Confidential

File No. NCR18650-1041

Issue Date: 2020/11/30

LITHIUM ION BATTERY SPECIFICATION

BATTERY CLASSIFICATION	LITHIUM ION BATTERY
PRODUCT CODE	BJ-A300602AA
CLIENT	

Client Agreement:

Signature: _____

Name in Block Letters: _____

Date: _____

*Please return this document with the signature within 30 days after receiving, or reply the requests of modification.

Cell Technology Department
Energy Solutions Business Division
SANYO Electric Co.,Ltd.
Industrial Solutions Company
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1 Revision History

No.	Date	Class	Description		
(a)	2020/11/30	—	Issue	Dft.	T.Higami
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				App.	
				Dft.	
				Chk.	
				Chk.	
				App.	

* Legend: A for Added, D for Deleted, R for Revised

File No.	NCR18650-1041	Energy Solutions Business Division SANYO Electric Co., Ltd.

2 Safety Instructions

The battery contains flammable materials such as organic solvents. Mishandling the battery may cause fire, smoke, or an explosion and the battery's functionality will be seriously damaged. Protection circuitry must be designed into the application device to protect the battery. Additionally, SANYO highly recommends adding these instructions to the owner's manual. Please read and check the following prohibited actions.

Danger

(1) Immersion

Do not immerse the battery in liquid such as water, beverages, or other fluids.

Exposure to liquid may damage the battery or the battery pack (including protection circuit). As a result, the battery may generate heat, smoke, catch fire, or explode.

(2) High Temperature

Do not use or place the battery near an open flame, heater or high temperature (above 80°C).

Subjecting the battery to high temperature may damage the polyolefin separator and can cause an internal short circuit. This may cause the battery to generate heat, smoke, catch fire, or explode.

(3) Chargers and Charge Conditions

Do not use unauthorized chargers.

Only charge the battery within specified conditions (e.g., temperature range, voltage, and current). Use of an unauthorized charger could cause the battery to generate heat, smoke, catch fire, or explode.

(4) Reverse Polarity

Do not attach or insert battery with polarity reversed.

A battery has polarity. If the battery does not easily fit into the charger or device, check the battery's orientation. Do not force the battery into the battery compartment. If attached to the device with reversed polarity, the battery may generate heat, smoke, catch fire, or explode.

(5) Direct Connection

Do not connect the battery to an AC outlet or DC automotive plug.

The battery requires a specific charger. If the battery is connected directly to a power outlet, the battery may generate heat, smoke, catch fire, or explode.

(6) Use in Other Equipment

Do not use the battery in equipment for which it was not intended.

If the battery is used in unapproved applications or systems, the battery may become damaged and generate heat, smoke, catch fire, or explode.

(7) Incineration and Heat

Keep the battery away from heat and fire.

Heat will damage the battery and may cause it to generate heat, smoke, catch fire, or explode.

(8) Short-Circuit

Do not apply a short-circuit.

Do not connect the positive (+) and negative (-) terminals with a conductive material. Do not carry or store the battery with any metal objects. If the battery is shorted, the shorting item may overheat and the battery may generate heat, smoke, catch fire, or explode.

(9) Impact

Avoid excessive impact to the battery.

Excessive impact may damage the battery. This may cause the battery to leak, generate heat, smoke, catch fire, or explode.

(10) Penetration

Do not penetrate the battery with a nail or strike with a hammer.

If subjected to a hard strike or penetrated by an object, the battery may be damaged or destroyed, thereby causing an internal short-circuit. This may cause the battery to generate heat, smoke, catch fire, or explode.

(11) Soldering

Do not directly solder to the battery.

Soldering directly to the battery could melt the separator or damage the gas release vent or other safety mechanisms. This may cause the battery to generate heat, smoke, catch fire, or explode.

(12) Disassembly

Do not disassemble the battery cell and battery pack.

Battery cell and/or battery pack may be deformed and damaged by disassembly.
Disassembly or modification of the battery cell and/or battery pack may damage the protection functions. This may cause the battery cell and/or battery pack to generate heat, smoke, catch fire, or explode.

(13) Charge near High Temperatures

Do not charge the battery near high temperature.

If the battery is charged while exposed to high temperature, the battery's protection circuit may activate and prevent charging, or fail and cause the battery to generate heat, smoke, catch fire, or explode.

(14) Deformation

Do not use the battery with conspicuous damage or deformation.

It causes the generating heat, smoke, rupture or flame.

Warning

(1) Ingestion

Keep away from small children.

Keep the battery away from small children. If the battery or any of its component parts is swallowed, seek medical attention immediately.

(2) Storage

Do not place the battery in or near a microwave or other cooking appliances.

If subjected to heat or electromagnetic radiation, the battery may leak, generate heat, smoke, catch fire, or explode.

(3) Mixed Use

Do not mix with other batteries.

The battery should not be used with other batteries having a different capacity, chemistry, or manufacturer. Doing so could cause the battery to generate heat, smoke, catch fire, or explode.

(4) Discoloration and Deformities

Do not use abnormal batteries.

Immediately stop using the battery if there are noticeable abnormalities, such as smell, heat, discoloration, or deformity. The battery may be defective and could generate heat, smoke, catch fire, or explode with continued use.

(5) Charging Time

Stop charging if the charging process cannot be finished.

If the battery can not finish the charging process within the specified time, halt the charging process.The battery may generate heat, smoke, catch fire, or explode.

(6) Leakage ①

Do not use a leaking battery near open flame.

If the battery or liquid leaking from the battery has an irritating odor, the battery should be kept away from any open flame. If exposed to an open flame, the battery could ignite and explode.

(7) Leakage ②

Do not touch a leaking battery.

If liquid leaking from the battery gets into your eyes, immediately flush your eyes with clean water and seek medical attention. If left untreated, it will cause significant eye damage.

(8) Transport

Pack the battery securely for transport.

To prevent short-circuit or damage during transport, securely pack the battery in a case or carton.

(9) Exposure to Direct Sunlight

Do not use or leave the battery in a location exposed to excessive heat.

If the battery is used in a location such as in direct sunlight or in a car, it could cause the battery to leak, generate heat, smoke, catch fire, or explode. It may also cause the battery's performance and life to deteriorate.

Caution

(1) Static Electricity

The battery pack has a protection circuit. Do not use the battery where static electricity in excess of 100V is generated as it may damage the protection circuit. If the protection circuit fails, the battery may generate heat, catch fire, smoke, or explode.

(2) Charging Temperature Range

Only charge the battery at our specified temperature range. Charging outside of this temperature range may cause the battery to leak, generate heat, or result in serious damage. It may also cause the battery's performance and life to deteriorate.

(3) Manual

Read the manual before use. Keep for future reference.

(4) Charging Method

Read the charger's manual before use for proper charging method.

(5) First Time Usage

Please contact the supplier if the battery gives off an unusual odor, generates heat, or shows signs of rust prior to its initial use.

(6) Use by Children

Parents must explain how to use the system and the battery. Please check back periodically to ensure children are using the system and the battery correctly.

(7) Flammable Materials

Do not charge or discharge near flammable materials. Doing so could result in fire.

(8) Leakage

If electrolyte leaks from the battery and comes into contact with skin or clothing, immediately flush with water. Otherwise, it may cause skin irritation.

(9) Handling of Exposed Contacts or Conductors

If the battery pack has a system interface consisting of stripped lead wires or exposed contact plates, handle with due care. Temporarily insulate exposed contacts and conductors with an insulator such as polypropylene tape or polyvinylchloride tape. Failure to do so could result in an electrical shock; a short circuit causing the battery to generate heat, smoke, catch fire, or explode; or the combustion of other materials.

(10) Recycling

When disposing of the battery, recycle it according to local rules and regulations.

3 Scope

This specification applies to the Lithium Ion Battery NCR18650G-H0SVA for Pedelec by SUZHOU PHYLION BATTERY CO., LTD.

Do not use this battery in applications other than described above.
If the battery was used in other applications, it may cause performance degradation and safety deterioration depending on the usage of the battery in the equipment.
Incorrect handling of the battery may cause potential hazards of overheat, smoke, fire, or explosion.
Battery usage other than described above could result in bodily injury or property damage.

This Specification shall not apply to special applications requiring a high degree of quality and reliability where the failure or malfunction of the products may directly jeopardize life or cause threat of personal injury.
A non-exhaustive list of such applications includes: weapons, aircraft and aerospace equipment, aircraft electronics equipment, medical equipment (excluding Class 1 equipment), intrinsically safe equipment, electric vehicles, hybrid electric vehicles, and electric motorcycles (excluding electric bicycles).

4 Battery Classification and Product Code

4.1 Battery Classification	Lithium Ion Battery
4.2 Product Code	BJ-A300602AA
4.3 Model Name	NCR18650G-H0SVA
4.4 Cell Type	NCR18650GA

5 Nominal Specifications

Item		Specifications	Notes
5.1 Rated Capacity	4.20 V Charge	3300 mAh	0.67 A discharge at 20°C
	4.15 V Charge*1	3190 mAh	
5.2 Capacity (Minimum) *2	4.20 V Charge	3350 mAh	0.67 A discharge at 25°C
	4.15 V Charge*1	3235 mAh	
5.3 Capacity (Typical)	4.20 V Charge	3450 mAh	Reference only
	4.15 V Charge*1	3360 mAh	
5.4 Nominal Voltage		3.6 V	0.67 A discharge
5.5 Discharging End Voltage		2.5 V	2.5 V
5.6 Charging Current	Low temp.	0.838 A or less	0 ~ +10°C
	Std. temp.	1.675 A or less	+10 ~ +45°C
5.7 Charging Voltage	4.20 V Charge	4.20 ± 0.03 V	
	4.15 V Charge*1	4.15 ± 0.03 V	
5.8 Charging Time (Std.)		4.0 hours	
5.9 Continuous Discharge Current (Max.) *3,4,6		10 A	0 ~ +40°C
5.10 Internal Resistance		less than 38 mΩ	AC impedance 1 kHz
5.11 Weight		less than 49.5 g	
5.12 Operating Temperature	Charge	+10 ~ +45°C	
	Discharge	-20 ~ +60°C	
5.13 Storage Conditions (State of Shipment)	less than 1 month	-20 ~ +50°C	Recoverable Capacity: 80%*5
	less than 3 months	-20 ~ + 40°C	
	less than 1 year	-20 ~ + 20°C	

*1 Regarding Charging Voltage Control, please refer to Item 6 "Charging control for Life End" and Item 11 "Standard Charging Method".

*2 Capacity is measured by the discharge at 0.67 A until end voltage of 2.5 V after fully charged at 25°C as described in the specification.

*3 Discharge at high rate or high temperature environment will accelerate the degradation of the battery capacity.

*4 The maximum discharge current is for a single cell use. However after the battery pack assembly , maximum discharge current will be limited by a protection circuit or device.

*5

$$\text{Recoverable Capacity} = \frac{\text{Discharge Time after Storage}}{\text{Initial Discharge Time}} * 100$$

The discharge time is measured by fully charging the battery at 25°C and then discharging it at a current of 0.67 A to 2.5 V per cell in series.

*6 Maximum cell surface temperature :The cell temperature must not exceed 70°C.

6 Charging Control for Life End

Safety and cycle characteristics of Lithium-ion batteries can be improved by reducing the voltage lower than the rated charging voltage.
Therefore, when designing the battery pack using this cell, SANYO will request to reduce the charging voltage from the beginning.
Or SANYO will request to add a function to reduce the charging voltage when the deterioration rate reaches a certain level.

6.1 During usage, if charging voltage can NOT be changed.
- The charging voltage should be reduced from the beginning.

6.2 During usage, if charging voltage can be changed.
- The charging voltage should be reduced before SOH (State of Health) reaches 70%.

※One of 6.1 or 6.2 above must be the mandatory item.

7 Electrical Characteristics

Item	Conditions	Criteria
7.1 Full Charge	[4.20 V charge] The battery is charged at a 1.675 A constant current until the voltage reaches 4.20 V. The current is then reduced to keep a constant voltage of 4.20 V. The total charging time is 4.0 hours at 25°C. [4.15 V charge] The battery is charged at a 1.675 A constant current until the voltage reaches 4.15 V. The current is then reduced to keep a constant voltage of 4.15 V. The total charging time is 4.0 hours at 25°C.	
7.2 Capacity	(1) Within 1 hour after fully charging at 25°C as per item 7.1, the battery is discharged at 0.67 A continuously to 2.5 V at 25°C.	[4.20V charge] More than 300 min. [4.15V charge] More than 289.7 min.
	(2) Within 1 hour after fully charging at 25°C as per item 7.1, the battery is discharged at 3.35 A continuously to 2.5 V at 25°C.	[4.20V charge] More than 54 min. [4.15V charge] More than 52 min.
7.3 Cycle Life	[4.20 V charge] After the battery has been subjected to 300 repeated charge and discharge cycles (charged by CC-CV of 1.675 A – 4.20 V for 4.0 hours; discharged by CC of 3.35 A to 2.5 V at 25°C), the discharge time is measured as per Item 7.2, (2).	More than 38 min.
	[4.15 V charge] After the battery has been subjected to 300 repeated charge and discharge cycles (charged by CC-CV of 1.675 A – 4.15 V for 4.0 hours; discharged by CC of 3.35 A to 2.5V at 25°C), the discharge time is measured as per Item 7.2, (2).	More than 36 min.

Item	Conditions	Criteria
7.4 Temperature Characteristics	(1) Within 1 hour after fully charging at 25°C as per item 7.1, the battery is stored at 0°C for 3.0 hours. The discharge time is then measured as per Item 7.2, (2) at 0°C.	[4.20V charge] More than 30 min. [4.15V charge] More than 28 min.
	(2) Within 1 hour after fully charging at 25°C as per item 7.1, the battery is stored at 60°C for 3.0 hours. The discharge time is then measured as per Item 7.2, (2) at 60°C.	[4.20V charge] More than 50 min. [4.15V charge] More than 48 min.
7.5 Storage at Fully Charged State	After fully charging at 25°C as per item 7.1, the battery is stored for 20 days at 60°C. After storage, the battery is held at 25°C for 3.0 hours. Then, the discharge time is measured as per Item 7.2, (2).	[4.20V charge] More than 30 min. [4.15V charge] More than 28 min.
	Then, the same battery is fully charged again and discharged a second time and measured as per Item 7.2, (2) at 25°C.	[4.20V charge] More than 40 min. [4.15V charge] More than 38 min.
7.6 Storage at Full Discharged State	After fully charging at 25°C, the battery is discharged as per Item 7.2, (2). Then, the battery is stored for 20 days at 60°C. After storage, the battery is held at 25°C for 3.0 hours and is then fully charged as per item 7.1. Then, the discharge time is measured as per Item 7.2, (2) at 25°C.	[4.20V charge] More than 50 min. [4.15V charge] More than 48 min.
7.7 Drop	After fully charging at 25°C, the cell is dropped 3 times in random directions from a height of 1 m onto a flat surface of concrete.	No rupture, no fire

STANDARD TEST CONDITIONS:

All tests shall be conducted with new batteries delivered within the last 7 days. Tests shall be performed at a temperature of 25±2°C and a humidity of 65±20% (the standard temperature tolerance for Class 2 and the standard humidity tolerance for Class 20, respectively, as specified by JIS Z 8703, Standard Atmospheric Conditions for Testing). The precision of the voltmeter and ammeter used in the tests shall be higher than Class 0.5 as specified by JIS C 1102-2, Special Requirements for Ammeters and Voltmeters.

8 Design and Dimensions

The battery design is shown in the following documents or drawings.

- Drawing number [NCR18650GA6W, NCR18650-SIYOUZ]

9 Appearance

There shall be no such defects as followings, which may adversely affect commercial value of the cell:

- Scratch
- Rust
- Discoloration
- Dirt
- Deformation

10 State of Charge at Time of Shipment

At time of shipment, the battery's state of charge shall be 30% of its rated capacity or less.

11 Standard Charging Method

The standard charge condition is a constant current – constant voltage method with a current of 1.675 A and a maximum voltage of 4.20 V. The charging process should be halted when either time, battery voltage, or current reach certain values.
However, the charging voltage should be reduced to 4.15 V before SOH (State of Health) reaches 70%.
Also, if SOH reaches 50~60%, further charging voltage reduction or alarm function for battery replacement should be installed. (Recommendation).
If the charging voltage cannot be changed during the cycle, the charging voltage should be reduced to 4.15 V from the beginning. (Mandatory)

When the battery is in a state of over-discharge (the battery voltage is less than 2.0 V per cell), the battery should be charged by a pre-charge circuit to prevent heat generation in the charge FETs.

The pre-charging current should be approximately 0.335 A. Once, the battery voltage reaches more than 2.5V per cell, the charger can resume the standard charging method. The pre-charge function should have a cut-off timer in order to detect a short circuit. If the voltage does not recover to over 2.5V per cell within the specified time, charging must be terminated.

The current interrupt device (CID) may activate if the battery is charged continuously after it has reached a fully-charged state or if the battery is charged at a high temperature. Please consult SANYO for instruction on the charge method.

12 Precautions for Designing the Pedelec, the Charger and the Battery pack

Please comply with the following instructions during every stage of application, charger, battery pack design and assembly processes otherwise the battery may experience a deterioration of functionality, quality, and safety. In the worst case, the battery may generate heat, smoke, catch fire, or explode.

12.1 Precautions for Designing the Pedelec and the Charger

(1) Charge

- The battery is charged by a method of constant current-constant voltage.
- Regarding NCR18650G-H0SVA, the charging current should not exceed 3.35 A/cell.
- The charging voltage is required to be set at less than or equal to 4.20 V/cell.
- The charging voltage should not exceed 4.23 V/cell with considering the accuracy of charger. However, when the charging voltage control is necessary, the charging voltage after the charging control is required to be set at less than or equal to 4.15 V/cell, and the charging voltage should not exceed 4.18 V/cell with considering the accuracy of charger.
  Even if the charger is failed, the total safety shall be secured.
- The charger shall be equipped with a pre-charge system.
- If battery voltage goes down to less than 2.5 V/cell, the battery should be charged by pre-charge current of maximum 0.335 A. Once, the battery reached more than 2.5 V/cell by the pre-charging, the charger can resume the standard charging method. However, if the battery voltage never recovers more than 2.5 V/cell, the charger must be stopped and turned off.
- The charger shall be equipped a full charge detection.
- The charger shall detect the full-charged state by a timer, current detection or open circuit voltage detection. When the charger detects the full-charge, the charger shall stop charging. Do not apply the continuous charging (trickle charging) method.
- The charging temperature should be confined to the range 0°C to +45°C.
- It is recommended that charging should be stopped to avoid continuous charging, when either of the following conditions are met;
  - The charging current reaches approximately 67 mA in CV mode.
  - The charging time reaches 4.0 hours in case of charging at 1.675 A.

(2) Discharge

- The discharge current should not exceed 10.0 A/cell.
- The discharge temperature should be between -20°C to +60°C.
- The discharge end voltage should be more than 2.5 V/cell.
  If cells are to be connected in series, please refer to Item 14.1.

(3) Over discharge

- Do not discharge the battery less than 2.0 V/cell.

(4) Design of Pedelecs and chargers

- The cells should be kept away from heat generating electronic parts in order to avoid deterioration of battery performance.

(5) Strength of the battery pack enclosure

- The battery pack enclosure must be designed to have sufficient strength to resist damage from specified or typical expected mechanical stresses such as bending, twisting, and impact due to drop of application.

12.2 Precautions for Battery Pack Design

(1) Shape, mechanism and material of battery packs

- The battery pack should be designed so it cannot connect to unauthorized chargers.
- The battery pack should be designed so it cannot connect with unauthorized equipment and/or devices.
- The terminal shape should be designed to avoid short circuit issues. In addition, the battery pack should be equipped with an over current protection function in order to prevent from external short circuit issues.
- The terminal shape and structure should be designed so that it cannot connect in backwards.
- The battery pack should be designed to prevent static electricity, electrolyte, or water ingress issues.
- The battery pack should be designed so the protection circuit functions can be inspected during the assembly process.
- The battery pack should be designed so electrolyte cannot reach to the protection circuit board even if electrolyte leak out of the cells.
- The cells should be fixed by tape or glue in the case. If the battery pack is dropped, the cells should be protected against dents, deformations, and other mechanical stresses.
- Plastic cases should be closed with glue. If an ultrasonic welding method is applied to the case sealing, SANYO will not accept any responsibilities for any defects.
- The pack shall be designed so end users cannot remove or disassemble the cells.
- Improper usage may damage the gas release vent on the cell, which generates flammable gas. If the flammable gas is generated, the battery could ignite and explode. Therefore, the battery pack should be designed that the flammable gas doesn't stay inside the pack.
- The battery pack or module shall be designed for the functions of anti-thermal propagation and flame containment in all usage. For SUZHOU PHYLION BATTERY CO., LTD.'s reference, the battery design items are shown as follows.
  - Gas management structure not to remain heated-gases.
  - Prevention of large current flow from other cells.
  - Prevention of heat transfer to neighbor cells.

(2) Protection circuit

The following protection circuit should be equipped in the battery pack:

- **Overcharge protection**

  We recommend the overcharge protection engages when cell voltage reaches more than 4.25 V/cell then, the current shall be shut down. However, when the charging control is necessary, the operation voltage of overcharge protection after the charging control is recommended to 4.20 V/cell.

- **Over discharge protection**

  If cell voltage reaches approximately 2.2V /cell, we recommend that the over discharge protection circuit shuts down the discharge current and the circuit consumption current is set to less than 1μA.

- **Over current protection**

  If discharge current exceeds approximately 10 A/cell, the over current protection will shut down the current.

(3) Electric circuit

- To avoid over discharge mode during long storage times, the consumption current of the battery pack's protection circuit should be set as low as possible.

(4) Cell connection

- The cells should not be connected using a soldering process. In order to avoid any damages, cells should be connected to lead plates by a spot welding method.

(5) Precautions on label

- The rating label should indicate required information and precautions.
- The precautions should be based on the information in section 2.

13 Storing Conditions

13.1 Storage Temperature and Humidity (Within 3 months)

- Cells should be stored in a stable environment characterized by low-humidity (less than 70%RH), free of corrosive gasses, and an ambient temperature between -20℃ and +40℃
- To prevent rust, avoid conditions that can create condensation such as rapid fluctuations in the ambient.

13.2 Long Duration Storage

- When long duration storage cells should be stored in a stable environment characterized by low-humidity (less than 70%RH), free of corrosive gasses, and an ambient temperature between -20℃ and +20℃.
- To prevent rust, avoid conditions that can create condensation such as rapid fluctuations in the ambient.
- For long term storage, a discharged or partial charged state of charge per section 10 is recommended.

14 Handling Precautions for Lithium Ion Cells

This section describes handling precautions for lithium ion cells which will be assembled as battery packs with SUZHOU PHYLION BATTERY CO., LTD. This battery pack consists of NCR18650GA.

14.1 Series Connections Precautions

When the cells are connected in series, use the same rank cells. This information is described in the label on the carton. In addition, the cell voltage should be checked and the voltage should be within 20mV.

14.2 Inspection of the Battery Pack before Shipping

All battery packs shall be inspected for:

- Voltage
- Internal impedance
- Function of protection circuit
- Thermistor resistance
- Thermal fuse

14.3 Precautions on Pack Assembly

- Do not use potentially abnormal cells which have been dropped, shorted, or deformed during handling or assembly even if no damage is readily apparent. Do not use cells giving off the odor of electrolyte.
- Do not bring battery near or into contact with heat sources such as soldering irons.
- Do not allow any metal to come into direct contact with cells inside the battery pack compartment.
- Do not lift the core pack by holding the lead wires or the printed circuited board. Do not unnecessarily twist or bend the lead wires or the printed circuited board.
- Do not re-work the battery.

15 Remark of Safety Design

- SANYO has been addressing to enhance the quality and the reliability of battery cell, but we also require our customers to introduce the safety design into the battery pack for avoiding unsafety situation.
- The event such as abnormal heat generation, smoke, fire and explosion might happen due to the failure of battery cell and the use out of the specification.
  SUZHOU PHYLION BATTERY CO., LTD. should discuss to the product manufacturer about having the safety design such as redundant design, the prevention design against the spread of the fire, and so on, in order to prevent the accident of injury, death, fire, social harm as the result of battery cell failure.
- SANYO will not be liable for any damage due to slack safety design.

16 Other Remarks

- If there are problems in this specification, SANYO will take them into consideration.
- SANYO can discuss specification or precautions that are not described in this specification.
- Do not use the provided cells for other applications.

17 Warranty Exemptions

- SANYO will not be liable for any damages that are caused by violations of the prohibited matters (section 2) and the precautions (section 12~15) in this specification. If some problem happen in the battery, please handle this matter under SUZHOU PHYLION BATTERY CO., LTD.'s responsibility.
- SANYO will not be liable for any problems caused by design defects of the battery packs, Pedelecs, or chargers.
- SANYO will not accept return of any abnormal cells that were damaged due to any incorrect assembly process.

18 Battery Warranty Period

In the event a defect is found in the cell, SANYO will replace the defective cell only, not whole cells in pack and module, without cost in case that all the following conditions are met:

(i) The defect is found and reported to SANYO within 1 year from the date of shipment of the defective battery;

(ii) The defect is caused by the reasons attributable to SANYO, such as a defect in design or manufacture; and

(iii) It is clear by evidence data such as log or/and inspection data that the defect is not caused by the reasons attributable to any third party other than SANYO, such as any misuse of the battery or failure to comply with this specification.

(iv) SUZHOU PHYLION BATTERY CO., LTD., and SANYO accomplished and confirmed the above and finally agreed that the reasons of the defect attributable to SANYO.

19 Battery Safety and Reliability Requirements

In order to ensure the safety and reliability of the battery, please contact SANYO to discuss design of the application from a mechanical and electrical perspective. Also, if there are special usage conditions (for example: a large current load, a quick charge method, or a special usage pattern), please consult SANYO before finalizing the product specification.

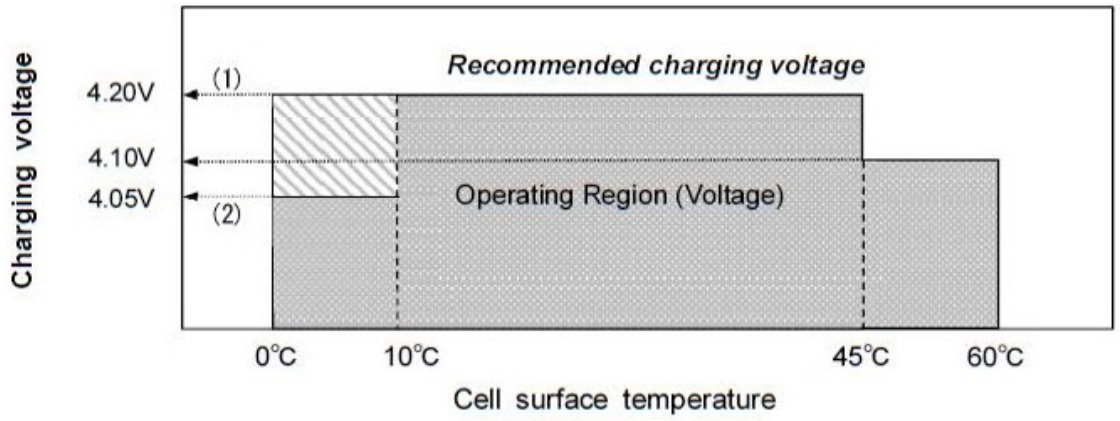
Appendix 1 < For Performance >

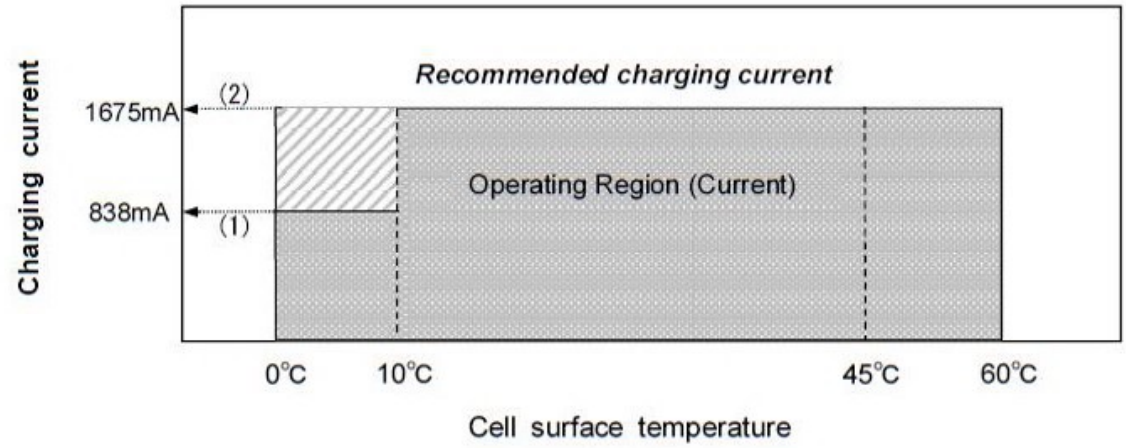
Regarding Operating Region for Performance, please follow the below condition.
The charging voltage and current should be lower than following Recommended charging voltage and Recommended maximum charging current in Table.1 for suppression of deterioration.

Model: [NCR18650G-H0SVA]

Table.1 Operating region (Cell surface temperature, voltage, current)

Temperature		Recommended charging voltage	Recommended maximum charging current
0°C~10°C	(1)	4.20 V	838 mA
	(2)	4.05 V	1675 mA
10°C~45°C		4.20 V	1675 mA
45°C~60°C		4.10 V	1675 mA





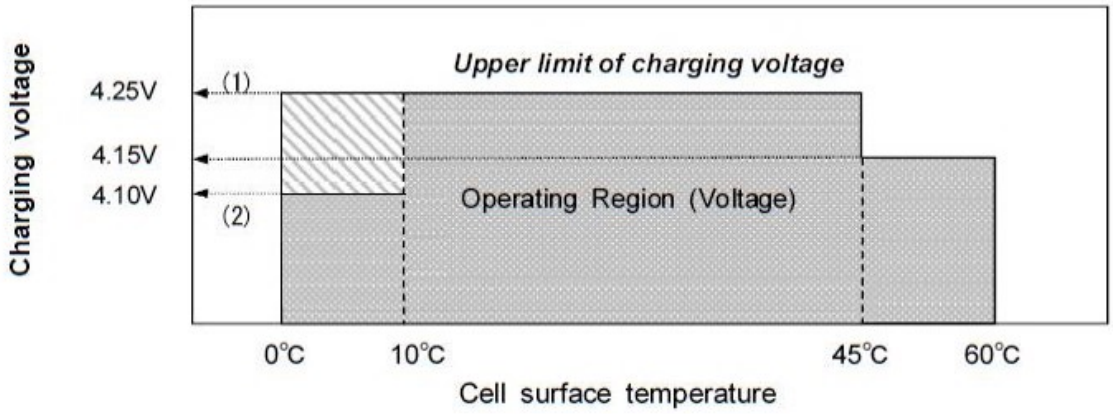
Appendix 2 < For Safety >

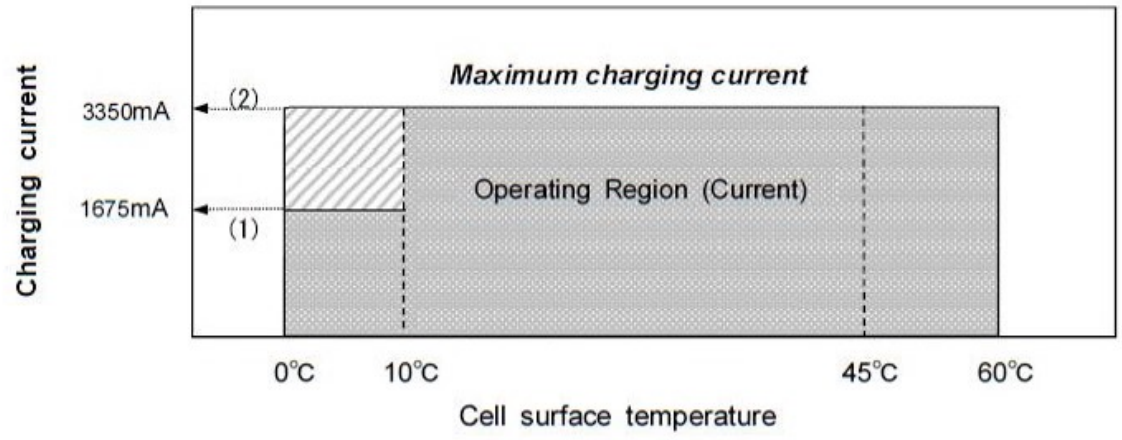
Regarding Operating Region for Safety, please follow the below condition.
The charging voltage and current shall not exceed following Upper limit of charging voltage and Maximum charging current in Table.2 for safe use.

Model: [NCR18650G-H0SVA]

Table.2 Operating region (Cell surface temperature, voltage, current)

Temperature		Upper limit of charging voltage	Maximum charging current
0°C~10°C	(1)	4.25 V	1675 mA
	(2)	4.10 V	3350 mA
10°C~45°C		4.25 V	3350 mA
45°C~60°C		4.15 V	3350 mA





Appendix 3 < Safety risk of lithium ion batteries >

Depending on the usage condition and environment, lithium ion batteries may become unstable and may cause serious risks such as heat generation, smoke, ignition or rupture.
Please ensure the safety of the battery packs for use in various usage conditions and environments, in consideration of multiple risk factors.

<Safety risks>

a) Cell electrolyte leakage from battery cells
Electrolyte leakage may cause short-circuit internally or externally of the battery packs, causing the battery cells to generate heat, smoke, fire or rupture.
・Please ensure the battery packs are designed so that the battery packs will not easily short-circuit even if electrolyte leaks from the battery cell.

b) High temp/flammable gas release from battery cells
High temperature gas from battery cells may cause the battery cells to generate heat, smoke, fire or rupture. Additionally, ignition of flammable gas may cause explosion of the battery cells.
・Please ensure the battery packs are designed with a gas release route so that the gas will not accumulate within the battery packs.

c) Deterioration of insulation and short-circuit due to vibration, drop and impact
Vibration, fall and shock causing damage (impact, deformation) to the battery cells may result in short-circuit of the battery cells, which may lead to a risk of tab break, leakage, heat generation, fire or rupture.
・Please ensure the battery packs are designed so that (i) short-circuit will not occur even if the battery is dropped or damaged in consideration of the actual usage condition, (ii) the battery cells will not deform in case of a drop.
・Please ensure the battery packs are designed to be safe even if the battery is repeatedly dropped or impacted by all potential misuse.

d) Abnormal heat generation of battery cell by usage outside the specification temperature
Use of the battery packs outside the temperature range as set forth in the Specification may cause the battery cells to leak, generate heat, smoke, fire or rupture.
・In order to use the battery cells within the specification temperature range, please monitor the cell temperature in appropriate position/method and appropriately control charge/discharge.
・Temperature distribution in the battery pack will greatly affect the safety when charging, so please ensure the battery packs are designed so that battery cell temperature within the battery pack is even.

※Note that safety risks may increase when more than one of factors a) –d) is combined.
Battery packs must be designed in consideration of safety risk associated with multiple factors such as a)- d).

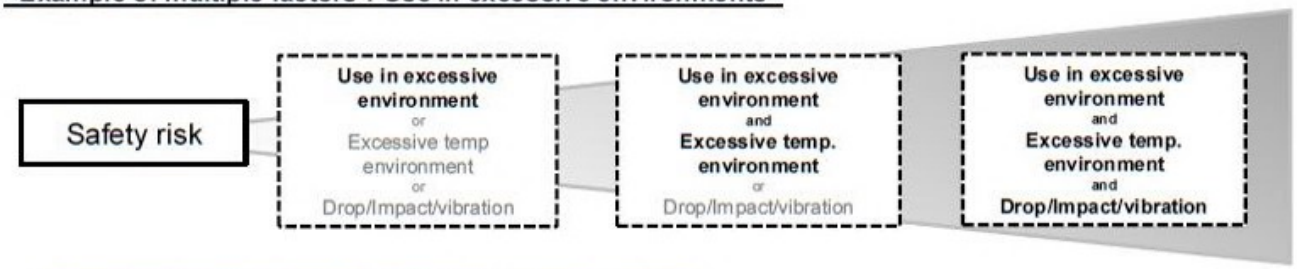
<Danger of electric shock>

In the case of high voltage battery pack, there may be a risk of life-threating electric shock.
・Please ensure the battery packs are designed with insulation measures, which does not directly touch (+) and (-) polar.
・Please ensure the battery packs are designed so that electric shock will not occur even if the battery pack is damaged by drop and impact, or is submerged.

Safety risk associated with multiple factors

To reduce the safety risk associated with multiple factors, please ensure the safety of the battery packs by conducting severe and marginal tests.

<Example of multiple factors : Use in excessive environments>



- As multiple factors increase, safety risk will also increase
- Suggested action for
  1) Confirmation the safety risk associated with multiple factors:
     Please make sure you to conduct severe and marginal test, based on actual and all foreseeable usage conditions.
     (i.e. Safety test after excessive temperature environment test, extension of test as in time and number for drop/impact/vibration)
  2) Instructions to end users:
     Please make sure you warn your customers against inappropriate usage of the battery packs in the user's manual.

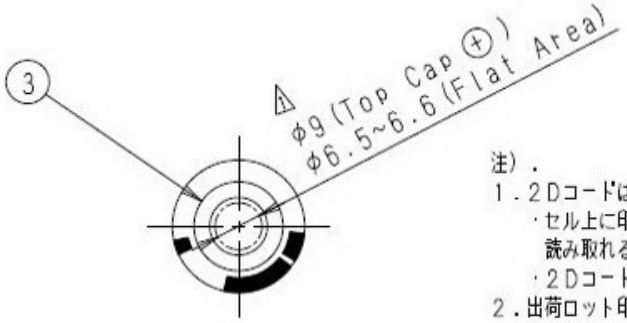
Important safety items about battery pack

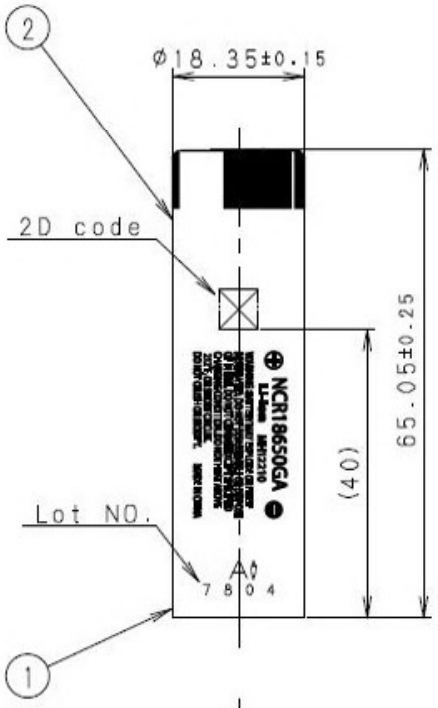
- Please design the battery packs to ensure safety in case of any leakage of the battery cells.
- Please design the battery packs and systems to ensure safety of equipment and users in case the current is cut off.
- Please design the battery packs considering any impact, drop, shock, vibration, or electric shock in case of deterioration of battery pack components.

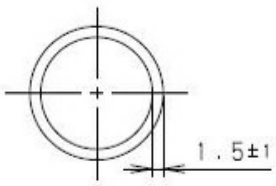
*** Please consult with the final product manufacturer with respect to the assumed deterioration period, assumed drop, shock or vibration of the final products.**

Safety risk of cells	Influence on battery pack	Check items
<Non operation>		
Dis-connection	■ Battery malfunction	・Safe design considering redundancy
<Unsafe operation>		
Leakage	■ External / internal short circuit ■ Degradation of battery parts by corrosion	・Safe design against leakage
High Temp./flammable gas release	■ Cause of burning(High Temp. gas) ■ Explosion by fire(Flammable gas)	・Anti-fire propagation / flame containment design ・Securing the gas release route
Internal / external short circuit	■ Deterioration of insulation ■ Battery pack malfunction ■ Abnormal heat generation, fire	・Charge control at the end of life ・Anti-fire propagation / flame containment design ・Safe design considering deterioration
Heat generation	■ Reduction of resistant ■ Abnormal heat generation, fire	・Confirmation of usage temp. range ・Safe design considering deterioration
< Consideration of shape change / lowering strength / use environment of battery pack >	■ Reduced tolerance (impact, drop, shock, electric shock) ■ External / internal short circuit ■ Electric shock or external short circuit caused by water immersion, dust, condensation.	・conducting safety tests considering the degraded conditions of battery cells and packs ・Safe design against water immersion, dust and condensation.

NO.	PART NAME	APPLICATION·PART CODE	QTY.	MATERIAL·SPECIFICATION	品質文書 NOTE
①	CELL	NCR18650GA	1		
②	OUTER JACKET	SHRINK TUBE	1		
③	INSULATOR	PAPER	1		







注）.
1．2Dコードは外装缶上に捺印されていること。
・セル上に印字される2Dコードは、SR-1000（KEYENCE製）で読み取れること．
・2Dコード仕様：データマトリックスコード（ECC200），16桁の英数字
2．出荷ロット印は~~チューブ上に~~捺印すること。（出荷ロットは充電日とする。）
XXXX ⚠外装缶上に
- 日（1日=01，2日=02，・・30日=30，31日=31）
- 月（1月=1，2月=2，・・9月=9，10月=X，11月=Y，12月=Z）
- 年（'96=6，'97=7，・・'17=7，'18=8・・）

例.）2017年8月4日・・・・7804

NOTE.
1．2D CODE TO BE PRINTED ON THE CAN.
・2D CODE ON CELL CAN BE READ BY THE EQUIPMENT SR-1000 (KEYENCE).
・2D CODE TYPE:DATA MATRIX CODE (ECC200), 16 DIGIT CHARACTER INSIDE.
2．STAMP LOT NO. ON THE ~~TUBE.~~ ⚠CAN (LOT NO IS CHARGING DATE)
XXXX
- DAY (1ST=01，2ND=02，・・30TH=30，31TH=31)
- MONTH (JAN=1，FEB=2，・・SEP=9，OCT=X，NOV=Y，DEC=Z)
- YEAR ('96=6，'97=7，・・'17=7，'18=8・・)

EX.) AUG.04.2017・・・・7804

SYM	DATE	DESCRIPTION
⚠3		
⚠2		
⚠1	Dec.3.2020	寸法追記および出荷ロット印字箇所変更 Add dimension and STAMP LOT NO change.

DATE	REMARK
Oct./30/2020	

D R	Segi
ENG	Mori
CHK	Sugimoto
CHK	Inaba
APP	Oshita

MODEL: NCR18650GA6W
CUSTOMER CODE:

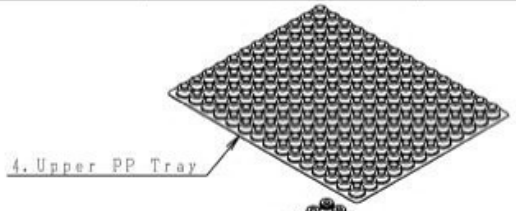
TOLERANCE	
60< L	±0.3
30< L ≦60	±0.3
6 < L ≦30	±0.2
3 < L ≦ 6	±0.1
L ≦ 3	±0.1

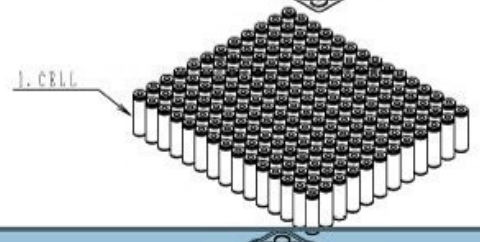
WEIGHT Approx. g
UNIT mm
QTY 1
SCALE 1:1

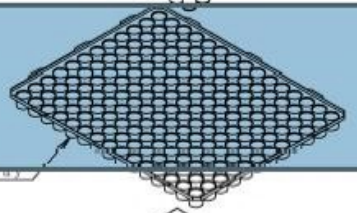
材料·規格 MATERIAL	
処理·加工 FINISH	
部品名 PART NAME	Dimension Sketch
PART CODE	Rev. 0
DRAWING NO	

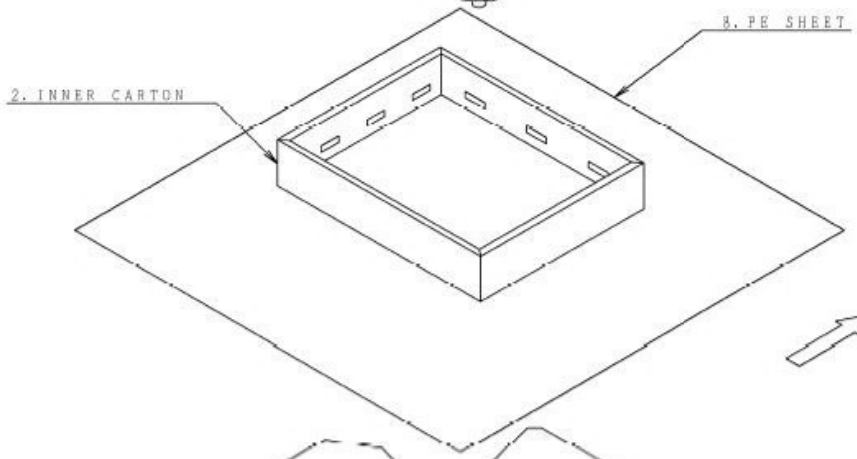
DRAWING NOT TO SCALE

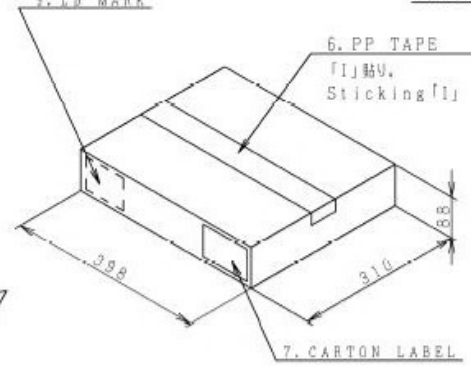
NO.	PART NAME	APPLICATION·PART CODE	QTY.	MATERIAL·SPECIFICATION	NOTE
1	CELL		180	NCR18650	
2	INNER CARTON		1		
3	LOWER PP TRAY		1		
4	UPPER PP TRAY		1		
5	OUTER CARTON		1		
6	PP TAPE		0.45		
7	CARTON LABEL		1		
8	PE SHEET		1		
9	LB MARK		1		

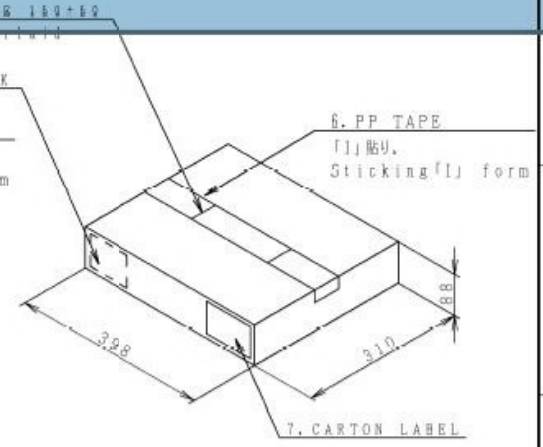




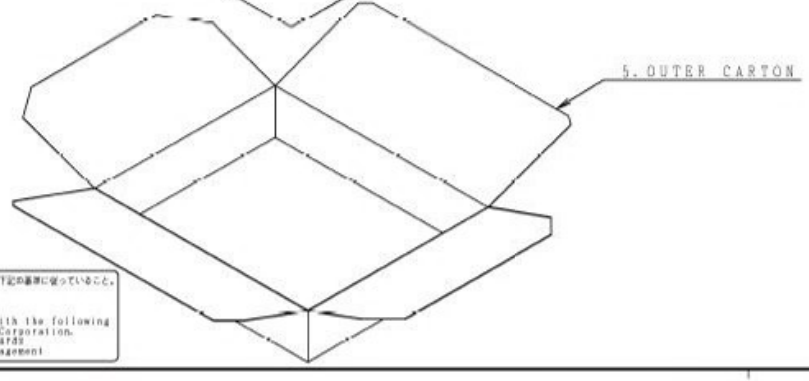








Fraction packaging



構成する材料は、パナソニック㈱が発行する下記の基準に従っていること。
a) グリーン調達基準書
b) 化学物質管理ランク指定

The material must comply with the following rules issued by Panasonic Corporation.
a) Green Procurement Standards
b) Chemical Substances Management

DRAWING NOT TO SCALE

DATE	REMARK	SYM	DATE	DESCRIPTION
NOV. 27. 2020			NOV. 27. 2020	1st DRAWING (K. Yoshimoto)
D R K. Yoshimoto	MODEL:NCR18650		材料・質感	
CHK	CUSTOMER CODE:		MATERIAL	
CHK	TOLERANCE / WEIGHT Approx. g		処理・加工	
ENG	UNIT		FINISH	
APP N. Higashine	QTY 1/180 SCALE FREE		品名	包装仕様図
			PART NAME	PACKING SPECIFICATION
			PART CODE	Rev.
			DRAWING NO	NCR18650-SIYOUZ

Sanyo Electric Co., Ltd.

A3