4.2V constant voltage to 0.05C
$45^{\circ}\text{C} \leq T \leq 55^{\circ}\text{C}$	Constant current charge from 0.33C to 4.2V, then constant voltage charge from 4.2V to 0.05C	Charge from 0.33C to 4.2V, then charge at a constant voltage of 4.2V to 0.05C
$>55^{\circ}\text{C}$	Charging is not allowed	

2.3 Discharge mode/parameter

No.	Parameter	Size of product	Condition
2.3.1	Standard discharge current	0.33C	25 °C
2.3.2	Maximum continuous discharge current	96A @ 25°C 46A @ 0°C 24A @ -20°C	The adiabatic temperature rise during continuous discharge at 25°C is below 35°C.
2.3.3	Maximum pulse discharge current (long pulse)	257 A@25°C 117A@0°C 53A@-20°C	The discharge time of the battery cell at 50% State of Charge (SOC) is less than 30 seconds.
2.3.4	Maximum pulse discharge current (short pulse)	397A@25°C 157A@0°C 61A@-20°C	The battery cell discharges in less than 10 seconds at 50% State of Charge (SOC).
2.3.5	Minimum pulse discharge cutoff voltage	2.8V 2.5V 2.1V	Temperature $T > -5^{\circ}\text{C}$ $-20^{\circ}\text{C} \leq \text{temperature } T \leq -5^{\circ}\text{C}$ Temperature $T \leq -20^{\circ}\text{C}$
2.3.6	Standard discharge temperature	$25 \pm 2^{\circ}\text{C}$	Cell temperature
2.3.7	Discharge temperature range	-30 - 55°C	If the cell temperature exceeds the discharge temperature range, discharge shall be stopped.

2.4 Pulse discharge mode

Pulse discharge refers to the process where battery cells undergo pulsed discharge during product operation. This discharge must strictly comply with the charging conditions and cell temperature specifications outlined in this technical specification. The magnitude and duration of the pulse current must strictly adhere to all charging conditions and cell temperature parameters listed in the table below. Failure to meet these pulse discharge requirements may cause permanent damage to the battery cells, thereby exempting CATL from any liability for product quality.

2.4.1 minimum pulse discharge cutoff voltage

$\leq -20^{\circ}\text{C}$	$\leq -5^{\circ}\text{C}$	$> -5^{\circ}\text{C}$
2.1V	2.5V	2.8V



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13REV. : 1.0SHEET : 9 of 15

2.4.2 Permissible pulse discharge power and duration

SOC	Power value (BOL, 30s)/W								
	<-20℃	≥-20℃	≥-15℃	≥-5℃	≥5℃	≥25℃	≥45℃	55℃	>55℃
20%	Not allow	56	76	134	224	560	558	314	Not allow
50%	Not allow	152	187	279	405	739	739	418	Not allow
80%	Not allow	168	206	307	446	812	811	453	Not allow

SOC	Power value (EOL, 30s)/W								
	<-20℃	≥-20℃	≥-15℃	≥-5℃	≥5℃	≥25℃	≥45℃	55℃	>55℃
20%	Not allow	25	36	64	106	268	268	151	Not allow
50%	Not allow	72	89	133	193	354	354	199	Not allow
80%	Not allow	79	98	146	212	389	388	216	Not allow

2.4.3 After each pulse discharge, the battery must enter a dormant period lasting at least as long as the regeneration pulse duration. During this period, the battery may remain in standard discharge/charge mode or zero-current inactive state, but pulse discharge is strictly prohibited.

2.5 rechargeable pulse charging mode

Regenerative pulse charging refers to the reverse charging of battery cells using pulse current during product operation. This process must strictly comply with the charging conditions and cell temperature specifications outlined in this manual. The pulse current magnitude and duration must strictly adhere to all charging states and cell temperature parameters listed in the table below. Failure to meet these charging conditions may cause permanent damage to the battery cells, thereby exempting CATL from product quality liability.

2.5.1 Maximum regenerative pulse charging voltage: 4.2V

2.5.2 Permissible recharge pulse charging power and duration

SOC	Power value (BOL, 15s)/W								
	<-20℃	≥-20℃	≥-15℃	≥-5℃	≥5℃	≥25℃	≥45℃	55℃	>55℃
20%	Not allow	31	46	84	155	463	463	229	Not allow
50%	Not allow	32	47	87	160	479	479	237	Not allow
80%	Not allow	27	35	70	122	370	370	185	Not allow

SOC	Power value (EOL, 15s)/W								
	<-20℃	≥-20℃	≥-15℃	≥-5℃	≥5℃	≥25℃	≥45℃	55℃	>55℃
20%	Not allow	31	46	84	148	449	448	222	Not allow
50%	Not allow	32	47	87	153	464	464	230	Not allow
80%	Not allow	19	27	51	94	283	283	141	Not allow



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13REV. : 1.0SHEET : 10 of 15

2.5.3 After each regenerative pulse charging, the battery must enter a dormant period lasting at least as long as the regenerative pulse duration. During this period, the battery may discharge or remain in zero-current inactive mode, but no regenerative pulse charging is permitted.

2.6 high and low temperature discharge capacity

No.	Parameter	Size of product	Condition (cell surface temperature)
2.6.1	25°C discharge capacity	$\geq 48\text{Ah}$	Standard charging at 25°C / Discharge at 48A to 2.8V at 25°C
2.6.2	45°C discharge capacity	$\geq 48\text{Ah}$	Standard charging at 25°C / Discharge at 48A to 2.8V at 45°C
2.6.3	55°C discharge capacity	$\geq 48\text{Ah}$	Standard charging at 25°C / Discharge at 48A to 2.8V at 55°C
2.6.4	Discharge capacity at -15°C	$\geq 35\text{Ah}$	Standard charging at 25°C-Discharge at 48A to 2.8V at 15°C
2.6.5	-20°C discharge capacity	$\geq 33.6\text{Ah}$	Standard charging at 25°C-Discharge at 48A to 2.8V at 20°C

2.7 self-discharge performance of battery

No.	Parameter	Size of product	Condition
2.7.1	Non-recoverable self-discharge rate at room temperature	$\leq 4\%$ every 30 days	Standard charging to 100% capacity, stored at 25°C
2.7.2	High temperature irrecoverable self-discharge rate	$\leq 8\%$ every 30 days	Standard charging to 100% capacity, stored at 55°C

3. cell temperature rise

In this specification, temperature rise is defined as the difference between the battery's surface temperature after discharge and before discharge. Measurements should be conducted in a room with stable ambient temperature and sufficient space. Each battery temperature measurement must use a calibrated temperature sensor capable of recording time data.

No.	Parameter	Size of product	Condition
3.1	Continuous discharge temperature rise	$\leq 15^\circ\text{C}$	Each battery was discharged at a current of 96 A for 10 minutes.
3.2	Continuous discharge temperature rise	$\leq 35^\circ\text{C}$	Adiabatic, 25°C, 1C, 100%DOD
3.3	Continuous discharge temperature rise	$\leq 12^\circ\text{C}$	Non-adiabatic, 25°C, 1C, 100%DOD
3.4	Continuous discharge temperature rise	$\leq 62^\circ\text{C}$	Adiabatic, -15°C, 1C, 100%DOD
3.5	Continuous discharge temperature rise	$\leq 18^\circ\text{C}$	Non-adiabatic, -15°C, 1C, 100%DOD
3.6	Temperature rise during pulsed discharge	$\leq 10^\circ\text{C}$	In any charging state, each battery discharges at 192A for 30 seconds

4. Safety and Reliability

4.1 Risk items:

This sample is currently in the development stage. The aforementioned lifespan data specifications are predictive values for reference only. Product specifications must be redefined during the mass production phase, and an official product specification document should be provided.

This sample is currently in the development stage, with design freeze and process reliability validation not yet completed, posing batch stability risks.



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13

REV. : 1.0

SHEET : 11 of 15

4.2 Restriction Usage:

This sample is for official announcements and testing purposes only. It is strictly prohibited to sell it to end customers.

5. Product Life Termination Management

To ensure battery safety, customers must implement an effective tracking system to monitor and record the internal resistance of each battery. The measurement and calculation methods for internal resistance require mutual discussion and agreement between the customer and CATL. If the internal resistance of a battery in use exceeds 250% of its initial value, the battery must be discontinued. Failure to comply with this requirement will exempt CATL from its product quality warranty obligations under the sales agreement and this specification.

6. Application Conditions

Customers must strictly comply with the following battery-related application conditions:

6.1 The customer shall install a battery management system to closely monitor, manage, and protect each battery.

6.1.1 The client shall provide CATL with detailed design specifications, system features, framework, data specifications, and format requirements for the battery management system, enabling CATL to conduct design evaluations and establish battery management documentation.

6.1.2 Customers must not modify or alter the design and framework of the battery management system without CATL's approval, as such actions may compromise battery performance.

6.1.3 Customers must retain complete battery operation monitoring data for reference in product quality liability allocation. CATL shall not assume product quality warranty liability if the complete monitoring data within the battery system's service life is not available.

6.1.4 The battery management system must meet the following fundamental testing and control requirements:

Note: The above parameters are cell specifications regulated by the management system. In practical applications, the BMS's latency effect must be considered.

No.	Parameter	Size of product	Protective action
6.1.4.1	Charge termination	4.2V	Stop charging when the battery voltage reaches 4.2V
6.1.4.2	First stage overcharge protection	Greater than or equal to 4.2 volts	The charging process terminates when the battery voltage reaches 4.2 volts.
6.1.4.3	Second stage overcharge protection	Greater than or equal to 4.25 volts	The charging process terminates when the battery voltage reaches 4.25 volts, and the battery management system (BMS) remains locked until technicians resolve the issue.
6.1.4.4	Discharge off	2.8 Fu	Stop discharging when the battery voltage reaches 2.8 volts, and reduce the current to the minimum.
6.1.4.5	First level over discharge protection	Minimum 2.5 volts	Stop discharging when the battery voltage reaches 2.5 volts, and reduce the current to the minimum.
6.1.4.6	Second level over discharge protection	Minimum 2.1 volts	When the battery voltage drops below 2.1 volts, lock the battery management system until technicians resolve the issue.
6.1.4.7	Short-circuit protection	Short circuits are not permitted	During a short circuit, the overcurrent device disconnects the battery (circuit).
6.1.4.8	Overcurrent protection	Refer to Section 2.3 Discharge Requirements	Battery management system controls discharge current to meet specifications
6.1.4.9	Overheat protection	Refer to Sections 2.2 to 2.3	Charging/discharging shall be terminated when the temperature exceeds the specifications in this manual.
6.1.4.10	Protection due to prolonged charging time	Charging time within 8 hours	If the charging time exceeds 8 hours, the charging will be terminated.



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13

REV. : 1.0

SHEET : 12 of 15

- 6.1.5 Prevent batteries from reaching over-discharge conditions. When the battery voltage drops below 2.1 volts, permanent internal damage may occur, at which point CATL's product quality warranty becomes invalid. As specified in Section 2.3.5 of this specification, if the actual discharge cutoff voltage falls below the standard threshold, the system will minimize internal energy consumption and extend the sleep time before recharging. Customers must train users to recharge promptly to prevent battery over-discharge.
- 6.1.6 Batteries must not be charged under low-temperature conditions prohibited by this specification (including standard charging, fast charging, emergency charging, and regenerative charging), as this may lead to unexpected capacity reduction. The battery management system should operate at the minimum charging and regenerative charging temperatures. Charging below the temperature limits specified in this specification is strictly prohibited; otherwise, CATL shall not be liable for quality assurance.
- 6.1.7 The design of the battery box must fully consider the heat dissipation of the cells. CATL shall not be liable for any damage to the cells or batteries caused by inadequate heat dissipation design in the battery box.
- 6.1.8 In the design of electrical boxes, adequate consideration must be given to the waterproofing and dustproofing of battery cells. The electrical boxes must meet the waterproofing and dustproofing standards specified by relevant national standards. CATL shall not be liable for quality assurance in cases of battery cell or battery damage caused by waterproofing or dustproofing issues (such as corrosion or rusting).

7. Security Protection

- 7.1 Do not immerse batteries in water.
- 7.2 Batteries must not be placed in flames or exposed to high temperatures exceeding those specified in Sections 2.1.7 and 2.1.8 of this specification, as this may cause fires. Under normal operating conditions, cell temperature must not exceed 60°C. If the cell temperature in the battery exceeds 60°C, the battery management system must shut down the battery and terminate its operation.
- 7.3 Short circuits between the positive and negative terminals of batteries are strictly prohibited, as high currents and elevated temperatures may cause personal injury or fires. Since the battery terminals are exposed within a plastic protective casing, adequate safety measures must be implemented during battery system assembly and connection to prevent short circuits.
- 7.4 Connect the battery terminals strictly according to the labeled polarity and instructions. Reverse charging is strictly prohibited.
- 7.5 Overcharging of batteries is strictly prohibited, as it may cause overheating and fire hazards. During battery installation and operation, both hardware and software must implement multiple overcharge failure safety protections. Minimum protection requirements are specified in Sections 6.1.4 and 7.11 of this specification.
- 7.6 According to Section 6.1.4.10 of this specification, normal charging should be terminated after charging. If the charging duration exceeds the reasonable time limit, the battery may overheat, potentially causing thermal runaway and fire. A timer should be installed for protection. Once the charging current reaches overcharge and cannot be terminated, the timer will activate to stop the charging process, as specified in Section 7.11 of this specification.
- 7.7 Customers should securely mount the battery on a solid surface and properly secure the power cord to prevent friction-induced arcs and sparks.
- 7.8 Plastic encapsulation of batteries or electrical connections made with plastic are strictly prohibited. Incorrect electrical connections may cause overheating during battery operation.
- 7.9 In the event of electrolyte leakage, avoid contact with the skin and eyes. If contact occurs, wash the affected area thoroughly with large amounts of clean water and seek medical assistance. It is strictly prohibited for any person or animal to ingest any components of the battery or substances contained within the battery.
- 7.10 Protect the battery from mechanical vibrations, impacts, and pressure shocks, as these may cause internal short circuits, leading to high temperatures and fires.
- 7.11 During battery charging, improper termination of charging may occur. Examples include exceeding the permitted charging duration, terminating charging due to excessively high voltage, or stopping charging due to overly strong current. These phenomena are collectively termed "improper termination of charging." When such occurrences happen, they may indicate electrical leakage in the battery system or malfunctioning components. Continuing to charge the battery without identifying and resolving the root cause could lead to...



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13

REV. : 1.0

SHEET : 13 of 15

Battery overheating or fire incidents. When such conditions occur, the battery management system must activate automatic locking functionality to prevent further charging and notify the user to return the vehicle containing the affected battery to the dealership for system maintenance. Charging may only be resumed after the battery has undergone comprehensive inspection by certified technicians, with root causes identified and thoroughly resolved through corrective measures.

8. Risk Warning

8.1 Warning Statement

Warning The battery poses potential hazards. Appropriate protective measures must be taken during operation and maintenance! Incorrect operation of the test procedures described in Section 2.6 of this specification may result in severe personal injuries and property damage!

The correct tools and protective equipment must be used when handling batteries.

Battery maintenance must be performed by personnel with battery expertise and safety training. Non-compliance with the above warnings may result in multiple disasters.

8.2 Danger type:

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

8.2.1 Operators may be injured by chemicals, electric shocks, or electric arcs during operation. Although the human body reacts differently to direct current (DC) and alternating current (AC), both DC voltages above 50 volts and AC currents pose equally severe hazards. Therefore, operators must adopt conservative postures during operation to avoid electric current injuries.

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

8.2.3 When operating batteries and selecting personal protective equipment, customers and their employees must consider the above potential risks to prevent accidental short circuits, resulting in electric arcs, explosions, or thermal runaway.



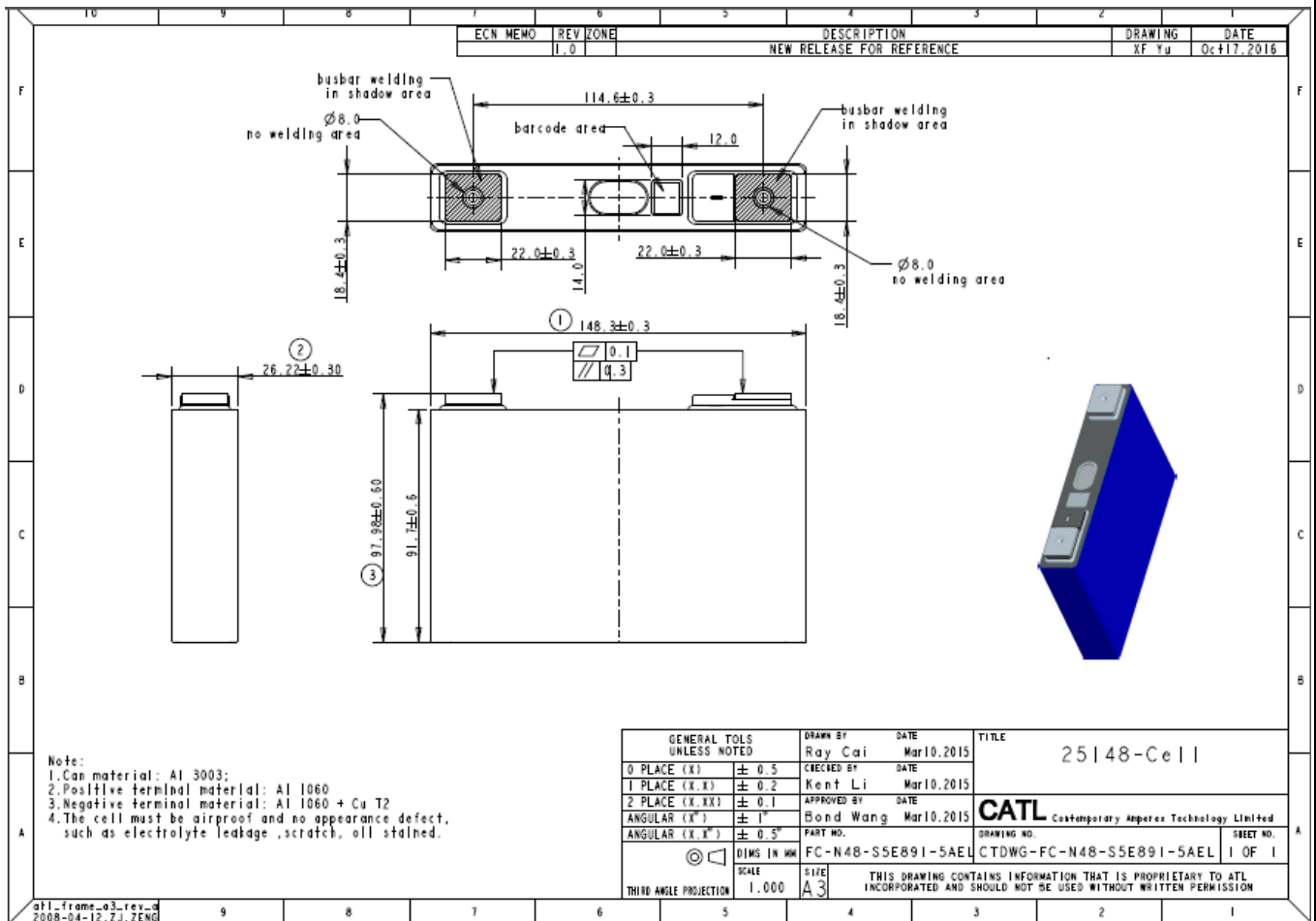
PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13

REV. : 1.0

SHEET : 14 of 15

9. Cell Drawing



Note: The dimensions shown above refer to the traditional envelope (side envelope), not the U-shaped envelope.



PRODUCT SPECIFICATION

DOC NO.: CTPS-S5E891-13

REV. : 1.0

SHEET : 15 of 15

VOC

Model: S5E891

Version: 1.0

We can also customize products to meet specific client requirements. Should your company have additional performance specifications beyond those outlined in this specification, please specify them below and send us your confirmation.

	Specific requirements	Standard
1		
2		
3		
4		
5		

Corporate name :

Sign one's name :

Date :