



# **FocusPower Ni-MH Batteries Specification**

Model No: FP-MH-C4000H

Prepared	by:	Date:
Checked	by:	Date:
Approved	by:	Date:

Add: Zhongshan hi tech developement zone , Zhongshan Port , Zhongshan, Guangdong ,China

Tel : 86-0760-87920558

Fax: 86-0760-89965992

Web: [www.focuspowerelec.com](http://www.focuspowerelec.com)

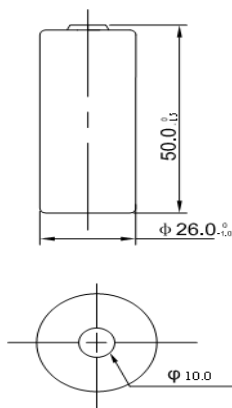
Postcode: 528437

**(Product Specification)**
**FP-MH-C4000H**
**High Temperature Series Nickel-Metal Hydride  
FP-MH-C4000H**

## Specifications for cell

Nominal Voltage		1.2V
Capacity <sup>1</sup>	IEC minimum	4000 mAh
	Typical <sup>2</sup>	4050 mAh
Dimensions	Diameter	mm
		26.0 <sub>-1.0</sub>
	Height	50.0 <sub>-1.5</sub>
Weight <sup>3</sup>	Grams	
	80	
Internal impedance <sup>3</sup> at 1000 Hz (After charge)		10mΩ max.
Charge	Standard	400mA×16h
	Permanent	200mA
	Trickle	10mA~200mA
Discharge	Maximum Continuous Current at 20°C	12A
Ambient Temperature	Charge	0°C to 55°C
	Discharge	-20°C to +70°C
	Storage	0°C to +35°C

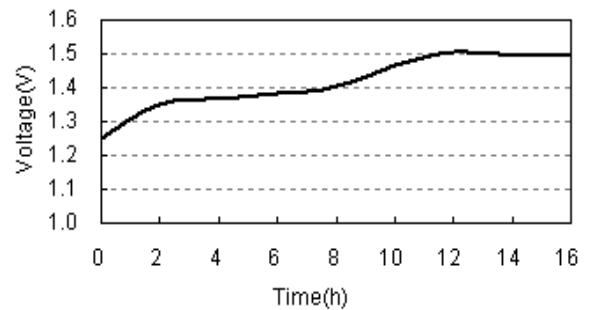
Dimensions with tube (dimensions are in mm)


**Note:**

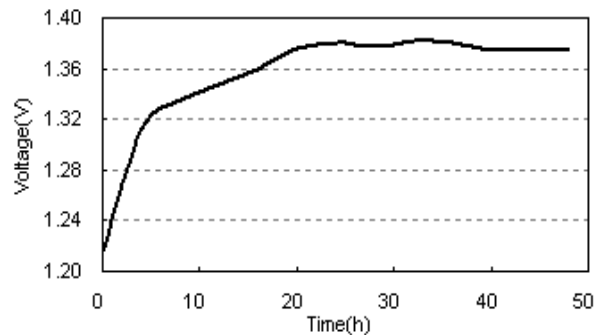
1. Charge 16h at 0.1C, discharge at 0.2C.
2. Average capacity, for reference only.
3. Weight and internal impedance are for reference.

**Typical characteristics**

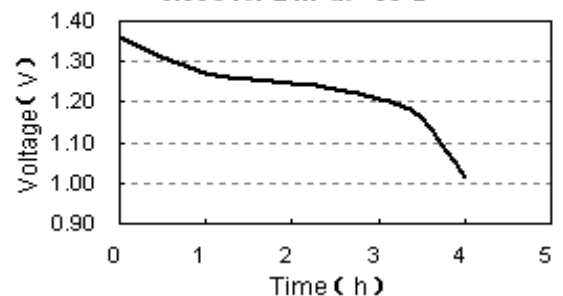
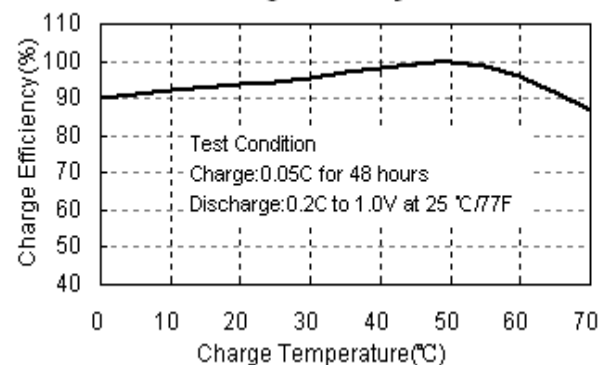
Standard charge at 0.1C at 25°C



Charge at 0.05C at +55°C



Discharge at 0.25C, after charge at 0.05C for 24h at +55°C


**Charge Efficiency**


**1. PERFORMANCE TEST**

Before proceed the following tests the cells should be discharged at 0.2C to 1.0V cut off. Unless otherwise stated, tests should be done within one month of delivery under the following conditions.

Ambient temperature: 20±5°C

Relative Humidity: 65±20%

Note: Standard Charge/Discharge Condition:

Charge: 400mA (0.1C)×16h

Discharge:8000mA (0.2C) to 1.0V/cell

**Table 1 Performance Test**

ITEM	UNIT	SPECIFICATION	CONDITION	NOTES
Capacity	mAh	≥4000	Discharge at 0.2C to 1.0V/cell after charge at 0.1C for 16h	Up to 3 cycles are allowed
Open circuit Voltage (OCV)	V	≥1.28	Within 1 hr after standard charge	Unit cell
Internal Impedance (Ri)	mΩ	≤25	Upon fully charge at 1kHz	Unit cell
Low Temperature Discharge	h	≥4	Standard Charge, Storage: 16 ~ 24hrs at 0±2°C; 0.2C discharge at 0±2°C	1.0V/cell cut off
Charge acceptance at 55°C	h	≥4.5	Charge and discharge at 55°C according to append.(1).	See append(1)
Charge Retention	h	≥3	Standard charge, then storage 28days, Standard discharge(0.2C)	1.0V/cell Cut off
Storage	mAh	≥3200	Standard charge, then Store at 20±5°C for 12 months, after completion of storage period, conduct capacity test.	
IEC Cycle Life Test	Cycle	≥500	IEC61951-2(2003) 7.4.1.1	See append(2)
Permanent charge endurance	h	≥2.5	IEC61951-2(2003) 7.4.2.3	See append(3)
Safety Device operation	N/A	No explosion	Force discharge at 0.2C to a final voltage of 0V, then the current be increased to 1C and forced discharge continue for 60 min.	Leakage of electrolyte and Deformation are acceptable

**2. CELL AND BATTERY MANAGEMENT****• Normal conditions**

FOCUSPOWER recommends to store the cell/battery within the temperature range 0°C to +35°C in a 65±5% relative humidity atmosphere.

An extended storage between -20°C and 0°C and between +35°C and 70°C at 65±5% relative humidity is permitted no more than one month.

**• Charge**

## ✧ Standard charge:

With standard charge rate 0.1C and with a timer cutoff.

## ✧ Permanent continuous charge:

The cell is designed to be permanently charged between 0°C to 55°C with 0.05C. Charging at the occasional temperature range between 55°C and 70 is allowed but will affect life duration.

A trickle charge in the range of 0.025C to 0.05C can be used to maintain the cell or battery pack in a fully charged state.

**• Overcharge**

Repeated overcharging out of the specification could cause leakage and deteriorates cell performances.

**• Overdischarge**

A deep discharge or 'over discharge' damages the cell performance so it is recommended to manage the discharge with an appropriate cut-off voltage (consult FOCUSPOWER for advice) .

**• Storage**

After a 28 days storage at 20±5°C, the cell shall retain typically 80% (minimum 65%) of its initial capacity, the cell being initially fully charged. The cell shall recover full initial capacity after a complete cycle.

In all cases, it is recommended to store cell/battery in minimum state of charge (50%) and in open circuit.

**• Cycle life**

Cycle life duration of a cell or battery pack depends mainly on the cell or battery pack temperature and overcharged capacity. Minimum life duration of a cell/battery is 4 years with the average operating condition of:

Temperature: up to 50±2°C

Permanent charge current: 200mA constant current

Discharge: 1~2 per month (at 1C rate Maximum)

Normally, if cell/battery is used under proper conditions as described above, a battery should last 4 years. Failure in charging, discharging, storage or temperature range can reduce the service life and damage the cell performances.

### 3. PRECAUTIONS

- Do not reversely charge batteries.
- Do not short circuit batteries, permanent damage to batteries may result.
- Do not incinerate or mutilate batteries, may burst.
- Do not solder directly to cells or batteries.
- Do not subject batteries to adverse condition such as extreme temperature, deep cycling and excessive overcharge/over discharge.
- Do not mix FocusPower Batteries with other battery brands or batteries of a different chemistry such as alkaline and zinc carbon.
- Do not mix new batteries in use with semi-used batteries, over discharge may occur.
- Do not attempt to take batteries apart or subject them to pressure or impact. Heat may be generated or fire may result. The alkaline electrolyte is harmful to eyes and skin, and it may damage clothing upon contact.
- Do not remove the outer sleeve from a battery pack nor cut into its housing.
- Never put a battery into water or expose to the rain
- When connecting a battery pack to a charge, ensure correct polarity.
- When not using a battery, disconnect it from the device.
- Unplug a battery by holding the connector itself and not by pulling at its cord.
- Keep away from children.

#### Append.

##### ① Charge acceptance at 55°C

Table 2 Charge acceptance at 55°C

Cycle number	Charge	Discharge	Minimum discharge duration
1	0.05C for 48h	0.2C to 1.0V	No requirement
2	0.05C for 24h	0.2C to 1.0V	4.5h
3	0.05C for 24h	0.2C to 1.0V	4.5h

\*Before test, the battery shall be discharged in an ambient temperature of 20±5°C at 0.2C to 1.0V and then stored in 55±2°C for not less than 16h and not more than 24h.

##### ② IEC61951-1 7.4.1.1 Endurance in cycles

Prior to the endurance in cycles test, the cell shall be discharge at 0.2C to a final voltage of 1.0V/cell. The following endurance test shall then be carried out, irrespective of cell designation, in an ambient temperature of 20±5°C, Charge and discharge shall be carried out at constant current throughout, using the conditions specified in table 5. Precautions shall be taken to prevent the cell-case temperature from rising above 35°C during the test, by providing a forced air draught if necessary.

Note---Actual cell temperature, not the ambient temperature, determines cell performance

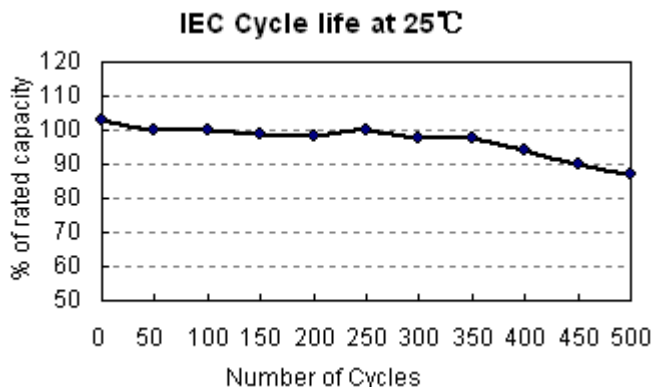
Table 3 Endurance in cycles

Cycle number	Charge	Rest	Discharge
1	0.1C for 16h	None	0.25C for 2h 20min <sup>a</sup>
2 to 48	0.25C for 3h 10min	None	0.25C for 2h 20min <sup>a</sup>
49	0.25C for 3h 10min	None	0.25C to 1.0V/cell
50	0.1C for 16h	1h~4h	0.2C to 1.0V/cell <sup>b</sup>

- a. If cell discharge voltage drops below 1.0V/cell, discharge may be discontinued.
- b. It is permissible to allow sufficient open-circuit rest time after the completion of discharge at cycle 50, so as to start cycle 51 at an exact two-week interval. A similar procedure may be adopted at cycles 100,150,200,250,300,350,400,450 and 500.

Cycles 1 to 50 shall be repeated until the discharge duration on any 50th cycle becomes less than 3h at this stage, a further cycle as specified for cycle 50 shall be carried out.

The endurance test is considered complete when two such successive cycles give a discharge duration less than 3h. The number of cycles obtained when the test is completed shall be not less than 500.



### ③ IEC61951-1 7.4.2.3 Permanent charge endurance

The permanent charge endurance test, shall be performed in three steps according to the conditions specified in Table 18. It consists of

- a charge acceptance test at +40°C;
- an ageing period of six months at +70°C;
- a final charge acceptance test to check the cell's performance after ageing.

NOTE : The temperature of 70°C has been selected to simulate four years of permanent charge operation at +40°C.

Prior to this test, the cell shall be discharged at 0.2C at 20°C±5°C to a final voltage of 1.0V and stored, in an ambient temperature of +40°C±2°C, for not less than 16h and not more than 24h. The cell shall then be charged and discharged at constant current under the conditions specified in Table 4. While maintained in an ambient temperature of +40°C±2°C or +70°C±2°C respectively as appropriate. The discharge conditions A or B may be chosen to suite the user's requirements. The discharge is carried out immediately on completion of charging. After performing the first charge acceptance test at +40°C the cell is stored, in an ambient temperature of +70°C±2°C, for not less than 16h and not more than 24h. During the ageing period of six months at +70°C±2°C, precautions shall be taken to prevent the cell-case temperature from rising above +75°C by providing a forced air draught, If necessary.

NOTE : Actual cell case temperature, not the ambient temperature, determines cell performance.

The discharge duration of the three cycles at +70°C shall be recorded. Leakage of electrolyte shall not occur during this test. After completion of ageing period, the cell shall be stored, in an ambient temperature of 40°C±2°C for not less than 16h and not more than 24h, the three cycles at 40°C of the initial charge acceptance test are then repeated using the condition specified in Table 4. The duration of the discharge shall be not less than the values specified in Table 4.

Table 4- Permanent charge endurance for LT, MT or HT cylindrical cells

Cycle number	Ambient temperature	Charge	Discharge A or B	Minimum discharge duration	Q.C passed minimum discharge time
1	+40°C± 2°C	0.05C for 48 h	A:0.2C to 1.0 V	No requirement	4.5 h
2		0.05C for 24 h	A:0.2C to 1.0 V	3 h 45 min	
3		0.05C for 24 h	A:0.2C to 1.0 V	3 h 45 min	
4	+70°C± 2°C	0.05C for 60 days	A:0.2C to 1.0 V	No requirement	
5		0.05C for 60 days	A:0.2C to 1.0 V		
6		0.05C for 60 days	A:0.2C to 1.0 V		
7	+40°C± 2°C	0.05C for 48 h	A:0.2C to 1.0 V	No requirement	3 h
8		0.05C for 24 h	A:0.2C to 1.0 V	2 h 30 min	
9		0.05C for 24 h	A:0.2C to 1.0 V	2 h 30 min	