



## Specification Approval Sheet

Name: Nickel Metal Hydride Battery

Model: 10600-0

SPEC: F , 1.2V , 13000mAh

Approved By	Checkup	Make

Customer Confirmation	Signature	Date
	Company Name :	
	Stamp :	

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**Specification alteration history**

No.	Date	Edition	Class*	Main altered item
1	2013-11-23	A/0		New issue
2	2014-2-10	A/1	R	Revised the specification format Revise the weight
3	2014-10-07	A/2	R	Revised item 4.3, 4.6
4	2016-4-19	A/3	R	Revised the specification format
5	2016-4-27	A/4	R	Revised item 4.3, 4.6

\*: Class A, D and R means added, deleted and revised respectively.



## 1.SCOPE

### BATTERY MODEL: HFR-90F13000

## 2.NOMINAL SPECIFICATION

2.1.Nominal voltage	1.2V
2.2.Nominal capacity*	13000mAh
2.3.Minimum capacity*	12500mAh
2.4.Charging**	
Standard charging	1250mA (0.1C)for 16 hours
Quick charging	2500mA(0.2C) for 7 hours
2.5.Discharge**	
Standard discharge	2500mA(0.2C) to 1.0V
2.6.Temperature (recommended)	
Standard charge	0~40°C
Quick charge	10~40°C
Discharge:	-10~50°C
Storage	-20~30°C
2.7.Relative humidity	45~85%
2.8.Weight	Approx. 230g
2.9.Dimensions	shown in the page 12

Note \*: Discharge capacity when the battery unit is discharged at 0.2C after being standard charged. Five cycles are permitted for this test .The test shall be terminated at the end of the first cycle which meets the requirement.

\*\* : Unless otherwise stated in these specifications, the battery unit should be discharged to 1.0V end voltage with 0.2C before charging.



### 3. APPEARANCE

There shall be no practical damage such as conspicuous liquid electrolyte leakage, flow and dirt under conditions of storage or operation as specified herein.

### 4.ELECTRICAL CHARACTERISTICS

Testing conditions

The battery shall be evaluated within 1 month from the arrival date.

Unless otherwise stated in these specifications, the following test shall be carried out in an ambient temperature of  $20\pm 5^{\circ}\text{C}$ , relative humidity of  $65\pm 20\%$ .

#### Characteristics

Test Items	Test Conditions	Requirements	Remark
4.1 Open-circuit Voltage (OCV)	Voltage between the battery terminals shall be measured within 14 days after standard charge	$\geq 1.25\text{V}$	
4.2 Capacity	After standard charge, rest for 1 hour before discharge to 1.0V at 0.2C current	$\geq 300$ minutes	Up to 5 cycles are allowed
4.3 High-rate discharge (1C)	After standard charge, rest for 1 hour before discharge to 0.9V at 1C current	$\geq 52$ minutes	Up to 5 cycles are allowed
4.4 Low temperature discharge	Within 1 hour after standard charged at $20^{\circ}\text{C}$ , discharged at a current of 0.2C to 1.0V at $0^{\circ}\text{C}$	$\geq 240$ minutes	
4.5 High temperature discharge	Within 1 hour after standard charged at $20^{\circ}\text{C}$ , discharged at a current of 0.2C to 1.0V at $40^{\circ}\text{C}$	$\geq 240$ minutes	
4.6 Internal impedance (Ri)	Upon fully charge (1KHz)	Max.6m $\Omega$	



Test Items	Test Conditions	Requirements	Remark
4.7 IEC cycle life	IEC61951-2 ( 2011 ) 7.5.1.2 See Remark 1	≥500 Cycles	
4.8 Charge retention	Standard charged ,stored for 28 days at 20±2°C , discharged at a current of 0.2C to 1.0V	≥210 Minutes	
4.9 Over-charge	Within 1 hour after being charged at a current of 0.1C for 48 hours, the battery unit shall be discharged at 20°C, at a current of 0.2C to 1.0V end voltage	≥300 Minutes	
4.10 Continuous low-rate charging	After standard charged battery unit is charged at 0.03C~0.05C for 28 days	No fire , nor explosion	
4.11 Forced discharge	The discharged battery unit is subjected to a reverse charge at 1C for 90 minutes	No fire , nor explosion	
4.12 Vibration	IEC62133 ( 2012 ) 7.2.2 See Remark 2	No leakage, nor fire , nor explosion	

**\*REMARK:**

**1. Cycle life:** IEC61951-2(2011) 7.5.1.2

Cycles	Charge	rest	Discharge
1	0.1C×16hrs	0	0.25C×2hrs 20mins
2~48	0.25C×3hrs 10mins	0	0.25C×2hrs 20mins
49	0.25C×3hrs 10mins	0	0.25C to 1.0V/cell
50	0.1C×16hrs	1~4hrs	0.20C to 1.0V/cell
Cycle 1 to 50 shall be repeated until the discharge duration on any 50 <sup>th</sup> cycle become less than 3hrs			

**2. Vibration: IEC62133 ( 2012 ) 7.2.2**

Frequency	10~55Hz
Amplitude	0.76mm
Rate of frequency variety	1 Hz/minute
Duration	90 minutes /axis (axis: X、 Y、 Z) 270 minutes in all

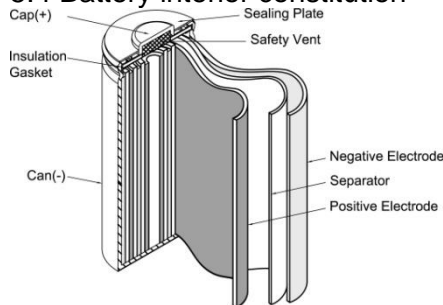
**5. ENVIRONMENTAL PROTECTION REQUIREMENT**

5.1 The requirement on Hazardous Substances in the materials must comply with TENERGY CORPORATION criterion on HSF.

5.2 The requirement on Hazardous Substances in the Products must comply with 2013/56/EU and TENERGY CORPORATION criterion on HSF.

5.3 TENERGY CORPORATION corporation is not responsible for the waste battery of collection and recycling in directive 2013/56/EU

**5.4 Battery interior constitution**



Never disassemble HIGHPOWER 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.

**5.5 Battery materials and components**

No.	Material name	CAS No.	Proportion (%)	Proportion [%]
1	Nickel-dihydroxide	12054-48-7	21.099472	15 - 22
2	Iron	7439-89-6	19.485413	16 - 20
3	Nickel	7440-02-0	38.713532	30 - 40
4	Manganese	7439-96-5	1.345624	0.3 - 1.5
5	Lanthanum	7439-91-0	4.139789	1.7 - 4.5
6	Cobalt	7440-48-4	2.371353	1.5 - 2.5
7	Potassium-hydroxide	1310-58-3	1.871353	1 - 2
8	Polyethylene	9002-88-4	0.522812	0 - 0.6
9	Cerium	7440-45-1	0.821525	0.29 - 0.9
10	Neodymium	7440-00-8	0.871353	0 - 1
11	Aluminium (metal)	7429-90-5	0.871353	0 - 1
12	Sodium-hydroxide	1310-73-2	1.871353	1 - 2
13	Lithium-hydroxide	1310-65-2	0.448541	0.1 - 0.5
14	Poly(tetrafluoroethylene)	9002-84-0	0.087135	0 - 0.1
15	Cellulose carboxymethyl ether sodium salt	9004-32-4	0.087135	0 - 0.1



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16	Polypropylene	9003-07-0	2.742706	1 - 3
17	Styrene polymer with 1,3-butadiene	9003-55-8	0.448541	0.1 - 0.5
18	Cobalt hydroxide (Co(OH)2)	21041-93-0	1.80703	0.5 - 2
19	Zinc-hydroxide	20427-58-1	0.087135	0 - 0.1
20	Water	7732-18-5	0.219708	0.15 - 0.23

## 6. TRANSPORT

To ensure battery safety during delivery, SOC( state of charge) recommended be below 50% , inside temperature of container could not be over 35°C. Product holder should be responsible for any possible loss during delivery if above conditions cannot be met completely.

Inside temperature of container must be below 20°C if any client requires SOC(state of charge)above 50%, the distance between battery master cartons should be not less than 10cm in container, and coercive air cross ventilation system is required in container to ensure even temperature for each master carton. Product holder should be responsible for any possibly accidental loss if above conditions cannot be met completely.

## 7.PRECAUTION

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!  
Do not connect the (+) positive and (-) negative terminals of TENERGY CORPORATION
- batteries together with electrically conductive materials, including lead wires. Do not transport or store TENERGY CORPORATION 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 TENERGY CORPORATION batteries using those specific chargers that satisfy TENERGY CORPORATION specifications. Only charge batteries under the conditions specified by TENERGY CORPORATION.
- Never disassemble TENERGY CORPORATION 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 solder lead wires directly on to TENERGY CORPORATION batteries.
- The (+) positive and (-) negative terminals of TENERGY CORPORATION batteries are predetermined. Do not force the terminals to connect to a charger or equipment. If the terminals cannot 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 TENERGY CORPORATION battery. For this reason, never deform this section or cover or obstruct its gas release structure.
- Do not directly connect TENERGY CORPORATION batteries to a direct power source or the cigarette lighter socket in a car.
- Do not use TENERGY CORPORATION batteries in any equipment other than those specified



by TENERGY CORPORATION.

- TENERGY CORPORATION batteries contain a strong colorless alkaline solution (electrolyte). The alkaline solution is extremely corrosive and will cause skin damage. If any fluid from a TENERGY CORPORATION 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 TENERGY CORPORATION 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.

**▲Warning!**

- Do not apply water, seawater or other oxidizing reagents to TENERGY CORPORATION 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 TENERGY CORPORATION batteries by exceeding the predetermined charging period specified by the battery charger's instructions or indicator. If TENERGY CORPORATION 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.
- TENERGY CORPORATION batteries contain a strong colorless alkaline solution (electrolyte). If the skin or clothing comes in contact with fluid from a TENERGY CORPORATION 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 21 TENERGY CORPORATION 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 TENERGY CORPORATION 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 TENERGY CORPORATION 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 TENERGY CORPORATION 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 TENERGY CORPORATION batteries.
- Store TENERGY CORPORATION 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 TENERGY CORPORATION batteries within a temperature range of 0 to 40 deg C (degrees Celsius).
- Be sure to use the recommended charging method for TENERGY CORPORATION 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 TENERGY CORPORATION batteries.

- Be sure to turn off the equipment after use of TENERGY CORPORATION batteries, otherwise may result in leakage of battery fluid.
- After removed from equipment, store TENERGY CORPORATION 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. (TENERGY CORPORATION recommends the storage temperature range from - 20 to +30deg.(for longer service life).
- Storage batteries should be charged one time every four months under the storage temperature of 30°C and below, every three months under 40°C and below, and every one month under 50°C and below.
- 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 battery for a few times.
- Do not use old and new batteries mixed together, or batteries at different charge levels. Do not use the TENERGY CORPORATION battery mixed 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 TENERGY CORPORATION 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. BATCH ACCEPTANCE

### Recommended test sequence for batch acceptance

The sampling procedure shall be established in accordance with IEC61951-2,2011 10.2 table 21. Unless otherwise agreed between supplier and purchaser, inspections and tests shall be performed using inspection levels and AQLs (acceptable quality level) recommended in table as follow:

Inspection item	Inspection level	AQL
1) Open voltage	II	0.65
2) Internal resistance	II	0.65
3) Capacity	S3	1.0
4) Dimensions	S3	1.0
5) Appearance	II	1.0

NOTE: Two or more failures on a single cell are not cumulative. Only the failure corresponding to the lowest AQL is taken into consideration.

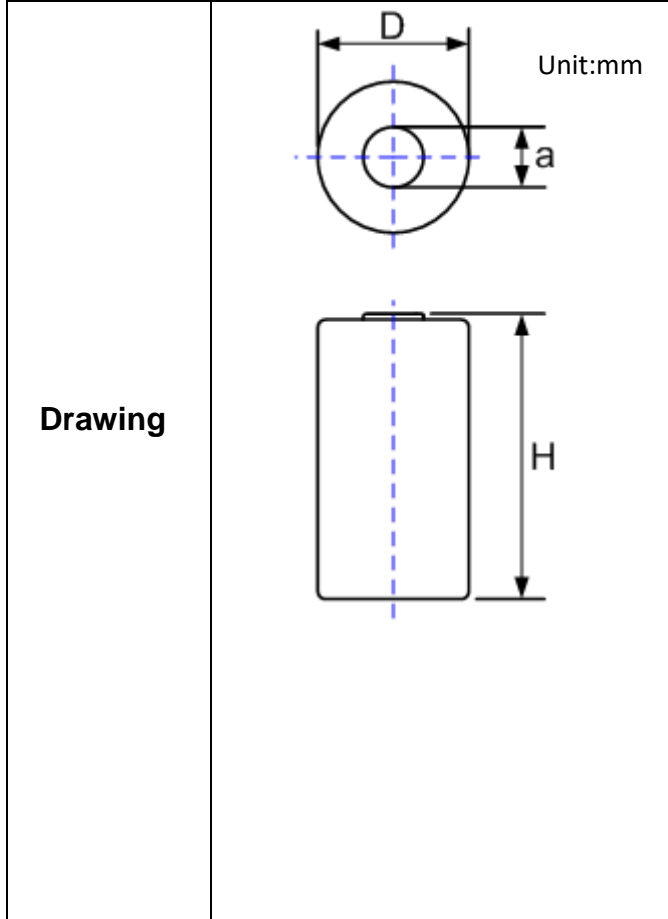
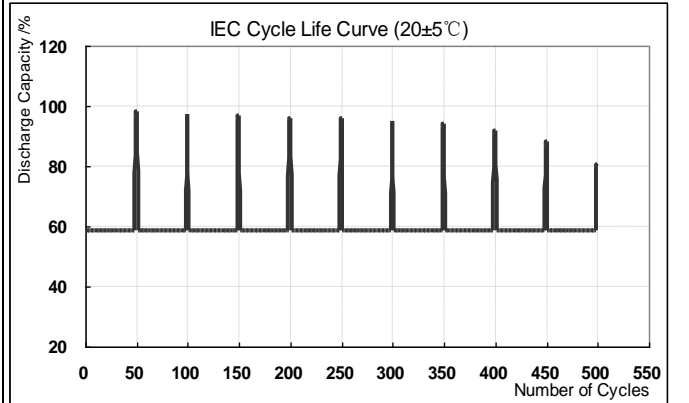
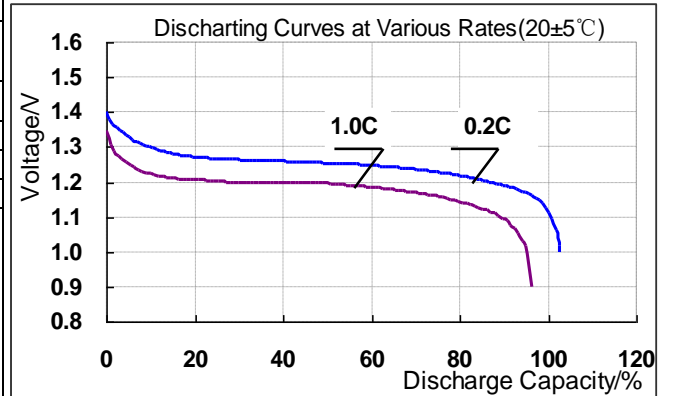
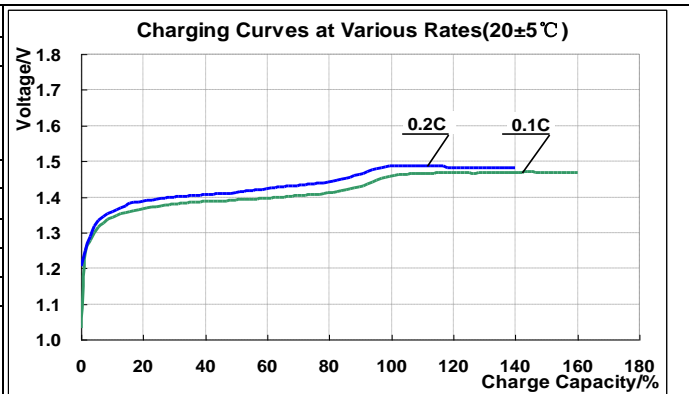
## 9. WARRANTY

One year limited warranty against battery self-defects.

**Notice:** To assure safety, please consult to the TENERGY CORPORATION technical staff for your applications including electrical specifications, mechanical designs, protective devices and any special specification. TENERGY CORPORATION reserve the right to alter or amend the design, model and specification without prior notice.

**Data Sheet**
**Battery Model: 90F13000**

Nominal voltage (V)		1.2
Capacity*	Nominal	13000
	(mAh) Minimum	12500
Charging**	Standard	0.1C×16hours
	Quick	0.2C×7hours
Temperature recommended	Standard charge	0~40
	Quick charge	10~40
	Discharge	-10~50
(°C)	Storage	-20~30
Internal resistance		≤6 mΩ
End voltage of discharge		1.0V
Charge (capacity) retention (20°C 28days 0.2C discharge to 1.0V)		≥210 minutes
Weight		Approx. 230g
Dimensions With tube	D Diameter	32.5 <sup>+0</sup> <sub>-0.5</sub>
	H Height	90.5 <sup>+0</sup> <sub>-1.5</sub>
	a Top diameter	10.0 <sup>+0.1</sup> <sub>-0.1</sub>



Note:

\*:The cycle life curve describes battery unit. Please discharge to the 1.0V end voltage with 0.2C before charging the battery unit.

**The data sheet is for reference only and should not be used as a basis for product described guarantee or warranty.**