



Control Number		SP-BK-3HGAE/BF1-01						
Issued on: April.17.2014								
To: <u>Panasonic Group</u>								
<u>Delivery Specification</u>								
<u>Products Name: SEALED NICKEL METAL HYDRIDE BATTERY</u>								
<u>Products Number: BK-3HGAE/BF1</u>								
<div>Received by Customer</div> <div>Received on:</div>								
<div><div>SENT ON 14.4.18 Energy Company</div><div>Panasonic Corporation Automotive & Industrial Systems Company Energy Device Business Division</div><table border="1"><thead><tr><th>Approved</th><th>Checked</th><th>Prepared</th></tr></thead><tbody><tr><td><i>Takashima</i></td><td><i>Goto</i></td><td><i>Takamura</i></td></tr></tbody></table></div>			Approved	Checked	Prepared	<i>Takashima</i>	<i>Goto</i>	<i>Takamura</i>
Approved	Checked	Prepared						
<i>Takashima</i>	<i>Goto</i>	<i>Takamura</i>						

SPECIFICATION AMENDMENT RECORD

CUSTOMER MODEL No.	Panasonic MODEL No.	CUSTOMER
	BK-3HGAE/BF1	Panasonic Group

[illegible]



1. BATTERY MODEL	BK-3HGAE/BF1
2. NOMINAL SPECIFICATION	
2-1. Nominal Voltage	1.2 V
2-2. Typical Capacity ^{*1}	2700 mAh
2-3. Minimum Capacity ^{*1}	2500 mAh
2-4. Charging Current ^{*2}	2700 mA
2-5. Charging Time ^{*2}	Approx. 65 min.
2-6. End Voltage of Discharge	1.0 V
2-7. Impedance ^{*3}	40 mΩ
2-8. Temperature(Recommended)	
Charge:	0~+40 deg. C
Discharge:	0~+50 deg. C (Recommended)
	-5~+50deg. C (Use at equipment)
Storage : Less than 90 days	-20~+40 deg. C
Less than 1 year	-20~+30 deg. C
2-9. Humidity	45~85 %
<p>*1: Discharge capacity when the single cell is discharged at 500mA after being charged at 250mA for 16 hours.</p> <p>*2: Use recommended charging system.</p> <p>*3: After repeating three cycles of charge and discharge under the conditions of paragraph 5-3-1., followed by the measurement 1 hour to 4 hours later. Measurement conditions And AC 1kHz</p>	
3. DESIGN, CONSTRUCTION, PHYSICAL DIMENSIONS	
The battery unit shall be of the design, construction and physical dimensions shown in the attached drawing.	
4. APPEARANCE	
There shall be no practical damage such as conspicuous liquid electrolyte leakage, flaw and dirt under conditions of storage or operation as specified herein.	

5. ELECTRICAL CHARACTERISTICS

5-1. Full-charge

Full-charge is defined as follows.

- Charging current : 2700mA.
- Charge Completion: When the battery voltage reaches the maximum value and voltage decreases by a predetermined value ($-\Delta V = 5mV$), the charge is complete.

5-2. Terminal Voltage (O.C.V)

Open circuit voltage shall be a minimum voltage of 1.25V within 14 days after being fully charged.

5-3. Capacity

5-3-1.

The battery unit shall be capable of supplying 500 mA continuous discharge current for a minimum of 255 minutes to 1.0 V end voltage within 1 hour after being fully charged using the condition specified in paragraph 5-1.

5-3-2.

The battery unit shall be capable of supplying 2500 mA continuous discharge current for a minimum of 49 minutes to 1.0 V end voltage within 1 hour after being fully charged using the condition specified in paragraph 5-1.

5-3-3.

The battery unit shall be capable of supplying 250 mA continuous discharge current for a minimum of 300 minutes to 1.0 V end voltage within 1 hour after following process.

- Charge with 250 mA for 16 hours after discharged with 500 mA to 1.0V.

Remarks : Item 5-3-3. is applied only for the capacity measurement. Please do not use item 5-3-3. for the design of the charger.

5-4. Cycle Life (IEC)

A battery unit shall be capable of 300 minimum cycles under the conditions as follows.
(The ambient temperature is 18~22 deg. C) .

Cycle	Charge	Rest	Discharge
1	250 mA x 16 hours	None	625 mA x 140 min.*
2-48	625 mA x 190 min.	None	625 mA x 140 min.*
49	625 mA x 190 min.	None	625 mA (E.V.=1.0V)
50	250 mA x 16 hours	1 to 4 hour	500 mA (E.V.=1.0V)

Cycles 1 to 50 shall be repeated until the discharge duration on any 50th cycle becomes less than 3 hours.

*If cell voltage drops below 1.0V, discharge shall be discontinued.

At 300 cycle, discharge time shall be a minimum of 180 minutes.

5-5. Over-discharge

The battery unit is discharged with 3 ohm load for 8 hours after fully charged.
After above operation, the battery unit shall not have deformation and leakage.

5-6. Temperature Characteristics

5-6-1.

Within 1 hour after fully charged at 40 deg. C, discharge time shall be a minimum of 41 minutes at 20 deg. C using the condition specified in paragraph 5-3-2.

5-6-2.

Within 1 hour after fully charged at 20 deg. C, discharge time shall be a minimum of 34 minutes at 0 deg. C using the condition specified in paragraph 5-3-2.

5-7. Self-discharge

5-7-1.

After fully charged battery unit is stored for 28 days at 20 deg. C, discharge time shall be a minimum of 41 minutes using the condition specified in paragraph 5-3-2.

5-7-2.

After fully charged battery unit is stored for 7days at 40 deg. C, discharge time shall be a minimum of 39 minutes using the condition specified in paragraph 5-3-2.

5-7-3.

After fully charged battery unit is stored for 90days at 40 deg. C, discharge time shall be a minimum of 35 minutes using the condition specified in paragraph 5-3-2.

5-8. Safety

5-8-1.

The battery unit shall not explode when it is charged at 2500 mA for 5 hours.
However it is acceptable for the battery unit to sustain leakage and show a change in appearance.

5-8-2.

The battery unit shall not explode when it is reverse-charged at 2500 mA for 5 hours.
However it is acceptable for the battery unit to sustain leakage and show a change in appearance.

5-9. Resistance to fall

Drop a fully charged battery from a distance of 1m onto a concrete surface. Drop battery 5 times in 3 different positions equaling a total of 15 drops.

Position 1: Battery's position is vertical; landing on it is positive terminal (X).

Position 2: Battery's position is vertical; landing on it is negative terminal (Y).

Position 3: Battery's position is horizontal; landing on it is side (Z).

After test, it is acceptable for the battery unit to sustain leakage of battery fluid and show a change in appearance.

5-10. Resistance to Leakage

After letting battery sit for 14 days at 33deg. C and 75~85% humidity, there should be no visual battery fluid leakage.

5-11. Vibration

Conduct test under the following conditions:

Frequency: 10 ~ 500Hz

Vibration amplitude: 50m/sec² maximum or peak amplitude of 0.35mm (Three axes intersecting at right angles to each other during oscillation)

Sweep number of cycles: 5 cycles

Sweep rate: 1 octave / min

Vibration test time: about 55 minutes per axis

The battery's structure should not show any signs of corruption. Battery capacity should fulfill 5-3-1 requirements.

5-12. Shipment

Battery's are shipped from Panasonic Corporation in a charged state.

However, the battery's charge status is not specified at the time of delivery.

6. STANDARD TEST CONDITIONS

The battery shall be evaluated within 1 month from the arrival date. Above mentioned specifications are tested at 18~22deg.C temperature, and 60~70% humidity. Additionally, voltmeter, ammeter to be used for the test should be a 0.5 or higher grade.

7. BATTERIES HANDLING PRECAUTIONS

Please keep in mind the following points when designing and manufacturing equipment. Please insert in your instruction manual. To prevent equipment malfunctions from affecting the batteries, be sure to use protection devices for electrical circuits and batteries.

Danger!

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

- Never dispose of Twicell batteries in a fire or heat them.
- Do not connect the (+) positive and (-) negative terminals of Ni-MH batteries together with electrically conductive materials, including lead wires. Do not transport or store Ni-MH batteries with their uncovered terminals or connected with a metal necklace or other electrically conductive material. When carrying or storing batteries, use a special case.
- Only charge Ni-MH batteries using those specific chargers that satisfy Panasonic's specifications. Only charge batteries under the conditions specified by Panasonic.
- Never disassemble Ni-MH 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, explosion and fire. Also, this is dangerous as it may cause splashing of alkaline fluid.
- Never modify or reconstruct Ni-MH 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, explosion and fire.
- Never solder lead wires directly on to Ni-MH batteries.
- The (+) positive and (-) negative terminals of Ni-MH batteries are predetermined. Do not force the terminals to connect to a charger or an equipment. If the terminals can not be easily connected to the charger or the equipment, check if the (+) and (-) terminals are incorrectly positioned.
- The gas release vent which release internal gas is located in the (+) positive terminal of the Ni-MH battery. For this reason, never deform this section or cover or obstruct its gas release structure.
- Do not directly connect Ni-MH batteries to a direct power source or the cigarette lighter socket in a car.
- Do not use Ni-MH batteries in any equipment other than those specified by Panasonic.

- Ni-MH batteries contain a strong colorless alkaline solution (electrolyte). The alkaline solution is extremely corrosive and will cause skin damage. If any fluid from a Ni-MH battery comes in contact with user's eyes, they should immediately flush their eyes and wash them thoroughly with clean water 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 Ni-MH batteries are to be incorporated in equipment or housed within a case, avoid air-tight structures, as this may lead to the equipment or the case being damaged or may be harmful to users.
- Contact Panasonic before inserting a Ni-MH battery into a waterproof housing or case. Accumulated gases from the battery with spark or ignition from parts may cause rupture.

Warning!

- Do not apply water, seawater or other oxidizing reagents to Ni-MH 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 explosion.
- Do not over-charge Ni-MH batteries by exceeding the predetermined charging period specified by the battery charger's instructions or indicator. If Ni-MH 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, and explosion. Be sure to handle recharged batteries carefully as they may be not.
- Ni-MH batteries contain a strong colorless alkaline solution (electrolyte). If the skin or clothing comes in contact with fluid from a Ni-MH battery, thoroughly wash the area immediately with clean water from the tap or another source. Battery fluid can irritate the skin.
- Do not connect more than 10 Ni-MH batteries in series, as this may cause electrical shocks, leakage of battery fluid and heat generation.
- 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, explosion and fire.
- If Ni-MH batteries leak fluid, change color, change shape, or change in any other way, do not use them, otherwise they may cause heat generation, explosion and fire.
- Keep Ni-MH batteries and the equipment using them out of the reach of babies and small children, in order to avoid accidental swallowing of the batteries. In the event the batteries are swallowed, consult a doctor immediately.

- When the operating time of a Ni-MH 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 Ni-MH batteries.
- Store NiMH 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.
- Be sure to charge Ni-MH batteries within a temperature range of 0 to 40 deg. C (degrees Celsius).
- Be sure to use the recommended charging method for Ni-MH batteries, read the battery charger's instruction manual carefully.
- 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 Ni-MH batteries.
- Be sure to turn off the equipment after use of Ni-MH batteries, otherwise may result in leakage of battery fluid.
- After removed from equipment, store Ni-MH batteries in a dry place and within the recommended storage temperature range. This will help preserve the batteries' performance and durability and minimize the possibility of leakage of battery fluid or corrosion. (Panasonic recommends the storage temperature range from -20 to +30 deg. C for longer service life).
- To use batteries for the first time after purchase or having not used them for a long period of time, be sure to charge them.
- After long term storage, there is a possibility that the battery could not be fully charged. In order to fully charge it, please charge and discharge the battery for a few times.
- Do not use old and new batteries mixed together, or batteries at different charge levels. Do not use the Ni-MH battery mixed together with a dry cell or other batteries of different capacity, type, or brand name. This may cause leakage of battery fluid and heat generation.
- If the Ni-MH battery terminals become dirty, clean up 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.



8.WARRANTY

Panasonic will be responsible for replacing the battery against any defects or poor workmanship for one year from the date of shipping.

Any other problems caused by malfunction of the equipment or misuse of the battery is not under this warranty.

9.SAFETY

To assure safety, please consult to the Panasonic technical staff for your applications including electrical specifications, mechanical designs, protective devices and any special specification.

10.Country of origin

This product is produced in Japan.



0.7

General	Tolerance	Sym.	Date	Revision	Drawn	Checked	Approved

Technical drawing of a battery component. Dimensions: $\phi 14.5 \pm 0.05$, 60 ± 0.05 , and $\phi 5.5$. Callout 2 points to a feature on the top view. Callout 1 points to the battery unit.

Image of a Panasonic Ni-MH 2700 battery. The label shows the product code BK-3HGA and the production code 1504.

2	Insulation Ring	FP 0.13t	1				
1	Label	PET 70μ	1				
	Battery	BK-3HGA	1	Charged			

Srs.	Item or Code No.	Material & Size	ct.	Process	Remark
		秘 Confidential			
Scale	Designed	Drawn	Checked	Approved	Name
/	T.Takemura	T.Takemura	H.Goto	H.Takeshima	Sealed Nickel Metal Hydride Battery BK-3HGAE/BF1
	15.Apr.14	15.Apr.14			No. C21253464

A4

Panasonic Corporation

3rd Axle System Unit-00

A4



0.7

43

Panasonic Corporation

3rd Series Station No. 1111

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

Drawn

Checked

Approved

Commercial

Form

Date

Apprizer

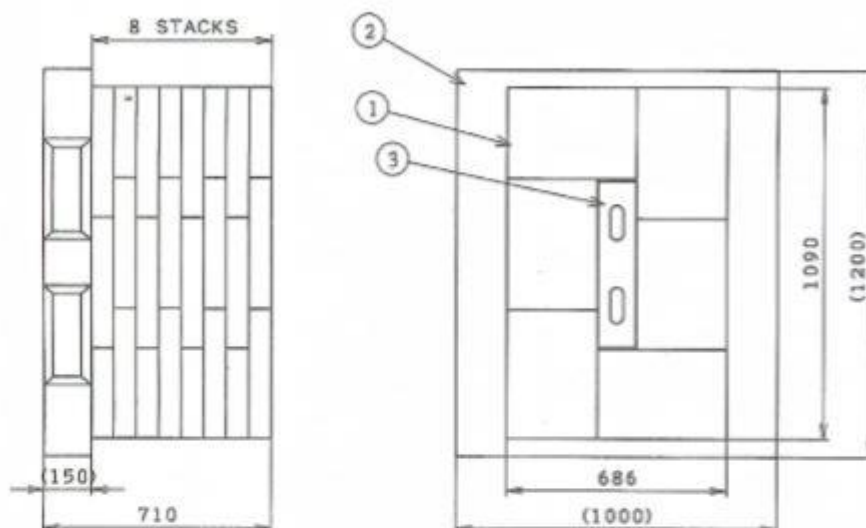
Drawn

Checked



07

Commercial Tolerance	Sym.	Date	Revision	Drawn	Checked	Approved



- [illegible]

NOTE) 1. THERE MUST BE EQUAL SPACE BETWEEN THE MASTER CARTONS AND THE EDGE OF THE PALLET.
2. COVER THE TOP WITH A POLYETHYLENE SHEET OF SIZE OF 1500x1500x0.1mm.
3. WRAP THE REMAINING PRODUCT.
• NUMBER OF TURNS FOR WRAPPING PALLET OVERSEAS SHIPMENT (4TURNS (UPPER) +
8TURNS (LOWER)) DOMESTIC SHIPMENT (4TURNS (UPPER) + 6TURNS (LOWER))
• THE SIZE OF TOP SHEET IS APPROX 20-100mm.
4. COVER THE WHOLE SIDE OF THE PALLET.
5. MAKE VENTILATION HOLE TOP SIDE. (NOT APPLY TO THE PALLETIZING WITH NO HOLES.)
6. <REFERENCE> NET WEIGHT: APPROX. 744kg

3	Spacer	L513xW119xH193 (Outer Dim.)	1/24000		
2	Pallet	L1200xW1000xH150	1/24000		
1	Carton		1/500	Charged	
Ser.	Item or Code No.	Material & Size	et.	Process	Remark
<div>秘 Confidential</div>			NameBK-3HGAE/BF1 Pallet Packing Specification		
Scale	Designed	Drawn			
/	T. Takekura	T. Takekura	H. Goto	H. Takeshima	
	15. Apr. 14	15. Apr. 14			
No.	C91253148				

A4

Panasonic Corporation

3rd Angle Section: Half-moon