



## Specification Approval Sheet

Name: Nickel Metal Hydride Battery Pack

Model: 11112

SPEC: 2/3A, 1600mAh

Approved By	Checkup	Make

Customer Confirmation	Signature	Date
	Company Name :	
	Stamp :	

436 Kato Terrace, Fremont, CA 94539 U.S.A.

Tel: 510.687.0388 Fax: 510.687.0328

[www.TenergyBattery.com](http://www.TenergyBattery.com)



## Tenergy Corporation

436 Kato Terrace

Fremont, CA 94539

Tel: 510.687-0388 Fax: 510.687.0328

[www.TenergyBattery.com](http://www.TenergyBattery.com) email: sales@tenergybattery.com

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### 1. Scope

This product specification covers the requirements for the following rechargeable sealed Nickel Metal Hydride battery pack manufactured and delivered by Tenergy Corporation.

### 2. Description and Model

2.1 Description Nickel Metal Hydride Battery Pack

2.2 Model 1600mAh, side-by-side, HiTec Connector (item# 11112)

### 3. Pack Dimensions

Length: 84 mm

Width: 30 mm

Thickness: 17 mm



## 4. Ratings

Nominal Voltage		6.0V
Discharge Capacity (after 2000mA (- Δ V=25mV) charging )	0.2C(320mA)discharge to 5.0V	1600mAh (duration 300min)
	1C(1600mA)discharge to 4.85V	1546mAh (duration 58min.)
	3C(4800mA)discharge to 4.5V	1440mAh (duration 18min.)
	10C(15A) discharge to 4.5V	1450mAh (duration 5.8min.)
	20C(30 A) discharge to 0.80V	1400mAh (duration 2.8min)
Internal Impedance (at 1kHz, fully charged, RT)		30mΩ
Charge	Standard	0.1C (140mA) for 16 hrs, (Peak Voltage reference : 1.46V/cell) 0.2C (320mA) for 8 hrs, (Peak Voltage reference : 1.48V/cell)
	Fast	Up to 1600mA for 1.2hrs,-delta V controlled : 5mV/cell, or $\frac{dT}{dt}$ controlled : 1°C per min.(Peak Voltage reference : 1.500V/cell) Up to 2000mA for 0.6hr,-delta V controlled : 25 mV/cell, or $\frac{dT}{dt}$ controlled : 1°C per min.(Peak Voltage reference : 1.52V/cell)
	Trickle	0.03C (48mA) to 0.05C (80mA)
Life Expectancy		500 cycles
Charge	Standard	0°C to 45°C
	Fast	10°C to 45°C
Discharge		-10°C to 65°C
Storage	< 1 year	-20°C to 35°C
	< 3 months	-20°C to 45°C

## 5. Cell Appearance

The cell shall be free from:

- swelling of cell bottom
- Leakage (liquid electrolyte, or crystal at vent)
- Damages (dents, defect shrinking tubes)
- Corrosion & contamination of welding areas



## 6. Performance

Unless otherwise stated, tests should be conducted under the following conditions: Time frame within one month of delivery

Ambient temperature  $20 \pm 5^{\circ}\text{C}$

Relative Humidity  $65 \pm 20\%$

### 6.1) Standard Charge

Discharge the cell to 1.0V at 0.2C (320mA), then charge at 0.1C (160mA) for 16hrs, or 0.2C (320mA) for 8hrs.

### 6.2) Standard Discharge Capacity

Measure the cell with a discharging current of 0.2C within one hour after the standard charge. Up to 3 cycles are allowed in order to reach the nominal capacity.

### 6.3) High rate capacity

Measure the cell with a discharging current of 1C to a Voltage of 0.97V after standard charge.

Discharge Rate	Discharge Current (mA)	Final Voltage (V/cell)	Minimum Capacity (mAh)	Minimum Discharge Duration (min.)
0.2C	320	1.00	1500	282
1C	1600	0.97	1460	55
3C	4800	0.95	1360	17
10C	15000	0.90	1374	5.5
20C	32000	0.80	1350	2.7

### 6.4) Open circuit Voltage

To be above 1.25V/cell within 1 to 4 hours after standard charge

### 6.5) Initial Impedance

Measure at  $20^{\circ}\text{C}$  and 1 KHz within one hour after standard charge

Initial internal impedance  $\leq 8.0\text{m}\Omega$

### 6.6) Charge retention

After standard charge and storage time 28 days at ambient temperature, the capacity is measured using standard discharge.

Capacity  $>1040\text{mAh}$  (duration  $> 195$  minutes)

### 6.7) IEC cycle life

According IEC285 (1993) 4.4.1, cycle life of 500 cycles is expected.



6.8) Leakage

After charging at 1C and storage for 14 days at room temperature, no leakage nor deformation.

6.9) Overcharging

After charging at 0.1C (160mA) for 48 hrs, no leakage or deformation.

Then, discharge at 0.2C (320mA) to 1.0V, capacity > 150mAh (duration 282 min.).

6.10) Abusive Charge

Test MUST be carried out in a protective chamber, with extreme caution! Charge at 1C (1600mA) for 1 hrs.

Leakage and deformation may occur, however, no explosion is allowed.

6.11) Over-Discharge

Test MUST be carried out in protective chamber, with extreme caution!

The cell is forced to be discharged at 0.2C (320mA) to 0.2V/cell, then at 1C (1600mA) for at least 1 hr. Leakage and deformation may occur, however, no explosion is allowed.

6.12) Short Circuit

Test MUST be carried out in protective chamber, with extreme caution!

After standard charge, the cell is short circuited for one hour with a copper wire with maximum resistance load of 0.1 Ohm. Leakage and deformation may occur; however, no explosion is allowed.

6.13) Reverse charging

Reverse charging is not allowed

6.14) Vibration Test

This means the endurance of the cell against vibrations

Conditions:   Amplitude:    4.0mm  
                  Vibration:    1000CPM (16.7 Hz)  
                  Time:            60min.

Criteria: no major mechanical damage or functional loss.

Minor OCT changes (<20mV) are acceptable.

6.15) Drop Test

This means the endurance of the cell against drop

Condition:    Height:        1m  
                  Direction:    Not specified  
                  Surface:       Oak board, 5cm thick

Number of test: 3 times

Criteria: No major mechanical damage or functional loss. Minor OCT changes (<20mV) are acceptable.



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## 7. Safety Instructions

### 7.1) Warnings:

Please follow the instructions to avoid electrolyte leakage, heat generation or explosion of the cells. The alkaline electrolyte of the cells may harmful to skin and eyes.

Do not short-circuit cells.

Do not dispose the cell of in fire.

Do not solder cells directly.

Do not disassemble cells.

Do not deform cells by applying pressure.

Do not dip cells into water.

Do not connect cells in reverse polarities.

Do not charge and discharge cells at high current.

Do not mix cells of different types and/or different models (dry cells, alkaline cells, or Nickel-Cadmium cells).

Do not use old and new cells together.

Do not install cells in a completely sealed casing or compartment.

### 7.2) Precautions:

Keep cells out of reach of children to avoid any accident.

Charge the cell before usage. Be sure to charge properly.

Make use of the specification in an appropriate and effective manner.

## 8. Battery Handling

### 8.1) Transportation

During transportation, the battery should be kept at refresh condition, being charged halfway.

### 8.2) Final Voltage

Our suggestion for each cell's final voltage: 1.0 to 1.1V

If final voltage higher than 1.1V, the battery does not fully discharge, causing it not delivering full capacity in subsequent cycle.

If final voltage lowers than 1.0V, the battery will be over-discharged or becoming anti-fresh.

## 9. Warranty

As long as the cell is treated in accordance with this product specification, 6-month limited warranty against workmanship and material defects is given.