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

SPECIFICATIONS OF

SEALED NICKEL METAL HYDRIDE BATTERIES

FOR MESSRS :

MODEL : HHR-30SCPY06

DATE : 31. JAN. 2001

SPECIFICATION No. : S1013180

	AMENDMENT	DATE OF ISSUE

Drawn	J. Kumagai
Checked	
Checked	
Approved	

APPROVED BY	SIGNATURE	DATE

FORM No. : EAAE06

SPECIFICATIONS

1. APPLICATION

This specification applies to the Sealed Nickel-Metal Hydride rechargeable cell or battery :

Model HHR-30SCPY06

for

2. RATINGS

○IEC Designation	HR23/43	
○Nominal voltage	1.2	V
○Rated (Minimum) capacity *1	2800	mAh
○Average capacity(for reference only)	3050	mAh
○Standard charge rate	300	mA × 16 h
○Rapid charge rate	3000	mA (with the following charge condition)*2
Value of dT/dt (for reference only)	1 to 2	℃/min
Value of -ΔV per cell	5 to 10	mV
Value of Tco	60	℃
Trickle current	100 to 150	mA (Need timer)
○Discharge cut-off voltage	(n×1.0)V (n=1～6) [(n-1)×1.2]V (n=7～10) (n:cell number)	
○Maximum continuous discharge current (single cell)	30000	mA (at 20 ℃)

○Operating temperature range	(Humidity : +65 %±20 %)
Standard charge	0 to +45 ℃ (32 to 113 ˚F)
Rapid charge	0 to +40 ℃ (32 to 104 ˚F)
Discharge	-10 to +65 ℃ (14 to 149 ˚F)
○Storage temperature range	(Humidity : +65 %±20 %)
within 1 year *3	-20 to +35 ℃ (-4 to 95 ˚F)
within 6 months	-20 to +45 ℃ (-4 to 113 ˚F)
within 1 month	-20 to +55 ℃ (-4 to 131 ˚F)
within 1 week	-20 to +65 ℃ (-4 to 149 ˚F)

*1 Rated capacity figures are based on single cell performance.
*2 All rapid charge systems should be discussed with our engineer.
*3 We recommend cells or batteries are charged at least once every 6 months.

When operation falls outside these parameters please contact our engineer.

3. ASSEMBLY & DIMENSIONS

as per attached drawing
drawing number C21302394-1

4. PERFORMANCE

4-1. TEST CONDITIONS

All tests are carried out on new cells or batteries. (within one month after delivery)
Ambient conditions :

Temperature	+20 ℃±5 ℃
Humidity	+65 %±20 %

4-2. TEST METHOD & PERFORMANCE

4-2-1. Outer appearance :

Cells and batteries shall be free from any stains, scratches or deformations which may reduce the commercial value of the product when visually inspected.

4-2-2. Capacity :
Following a 16hour charge period at 300 mA, the cell shall be stored for a period of 1hour. The discharge duration shall exceed 4 hour(s) 40 min(s) when discharged at 600 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 300 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 300 mA, the closed circuit voltage of the cell or battery shall be checked with a 0.40 Ω 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 300 mA, the Internal impedance of the cell or battery shall be checked at 1000 Hz within 1hour. The internal impedance shall be less than 7 mΩ per cell.

4-2-6. High rate discharge :
Following a 16hour charge period at 300 mA, the cell or battery shall be stored for a period of 1hour. The discharge duration shall exceed 46 min(s) when discharged at 3000 mA.

4-2-7. Low temperature discharge :
Following a 16hour charge period at 300 mA, the cell or battery shall be stored for a period of 24hours at 0 ℃±2 ℃. The discharge duration shall exceed 2 hour(s) 48 min(s) when discharged at 600 mA at ambient temperature of 0 ℃±2 ℃.

4-2-8. Self discharge :
Following a 16hour charge period at 300 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) 02 min(s) when discharged at 600 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 300 mA. The subsequent discharge duration shall exceed 3 hour(s) 58 min(s) when discharged at 600 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 300 mA, the cell or battery shall be stored for a period of 1hour. The subsequent battery discharge duration shall exceed 4 hour(s) 40 min(s) when discharged at 600 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 2 hour(s) 48 min(s). (Ambient temperature is 20 ℃±5 ℃)

Test condition :

Cycle number	Charge	Rest	Discharge
1	300 mA for 16 hours	none	750 mA for 2.33hours
2~48	750 mA for 3.17hours	none	750 mA for 2.33hours
49	750 mA for 3.17hours	none	750 mA to 1.0 V per cell
50	300 mA for 16 hours	1-4h	600 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 35 min(s) under the following test conditions.
Test conditions :

charge	using the rapid charge condition specified in clauses "2. RATINGS"
discharge	3000 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 ℃±3 ℃ (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 4 hour(s) 40 min(s) when discharged at 600 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 4 hour(s) 40 min(s) when discharged at 600 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 3000 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 3000 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.

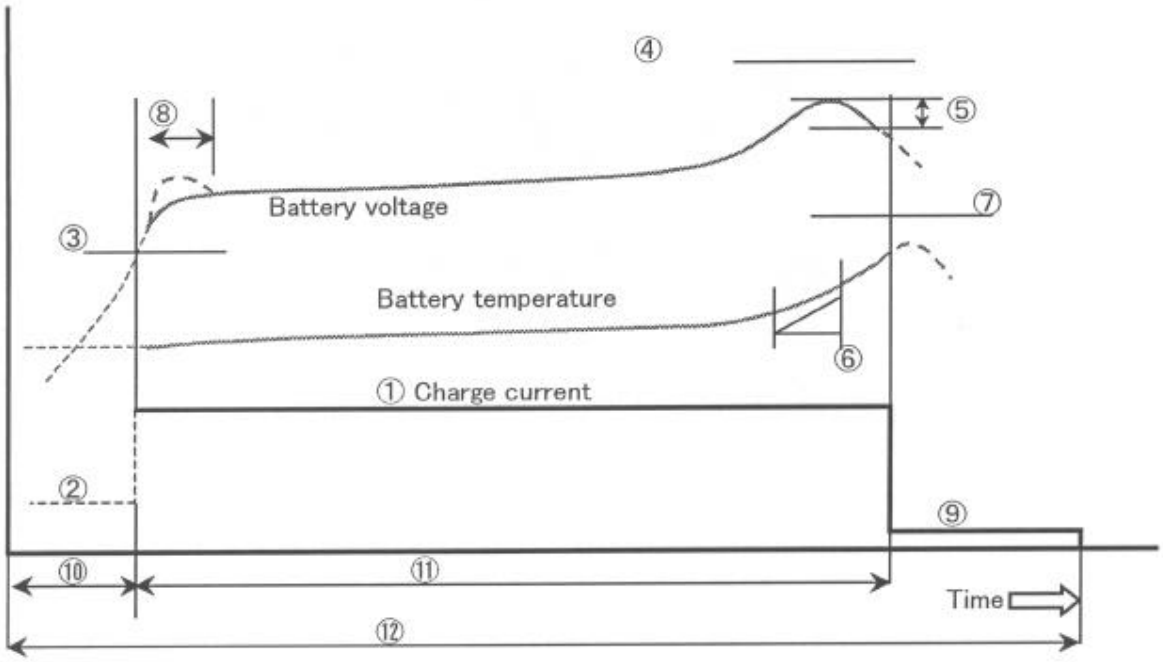
* In case of over 2C mA discharge a cut-off voltage should be 0.8 V per cell.

Specification can be changed upon mutual agreement between
METABO
and Matsushita Battery Industrial Co., Ltd.

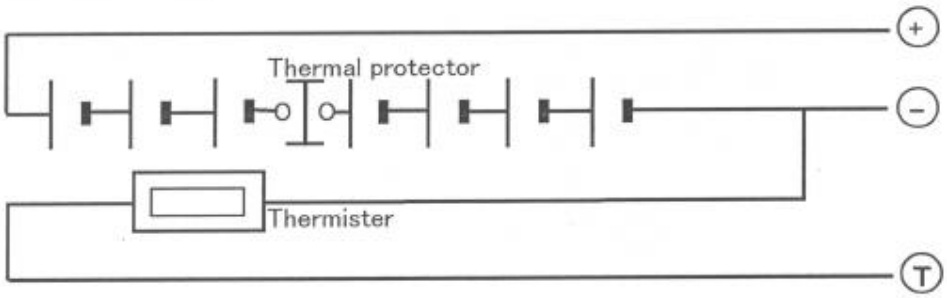
Ni-MH Battery ; Example on rapid charge system

1. Basic charge system

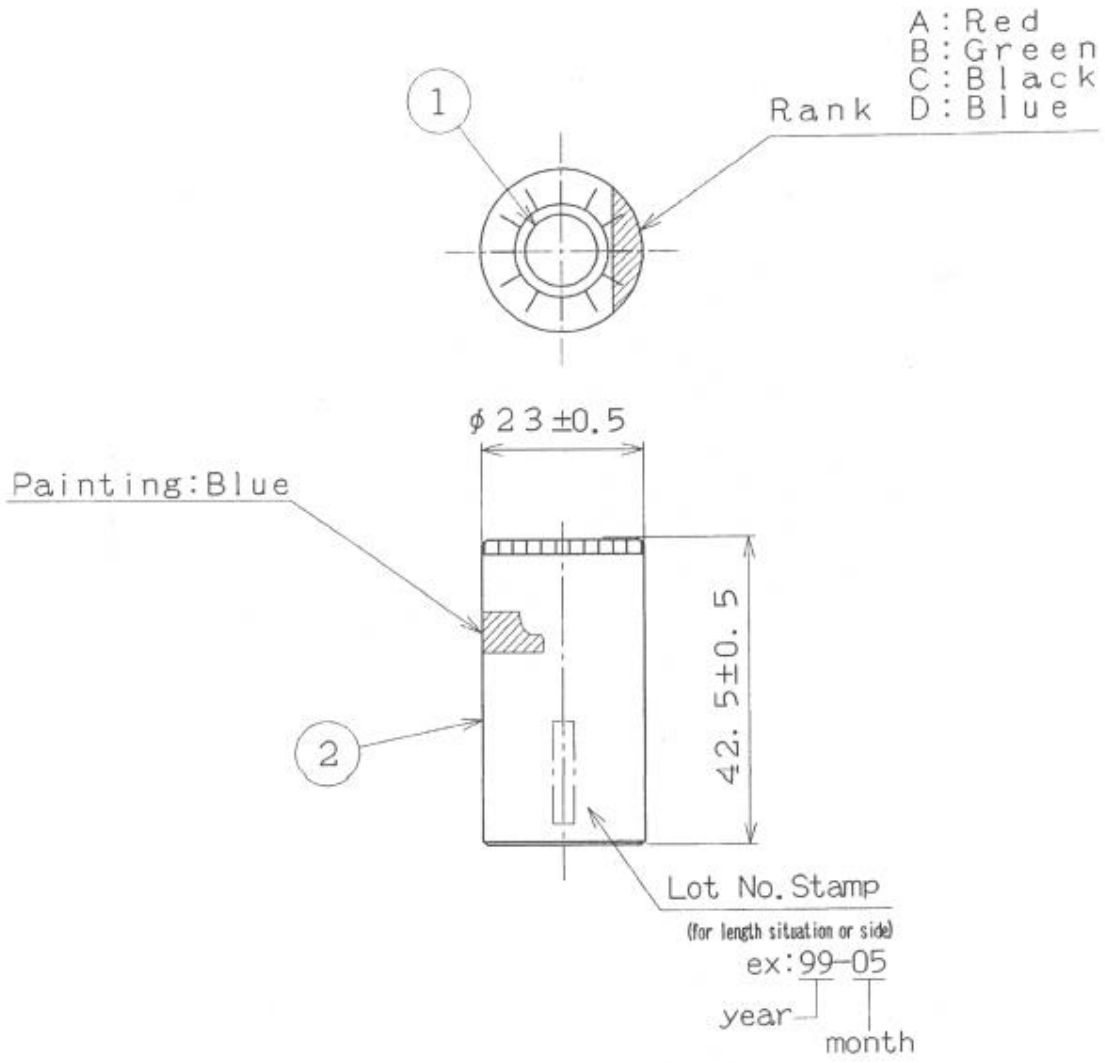
① Rapid charge current	: 0.5C to 1.0C mA
② Charge current to voltage for rapid charge	: 0.2C to 0.3C mA
③ Start voltage of rapid charge	: above 0.8 V per cell
④ Upper limit voltage (to trickle charge)	: 1.8 V per cell
⑤ Value of minus delta V (−ΔV)	: 5 to 10 mV per cell
⑥ Temperature increase rate (dT/dt)	: 1 to 2 °C/min
⑦ Upper limit temperature (Tco)	: 60 °C
⑧ Initial non-detection timer of minus delta V(−ΔV)	: 5 to 10 min
⑨ Trickle charge current	: 1/20C to 1/30C mA
⑩ Transfer timer to rapid charge	: 60 min
⑪ Total rapid charge timer	: 1.5 h
⑫ Total charge timer	: 10 to 20 h
⑬ Ambient temperature for rapid charge	: 0 to 40 °C



2. Basic pack circuit



Commercial Tolerance	Sym.	Date	Revision	Drawn	Checked	Approved
	△					



Nominal voltage 1.2 V
Rated capacity (Minimum) 2800 mAh
Average capacity (for reference only) 3050 mAh
Approx. weight 55 g

Sym.	Item or Code No.	Material & Size	qt.	Process	Remark
2	Sleeve	Paper	1		
1	Battery	HHR-300SCP	1		

Scale	Designed	Drawn	Checked	Approved	Name	Sealed Nickel Metal Hydraid Battery HHR-30SCPY06
1/1	KUMAGAI 24. FEB. 99	KUMAGAI 24. FEB. 99			No.	C21302394-1

A4 FORM No. : EAAE09 Matsushita Battery Industrial Co., Ltd. 3rd Angle System Unit: mm