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Product Standard

Product Specification

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File Change Status Record

Document Change Record

Date Date	Version	Content before change	Modified content After Change	Change Number of items	Change person Reviser
2019/6/5	C	1. **Nominal voltage: 3.65V; Cycle life: 2500 cycles; Room temperature discharge power: 1200W; Operating temperature range: -30 °C to 60°C; Internal resistance ≤ 0.75mΩ, average internal resistance: 0.55±0.2mΩ; Discharge power density: 1364W/kg. 2. Cell dimensions modified to 26.68 mm*91.35mm*148.88mm. 3. Recommended SOC range adjustment from 0-100% to 15-95%.4. Other charging modes; Maximum continuous discharge current: 255A.5. Pulse discharge current and pulse charge current; Discharge capacity at 55°C ≥45.9Ah; Updated cell product drawings.**	1. **1. Nominal voltage: 3.62V; cycle life adjusted to 2000 cycles; room temperature discharge power adjusted to 1300 W; operating temperature adjusted for charging: -20℃ to 55℃, discharge: -30 ℃ to 55℃; internal resistance ≤0.60mΩ, average internal resistance 0.50±0.1m Ω; discharge power: 1500W/kg. 2. Cell dimensions modified to 26.68mm×91.4 mm×148.3mm. 3. Recommended SOC range adjustment to 15-95%.4. Charging mode modified to stepwise charging current; maximum continuous discharge current adjusted to 153A.5. Updated pulse discharge current and pulse charging current; discharge capacity at 55°C adjusted to ≥51Ah; updated cell finished product drawings.**	18	Liang Minggang
2019/11/28	D	**1.1. Key performance parameters of the battery cell: Operating voltage 2.8-4.2V; 2. Cell weight 0.865kg, cell thickness 26.68mm; 3. Pulse discharge/charge current/charging conditions; 4. Temperature rise description for the battery cell, along with requirements for battery management system (BMS) detection and control; 5. Updated cell schematic diagrams.**	1.**1. The main performance parameters of battery cells now include a "≥" requirement; operating voltage is categorized by temperature ranges; 2. Cell weight is adjusted to 0.855kg with thickness set at 26.72mm; 3. Pulse discharge/charge current and charging conditions have been updated; 4. The temperature rise section description has been revised, while the battery management system (BMS) detection and control requirements now include protection item classification; 5. Battery cell diagrams have been updated.**	10	Liang Minggang
2020/03/16	E	**1.The source code for the published document cover page product is BQ 01**	**1. The product source code has been corrected to CP01, and the document content remains unchanged.**	1	Liang Minggang

Catalogue

1 Terminology Definition

Term	Definition
Product	In this specification document, the term "product" refers to the 51Ah 3.62V rechargeable ternary system power cell manufactured by the company.
Client	Refers to the buyer in the "SVOLT CP01 Product Sales Contract".
SVOLT	Refers to the seller in the "SVOLT CP01 Product Sales Contract".
Ambient temperature	The ambient temperature surrounding the battery cell.
Battery Management System (BMS)	A customer utilizes this system as an effective tracking and control mechanism for monitoring and recording operational parameters of products throughout their service life. The tracked parameters include, but are not limited to, voltage, current, and temperature, to regulate 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 cell. The selection of temperature sensors and measurement circuits is jointly determined by SVOLT and the customer.
Fresh cell state	It refers to the battery cell's condition within 7 days from the product's release date.
C-Rate charging rate	The charging current divided by the capacity value of the battery cell measured multiple times by the battery management system. For example: If the battery cell capacity is 51Ah and the charging current is 51A, the charging rate is 1.0C.
Cycle recurrence	A battery cell cycle is defined as one complete charge-discharge cycle according to specified charging and discharging standards. A cycle comprises a combination of short-duration normal charging or regenerative charging processes with discharging. During charging, there may occasionally be only normal charging without regenerative charging. Discharge can be formed by the combination of partial discharges.
Production information	Manufacturing date of the battery cell. Established according to the latest national battery cell traceability coding rules, it includes production year, month, production line serial number, extended structure, and other information.
Open Circuit Voltage (OCV)	The voltage measured at a normal cell when no load or circuit is connected.
Recoverable capacity	After storage, the capacity of the battery cell is measured under the standard charge-discharge conditions specified in Sections 2.2.1 and 2.4.1 of this specification. The values are determined by selecting the maximum values from three measurements according to the respective charge-discharge standards outlined in Sections 2.2.1 and 2.4.1 of this specification.
Product Supply Agreement	The transaction terms for the product specified in this specification are jointly agreed upon by SVOLT and the customer.
Standard charging	The charging mode specified in Section 2.2.1 of this specification.
Standard discharge	The discharge current of 51A, as specified in Section 2.4.1 of this specification, is discharged to a minimum voltage of 2.8V.
Charging status (SOC)	The linear relationships between cell charging capacity state and parameters measured in ampere-hours or watt-hours under no-load conditions. A 100% SOC state indicates full charging of the cell to 4.2V, while a 0% SOC state represents complete discharge to 2.8V.

Measurement unit	"V" (Volt), a unit of voltage A" (Ampere) A, unit of electric current "Ah" (Ampere-Hour) is a unit of load. Wh (Watt-Hour), a unit of energy Ω (ohm), a unit of resistance "mΩ" (MilliOhm) is a unit of resistance. ℃ (degree Celsius), a temperature unit "mm" (millimeter), a unit of length "s" (second) s, time unit Hz (Hertz), a unit of frequency

2 Product Electrical Performance Specifications

2.1 Main Performance

No.	Parameter	Size of product	Condition
2.1.1	Cell capacity	≥51Ah	Discharge at 25°C with a discharge current of 51A (1C) and a cutoff voltage of 2.8V
2.1.2	Discharge energy	≥185Wh	Capacity × Nominal Voltage
2.1.3	Energy density	≥210Wh/Kg	(Capacity * Nominal Voltage) / Weight
2.1.4	Operating voltage range	2.8-4.2V 2.5-4.2V 2.1-4.2V	Temperature T>5℃; Temperature -20℃<T≤5℃; Temperature T≤-20℃;
2.1.5	Cell internal resistance (1KHz)	≤0.60mΩ	Fresh cell at 25°C with SOC=40%, AC frequency 1KHz
2.1.6	Average internal resistance of the cell (1KHz)	0.50±0.10mΩ	Fresh cell at 25°C with SOC=40%, AC frequency 1KHz
2.1.7	Cell shipment voltage	3.635±0.010V	25℃ 40%SOC
2.1.8	Shipments capacity	≥51Ah	Discharge at 25°C with a discharge current of 51A (1C) and a discharge cutoff voltage of 2.8V
2.1.9	Working temperature (charging)	-20℃ ~ 55℃	-
2.1.10	Operating temperature (discharge)	-30℃ ~ 55℃	-

2. 1. 11	**Cycle life**	≥2000cycle	**1C/1C 100%DOD cycle at 25°C**
2. 1. 12	**Room temperature discharge power**	≥1300W	**25°C, 50% SOC @ 416A for 10-second pulse discharge**
2. 1. 13	**Room temperature discharge power density**	≥1500W/Kg	**25°C, 50% SOC @ 416A for 10-second pulse discharge**
2. 1. 14	**Recommended scope of SOC use**	15%-95%	–
2. 1. 15	**Cell weight**	0. 855±0. 015 Kg	**Weight of membrane included**
2. 1. 16	**Cell size**	**26.72mm(thickness) * 91.4mm (excluding pole height) * 148.3mm (width)**	**The size of the encapsulated cell is shown in the attached figure.**

2.2 Charging Mode/Parameters

2.2.1 Standard charging current and voltage

The standard operating temperature for individual cells is 25±3°C, with a standard charging current of 51 A and a maximum charging voltage of 4.2V.

Charge the cell at 51A constant current to 4.2V under 25°C, then continue charging at 4.2V constant voltage until the current approaches 2.55±0.3 A, concluding the charging process.

2.2.2 absolute charging temperature

Regardless of the charging mode, charging shall be stopped once the cell temperature exceeds the absolute charging temperature range of-20°C to 55°C.

2.2.3 absolute charging voltage

Regardless of the battery cell's charging mode (including regenerative charging), charging will be stopped immediately if the cell voltage exceeds the maximum absolute charging voltage range of 4.2V.

2.3 Other Charging Conditions (modes)

Cell temperature	Stepwise charging method
<-20°C	**Continuous charging is not allowed**
-20≤T≤-10°C	**4A charging to 3.71V,3A charging to 3.82V,2A charging to 3.94V,1.5A charging to 4.08V, and 1A charging to 4.16V.**
-10<T≤-5°C	**10A charging to 3.73V,7.5A charging to 3.80V,6A charging to 3.92V,4A charging to 4.05V, and 3A charging to 4.16V.**
-5<T≤0°C	**17.8A charging to 3.74V,12.7A charging to 3.80V,10.7A charging to 3.92V,7.9A charging to 4.05V,5.3A charging to 4.16V;**
0<T≤5°C	**25.5A charging to 3.75V,17.8A charging to 3.80V,15.3A charging to 3.93V,11.7A charging to 4.06V,7.6A charging to 4.16V;**
5<T≤10°C	**30.6A charging to 3.74V,24.2A charging to 3.80V,20.4A charging to 3.92V,16.1A charging to 4.06V,11.5A charging to 4.16V;**
10<T≤15°C	**35.7A charging to 3.73V,30.6A charging to 3.80V,25.5A charging to 3.92V,20.4A charging to 4.06V,15.3A charging to 4.16V;**
15<T≤25°C	**40.8A charging to 3.73V,35.7A charging to 3.93V,25.5A charging to 4.06V**

	17.8A charging to 4.16V;
25＜T≤35℃	61A charged to 3.8V, 51A charged to 3.95V,40.8A charged to 4.06V, and 25.5A charged to 4.16V;
35＜T≤45℃	61A to 3.79V,51A to 3.93V,40.8A to 4.05V,25.5A to 4.16V;
45＜T＜55℃	31A charging to 3.78V,26A charging to 4.16V;
~55℃	Charge to 4.16V for 5A;
＞55℃	Continuous charging is not allowed

2.4 Discharge Mode/parameters

2.4.1 Standard discharge current and voltage

The standard operating temperature for single-cell batteries is 25±3°C, with a standard discharge current of 51A and a minimum discharge voltage of 2.8V.

2.4.2 Maximum continuous discharge current

The normally operating single-cell battery was discharged under constant current conditions of 153A at 25±3°C.

2.4.3 Maximum pulse discharge current (short pulse)

A normally operating single-cell battery operates at 25±3°C with a maximum pulse discharge current of 416A, maintaining a cell temperature below 50°C and a maximum discharge duration of 10 seconds.

2.4.4 absolute discharge temperature

Whether the battery cell is in continuous discharge mode or pulse discharge mode, discharge will be stopped if the cell temperature exceeds the absolute discharge temperature range of-30 to 55°C.

2.5 Pulse Discharge Mode

Pulse discharge refers to the process where battery cells undergo pulsed discharge during product operation. This discharge procedure must strictly comply with the charging conditions and cell temperature parameters specified in this specification. The magnitude and duration of pulse current must rigorously adhere to all charging states and cell temperature requirements listed in the table below. Failure to meet pulse discharge specifications may result in permanent cell damage, thereby voiding SVOLT's product quality liability.

2.5.1 Minimum cutoff voltage for pulsed discharge

Temperature T/℃	T≤-20℃	-20℃＜T≤5℃	T＞5℃
Cutoff voltage /V	2. 1V	2. 5V	2. 8V

The discharge cutoff voltage is 2.8V when the cell and ambient temperature T exceeds 5°C, 2.5V when T ranges from-20°C to 5°C, and 2.1V when T is below-20°C.

2.5.2 Allowable pulse discharge current and duration (BOL)

SOC	Cell temperature								
	＜-30℃	≥-30℃	≥-20℃	≥-10℃	≥0℃	≥10℃	≥25℃	~55℃	＞55℃
≥20%SOC	Not allow	54A	76A	97A	139A	191A	302A	15A	Not allow
Discharge time	Not allow	30s	30s	30s	30s	30s	30s	30s	Not allow

2.5.3 Post-pulse protection mode

After each pulse discharge, the battery cell requires a dormant period, which should be equal to or longer than the duration of the regeneration pulse. During the dormant period, the battery cell may remain in standard discharge state, charging state, or zero-current inactive state. However, the battery cell must not undergo further discharge during this dormant period.

Discharge phenomenon.

2.6 Regenerative Pulse Charging Mode

Regenerative pulse charging refers to the reverse charging process of battery cells using pulsed current during product operation. This charging method must strictly comply with the charging conditions and cell temperature specifications outlined in this technical specification. The magnitude and duration of pulsed current must rigorously adhere to all charging states and cell temperature parameters listed in the table below. Failure to meet regenerative pulse charging requirements may result in permanent cell damage, thereby voiding SVOLT's product quality liability.

2.6.1 Maximum regenerative pulse charging voltage

The maximum regenerative pulse charging cutoff voltage is 4.2V

2.6.2 Allowable regeneration pulse charging current and duration (BOL)

SOC	Cell temperature								
	<−30℃	≥−30℃	≥−20℃	≥−10℃	≥0℃	≥10℃	≥25℃	~55℃	>55℃
≤80%SOC	Not allow	1. 3A/10s	4A/10s	9. 5A/10s	25A/10s	53. 5A/10s	105A/10s	14. 9A/10s	Not allow
≤70%SOC	Not allow	1. 6A/10s	4. 1A/10s	10. 2A/10s	27A/10s	63. 2A/10s	127. 5A/10s	14. 9A/10s	Not allow

2.6.3 Post-pulse protection mode

After each regenerative pulse charging, the battery cell requires a dormant period whose duration should equal or exceed the duration of the regenerative pulse. During the dormant period, the battery cell may remain in a discharged state or a zero-current inactive state, but regenerative pulse charging is prohibited during this period.

2.7 High and Low Temperature Capacity

The capacity at 25°C is ≥51Ah. New cell condition, standard charge/discharge at 25°C.

The capacity at 55°C is ≥51Ah. New cell condition, standard charging at 25°C, standard discharge at 55°C.

The capacity at-20°C is Cap≥35.7Ah. New cell state, standard charging at 25°C, standard discharge at-20°C.

Standard charging refers to the charging method where the battery is charged at 1C rate to 4.2V under 25°C conditions, followed by constant voltage charging at 0.05C rate.

Standard discharge refers to the discharge method of 1C discharge to 2.8V under 25°C conditions.

2.8 Safety and Reliability

2.8.1 This product complies with the requirements of the new GBT national standard.

2.8.2 Restriction on use: This product is intended for use only in announcements, testing, etc., and is prohibited from being sold to end customers.

2.9 Self-Discharge Performance of Battery Cells

The battery cells maintained a capacity retention rate of no less than 85% of the initial capacity and a capacity recovery rate of no less than 90% of the initial capacity after being stored at room temperature for 28 days or at 55°C for 7 days under full charge conditions.

3 Cell Temperature Rise

In this specification, temperature rise refers to the difference between the surface temperature of the battery cell after discharge and its pre-discharge temperature. Measurements should be conducted in a room with stable ambient temperature and sufficient space to allow natural convection cooling.Each cell temperature measurement must use calibrated temperature sensors capable of recording time data.

The temperature rise during continuous discharge above 0°C was ≤15°C, with each cell discharged at 51A for 30 minutes.

4 Storage Performance

The cell is charged to full charge status by standard charging and stored at 25℃ for 30 days, with recoverable capacity (short-term) ≥48Ah.

5 Product Life Termination Management

The service life of battery cells is limited. An effective tracking system should be established during operation to monitor and record the internal resistance and capacity of each cell within its service life. Measurement methods and calculation procedures for internal resistance and capacity must be jointly discussed and agreed upon by both downstream partners and the battery cell manufacturers. If the internal resistance of a cell in use exceeds 150% of its initial resistance value, the cell should be immediately retired from service.

6 Application Conditions

6.1 Cell Application-Related Conditions

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

6.1.1. Customers must install a battery management system to closely monitor, manage, and protect each individual cell.

6.1.2. The client shall provide SVOLT with detailed design specifications, system features, framework, data specifications, and format requirements for the battery management system, enabling SVOLT to conduct design evaluations and establish cell management records.

6.1.3. Customers must not modify or alter the design and framework of the battery management system without SVOLT's consent, as such actions may compromise the performance of the battery cells.

6.1.4. Customers shall retain complete monitoring data of cell operation for reference in product quality liability allocation. SVOLT shall not assume corresponding design liability if complete monitoring data within the battery system's service life is unavailable.

6.1.5. The battery management system must meet the following fundamental detection and control requirements:

Charge termination: Charging is terminated when the cell voltage reaches 4.2V.

Primary overcharge protection: Charging is terminated when the cell voltage reaches 4.25V.

Secondary overcharge protection: Charging is terminated when the cell voltage reaches 4.3V, and the battery management system is locked until technicians resolve the issue.

discharge off： When the cell voltage reaches 2.8V, reduce the current to the minimum.

Primary over-discharge protection: When the cell voltage reaches 2.5V, reduce the current to the minimum.

Secondary over-discharge protection: The battery management system will remain locked when the cell voltage drops below 2.1V until technicians resolve the issue.

short-circuit protection： During a short circuit, the overcurrent protector disconnects the battery cell (circuit).

overcurrent protection： The battery management system controls the discharge current to meet specification requirements.

overheat protection： Charging/discharging shall be terminated when the temperature exceeds the specifications stipulated in this manual.

Protection for prolonged charging time: If the charging time exceeds 8 hours, charging shall be terminated.

Note: The above constitutes warning clauses. Please note that when the battery cell reaches any of the specified performance indicators or parameter thresholds outlined herein, it signifies that the cell has exceeded the operational conditions defined in this specification. Customers must implement protective measures for the battery cell in accordance with the 'Protection Actions' and other relevant provisions of this specification.

6.2 Prevent the Battery Cell from Reaching Over-Discharge State

When the cell voltage drops below 2.0V, permanent internal damage may occur, rendering the product's quality warranty invalid. If the actual discharge cutoff voltage falls below the standard threshold, the system minimizes internal energy consumption and extends the sleep duration before recharging. Customers should train users to recharge promptly to prevent cells from entering an over-discharge state.

6.3 Low Temperature Charging Protection

The battery cell 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 specified herein. Charging below the temperature limits stated in this specification is strictly prohibited; otherwise, SVOLT shall not be liable for quality assurance.

6.4 Short Term Storage

If the battery cells are expected to be stored for over 30 days, the SOC should be adjusted to approximately 40%-60%.

6.5 Long-Term Storage

If the interval between two battery charges exceeds two months, the standard charging mode should be used first before applying the fast charging mode at the specified rate.

6.6 Heat Protection

The heat dissipation of the battery cells should be fully considered in the design of the electrical box.SVOLT shall not be liable for quality assurance in case of battery cell damage or overheating caused by the electrical box heat dissipation design.

6.7 Dustproof and Waterproof Protection

During the design of electrical enclosures, adequate consideration must be given to waterproofing and dustproofing requirements for battery cells. The enclosures must comply with national standards specifying required waterproofing and dustproofing ratings.SVOLT shall not be liable for any damage to battery cells caused by waterproofing or dustproofing issues, including corrosion or rust formation.

7 Security Protection

Do not immerse the battery cells in water.

It is strictly prohibited to place battery cells in flames or expose them to high-temperature environments exceeding the temperature conditions specified in Sections 2.1.9 and 2.1.10 of this specification, as this may cause fires. Under normal operating conditions, the temperature inside battery cells must not exceed 60°C. If the temperature exceeds this threshold, the battery management system (BMS) must immediately deactivate the cell and halt its operation.

Short circuits between the positive and negative electrodes of the battery cell are strictly prohibited, as high currents and elevated temperatures may cause personal injury or fire. Since the positive and negative electrodes of the battery cell are exposed within a plastic protective casing, adequate safety measures must be implemented during the assembly and connection of the battery cell system to prevent short circuits.

Connect the positive and negative electrodes of the battery cells strictly according to the markings and instructions. Reverse charging is prohibited.

Overcharging of battery cells is prohibited, as it may lead to overheating and fire accidents. During battery cell installation and use, both hardware and software must implement multiple overcharge failure safety protections.

When the continuous charging duration exceeds the reasonable time limit, the battery cell may experience overheating, which could lead to thermal runaway and fire. A timer should be installed for protection. Once the charging current reaches an overcharge state and cannot be terminated, the timer will activate to terminate the charging process.

Customers should securely mount the battery cells on a solid surface and properly secure the power cord in an appropriate position to prevent friction-induced arcs and sparks.

It is strictly prohibited to encapsulate battery cells with plastic or use plastic for electrical connections. Incorrect electrical connection methods may lead to overheating during battery cell operation.

In the event of electrolyte leakage, avoid contact with the electrolyte through skin or 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 cell or substances contained within the battery cell.

Make every effort to protect the battery cells from mechanical vibrations, impacts, and pressure shocks, as internal short circuits may occur otherwise, leading to high temperatures and fires.

During battery cell charging processes, improper termination of charging may occur. Examples include exceeding permitted charging duration, terminating charging due to excessively high voltage levels, or stopping charging when current intensity exceeds safe limits. These phenomena are collectively termed "improper charging termination." When such occurrences happen, they may indicate electrical leakage in the battery system or component failures. Continuing charging without identifying root causes and implementing corrective measures could lead to battery overheating or fire risks. In such cases, the battery management system should activate automatic locking functionality to prevent further charging and notify users to return vehicles containing the faulty cell to dealers for system maintenance. The battery cell must undergo comprehensive inspection by certified technicians, with root causes identified and thoroughly resolved before charging can be resumed.

The test experiments described in this specification China may cause battery fires or explosions if operated improperly. These test experiments can only be conducted by professionals equipped with appropriate protective gear in specialized laboratories. Otherwise, serious personal injuries and property losses may occur.

8 Risk Warning

8.1 Warning Statement

warn

Battery cells pose potential hazards, requiring appropriate protective measures during operation and maintenance. Incorrect execution of charge-discharge test procedures specified in this product standard may result in severe personal injuries and property damage. Only qualified personnel equipped with proper tools and protective gear should handle battery cells. Maintenance operations must be performed exclusively by professionals with specialized expertise in battery cells and completed safety training. Failure to comply with these warnings may lead to multiple catastrophic consequences.

8.2 Risk Type:

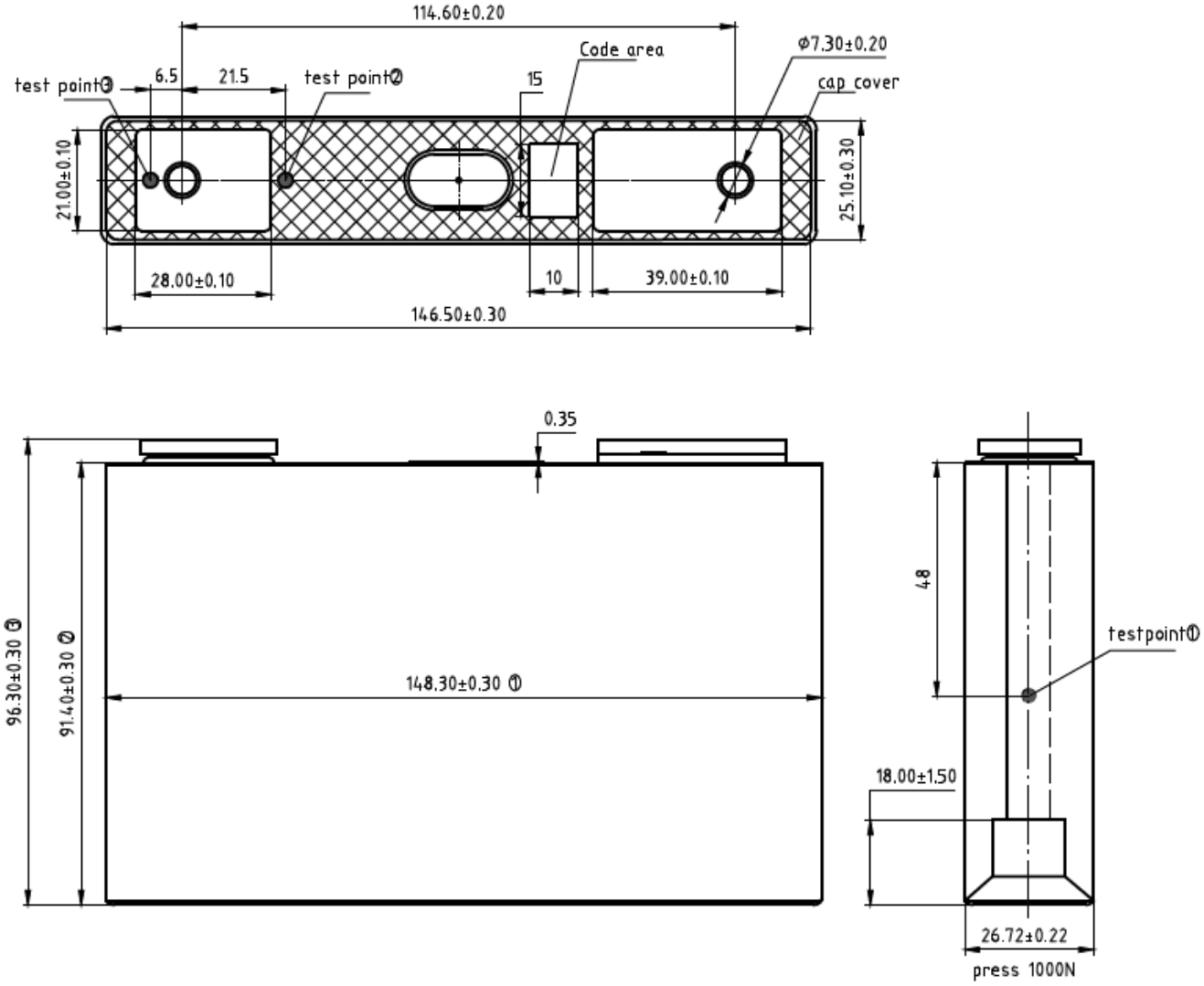
Customers are aware of the following potential hazards during battery cell usage and operation:

Operators may suffer injuries from chemicals, electric shocks, or electric arcs during operation. Although the human body reacts differently to direct current (DC) and alternating current (AC), DC voltages exceeding 50 volts and AC currents pose equally severe hazards to human health. Therefore, operators must adopt conservative postures during operations to avoid electric current injuries.

There are chemical risks from the electrolyte in the cell.

When handling battery cells and selecting personal protective equipment (PPE), customers and their employees must consider the aforementioned potential risks to prevent accidental short circuits that may lead to arcing, explosions, or thermal runaway.

9 Attached Map：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Code area
φ7.30±0.20
cap cover
test point③
6.5
21.5
test point②
15
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25.10±0.30
28.00±0.10
10
39.00±0.10
146.50±0.30
0.35
96.30±0.30 ③
91.40±0.30 ②
148.30±0.30 ①
4.8
testpoint①
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