Confidential

File No. NCR18650-604

Issue Date: 2015/3/24

LITHIUM ION BATTERY SPECIFICATION

BATTERY CLASSIFICATION	LITHIUM ION BATTERY
PRODUCT CODE	NCR 18650BE, NCR 18650BM
CLIENT	

Client Agreement:

Signature:

Name in Block Letters:

Date:

* If there is no reply within 30 days following delivery, this document shall be presumed to be valid.

Portable Rechargeable Battery Business Division,
SANYO Electric Co.,Ltd.
Automotive & Industrial Systems Company
of Panasonic Group
Technical Service Group No.2
PA Business Development Team

Dft.	R. Hamaguchi
Chk.	K. Nishimura
Chk.	T. Nishitani
App.	H. Yoneda

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1 Revision History

No.	Date	Class	Description		
(a)	2015/3/24	—	Issue	Dft.	R.Gomimoto
				Chk.	K.Nishimura
				Chk.	T.Nishitani
				App.	H.Yoneda
				Dft.	
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				Chk.	
				App.	
				Dft.	
				Chk.	
				Chk.	
				App.	

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

File No.		Portable Rechargeable Battery 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.

Impact beyond specification 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.

Disassembly or modication of the battery may damage the protection circuit. This may cause the battery 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.

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) Rust, 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.

Caution

(1) Exposure to Direct Sunlight

Do not use or leave the battery in a location exposed to excessive heat, such as in direct sunlight or in a car. Doing so could cause the battery to generate heat, smoke, catch fire, or explode. It may also cause the battery's performance and life to deteriorate.

(2) 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.

(3) Charging Temperature Range

Only charge the battery between 0°C and 45°C. 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.

(4) Manual

Read the manual before use. Keep for future reference.

(5) Charging Method

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

(6) 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.

(7) 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.

(8) Flammable Materials

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

(9) 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.

(10) 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.

(11) Recycling

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

3 Scope

This specification applies to the Lithium Ion Battery

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.

4 Battery Classification and Product Code

4.1 Battery Classification	Lithium Ion Battery
4.2 Product Code	
4.3 Model Name	
4.4 Cell Type	NCR18650BE

5 Nominal Specifications

Item		Specifications	Notes
5.1 Rated Capacity		2980mAh	0.606A discharge at 20°C
5.2 Capacity (Minimum)		3030mAh	0.606A discharge at 25°C
5.3 Capacity (Typical)		3180mAh	Reference only
5.4 Nominal Voltage		3.6V	0.606A discharge at 25°C
5.5 Discharging End Voltage		2.5V	
5.6 Charging Current (Std.)		0.909A	
5.7 Charging Voltage		4.20± 0.03V	
5.8 Charging Time (Std.)		5.0hours	
5.9 Continuous Discharge Current (Max.) *1		3.636A	0 ~ +40°C 10A discharge is possible. But, SANYO doesn't guarantee the performance.
5.10 Internal Resistance		less than 40mΩ	AC impedance 1 kHz
5.11 Weight		less than 49.5g	
5.12 Operating Temperature	Charge	+10 ~ +45°C	
	Discharge	-20 ~ +60°C	
5.13 Storage Conditions	less than 1 month	-20 ~ +50°C	Recoverable Capacity: 80%*2
	less than 3 months	-20 ~ + 40°C	
	less than 1 year	-20 ~ + 20°C	

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

*2 $Recoverable\ Capacity = \frac{Discharge\ Time\ after\ Storage}{Initial\ Discharge\ Time} * 100$

The discharge time is measured by fully charging the battery at 25°C and then discharging it at a current of 0.606A to 2.5V per cell in series.

6 Electrical Characteristics

Item		Conditions	Criteria
6.1	Full Charge	The battery is charged at a 0.909A constant current until the voltage reaches 4.2V. The current is then reduced to keep a constant voltage of 4.2V. The total charging time is 5.0hours at 25°C.	
6.2	Capacity	(1) Within 1 hour after fully charging at 25°C as per item 6.1, the battery is discharged at 0.606A continuously to 2.5V at 25°C.	More than 300 min.
		(2) Within 1 hour after fully charging at 25°C as per item 6.1, the battery is discharged at 3.03A continuously to 2.5V at 25°C.	More than 51 min.
6.3	Cycle Life	After the battery has been subjected to 300 repeated charge and discharge cycles (charged by CC-CV of 0.909A – 4.2V for 5.0hours; discharged by CC of 3.03A to 2.5V at 25°C), the discharge time is measured as per Item 6.2, (2).	More than 38 min.
6.4	Temperature Characteristics	(1) Within 1 hour after fully charging at 25°C as per item 6.1, the battery is stored at 0°C for 3 hours. The discharge time is then measured as per Item 6.2, (2) at 0°C.	More than 30 min.
		(2) Within 1 hour after fully charging at 25°C as per item 6.1, the battery is stored at 60°C for 3 hours. The discharge time is then measured as per Item 6.2, (2) at 60°C.	More than 50 min.
6.5	Storage at Fully Charged State	After fully charging at 25°C as per item 6.1, the battery is stored for 20 days at 60°C After storage, the battery is held at 25°C for 3 hours. Then, the discharge time is measured as per Item 6.2, (2).	More than 30 min.
		Then, the same battery is fully charged again and discharged a second time and measured as per Item 6.2, (2) at 25°C.	More than 42 min.
6.6	Storage at Full Discharged State	After fully charging at 25°C, the battery is discharged as per Item 6.2, (2). Then, the battery is stored for 20 days at 60°C. After storage, the battery is held at 25°C for 3 hours. Then, the discharge time is measured as per Item 6.2, (2) at 25°C.	More than 48 min.

Item	Conditions	Criteria
6.7 Drop	After fully charging at 25℃, 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 pe rformed at a temperature of 25±2°C and a humidity of 65±20% (the standard temperature toleranc e 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 ammete r used in the tests shall be higher than Class 0.5 as specified by *JIS C 1102-2, Special Require ments for Ammeters and Voltmeters*.

7 Design and Dimensions

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

- Drawing number [NCR18650BE]

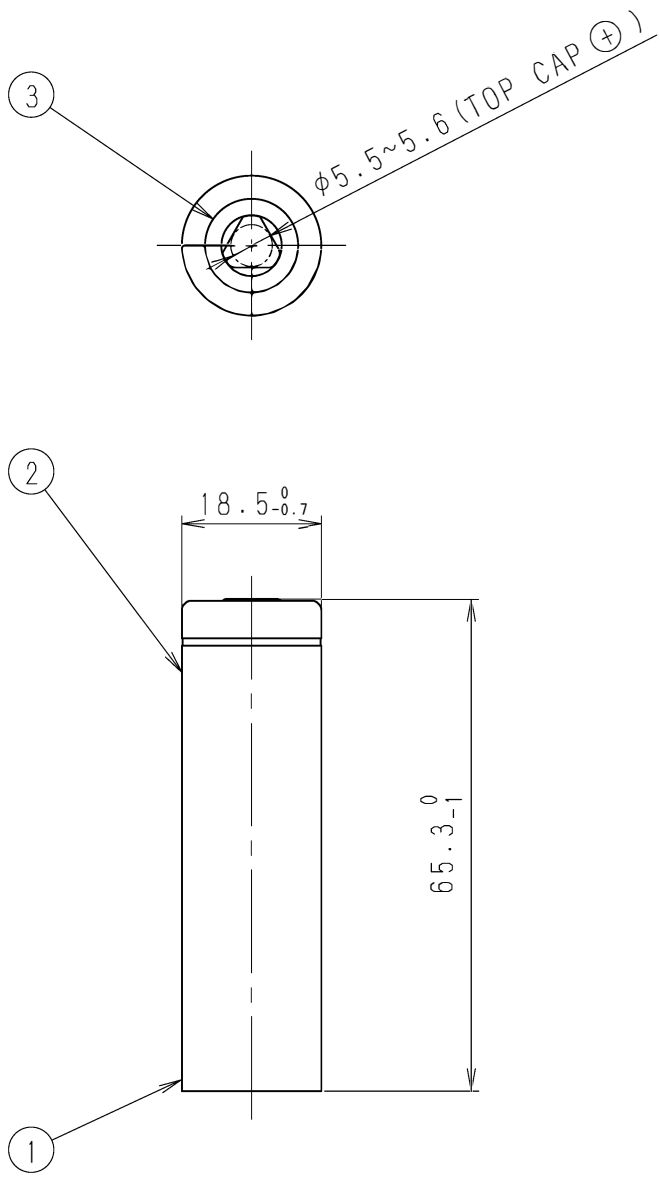
8 Appearance

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

・Scratch
・Rust
・Discoloration
・Dirt
・Deformation
・Leakage

9 State of Charge at Time of Shipment

Symbol	Date	Revision	Signe	Checked



Unit:mm

③	INSULATOR	PAPER	1			
②	OUTER JACKET	SHRINK TUBE	1			
①	CELL		1			
Symbole	Name	Material	qt.	Process	Remark	

Scale	Designed	Drawn	Checked	Checked	Approved	Model No.	NCR18650BE
1:1	Sugimoto	Sugimoto	Miyata	Nagasaki	Tamagawa	Name	DIMENSION SKETCH
	13 Dec 25	13 Dec 25	13 Dec 25	13 Dec 25	13 Dec 25		

SANYO Electric Co.,Ltd Unit:mm