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Specification

1. Manfr. : SEALED ENERGY SYSTEMS
2. Product : **NiMH 9S1P Battery Pack (3,800mAh)**
3. Model : **SE35S**

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1. Scope

This Product Specification ('Specification' hereinafter) covers the requirements for the rechargeable Nickel Metal Hydride battery Hard Pack ('Pack' hereinafter) manufactured and supplied by Sealed Energy Systems, India.

The pack contains Nickel Metal Hydride cells, safety devices, and a fuel gauge module compatible with Smart Battery Specification R1.0.

2. Descriptions and Model name

2.1. Description	NiMH rechargeable smart battery pack
2.2. Battery Cell Configuration	9S1P
2.3. Model name	SE35S

3. Ratings

3.1. Normal Capacity	3,800mAh (Capacity at 0.1C Charge / 0.2C Discharge)
3.2. Minimum Capacity	3,600mAh (Capacity at 0.1C Charge / 0.2C Discharge)
3.3. Nominal Voltage	10.8V
3.4. Charging Method	CC (Constant-Current)
Charging Voltage	18.0V
Standard Charging Current	380mA
Rapid Charge	2,000mA (With control system)
3.5. Maximum Discharge Current	3,800mA
3.6. Discharge Cut-off Voltage	9.0V
3.7. Internal Resistance (impedance)	≤ 450mΩ
3.8. Weight	≤ 520g
3.9. Operating Temperature	
Standard Charge	0 ~ 45 °C
Standard Discharge	-10 ~ 60 °C
3.10. Storage Temperature	
-20 ~ 25 °C	≤ 1 Year
-20 ~ 45 °C	≤ 3 Months
-20 ~ 60 °C	≤ 1 Month
3.11. Storage Humidity	20 ~ 85 %RH (not condensed)

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4. Smart Battery System Support

4.1. General

This pack has a Smart Function Module with SMBus R1.0 Interface and supports the Smart Battery Data(SBData revision 1.0 fully compatible) commands, SBData charge control function, battery state of charge, remaining capacity, remaining time, chemistry, and manufacturer's info over the serial link.

4.2. Major Feature

Provides accurate measurement of the electrical properties in the packs such as voltage, current, temperature, full capacity, remaining capacity and time.

Four segment LED display for remaining capacity. Battery charge state can be directly indicated using a four segment LED display to graphically depict battery full-to-empty in 25% increments.

Fully compatible with SMBus(System Management Bus) v1.0.

Fully compatible with SBS(Smart Battery System) v1.0 include charger control, multi-master

5. Outline Dimension

W x L x H = 214.5±0.5 x 52.5±0.5 x 18.5±0.5 (mm) (Refer to attached drawings.)

6. Appearance

Any cosmetic damage should not be found on the product.

7. Standard test condition

7.1. Test sample condition

The battery used for the test shall be manufactured and delivered no later than one month.

7.2. Environmental condition

Unless otherwise specified, all tests stated in the specification are conducted at temperature 25±5°C and humidity 65±20%RH and charged state.

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7.3. Test equipment condition

The grade of voltmeter and ammeter used in the test shall be higher than class 0.5, a high impedance type.

8. Characteristics

8.1. Standard Charge

“Standard Charge” means charging the pack with the constant current at 380mA until a full charge condition is detected.

The full charge condition can be detected as below conditions:

- Pack temperature is higher than 55°C while charging (Maximum T Control).
- Pack temperature is increased by 1°C/min or higher (dT/dt Control).
- Pack voltage is decreased by 50mV while charging (-dV Control).
- Full charge is detected by the smart module in the battery pack.

8.2. Initial Capacity

“Initial Capacity” is defined as the initial discharge capacity of the pack. which is measured in discharge current of 760mA with 10.0V cut-off at 25°C within 1~2 hour after a standard charge.

The initial discharge time shall be longer than 270min.

8.3. Cycle Life

Cycle life is defined by the discharge time one day after 299 cycles and measured under same condition in 8.2.

The discharge time of the 300th is more than 210min.

8.4. Initial internal impedance

Internal impedance shall be checked at 1000Hz with standard charge state.

The initial internal impedance of the pack is lower than 450mΩ.

8.5. Discharge capacity with temperature

This means relative value of discharge time at various temperature compared with the discharge time Measured under same conditon in 8.2. except the temerature condition.

Temperature	-10°C	25°C	45°C	60°C
Relative Capacity	60%	100%	95%	90%

8.6. Storage characteristics

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The pack is fully charged by the standard charge and stored at 25°C for 30 days. And capacity is measured by the initial capacity measure condition (8.2).

Remaining Capacity (after storage) is more than 2,880mAh.

9. Safety test

9.1 Overcharge Test

Method : Apply charge to continuous until the thermal protection is operated.

Criteria : No leakage, flame, or fire is allowed.

9.2 Over Current Test

Method : Short-circuit the fully charged pack by connecting positive and negative terminals with 1Ω wire for one hour.

Criteria : Internal Over-current Protector shall operate and decrease the discharge current.

No damage such as leakage, flame, or fire is allowed.

9.3 Over Discharge Test

Method: Discharge the pack to voltage less than 6.0V

Criteria: No damage such as leakage, flame, or fire is allowed.

10. Mechanical Characteristics

10.1 Drop Test

Method : Drop the full charged pack onto the concrete floor from 0.76m heights at any directions for 3 times.

Criteria : No leakage, OCV higher than 10.8V, and internal impedance lower than 450mΩ

10.2 Vibration Test

Method : This means the endurance of the pack against vibration.

Frequency and amplitude : 10Hz → 55Hz → 10Hz/0.8mm.

Sweep speed : 1±0.055Hz/min.

Criteria : No leakage, OCV higher than 10.8V, and internal impedance lower than 450mΩ

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11. Shipment

The battery shall be shipped in about 50%~80% charged state.

12. Caution and prohibition

Before using and handling the pack, see carefully attached "Handling Instruction Guide for NiMH Battery Pack"

For the safety reason, rechargeable batteries are shipped out in a safe capacity state.

All battery packs have to be fully charged and discharged up to 3 times to utilize and optimize the full capacity and smart data set.

The battery pack is initialized before shipping. However, if the battery pack is used without fully charged and discharged for a long period of time, the accuracy loss will occur.

Recovering to the better performance will be done thru a few cycles of full charging and discharging.

13. Others

13.1 Storage for a long term

If the pack is kept for a long term (3 months or more), it is strongly recommended that the pack be preserved at a dry and low temperature atmosphere and should be recharged before use.

13.2 Warranty

Sealed Energy Systems will be responsible for replacing the pack against defects or poor workmanship for 12 months from the date of shipping. Any other problems caused by malfunction of the equipment or misuse of the battery are not under this warranty.

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Handling Instruction Guide for NiMH Battery Pack

1. General

Battery packs supplied by Sealed Energy Systems have to be handle carefully according to the specification. Here are some more to be followed.

2. Storage of pack

The packs are requested to be stored under the following conditions:

- a. Indoor storage in a cool circumstances without direct sun light on the packs or cartons.
- b. Store batteries in a dry location with low humidity, and a temperature range of -20°C to $+30^{\circ}\text{C}$.

In case of the long term storage

- a. As a long-term storage can accelerate battery self-discharge and lead to the deactivation of the batteries. To minimize the deactivation effect, store battery packs in a temperature range of $+10^{\circ}\text{C}$ to $+30^{\circ}\text{C}$.
- b. When charging the battery for the first time after long-term storage, deactivation of the packs may result in the decreased capacity. To recover capacity degraation upto original performance, please go through repeated several cycles of full charging and discharging.
- c. In case of more than 6 months storage, please charge the battery at least once fore every 6 months to prevent leakage and deterioration in performance due to self-discharging.

3. Charging pack

- a. Use suitable charger with the specified voltage and current for charging. We strongly recommend smart battery chargers.

If you want to get more information, please contact us.

- b. **Never attempt reverse charging.** Charging with polarity reversed can cause a reversal in battery polarity, causing gas pressure inside of the battery to rise, which can be led to leakage of the batteries.

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c. Avoid overcharging. Repeated overcharging can be led to battery deterioration and Over-heat can be occurred.

d. Charging efficiency drops at temperatures above 40°C.

4. Protection from unexpected damaged on the battery pack

- a. (+) and/or (-) terminals must not be connected in metal wire, necklace, or chains.
- b. Do not drop packs from height to prevent them from possible malfunction or damage.
- c. Do not twist or bend packs to prevent possible damage.

5. For Safety

- a. Do not disassemble packs.
- b. Do not use pack when something abnormal found such as smells, deformation, discoloration, and so on.
- c. Do not re-use NiMH cells or other parts after removing from the packs.
- d. When the electrolyte leakage occurs, do not touch the liquid.
- e. Once watered, packs may have potential malfunctions. Do not use those packs.
- f. Do not have packs in the hot-temperature (60°C or more).
- g. Do not put packs into fire.
- h. Do not crush/nail packs.
- i. Do not apply solder directly to packs.

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Appendix A : Out-view drawing

