

*A. Matsuki*

**Matsushita Electric Industrial Co., Ltd.**  
**Matsushita Battery Industrial Co., Ltd.**

SPECIFICATIONS OF  
SEALED NICKEL METAL HYDRIDE BATTERIES

FOR MESSRS : P I E

MODEL : HHR-210AAZ2B

DATE : 18. JUL. 2003

SPECIFICATION No. : S3071844



	AMENDMENT	DATE OF ISSUE	Drawn	<i>O. Bartz</i>
			Checked	<i>S. Fure</i>
			Checked	<i>A. Matsuki</i>
			Checked	<i>K. Aoki</i>
			Approved	<i>A. Matsuki</i>

APPROVED BY	SIGNATURE	DATE
<b>Panasonic</b> Industrial Europe GmbH Postfach 540849 <b>22508 Hamburg</b> Winsbergring 15 <b>22525 Hamburg</b>		<i>25.07.03</i>



## 4-2-2. Capacity :

Following a 16hour charge period at 200 mA, the cell shall be stored for a period of 1hour. The discharge duration shall exceed 5 hour(s) 00 min(s) when discharged at 400 mA down to a terminal voltage of 1.0 V. The capacity returned may not initially attain the specified value following the first charge - discharge cycle. In this event, the test may be repeated a further two or three times to attain the specified value.

## 4-2-3. Open circuit voltage : (O.C.V.)

Following a 16hour charge period at 200 mA, the open circuit voltage of the cell or battery shall be checked within 1hour. The O.C.V. shall exceed 1.25 V per cell.

## 4-2-4. Closed circuit voltage : (C.C.V.)

Following a 16hour charge period at 200 mA, the closed circuit voltage of the cell or battery shall be checked with a 0.75  $\Omega$  per cell load within 1hour. The C.C.V. shall exceed 1.2 V per cell within 1sec.

## 4-2-5. Internal impedance :

Following a 16hour charge period at 200 mA, the Internal impedance of the cell or battery shall be checked at 1000 Hz within 1hour. The internal impedance shall be less than 40 m $\Omega$  per cell.

## 4-2-6. High rate discharge :

Following a 16hour charge period at 200 mA, the cell or battery shall be stored for a period of 1hour. The discharge duration shall exceed 48 min(s) when discharged at 2000 mA.

## 4-2-7. Low temperature discharge :

Following a 16hour charge period at 200 mA, the cell or battery shall be stored for a period of 24hours at  $0\text{ }^{\circ}\text{C}\pm 2\text{ }^{\circ}\text{C}$ . The discharge duration shall exceed 4 hour(s) 00 min(s) when discharged at 400 mA at ambient temperature of  $0\text{ }^{\circ}\text{C}\pm 2\text{ }^{\circ}\text{C}$ .

## 4-2-8. Self discharge :

Following a 16hour charge period at 200 mA, the cell or battery shall be stored on open circuit for a period of 28 days. The subsequent discharge duration shall exceed 3 hour(s) 15 min(s) when discharged at 400 mA.

## 4-2-9. Storage :

The cell shall be stored on open circuit for a period of 12months at discharged state. Following completion of the storage period, the cell shall be charged for 16hours at 200 mA. The subsequent discharge duration shall exceed 4 hour(s) 15 min(s) when discharged at 400 mA. The test may be repeated a further two or three times to reach the specified capacity.

## 4-2-10. Over-charge # 1 :

Following a 48hour continuous overcharge period at 200 mA, the cell or battery shall be stored for a period of 1hour. The subsequent battery discharge duration shall exceed 5 hour(s) 00 min(s) when discharged at 400 mA. The cell or battery shall not be externally deformed and no leakage of electrolyte in liquid form shall be observed.

## 4-2-11. Life time (Based on IEC) :

Based on 50 charge -discharge cycles as outlined in the table below, the discharge time of the 50th, 100th, 150th, 200th, 250th, 300th, 350th, 400th, 450th and 500th shall exceed 3 hour(s) 00 min(s). (Ambient temperature is  $20\text{ }^{\circ}\text{C}\pm 5\text{ }^{\circ}\text{C}$ )

## Test condition :

Cycle number	Charge	Rest	Discharge
1	200 mA for 16 hours	none	500 mA for 2.33hours
2~48	500 mA for 3.17hours	none	500 mA for 2.33hours
49	500 mA for 3.17hours	none	500 mA to 1.0 V per cell
50	200 mA for 16 hours	1-4h	400 mA to 1.0 V per cell

## 4-2-12. Life time (Rapid charge) :

For the 300th cycle the cell or battery shall supply more than 36 min(s) under the following test conditions.

Test conditions :

charge	using the rapid charge condition specified in clauses "2.RATINGS"
discharge	2000 mA to 1.0 V per cell

## 4-2-13. Humidity :

No leakage of electrolyte in liquid form shall be observed during 14days of storage under the following storage conditions :

33 °C±3 °C (91.4 °F±5.4 °F) Relative humidity of 80 %±5 %. (Salting is permitted)

## 4-2-14. Vibration :

Following vibration tests over an amplitude of 4 mm (0.1575 inches) at a frequency of 16.7 Hz (1000 cycles per minute) and repeated through any axes during 60mins, the discharge duration shall exceed 5 hour(s) 00 min(s) when discharged at 400 mA and the cell or battery shall not be externally deformed and no leakage of electrolyte in liquid form shall be observed.

## 4-2-15. Free falling : (Drop)

Following a drop test from 450 mm( 17.717 inches) on to a hard-wood board in a vertical axis 2 times on each of 2 mutually perpendicular axes, the discharge duration shall exceed 5 hour(s) 00 min(s) when discharged at 400 mA and the cell or battery shall not be externally deformed and no leakage of electrolyte in liquid form shall be observed.

## 4-2-16. Short :

The cell or battery shall not explode during or at the end of a 1hour short-circuit test. However, leakage of electrolyte, external deformation or outer sleeve cracking is permitted.

## 4-2-17. Incorrect polarity charging :

The cell or battery shall not explode during or at the end of a 1hour period of incorrect polarity charging at 2000 mA. However, leakage of electrolyte, external deformation or outer sleeve cracking is permitted.

## 4-2-18. Over charge # 2 :

The cell or battery shall not explode during or at the end of a 5hour charging period at 2000 mA. However, leakage of electrolyte, external deformation or outer sleeve cracking is permitted.

5. OTHERS

5-1. The cell or battery shall be charged state at shipping.

## 5-2. Cut-off voltage :

○We recommend a cut-off voltage of 1.0 to 1.1 V per cell.

○If the cut-off voltage is above 1.1 V per cell, the battery may be underutilized resulting in insufficient use of the available capacity.

○If the cell voltage drops below 1.0 V per cell, the battery may become over discharged or reverse charged.

\* In case of over 2C mA discharge a cut-off voltage should be 0.8 V per cell.

Specification can be changed upon mutual agreement between

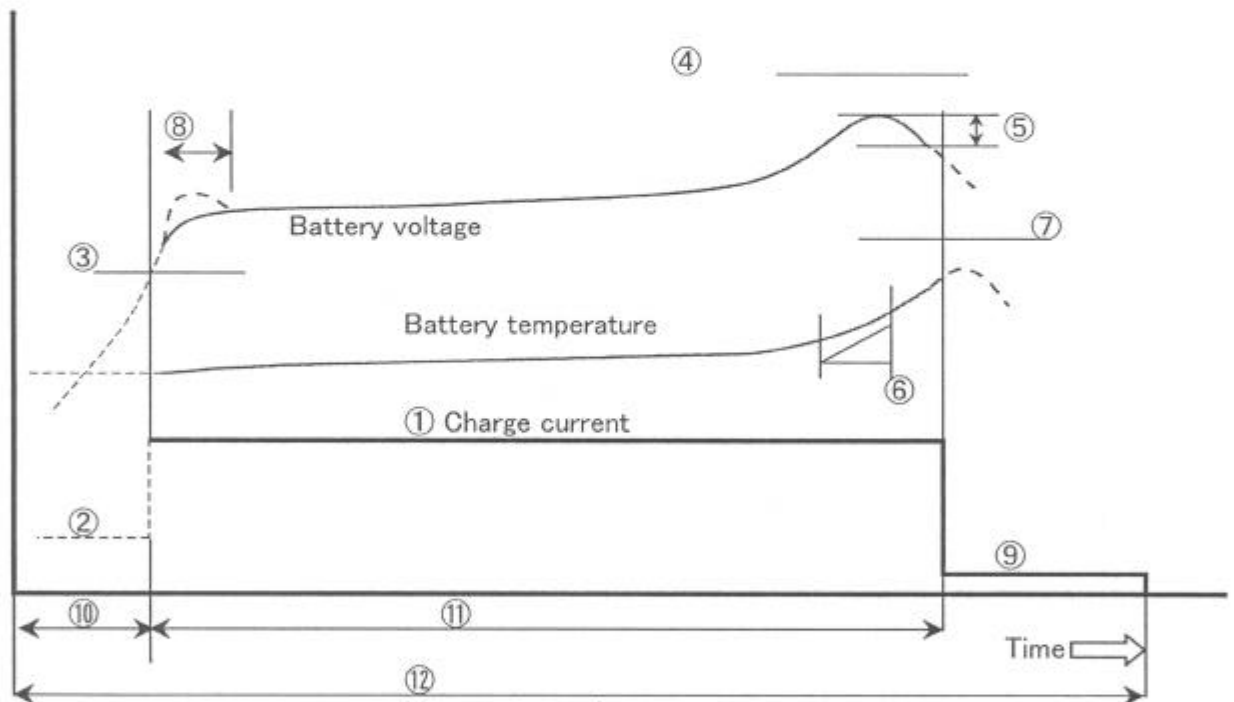
PIE

and Matsushita Battery Industrial Co., Ltd.

## Ni-MH Battery ; Example on rapid charge system

### 1. Basic charge system

① Rapid charge current	: 950 to 1200 mA
② Charge current to voltage for rapid charge	: $0.2It$ to $0.3It$ mA
③ Start voltage of rapid charge	: above 0.8 V per cell
④ Upper limit voltage (to trickle charge)	: 1.8 V per cell
⑤ Value of minus delta V ( $-\Delta V$ )	: 5 to 10 mV per cell
⑥ Temperature increase rate ( $dT/dt$ )	: 1 to 2 °C/min
⑦ Upper limit temperature ( $T_{co}$ )	: 55 °C
⑧ Initial non-detection timer of minus delta V ( $-\Delta V$ )	: 5 to 10 min
⑨ Trickle charge current	: $1/20It$ to $1/30It$ mA
⑩ Transfer timer to rapid charge	: 60 min
⑪ Total rapid charge timer	: 2 ~ 2.5 h
⑫ Total charge timer	: 10 to 20 h
⑬ Ambient temperature for rapid charge	: 0 to 40 °C



### 2. Basic pack circuit

