Confidential

File No. UR1850-360

Issue Date: 2021/10/26

LITHIUM ION BATTERY SPECIFICATION

BATTERY CLASSIFICATION	LITHIUM ION BATTERY
PRODUCT / CODE	UR18500Y / BJ-A700081AA (Separator2, 50%SOC) UR18500Y / BJ-A700080AA (Separator2, 30%SOC)
CLIENT	P&G INTERNATIONAL OPERATIONS SA, Switzerland
MODEL NAME / CELL TYPE	UR18500Y-H023A / UR18500Y (Separator2, 50%SOC) UR18500Y-H022A / UR18500Y (Separator2, 30%SOC)

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.

Department of Development strategy
Corporate of Development strategy
Cell Development Division
SANYO Electric Co., Ltd
Energy Company of Panasonic Group

Dft.	
Chk.	
Chk.	
App.	

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1 Revision History

No.	Date	Class	Description		
(0)	2018/04/27	—	Issue (Preliminary)	Dft.	M.Takeuchi
				Chk.	S.Takeuchi
				Chk.	T.Nishitani
				App.	M.Nakanishi
(1)	2019/07/02	—	Base on P&G requested format change	Dft.	M.Takeuchi
				Chk.	N.Okumura
				Chk.	T.Nishitani
				App.	H.Yoneda
(2)	2019/09/02	R	・Change of company name ・Change the wording (Item 14. Performance Criteria and Warranty Period)	Dft.	M.Takeuchi
				Chk.	N.Okumura
				Chk.	T.Nishitani
				App.	H.Yoneda
(3)	2020/01/31	R A	・Add calculation formula in item 5 ・Add actual voltage in item 5.4 ・Add item “d” in Appendix 3 ・Add Positive Active Material (LMO) in Appendix 4 ・Safety Instructions (Item 2) Warning (8) : Move from “Caution” to “Warning” and add “leak” Warning (9) Move from “Caution” to “Warning” and change wording	Dft.	H.Ijitsu
				Chk.	S.Takeuchi
				Chk.	T.Nishitani
				App.	H.Yoneda
(a)	2020/08/04	R A	・Safety Instructions (Item 2), Danger (8): Give examples for shorting item. ・ Change of item 7: Visible defect content ・ State of charge (items 8): Increase upper SOC limit. ・ Standard Charging Method (Item 9): Definition of battery ・ Precaution for Design (item 10): Reference to P&G document. ・ Add 14.3 incoming inspection and appendix 6 incoming inspection contents as reference ・ Apendix 3 : Remove "UR18500Y contains PTC" ・ Drawing: Changed and added content. (Rev 3A)		
				Dft.	H.Ijitsu
				Chk.	M.Nabekura
				Chk.	H.Fujii
				App.	R.Ohshita

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

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No.	Date	Class	Description		
(b)	2020/09/25	R A	・Change Criteria in item 5.2(2) : 3.58V → 3.54V ・Change State of Charge at Time of Shipment in item 8 : 520mAh (SOC40%)→572mAh (SOC44%) ・Added “Background” comment to Appendix 6	Dft. Chk. Chk. App.	H.Ijitsu M.Nabekura H.Fujii R.Ohshita
(c)	2020/12/17	R A D	・Change Applications “Shaver, Epilator” → ”Household appliance & personal care” ・Change Criteria in item 5.2(2) : 3.54V → 3.58V ・Added comments to Item 10.2 (2) “Overcharge protection” ・Change Maximum charging current in Appendix 2: 1950mA(1.5C) →2600mA(2.0C) ・Delete “thermal fuse” in item 11.2 ・Change comments in 14.1 and 14.2	Dft. Chk. Chk. App.	H.Ijitsu M.Nabekura H.Fujii R.Ohshita
(d)	2021/01/26	A	・Added model and drawing: UR18500Y-H01UA / UR18500Y (30%SOC)	Dft. Chk. Chk. App.	H.Ijitsu M.Nabekura H.Fujii R.Ohshita
(e)	2021/1026	R	With the change of separator, the model names will be replaced with UR18500Y (Separator 2) model names. - UR18500Y-H022A / UR18500Y (Separator 2, 30%SOC) (Original: UR18500Y-H01UA) - UR18500Y-H023A / UR18500Y (Separator 2, 50%SOC) (Original: UR18500Y-H00CA) - Drawings change	Dft. Chk. Chk. App.	H.Ijitsu M.Nabekura H.Fujii Y.Inaba

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

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2 Safety Instructions

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

Danger

(1) Immersion

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

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

(2) High Temperature

Keep the cell away from heat and fire.

In case of abnormal operation, especially, avoid cell temperature greater than 85°C while charging or overcharging (> 4.2 V).

Abnormal operation is operation out of normal operation which is specified in Appendix 2

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

(3) Chargers and Charge Conditions

Use only chargers authorized by Procter & Gamble.

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

(4) Reverse Polarity

Do not attach or insert cell with polarity reversed.

A cell has polarity. Check cell's polarity and bring it into the right orientation to the device. Do not force the cell into the battery pack compartment. If attached to the device with reversed polarity, the cell / battery pack may generate heat, smoke, catch fire, or explode.

(5) Direct Connection

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

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

(6) Leakage

Do not touch a leaking cell / battery pack.

If electrolyte leaks from the cell and comes into contact with skin or clothing, immediately flush with tap water. Otherwise, it may cause skin irritation.
If liquid leaking from the cell gets into your eyes, immediately flush your eyes with clean tap water and seek medical attention. If left untreated, it will cause significant eye damage.

(7) Use in Other Equipment

Do not use the battery pack in equipment for which was not designed by Procter & Gamble.

If the battery pack is used in unintended applications or systems, the battery pack may become damaged and 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 pack with any metal objects. If the battery pack is shorted, the shorting item(such as PCBA, wiring and other components) may overheat and the battery pack may generate heat, smoke, catch fire, or explode.

(9) Impact

Avoid excessive impact to the cell.

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

(10) Penetration

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

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

(11) Soldering

Do not directly solder to the cell.

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

(12) Disassembly

Do not disassemble the cell and battery pack during the product life.

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

(13) Deformed cell using

Do not use / assemble the cell with conspicuous damage or deformation.
This may cause the cell and/or battery pack to generate heat, smoke, catch fire, or explode.

Warning

(1) Ingestion

Keep away from small children.

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

(2) Storage

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

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

(3) Mixed Use

Do not mix with other cells.

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

(4) Discoloration and Deformities

Do not use abnormal cells /battery pack

Immediately stop using the cell / batttery pack if there are noticeable abnormalities, such as smell, heat, discoloration, or deformity. The cell / battery pack 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 within the specified time.

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

(6) Leakage

Do not use a leaking cell / battery pack near open flame.

If liquid leaks from the cell then the cell / battery pack should be kept away from any open flame. If exposed to an open flame, the cell / battery pack could ignite and explode.

(7) Transport

Pack the cell / battery pack securely for transport.

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

(8) 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.

(9) Recycling

Do not throw away used batteries as home rubbish.

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

If used batteries are thrown away as home rubbish, there is possibility that batteries catch fire or smoke according to damage in rubbish collection.

Caution

(1) Static Electricity

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

(2) Charging Temperature Range

Only charge the cell / battery pack at our specified temperature range(see Appendix 1 and 2). Charging outside of this temperature range may cause the cell to leak, generate heat, or result in serious damage. It may also cause the cell / battery pack's performance and life to deteriorate.

(3) User Manual

Recommendation for P&G to instruct the end-user in the manual how to use the products.

(4) Charging Method

Recommendation for P&G to instruct the end-user in the manual how to use the products.

(5) First Time Usage

Please contact the supplier if the cell / battery pack 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 pack. Please check back periodically to ensure children are using the system and the battery pack correctly.

(7) Flammable Materials

Do not charge or discharge near flammable materials (*e.g.* Flammable liquids), which can catch fire and burn easily at normal working temperatures, whereas combustible material require higher than normal temperatures to ignite) Doing so could result in fire.

(8) Handling of Exposed Contacts or Conductors

If the cell type is used within a battery pack, then 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 a short cuiruit; a short circuit causing the battery pack to generate heat, smoke, catch fire, or explode; or the combustion of other materials.

3 Scope

This specification applies to the Lithium Ion Battery UR18500Y-H023A and UR18500Y-H022A for Household appliances & personal cares by P&G INTERNATIONAL OPERATIONS SA, Switzerland.

Do not use this cell in applications other than described above.
If the cell was used in other applications, it may cause performance degradation and safety deterioration depending on the usage of the battery pack in the equipment.
Incorrect using of the cell may cause potential hazards of overheat, smoke, fire, or explosion.
Cell 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 Nominal Specifications

Item			Specifications	Notes
4.1	Rated Capacity*1		1300 mAh	0.26 A discharge at 20°C
4.2	Capacity (Minimum)		1300 mAh	0.26 A discharge at 25°C
4.3	Capacity (Typical)		1400 mAh	Reference only
4.4	Nominal Voltage		3.7 V	0.26 A discharge
4.5	Discharging End Voltage		2.75 V	
4.6	Charging Current	Low temp.	Refer to page Appendix 1 & 2	
		Std. temp.	Refer to page Appendix 1 & 2	
4.7	Charging Voltage		Refer to Section 10.1 (charge)	
4.8	Charging Time (Std.)		Approx. 3.0 hours	CC-CV
4.9	Continuous Discharge Current (Max.) *2,3,4		2.6 A	0 ~ +40°C
4.10	Internal Resistance		less than 100 mΩ	AC impedance 1 kHz
4.11	Weight		less than 32.9 g	
4.12	Operating Temperature	Charge	Refer to page Appendix 1 & 2	
		Discharge	-20 ~ +60°C	Ambient temperature
4.13	Storage Conditions*5	less than 3 months	-20 ~ +40°C	Recoverable Capacity: 80%*6 (Actual : 95%)
		less than 1 year	-20 ~ +20°C	
4.14	Volumetric energy density		379Wh/l	As reference
4.15	Gravimetric energy density		151Wh/kg	As reference

*1 Capacity is measured by the discharge at 0.26A(0.2C) until end voltage of 2.75V after fully charged at 20℃ as described in the specification 5.1 charging method.

*2 Discharge at high rate or high temperature environment will accelerate the degradation of the cell capacity.

*3 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.

*4 Maximum cell surface temperature :The cell temperature must not exceed 70℃(cell temp.).

*5 Storage Temperature and Humidity

- 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℃(Within 3 months). And in case of long duration storage (less than 1year) cells should be stored in 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 (more than 3months), a discharged or partial charged state of charge per section 9 is recommended.

*6 $$Recoverable\ Capacity = \frac{Discharge\ Time\ after\ Storage}{Initial\ Discharge\ Time} * 100$$

The discharge time is measured by fully charging the cell at 25°C and then discharging it at a current of 0.26A to 2.75V per cell in series. Actual values are 95% (reference)

5 Electrical Characteristics

Item	Conditions	Criteria
5.1 Full Charge	The cell is charged at a 1.30A(1.0C) constant current until the voltage reaches 4.20V. The current is then reduced to keep a constant voltage of 4.20V. This charge method is called „Constant Current – Constant Voltage“ (CC-CV). Then CC-CV is terminated by 26mA.	
5.2 Capacity	(1) Within 1 hour after fully charging at 25°C as per item 5.1, the cell is discharged at 0.26A(0.2C) continuously to 2.75V at 25°C. And confirm the Average voltage.	More than 300 min. (≧1300 mA / 260 mA×60min) More than 3.7V
	(2) Within 1 hour after fully charging at 25°C as per item 5.1, the cell is discharged at 1.30A continuously to 2.75V at 25°C. And confirm the Average voltage.	More than 57 min. (≧1250 mA / 1300mA×60min) More than 3.58V
	(3) Within 1 hour after fully charging at 25°C as per item 5.1, the cell is discharged at 2.60A continuously to 2.75V at 25°C. And confirm the Average voltage.	More than 27 min (≧1200 mA / 2600mA×60min) More than 3.45V
5.3 Cycle Life	After the cell has been subjected to 300 repeated charge and discharge cycles (charged by CC-CV of 1.30A – 4.20V for 3.0 hours ; discharged by CC of 1.3A to 2.75V at 25°C), the discharge time is measured as per Item 5.2, (2).	More than 38 min. (> 823 mA / 1300 mA×60min) More than 2.9V
5.4 Temperature Characteristics	(1) Within 1 hour after fully charging at 25°C as per item 5.1, the cell is stored at 0°C for 3.0 hours. The discharge time is then measured as per Item 5.2, (2) at 0°C.	More than 30 min (≧650 mA / 1300 mA×60min) (Actual 3.46 V)
	(2) Within 1 hour after fully charging at 25°C as per item 5.1, the cell is stored at 60°C for 3.0 hours. The discharge time is then measured as per Item 5.2, (2) at 60°C.	More than 50 min. (≧1083 mA / 1300 mA×60min) (Actual 3.66V)

Item	Conditions	Criteria
5.5 Storage at Fully Charged State	After fully charging at 25°C as per item 5.1, the cell is stored for 20 days at 60°C After storage, the cell is held at 25°C for 3.0 hours. Then, the discharge time is measured as per Item 5.2, (2).	More than 30 min (≧650 mA / 1300 mA×60min)
	Then, the same cell is fully charged again and discharged a second time and measured as per Item 5.2, (2) at 25°C.	More than 40 min. (≧867 mA / 1300 mA×60min)
5.6 Storage at Full Discharged State	After fully charging at 25°C, the cell is discharged as per Item 5.2, (2). Then, the cell is stored for 20 days at 60°C. After storage, the cell is held at 25°C for 3.0 hours and is then fully charged as per item 5.1. Then, the discharge time is measured as per Item 5.2, (2) at 25°C.	More than 50 min. (≧1083 mA / 1300 mA×60min)

STANDARD TEST CONDITIONS:

All tests shall be conducted with cells received 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.

6 Cell dimensions and apprearance

The cell appearance is shown in the following documents or drawings.

- Cell dimensions, tolerances, shrink tube print layout, date code, color of shrink tube and color of insulation ring are given by drawing number [UR18500Y-H023A01] and [UR18500Y- H022A01]
  * Regarding UR18500Y model, there is 2D code on the cell body and bottom side.

7 Visible defect

There shall be no such defects as followings, which may adversely affect commercial value of the cell:
Positive and negative terminal: No negative effect for the welding
Appearance: No negative effect for the assembling
Defect items: Scratch, Rust, Discoloration, Dirt, Deformation, Leaked material detectable by liquid or sediments
There shall be no such defects in outer carton, which may adversely affect commercial value of inside cell.

8 State of Charge at Time of Shipment

Version for non-airfreight transport is UR18500Y / BJ-A700081AA / UR18500Y-H023A:
At time of shipment, the cell has to be charged from 572mAh (SOC44%) to 715 mAh (SOC55%).
Version for airfreight transport is UR18500Y / BJ-A700080AA / UR18500Y-H022A:
At time of shipment, the cell has to be charged from 325mAh (SOC25%) to 390mAh (SOC30%).

9 Standard Charging Method

* In this section, the term “battery” refers to the built-in cell.

The standard charge condition is a constant current – constant voltage method with a current of 1.30A and a maximum voltage of 4.20V. The charging process should be halted when either time, battery voltage, or current reach certain values.

When the battery is in a state of over-discharge (the battery voltage is less than 2.0V (CCV) 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 0.13A. Once, the battery voltage reaches more than 3.0V/cell (CCV), 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 3.0V/cell (CCV) 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.

In case of the other charging method (such as CC-PC), please consult with Panasonic in detailed.

10 Precautions for Designing Household appliance & personal care, 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 pack may experience a deterioration of functionality, quality, and safety as a recommendation. In the worst case, the battery pack may generate heat, smoke, catch fire, or explode.

Numerical data given in section 10.1 (1), (2), (3), referring to Appendix 1, as welll as data given in 10.2 (2), refering to Appendix 2, are harmonized with the Memorandum of Safety (MOS). Changes in any of these documents might require harmonization of the other ones.

10.1 Precautions for Designing the Household appliance & personal care and the Charger

(1) Charge * Refer to appendix 1 & 2

- It is recommended the battery pack is charged by a method of const. current-const. voltage (CC-CV).
- Regarding UR18500Y-H023A and UR18500Y-H022A, the charging current should not exceed 1.30A/cell (1C).
- The charging voltage is required to be set to less than 4.2V+30mV (incl. tolerance) /cell with considering the accuracy of charger. Even if the charger is failed under this condition, the battery pack safety is secured by CID.
- It is recommended the charger / system shall be equipped with a pre-charge.
- If battery pack OCV goes down to less than 3.0V/cell, the battery pack should be charged by pre-charge current of approx. 0.13A. Once the battery pack CCV reached more than 3.0V/cell by the pre-charging, the charger can resume the standard charging method as an example. However, if the battery pack never recovers more than 3.0V/cell, the charger must be stopped and turned off.
- The charger shall be equipped with a full charge detection.
- The charger shall detect the full-charged state by a timer, current detection or open circuit voltage detection for pulse charge. When the charger detects the full-charge, the charger shall stop charging. Do not apply the continuous charging (trickle charging) method as it will result to overcharge (greater than 4.25V).
- Regarding charging temperature, refer to the appendix 1 & 2.

- 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 26mA in CV mode.
  - The charging time reaches 3.0 hours in case of charging at 1.30A

(2) Discharge

- The discharge current should not exceed 2.60A/cell.
- The discharge end voltage should be more than 2.75V/cell.
  If cells are to be connected in series, please refer to Item 11-1.

(3) Over discharge

- Do not discharge the battery pack less than 2.0V/cell (CCV).

(4) Design of Household appliances & personal cares and chargers

- The cells should be kept away from heat generating electronic parts (cell temp limits for charge and discharge and storage: Section 5.12) in order to avoid deterioration of battery pack performance.

10.2 Precautions for Battery Pack Design

(1) Shape, mechanism and material of battery packs

- The battery pack should be designed so it can connect to only authorized charger by P&G.
- The battery pack should be designed so it cannot connect with unauthorized charger and/or devices / applications.
- The terminal shape should be designed to avoid short circuit issues. In addition, it is recommended the battery pack is 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.
- It is recommended the battery pack should be designed to prevent static electricity, electrolyte, or water ingress issues.
- It is recommended 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.
- It is recommended 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 battery pack shall be designed so end users cannot replace / remove the cells, except for disposal.
- The battery pack or module shall be designed for the functions of anti-thermal propagation and flame containment. For P&G INTERNATIONAL OPERATIONS SA, Switzerland's reference, the battery pack design items are shown as follows.
  - Gas management structure not to remain heated-gases (open housing is accepted).
  - Prevention of heat transfer to neighbor cells (Propagation test must be passed).

- If the cell is used in the battery pack, the battery pack enclosure (which might be the device 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.

(2) Protection circuit

The following protection circuit should be equipped in the battery pack/ Household appliance & personal care :

- **Overcharge protection**

  We recommend the overcharge protection engages, when cell voltage reaches more than 4.25V/cell including tolerance. Then the current shall be shut down.

  However, under following condition, we accept that the value of overcharge protection is Max.4.33V. (*)

  - 1 series battery pack.
  - Charging voltage is controlled Max.4.25V.

  (*)Regarding operation region for safety, Panasonic recommends the charging operation in "Appendix 2".

- **Over discharge protection**

  If cell voltage reaches approximately 2.0V/cell(CCV), we recommend that the over discharge protection circuit shuts down the discharge current and the circuit consumption current is set to less than 2μA.

- **Over current protection**

  If discharge current exceeds approximately 2.60A/cell, the over current protection shall shut down the current.

(3) Cell connection

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

(4) Precautions on label

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

11 Handling Precautions of Lithium Ion Cells for battery pack production

This section describes handling precautions for lithium ion cells which will be assembled as battery packs with P&G INTERNATIONAL OPERATIONS SA, Switzerland. This battery pack consists of UR18500Y.

11.1 Series Connections Precautions

- When the cells are connected in series, make sure that the lot number, shipping charge date, and capacity rank match. Please do not mix cells with different lot numbers, shipping charge dates, or capacity ranks. The voltage variability between cells should be within 20mV.
- The lot number, the shipping charge date and the capacity rank are indicated on the shipping carton label.
- If the cells are connected in series, the discharge end voltage should be set more than 2.75 V/cell (CCV).

11.2 Inspection of the Battery Pack before Shipping

All battery packs shall be inspected for:

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

11.3 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 cells 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 pack.

12 Remark of Safety Design

- SANYO has been addressing to enhance the quality and the reliability of 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 cell and the use out of the specification.
  P&G INTERNATIONAL OPERATIONS SA, Switzerland 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 cell failure.
- SANYO will not be liable for any damage due to slack safety battery pack design.
- In order to ensure the safety of the battery pack, 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

13 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.
- If this cell type is intended for use in other applications than listed under Scope then SANYO needs to be contacted.

14 Performance Criteria and Warranty Period

- Warranty period conditions are agreed by P&G and SANYO in a separate Purchase Agreement. Cell performance details are agreed by P&G and SANYO in this Lithium Ion Battery Specification.

14.1 Shelf-life performance

- Warranty period starts as specified in the Purchasing Agreement.
- The cells are installed under the devices, in devices meeting the precautions in Section 10 (Precautions for Designing the Household appliance & personal care, the Charger and the Battery pack) and Section 11 (Handling Precautions for Lithium Ion Cells).
- The cells / devices are stored at 25±2°C and a humidity of 65±20% without any usage (no charge / discharge) in P&G's Distribution warehouse at Shipping charge (refer to Section 8: State of Charge at Time of Shipping).

< Conditions for performance assessment at end of warranty period >
1) Cell is charged at 5.1 condition. Then, cell is discharged at 5.2 1) condition.
2) Cell is charged at 5.1 condition. Then, cell is discharged at 5.2 2) condition.
*Regarding the above charge / discharge, the test can be conducted within 3 cycles

< Performance test criteria >
1) At 5.2 1) condition, discharge runtime (capacity) is more than 240min. (Actual: 290min)
Average voltage is more than 3.3V. (Actual: 3.7V)
2) At 5.2 2) condition, discharge runtime (capacity) is more than 42min. (Actual : 58min)
Average voltage is more than 3.2V. (Actual: 3.6V)
3) At shelf-life performance under warranty period, AC impedance is less than 90mOhm

14.2 Service Life (cycle life and storage period)

It is defined the service life corresponds to the cycle life in section 5.3 in accordance with the cycle count of the usage.

- Warranty period starts as specified in the Purchasing Agreement
- The cells are installed under the devices, in devices meeting the precautions in Section 10 (Precautions for Designing the Household appliance & personal care, the Charger and the Battery pack) and Section 11 (Handling Precautions for Lithium Ion Cells)
- Under this Service life period, the Cell is stored at 25±2°C and a humidity of 65±20%.

< Conditions for performance assessment at end of warranty period >
1) Cell is charged at 5.1 condition. Then, cell is discharged at 5.2 1) condition.
2) Cell is charged at 5.1 condition. Then, cell is discharged at 5.2 2) condition.
*Regarding the above charge / discharge, the test can be conducted within 3 cycles

< Performance test criteria >SHA
1) At 5.2 1) condition, discharge runtime (capacity) is more than 200min.
Average voltage is more than 3.1V.
2) At 5.2 2) condition, discharge runtime (capacity) is more than 38min.
Average voltage is more than 2.9V.
3) At shelf-life performance under warranty period, AC impedance is less than 90mOhm.

14.3 Incoming inspection

Incoming inspection shall be performed referring appendix 6. Criteria for visual inspection shall be followed to 7.Visible defect in this specification.

Appendix 1 < For Performance >

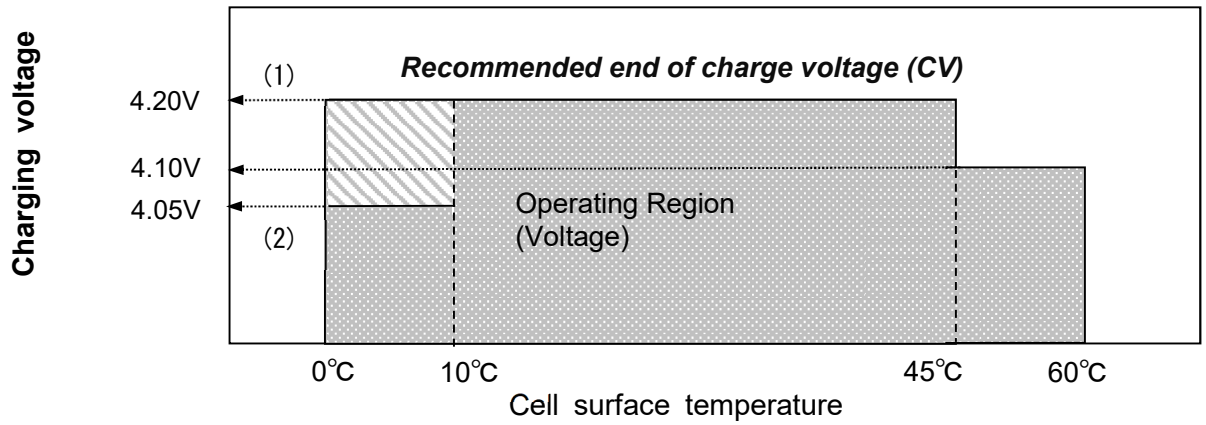
Regarding Operating range for Performance, please follow the below condition.
Recommendation: The charging voltage and current should be lower than following Recommended charging voltage and Recommended maximum charging current in Table.1 for suppression of deterioration.

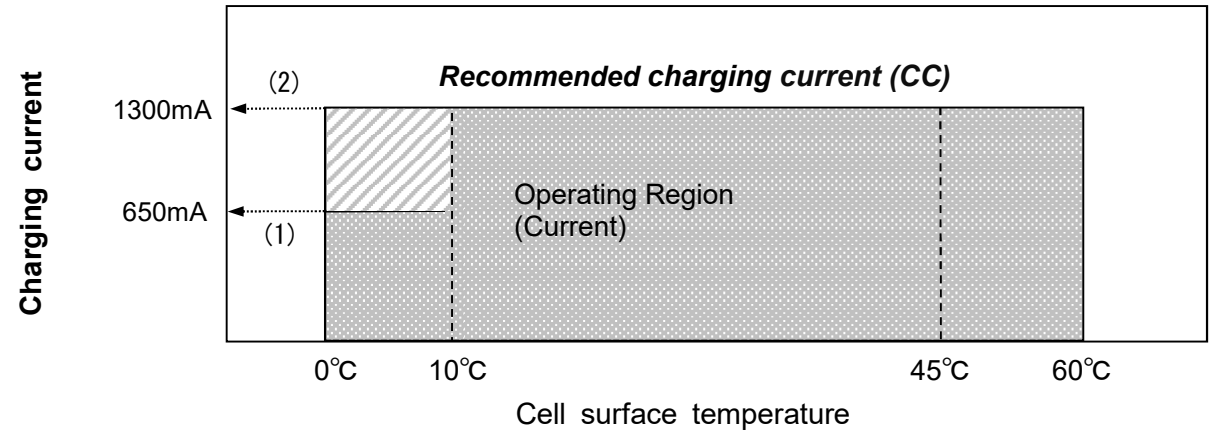
Model: UR18500Y-H023A Recommended parameters for charging method : CC-CV*
UR18500Y-H022A *Constant-Current and Constant-voltage)

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

Temperature		CV values	CC values
0℃~10℃	(1)	4.20 V	650 mA (0.5C)
	(2)	4.05 V	1300 mA (1.0C)
10℃~45℃		4.20 V	1300 mA (1.0C)
45℃~60℃		4.10 V	1300 mA (1.0C)

In case of the other charging method, please consult with Panasonic in detailed.
* If the customer accepts the performance with the specific condition under above charge, it would be negotiable.





Appendix 2 < For Safety >

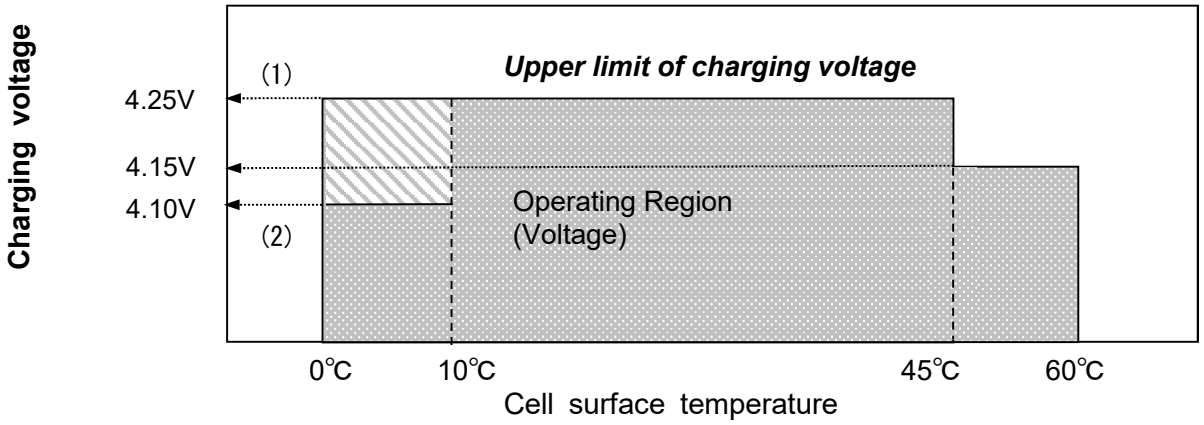
Regarding Operating range for Safety, please follow the below condition.
Requirement: The charging voltage and current shall not exceed following Upper limit of charging voltage and Maximum charging current in Table.2 for safe use.

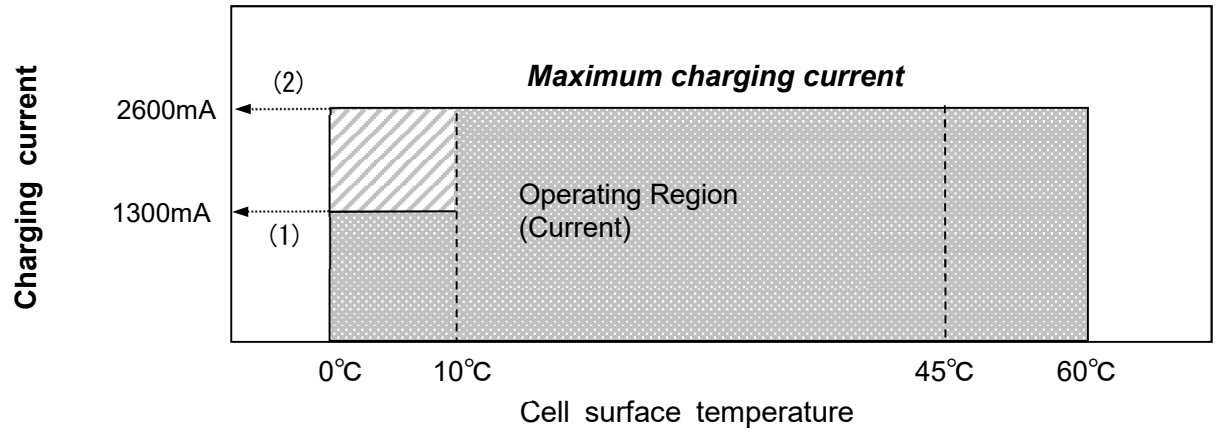
Model: UR18500Y-H023A Recommended parameters for charging method : CC-CV*
UR18500Y-H022A *Constant-Current and Constant-voltage)

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

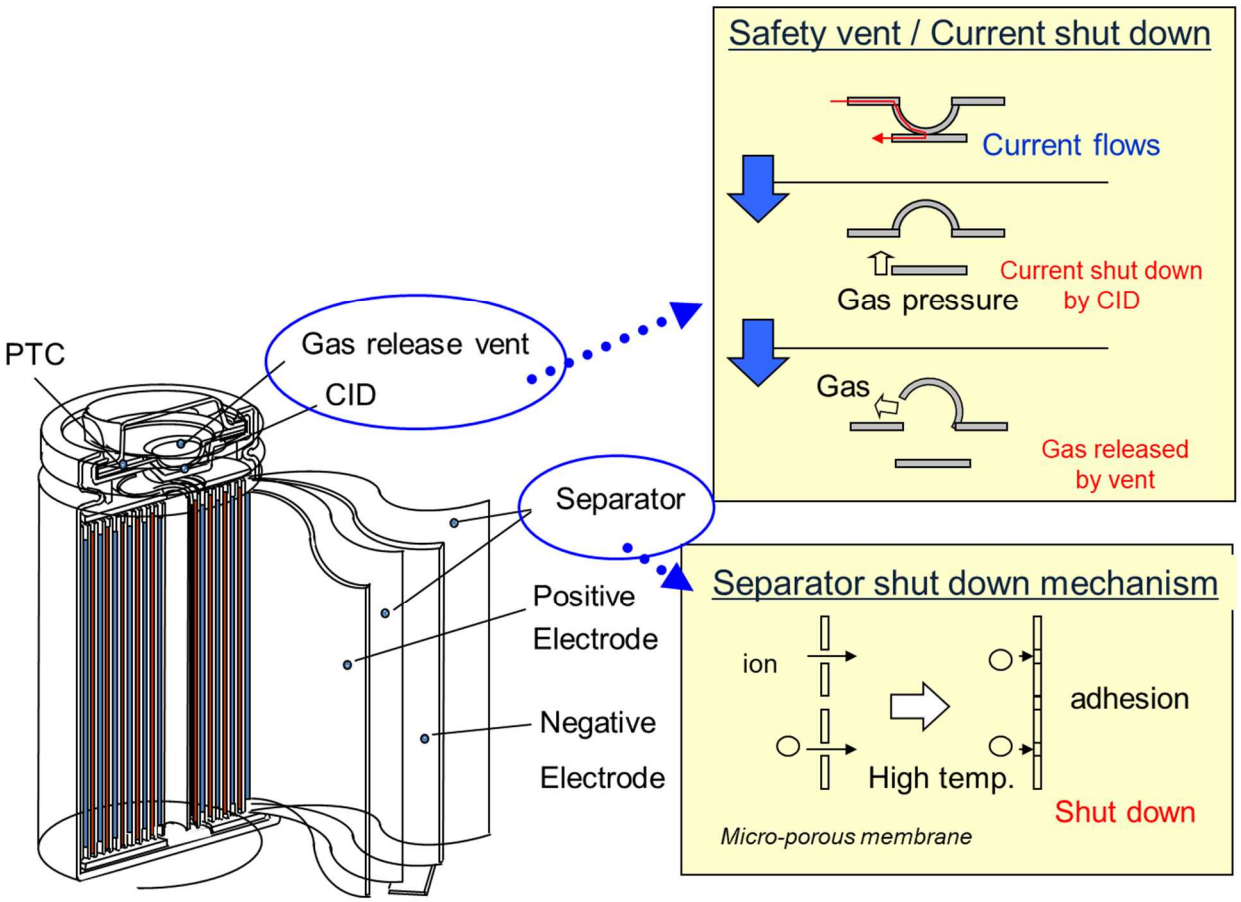
Temperature		Upper limit of charging voltage	Maximum charging current
0℃~10℃	(1)	4.25 V	1300 mA (1.0C)
	(2)	4.10 V	2600 mA (2.0C)
10℃~45℃		4.25 V	2600 mA (2.0C)
45℃~60℃		4.15 V	2600 mA (2.0C)

These value based on JIS C 8714.





Appendix 3 < safety features (separator, vent, CID) >



Safety elements inside cell

UR18500Y contains the following internal safety elements:

a. Irreversible current interruption element which is able to interrupt the current in case of high internal pressure (for example current interruption device - CID).
b. Irreversible internal pressure reduction element which opens the cell in case of increased internal pressure after current interruption (for example: safety vent).
c. Irreversible internal element which stops flow of ions if temperature exceeds critical limit (for example: shut-down separator).
d. Reversible current limitation element which is able to reduce over-current (for example: PTC - resistor that becomes high resistive if a specific temperature is exceeded.)

Appendix 4 < Chemical system of UR18500Y >

Positive Active Material : NCM/LMO
Negative Active Material : Graphite without Silicon
Electrolyte : Organic Solvent

Appendix 5 < Applicable standard >

Cell type has to meet the latest effective version of following standards.
The cell manufacturer has to provide corresponding certificates

Regarding UR18500Y, it will apply for the below standards :

a. **IEC 62133 / EN 62133**
Secondary cells and battery packs containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for battery packs made from them, for use in portble applications.

b. **UL1642**
Requirements for primary and secondary lithium (metallic, alloy or ion) cells for use as power sources in products.

c. **2006/66/EC**
Directive of the European Parliament and of the Council of 6 September 2006 on cells and accumulators and waste battery packs and accumulators and repealing Directive 91/157/EEC.
Content of harmful substances of the cell including tube have to meet the latest effective version.

d. **RoHS**
Directive 2011/65/EC of the European Parliament and the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment and amendments
The tabs of the cell or any kind of means welded on the cell to connect it to a printed circuit board have to meet this directive.

e. **REACH**
Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

f. **United Nations Economic Commission for Europe UNECE ST/SG/AC.10/11/Rev. "latest"**
Committee of experts on the transportation of dangerous goods:
Third revised edition of the Recommendations on the Transport of Dangerous Goods, Manual of Test and Criteria (Refer to ST/SG/AC.10/11/Revision "latest") and amendments. Paragraph 38.3.

g. **Korea**
KC62133: Li-Ion cells (Refer to IEC62133)

h. **India**
IS16046

Appendix 6 < Incoming inspection >

Background: Purpose of Appendix 6 is to demonstrate that P&G is doing an incoming inspection.
The limit values for the pass criteria are not provided within this cell specification.
They are part of the incoming inspection quality scheme from P&G.

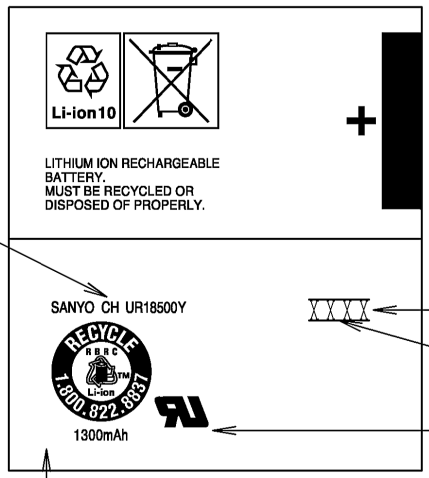
a. Visual incoming inspection
Following points have to be checked with a lot of 32 cells per delivery
(may be reduced to 10 cells if required by testing capacity).
- Outer carton: no damage, no contamination.
- Carton label: as specified.
- Cells: no dents, scratches, rust, sediments like crystals or other materials.
- Shrink tube: according to technical cell drawing by P&G.

b. Electrical incoming inspection
Following tests have to be conducted @ 20°C...25°C with a lot of 32 cells per delivery
(may be reduced to 10 cells if required by testing capacity).within 2 weeks after arrival.

Cycle	Charge ❶	Rest ❷	Discharge ❸	Rest ❹	Discharge ❺	Rest ❻	Pass criteria
0	---	4 h acclimate	1C, 3.00V	30 min	0.2C, 3.00V	1 h	$C_{initialmin} \le C_{initial} \le C_{initialmax}$ ❸
1	CC-CV: 1C, 4.2V, 50 mA	1 h	1C, 3.00V	30 min	0.2C, 3.00V	1 h	$C_{1C} \ge C_{1Cmin}$ ❸ $C_{1C+0.2C} \ge C_{min}$ ❸+❺ $V_{avg1C} \ge V_{avg1Cmin}$ ❸
2	CC-CV: 1C, 4.2V, 50 mA	1 h	2C, 3.00V	30 min	0.2C, 3.00V	1 h	$C_{2C} \ge C_{2Cmin}$ ❸ $C_{2C+0.2C} \ge C_{min}$ ❸+❺ $V_{avg2C} \ge V_{avg2Cmin}$ ❸ $R_{DC} \le R_{DCmax}$ No leakage.

Average discharge voltage V_{avg1C} = Energy E_{1C} / Capacity C_{1C}
Internal resistance $R_{DC} = (V_{avg1C} - V_{avg2C}) / (2C - 1C)$
Extract minimum, average and maximum of each pass criterion.
Total test time = ~ 6.5 h + ~ 6.5 h + ~ 5.5 h = ~ 18.5 h

NO.	PART NAME	APPLICATION・PART CODE	QTY.	MATERIAL・SPECIFICATION	NOTE
	BATTERY		1	UR18500Y	SHIPPING WITH CHARGE
1	TUBE		1	PET	RED TRANSPARENT
2	INSULATION RING		1	PAPER 0.25t	YELLOW GREEN

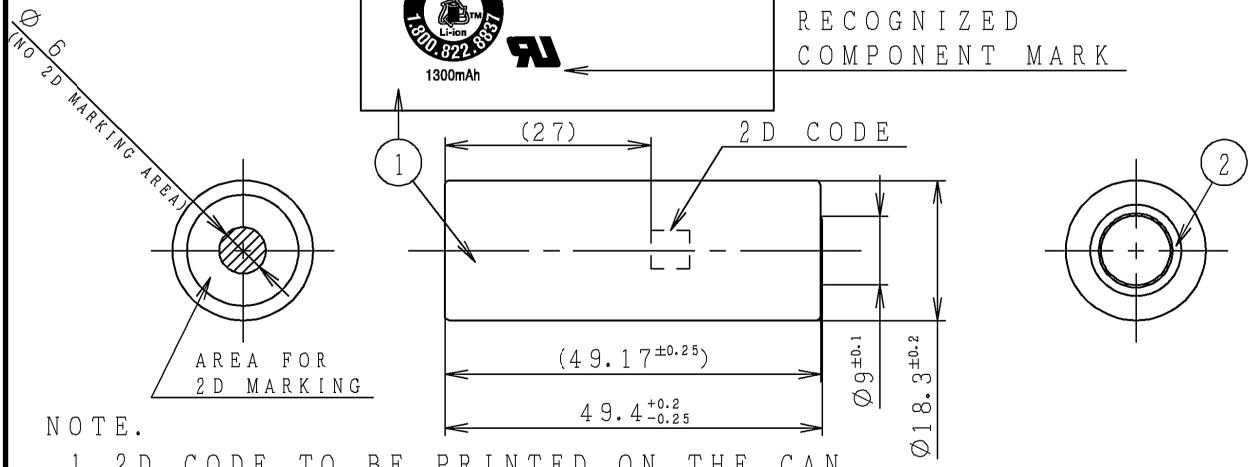


*IT'S POSSIBLE TO TURN OVER THE DIRECTION OF LETTER IN STAMPING.

FACTORY ID SEE FOLLOWING TABLE 1.

XXXX LOT NO.

RECOGNIZED COMPONENT MARK



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. (LOT NO. IS CHARGING DATE)
   XXXX
   - DAY (1ST=01, 2ND, =02, ・・30TH=30, 31ST=31)
   - MONTH (JAN=1, FEB=2, ・・SEP=9, OCT=X, NOV=Y, DEC=Z)
   - YEAR (' 96=6, ' 97=7, ・・' 21=1, ' 22=2, ・・)

   EX.) OCT. 11. 2021・・・・・1X11
3. DO NOT COVER PRINTED CONTENTS & RECYCLE MARKS WITH 2D CODE.
4. STAMP COLOR: BLACK

TABLE. 1

FACTORY ID	FACTORY
CH	CHUOU ELECTRIC CO.,LTD. HIROTA FACTORY

DRAWING NOT TO SCALE

DATE		REMARK
OCT. 11. 2021		
D R	K. Yoshimoto	
CHK		
CHK		
ENG		
APP	N. Higashine	

SYM	DATE	DESCRIPTION
1		
0	OCT. 11. 2021	1st DRAWING (K. Yoshimoto)

MODEL: UR18500Y-H023A

CUSTOMER CODE:

TOLERANCE	
250< L	± 5
< L ≤	±
50< L ≤250	± 4
18< L ≤ 50	± 3
L ≤ 18	± 2

WEIGHT Approx. g

UNIT mm

QTY 1

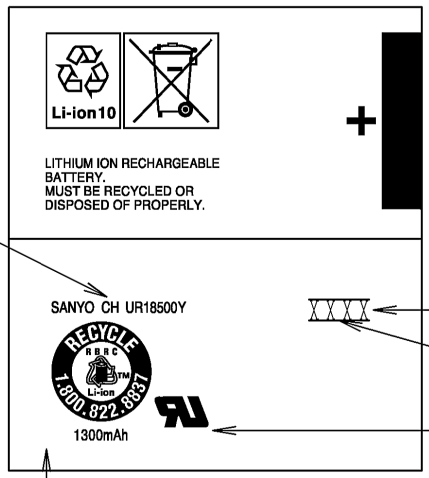
SCALE 1/1

材料・規格 MATERIAL	
処理・加工 FINISH	
部品名 PART NAME	完成電池 BATTERY PACK (finish goods)
PART CODE	Rev.
DRAWING NO	UR18500Y-H023A01

Sanyo Electric Co., Ltd.

A4

NO.	PART NAME	APPLICATION・PART CODE	QTY.	MATERIAL・SPECIFICATION	NOTE
	BATTERY		1	UR18500Y	SHIPPING WITH CHARGE
1	TUBE		1	PET	RED TRANSPARENT
2	INSULATION RING		1	PAPER 0.25t	YELLOW GREEN



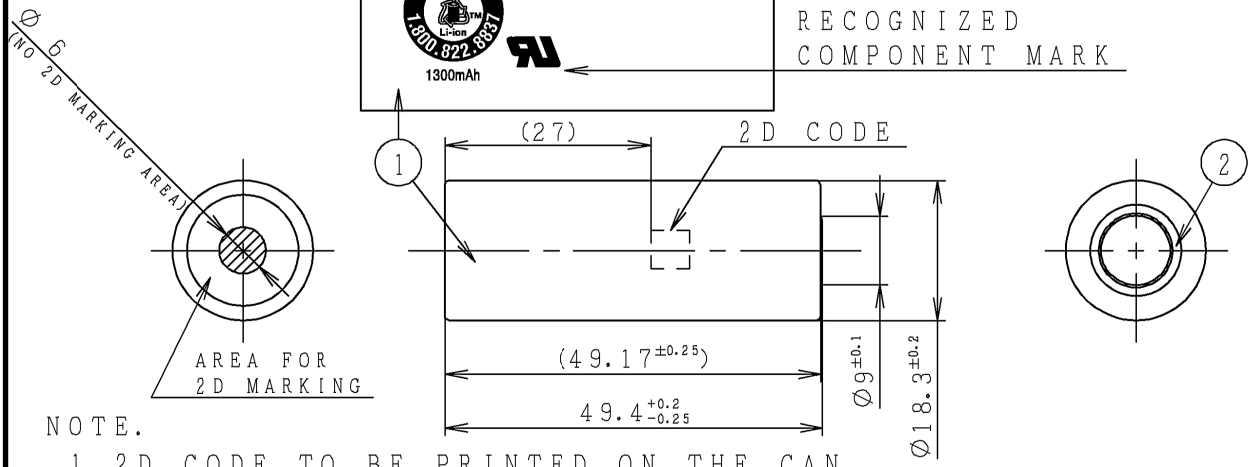
*IT'S POSSIBLE TO TURN OVER THE DIRECTION OF LETTER IN STAMPING.

FACTORY ID SEE FOLLOWING TABLE 1.

XXXX

LOT NO.

RECOGNIZED COMPONENT MARK



DRAWING NOT TO SCALE

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. (LOT NO. IS CHARGING DATE)
   XXXX
   - DAY (1ST=01, 2ND, =02, ・・30TH=30, 31ST=31)
   - MONTH (JAN=1, FEB=2, ・・SEP=9, OCT=X, NOV=Y, DEC=Z)
   - YEAR (' 96=6, ' 97=7, ・・' 21=1, ' 22=2, ・・)

   EX.) SEP. 22. 2021・・・・・1922
3. DO NOT COVER PRINTED CONTENTS & RECYCLE MARKS WITH 2D CODE.
4. STAMP COLOR: BLACK

TABLE. 1

FACTORY ID	FACTORY
CH	CHUOU ELECTRIC CO.,LTD. HIROTA FACTORY

SYM	DATE	DESCRIPTION
1		
0	SEP. 22. 2021	1st DRAWING (K. Yoshimoto)

DATE: SEP. 22. 2021

REMARK

D R	K. Yoshimoto
CHK	
CHK	
ENG	
APP	N. Higashine

MODEL: UR18500Y-H022A

CUSTOMER CODE:

TOLERANCE	
250< L	± 5
< L ≤	±
50< L ≤250	± 4
18< L ≤ 50	± 3
L ≤ 18	± 2

WEIGHT Approx. g

UNIT mm

QTY 1

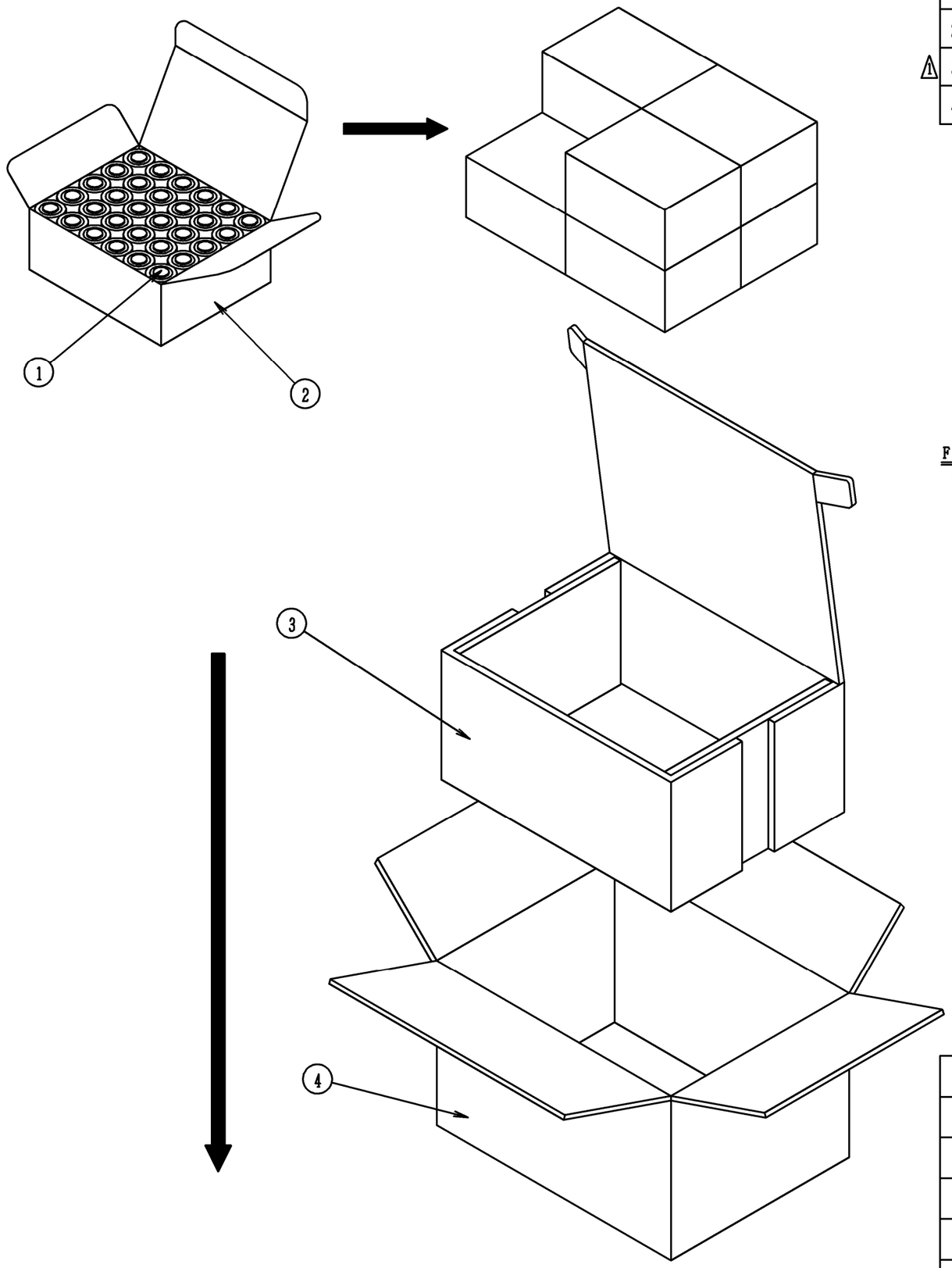
SCALE 1/1

材料・規格 MATERIAL	
処理・加工 FINISH	
部品名 PART NAME	完成電池 BATTERY PACK (finish goods)
PART CODE	Rev.
DRAWING NO	UR18500Y-H022A01

Sanyo Electric Co., Ltd.

A4

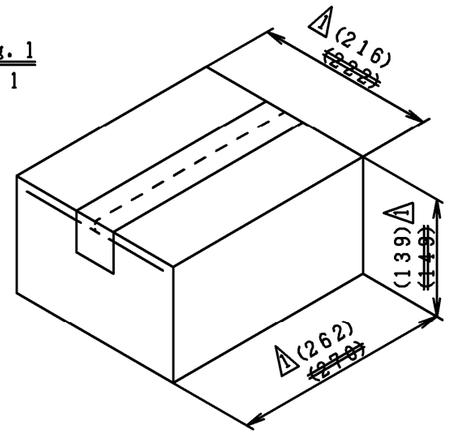
NO.	PART NAME	APPLICATION・PART CODE	QTY.	MATERIAL・SPECIFICATION	NOTE
1	完成電池 BATTERY PACK		1	UR18500	
2	化粧箱 INNER BOX		1/30	コートボール COAT BOARD	
⚠1 3	スリーブパッド SLEEVE PAD		1/240	AP-K170/K180 ~~ABP-K170/SCP120X3/K180~~	
4	段ボール箱 MASTER CARTON		1/240	ABF-K180/SCP120X3/K180	



NOTES.
1. MASTER CARTON TO BE PACKED AS KNOWN DRAWING. (Fig. 1)
2. UPPER AND BOTTOM : TAPE OR STAPLER SEALING. (Fig. 2)
(SPECIFIED SANYO STANDARD SPEC. STD-BHP-EX)

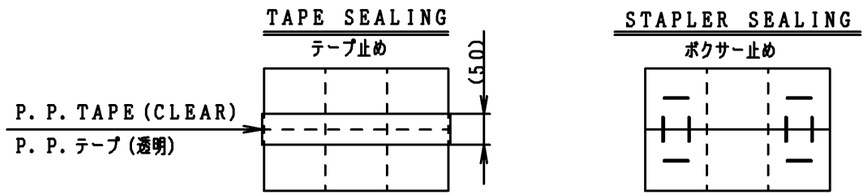
注) 1. 段ボール箱は、図1に示す様に包装すること。
2. 天面、底面は、テープ止め又はボクサー止めとする。(図2参照)
(三洋標準仕様STD-BHP-EXに準ずる。)

Fig. 1
図 1



・OUTSIDE DIMENSIONS ARE INDICATED.
・QUANTITY:
・INNER BOX 30pcs. (5X6X1)
・MASTER CARTON 240pcs. (2X2X2)
・GROSS MASS:APPROX. 10kg
・寸法は外寸とする。
・入数は下記の通りとする。
・化粧箱 30個 (5列X6列X1段)
・段ボール箱 240個 (2列X2列X2段)
・質量 : 約10kg

Fig. 2
図 2



DRAWING NOT TO SCALE

DATE		REMARK	SYM	DATE	DESCRIPTION
APR.-4.2013			⚠1	APR.-4.2013	CHANGED SLEEVE PAD SPEC & OUTSIDE DIMENSIONS.
D R	K.Yoshimoto		⚠0	DEC.28.2010	1st DRAWING/初回出図 (K.Yoshimoto)
CHK		MODEL:UR18500-SSTD		材料・規格 MATERIAL	
CHK		CUSTOMER CODE:SSTD		処理・加工 FINISH	
ENG		TOLERANCE / WEIGHT Approx. g / UNIT		部品名 PART NAME	包装仕様図 PACKING SPECIFICATION
APP	M.Kagoshima	QTY 1/240 / SCALE FREE		PART CODE / DRAWING NO	AUR18500-SIYOUZ Rev. 0A

Sanyo Electric Co., Ltd. Portable Rechargeable Battery Business Division A3