

Think GAIA
For Life and the Earth

SANYO

Sanyo Nickel-Metal Hydride
Rechargeable Batteries

Twicell[®]




URL <http://www.sanyo.co.jp/energy/>

Twicell Batteries Handling Precautions

Carefully read this instruction manual before using Twicell batteries for the first time.

Important: For your safety and that of your customers observe all cautionary information provided in this manual. Save this manual for future reference. The following information is intended to highlight potential safety hazards that can be associated with the misuse, misapplication or damage to Twicell batteries. Please carefully evaluate the information in this section when using Twicell batteries (single cell or packed cells) or when using or manufacturing equipment incorporating Twicell batteries.

This manual is no substitute for your independent evaluation of equipment incorporating Twicell batteries. Customers incorporating Twicell batteries into their equipment must assure that their completed product has been properly designed, manufactured and tested. End users of equipment incorporating Twicell batteries should also be provided with sufficient warnings and instructions on their safe operation. As appropriate, some or all of the following warnings and information should be incorporated by you into the instruction manual accompanying your equipment.

DANGER!

● Failure to carefully observe the following procedures and precautions can result in leakage of battery fluid (electrolyte), heat generation, bursting, fire and serious personal injury!

● Never dispose of Twicell batteries in a fire or heat them.

Doing so may melt the insulation, damage the gas release vents or protective devices, ignite hydrogen gas, cause leakage of battery fluid (electrolyte), heat generation, bursting and fire.

● Do not connect the ⊕(positive) and ⊖(negative) terminals of Twicell batteries together with electrically conductive materials, including lead wires. Do not transport or store Twicell batteries with their uncovered terminals or connected with a metal necklace or other conductive material. Doing so may short circuit a battery, which would result in excessive current flow and possibly cause leakage of battery fluid, heat generation, bursting and fire. When carrying or storing batteries, use a special case.

● Only charge Twicell batteries using those specific chargers that satisfy Sanyo's specifications. Only charge batteries under the conditions specified by Sanyo. Failure to follow proper charging procedures may cause excessive current flow, loss of control during charging, leakage of battery fluid, heat generation, bursting and fire.

● Never disassemble Twicell batteries. Doing so may cause an internal or external short circuit or result in exposed material of battery reacting chemically with the air. It may also cause heat generation, bursting and fire. Also, this is dangerous as it may cause splashing of alkaline fluid.

● Never modify or reconstruct Twicell batteries. Protective devices to prevent danger are built into batteries(single cell or packed cells). If these are damaged, excessive current flow may cause loss of control during charging or discharging of the battery, leakage of battery fluid, heat generation, bursting and fire.

● Never solder lead wires directly on to Twicell batteries.

The heat of the soldering operation may melt the insulation, damage the gas release vents or protective devices, cause leakage of battery fluid, heat generation, bursting and fire.

● The ⊕(positive) and ⊖(negative) terminals of Twicell batteries are predetermined. Do not force the terminal connection to a charger or equipment. If the terminals can not be easily connected to the charger or equipment, check if the ⊕and ⊖terminals are correctly positioned. If the terminals are reversed, during charging the battery may be discharged rather than charged. Furthermore, reversed connections may cause abnormal chemical reaction in the battery, the flow of abnormal currents, leakage of battery fluid, heat generation, bursting and fire.

● The gas release vent which release internal gas is located in the ⊕positive terminal of the Twicell battery. For this reason, never deform this section or cover or obstruct its gas release structure. If this section is deformed or covered or obstructed, the gas release vent will not function properly, possibly causing leakage of battery fluid, heat generation, bursting and fire.

● Do not directly connect Twicell batteries to a direct power source or the cigarette lighter socket in a car. High voltage may cause excessive current flow, leakage of battery fluid, heat generation, bursting and fire.

● Do not use Twicell batteries in any equipment other than those specified by Sanyo. Depending on the equipment being used, doing so may cause abnormal current flow, leakage of battery fluid, heat generation, bursting and fire.

● Twicell batteries contain the strong colorless alkaline solution(electrolyte). The alkaline solution is extremely corrosive and will cause skin damage. If any fluid from Twicell battery comes in contact with a user's eyes, they should immediately flush their eyes and wash them thoroughly with clean water enough from the tap or another source and consult a doctor urgently. The strong alkaline solution can damage eyes and lead to permanent loss of eyesight.

● When Twicell batteries are to be incorporated in equipment or housed within a case, avoid air-tight structures as this may lead to the equipment or case being damaged or may be harmful to users.

WARNING!

● Do not apply water, seawater or other oxidizing reagents to Twicell batteries, as this can cause rust and heat generation. If a battery becomes rusted, the gas release vent may no longer operate, and can result in bursting.

● Do not connect more than 21 Twicell batteries in series, as this may cause electrical shocks, leakage of battery fluid and heat generation.

● Keep Twicell batteries or the equipment out of the reach of babies and small children, in order to avoid them to swallow batteries. In the event the batteries are swallowed, consult a doctor immediately.

● Do not charge or use Twicell batteries with the ⊕ and ⊖ terminals reversed. Charging batteries with the terminals reversed may discharge rather than charge the batteries, or it may cause abnormal chemical reaction in the batteries. Using batteries with the terminals reversed may discharge with of abnormal current, leakage of battery fluid, heat generation, bursting and fire.

● Do not over-charge Twicell batteries by exceeding the predetermined charging period specified by the battery charger's instructions or indicator. If Twicell batteries are not fully charged after the battery charger's predetermined charging period has elapsed, stop the charging process. Prolonged charging may cause leakage of battery fluid, heat generation, bursting. Be sure to handle recharged batteries carefully as they may be hot.

● Do not remove the outer tube from a battery or damage it. Doing so will expose the battery to the risk of a short circuit, and may cause leakage of battery fluid, heat generation, bursting and fire.

● If Twicell batteries leak fluid, change color, change shape, or change in any other way, do not use them, otherwise they may cause heat generation, bursting and fire.

● Twicell batteries contain the strong colorless alkaline solution(electrolyte). If the skin or clothing comes in contact with fluid from Twicell battery, thoroughly wash the area immediately with clean water from the tap or another source. Battery fluid can irritate the skin.

● When the operating time of a Twicell battery becomes much shorter than its initial operating time even after recharged, it should be replaced to a new battery as its battery life has ended.

CAUTION!

● Do not strike or drop Twicell batteries. Sharp impacts or concussions to Twicell batteries may cause leakage of battery fluid, heat generation, bursting and fire.

● Store Twicell batteries out of the reach of babies and small children. When charging or using a battery, do not let babies or small children remove the battery from the charger or the equipment being used.

● Children should not use Twicell batteries unless they have been carefully instructed on the contents of this instruction manual and their parents or guardians have confirmed that the children understand and appreciate the proper usage and safety hazards presented by the batteries.

● Be sure to charge Twicell batteries within a temperature range of 0 to 40°C(degrees Celsius). When used at temperatures outside this range(0 to 40°C) the batteries may cause leakage of battery fluid or heat generation. It could also impair performance or shorten service life of Twicell batteries.

● Do not charge Twicell battery when it has been cooled to 0°C or below. Doing so may cause leakage of battery fluid, impair performance or shorten operating life of Twicell batteries.

● Do not use or store battery at high temperature, such as in strong direct sunlight, in cars during hot weather, or directly in front of a heater. This may cause leakage of battery fluid. It could also impair performance and shorten operating life of Twicell batteries.

● Do not use old and new batteries mixed together, or batteries at different charge levels. Do not use the Twicell battery mixed together with a dry cell or other battery of different capacity, type, or brand name. This may cause leakage of battery fluid and heat generation.

● When more than two batteries are to be used together, charge them simultaneously prior to use. If they are not charged at the same time, it could cause leakage of battery fluid and heat generation.

● Do not connect Twicell batteries in parallel as this may cause leakage of battery fluid, heat generation, bursting and fire.

● For the recommended charging method for Twicell batteries, read the battery charger's instruction manual carefully.

● If Twicell batteries do not perform or function well with certain equipment, refer to the instruction manual or warnings of the subject equipment.

● Do not charge Twicell batteries beyond the recommended time described in the instruction manual for charger or equipment. Over charging cause leakage of battery fluid, heat generation, bursting and fire. It could also impair performance and shorten service life of Twicell batteries.

● After long term storage, there is a possibility that the battery could not be fully charged. In order to fully charge it, charge and discharge the battery for a few times.

● Be sure to turn off the equipment after use of Twicell batteries, as this may result in leakage of battery fluid.

● After they have been removed from equipment, store Twicell batteries in a dry place and within the recommended storage temperature range. This will help preserve the batteries' performance and durability and to minimize the possibility of leakage of battery fluid or corrosion. (For the indicated storage temperature range, refer to the rating table of this catalog. Sanyo recommends a temperature range from -20 to 30°C for longer service life).

● Before using the Twicell, be sure to read the operation manual and all precautions carefully, then store the manual and precautions carefully to use as reference when the need arises. If you have specific questions about the operation manual or the precautions, contact Sanyo at the location listed on the last page of this manual.

● If corrosion, heat generation or other abnormalities with new Twicell batteries are detected. Immediately stop using them and return them to the store that they were purchased from.

● If the Twicell battery terminals become dirty, clean them with a soft dry cloth prior to use. Dirt on the terminals can result in poor contact with the equipment, loss of power, or inability to charge.

Twicell Line up

A broad range of Twicell is available. Twicell significantly contributes to the compact, lightweight, multi-function and low-cost features of various portable equipment



High capacity Twicell

For communication equipment, notebook computers, etc



High durability Twicell

For cordless phones, razors, power back-up uses, etc



High-rate discharge Twicell

For power tools, electric motor applications, etc



Dry cell compatible Twicell

For digital cameras, audio equipment, etc

■ Features of Twicell Batteries

Extended service life and superior economy

Despite discharge capacity that is virtually equal to that of conventional dry cells, Sanyo Twicell batteries feature minimal internal resistance and exhibit excellent discharge characteristics under high-rate discharge current conditions. With output power much higher than that of dry cells. In addition, even though the batteries are stored for a long time, the original capacity is almost recovered by repeated charging/discharging, offering excellent storage characteristics.

Wide-ranging lineup and interchangeability with dry cells

Customized assembled batteries tailored to specific equipment space requirements are also available.

Excellent high-rate discharge performance and overcharge/overdischarge capability

Sanyo's original electrode manufacturing process and current collectors minimize internal resistance, which in turn enables high-rate discharging and guarantees stable discharge voltage.

Improved reliability

In 1990, SANYO began the mass-production of twicell batteries. Sanyo twicell batteries are manufactured under strict quality control conditions, and undergo 100% inspection before shipment. This assures superior reliability.

Simple to maintain and strong

The special sealed construction eliminates the need to replenish the electrolyte, for easier maintenance. As Sanyo Twicell batteries may be installed in any direction in equipment, they are exceptionally easy to handle. Moreover, Twicell batteries employ a rigid metal casing for superior resistance to shock and vibration.

High Cost Performance, High Energy Density

■ Features

High capacity

High capacity Twicell has shown the high energy density by using newly developed materials and constitution. High capacity Twicell can contribute to prolonging the running time of the equipment.

Rapid charging capability

When a specifically designed charger is used, Twicell batteries can be charged in only 1.1 hours*. A charge control module is also available.

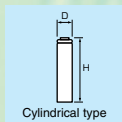
* Needs special charge control circuit.

A broad range

A broad range of high capacity Twicell is available. High capacity Twicell is ideal for more compact, efficient applications.

■ Use

For audio, 2-way radios and other communication devices.
For notebook computers, etc.



■ Ratings

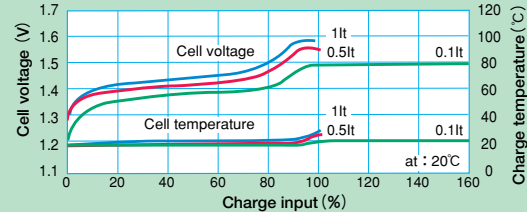
Model No.	Voltage (V)	Typical Capacity (mAh)*1	Minimum Capacity (mAh)*2	Quick-Charge*3		Dimensions(mm) (incl. tube)*4		Weight (approx.g)*4	Notes
				Current(mA)*3	Time(hr.)	Diameter(D)	Height(H)		
HR-AAA	1.2	730	650	730	1.1	10.5	44.5	13	For audio, 2-way radios and other communication devices
HR-5/4AAA	1.2	850	760	850	1.1	10.5	50.0	15	For audio, 2-way radios and other communication devices
HR-AA	1.2	1650	1500	1650	1.1	14.2	50.0	28	For 2-way radios and other communication devices
HR-4/5AU	1.2	2150	1950	2150	1.1	17.0	43.0	35	For 2-way radios and other communication devices
HR-AU	1.2	2700	2450	2700	1.1	17.0	50.0	40	For 2-way radios and other communication devices
HR-4/3AU	1.2	4000	3600	3000	1.5	17.0	67.5	55	For notebook computers, etc.
HR-4/3FAU	1.2	4500	4100	3000	1.5	18.0	67.5	62	For notebook computers, camcorders, portable DVD players, etc.

*1 Typical capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours.

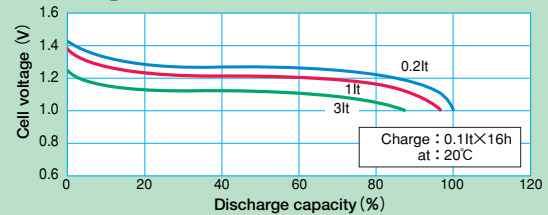
*2 Minimum capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. *3 Consult Sanyo according to conditions of use. *4 Including tube.

Characteristics(HR-AAU)

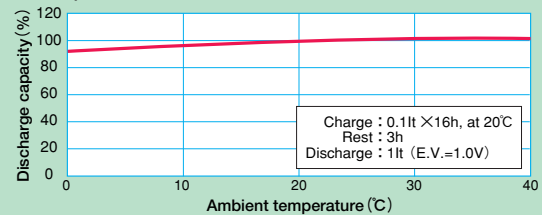
● Charge Characteristics



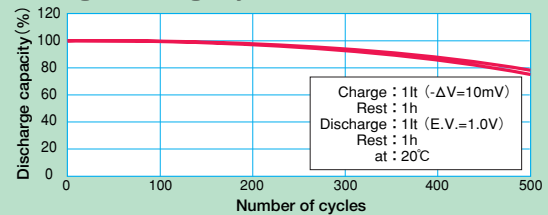
● Discharge Characteristics



● Temperature Characteristics



● Charge/Discharge Cycle Characteristics



Superior Reliability and Stable Characteristics

■ Features

Superior service life

High durability Twicell realizes superior service life than high capacity Twicell at continuous low-rate charging and charge and discharge cycles. High durability Twicell offers better performance for cordless phones, power back-up uses, etc.

A powerful range

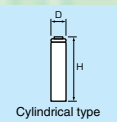
A broad range of high durability Twicell is available. High durability Twicell is available for many applications.

Newly developed "T series" realizes higher durability than conventional "C series" for emergency lights, etc.

■ Use

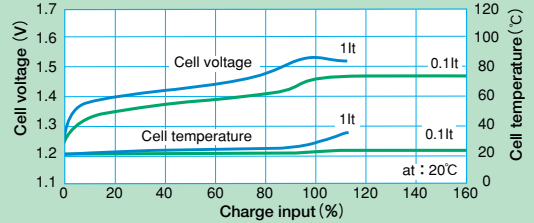
T series : For emergency lights, power back-up uses, etc.

C series : For cordless phones, razors, power back-up uses, etc.

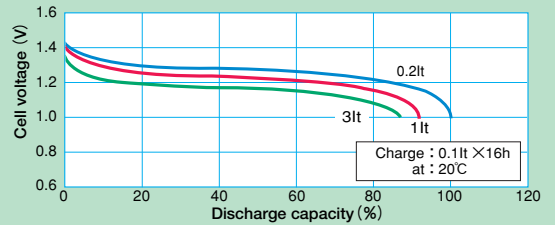


Characteristics(HR-AAC)

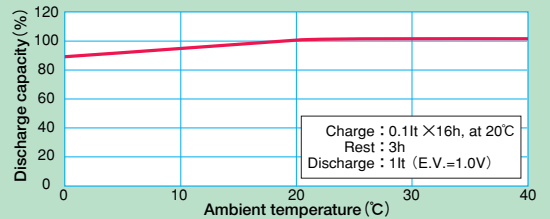
● Charge Characteristics



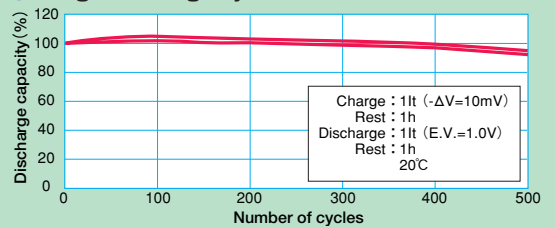
● Discharge Characteristics



● Temperature Characteristics



● Charge/Discharge Cycle Characteristics



■ Ratings

〈High durability Twicell〉		〈T series〉		Quick-Charge*3		Dimensions(mm) (incl. tube)*4		Weight (approx.g)*4	Notes
Model No.	Voltage (V)	Typical Capacity (mAh)*1	Minimum Capacity (mAh)*2	Current(mA)*3	Time(hr.)	Diameter(D)	Height(H)		
HR-4/5FAUPT	1.2	1650	1500	1650	1.1	18.1*5	43.2*5	39	For emergency lights, power back-up uses, etc.
HR-5/4SCUT	1.2	3250	3000	3250	1.1	23.0	50.0	67	For emergency lights, power back-up uses, etc.

〈High durability Twicell〉		〈C series〉		Quick-Charge*3		Dimensions(mm) (incl. tube)*4		Weight (approx.g)*4	Notes
Model No.	Voltage (V)	Typical Capacity (mAh)*1	Minimum Capacity (mAh)*2	Current(mA)*3	Time(hr.)	Diameter(D)	Height(H)		
HR-4UC	1.2	650	600	650	1.1	10.5	44.5	13	For cordless phones, toothbrushes, etc.
HR-4/5AAUC	1.2	1100	1000	1100	1.1	14.2	43.0	23	For razors, cordless phones, toothbrushes, etc.
HR-AAC	1.2	1000	950	1000	1.1	14.2	50.0	27	For razors, cordless phones, toothbrushes, etc.
HR-2/3AUC NEW	1.2	1000	950	1000	1.1	17.0	28.5	23	For razors, toothbrushes, etc.
HR-4/5AUC	1.2	1700	1550	1700	1.1	17.0	43.0	35	For razors, toothbrushes, etc.
HR-4/3FAUPC	1.2	3200	3050	3200	1.1	18.1*5	67.0*5	59	For power back-up uses, etc.
HR-4/3FAUC	1.2	3700	3300	3000	1.5	18.0	67.5	62	For power back-up uses, etc.
HR-SCC	1.2	2100	1900	2100	1.1	23.0	43.7	59	For power back-up uses, etc.

*1 Typical capacity when a single cell is discharged at 0.2lt after being charged at 0.1lt for 16 hours. *2 Minimum capacity when a single cell is discharged at 0.2lt after being charged at 0.1lt for 16 hours.
*3 Consult Sanyo according to conditions of use. *4 Including tube. *5 With paper tube. Other cells are with heat shrink tube.

Stable Discharge Voltage at High-rate Discharge

■ Features

Superior high-rate discharge characteristics

Sanyo's original electrode manufacturing process and current collectors minimize internal resistance, which in turn enables high-rate discharging and guarantees stable discharge voltage.

Improved reliability with wide operating temperature

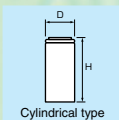
In addition to displaying only minimal variation in performance over a wide temperature range.

A powerful range

High-rate discharge Twicell consists of wide variation. It enables to be used many applications.

■ Use

For power tools, cordless cleaners, electric motor applications, etc.



Cylindrical type

■ Ratings

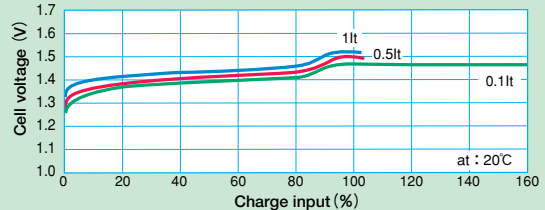
<High-rate discharge Twicell>

Model No.	Voltage (V)	Typical Capacity (mAh)*1	Minimum Capacity (mAh)*2	Quick-Charge*3		Dimensions(mm) (incl. tube)*4		Weight (approx.g)*4	Notes
				Current(mA)*3	Time(hr.)	Diameter(D)	Height(H)		
HR-4/5FAUP	1.2	1950	1800	1950	1.1	18.1 *5	43.2 *5	39	For power tools, cleaners, electric motor applications, etc.
HR-4/3FAUP	1.2	3600	3400	3600	1.1	18.1 *5	67.0 *5	59	For notebook computers, electric motor applications, camcorders, portable DVD players, etc.
		4000	3750	4000				60	
HR-SCUP	1.2	2600	2400	2600	1.1	23.5 *5	44.2 *5	54	For power tools, cleaners, electric motor applications, etc.
HR-SCU	1.2	3000	2700	3000	1.1	23.5 *5	44.2 *5	59	For power tools, cleaners, electric motor applications, etc.
HR-D	1.2	7300	6500	5000	1.7	34.0	59.3	175	For electric motor applications, etc.
HR-DU	1.2	10000	9300	5000	2.2	34.0	59.3	175	For electric motor applications, etc.

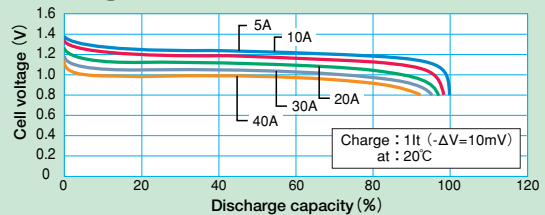
*1 Typical capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. *2 Minimum capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours.
*3 Consult Sanyo according to conditions of use. *4 Including tube. *5 With paper tube. Other cells are with heat shrink tube.

Characteristics(HR-4/3FAUP)

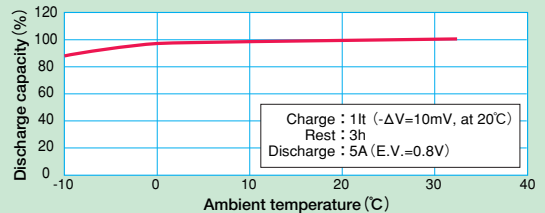
● Charge Characteristics



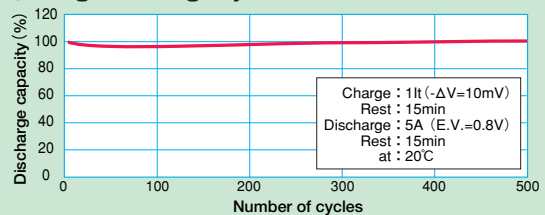
● Discharge Characteristics



● Temperature Characteristics



● Charge/Discharge Cycle Characteristics



After revision

Application	Type	High Capacity Twicell	High durability Twicell	High-Rate Discharge Twicell	Dry cell compatible Twicell
Audio	Radio	●	●		●
	Music Player	●			●
	Wireless Speaker	●	●	●	
	Wireless Microphone	●	●		●
Camera	DVD player	●		●	
	Camcorder	●		●	
information	Digital Camera				●
	Notebook Computer	●		●	
	PDA, Data Entry	●	●		●
	Cordless Mouse	●	●		●
	Portable Printer	●		●	●
	Uninterrupted Power Systems (UPS)		●		
Communication	2Way Radio	●	●	●	●
	Cordless Phone		●		
	Base station Back-up		●		
Home Application	Electric Razor, Toothbrushes	●	●		
	Vacuum Cleaner		●	●	
Power Tool	Power Tool			●	
Emergency	Fire Alarm		●		
	Emergency light		●		
	Emergency Communication		●		
Light	Photographic Lighting Equipment	●	●	●	
	Light	●	●	●	●
Toy	Remote control Toys	●		●	●
	Game Machine	●			●
Medical	Medical Equipment		●	●	
Construction	Sola-powered Equipment		●		
Transport	Electric Motor applications, Electric carrier			●	
	Power Assisted Bicycles or Vehicles			●	
Othera	Measuring Instrument	●	●	●	●
	Robots			●	
	Security machinery		●		
	Remote controller		●		●
	Dry Cell-applied Products				●

※ Typical applications are shown in the table. For other purposes, consult Sanyo.

⚠ Precautions for Incorporating Assembled Batteries

● When batteries are used at high temperature, their charge efficiency decreases and degradation of their performance and material properties is accelerated. To prevent this, keep the battery away from heat generating parts such as in transformers, and attempt to improve the heat diffusion of equipment and battery.

● Reverse charging of battery may cause leakage of electrolyte (strong alkaline aqueous solution), thus

calling for alkaline-resistant materials in the periphery of the battery. Together with the electrolyte, oxygen or hydrogen gas may leak. During design, measures must be incorporated to prevent combustion, which may be caused by sparks from motors or switches.

● Avoid contact-type connections such as those employing a spring, as an oxidized coating will form on the contact surface after prolonged periods of use, leading to possible improper contact. If a

contact-type connection is used, remove the battery and wipe the contact with a cloth every few months to improve conductivity.

● Select the material for the connection plate that has excellent resistance to alkaline. The materials that contain copper may cause a trouble like rust.

● Avoid direct attachment to a printed board, as leakage will corrode the board. If direct attachment is necessary, please consult with Sanyo representative.



Certified by ISO 9000S



SANYO Electric Group has received Environmental Management System ISO 14001 certification.

USA

● SANYO Energy (USA) Corporation
TEL : (+1)469-362-5600
FAX : (+1)469-362-5699
● New Jersey Office
TEL : (+1)973-256-8923
FAX : (+1)973-256-8375

CANADA

● SANYO Canada Inc.
TEL : (+1)905-760-9944
FAX : (+1)905-760-9945

EUROPE

● SANYO Component Europe GmbH
TEL : (+49)89-4600950
FAX : (+49)89-460095190
● France Office
TEL : (+33)1-30155137
FAX : (+33)1-30155135
● UK Office
TEL : (+44)1923-246363
FAX : (+44)1923-477479

ASIA

● SANYO Energy (HK) Company Ltd.
TEL : (+852)2301-2213
FAX : (+852)2301-2191
● SANYO Energy (Taiwan) Company Ltd.
TEL : (+886)2-8780-8810
FAX : (+886)2-8780-8850
● SANYO Energy (Singapore) Corp., Pte. Ltd.
TEL : (+65)6736-3100
FAX : (+65)6736-1230

AUSTRALIA

● SANYO Oceania Pty. Ltd.
TEL : (+61)2-9815-5822
FAX : (+61)2-9815-5981

SANYO

SANYO Electric Co., Ltd.
<Mobile Energy Company>
<Factory, Sales>
Sumoto-city, Hyogo, Japan
TEL : (+81)799-24-4111
FAX : (+81)799-24-4123

● For more detailed information, contact the above.
● Any and all information described or contained in this brochure are subject to change without notice due to product / technology improvement, etc.