



PRODUCT SPECIFICATION

CONFIDENTIAL

Discription

FE105A

Document No.

Date

2018.10.12

Rev.

1

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PRODUCT SPECIFICATION

Rechargeable Lithium-ion Battery Cell

Model : FE105A



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1. General Information

1.1 Scope

This product specification defines the requirements of the rechargeable lithium ion battery cell to be supplied to the Customer by Narada Power Source Co., Ltd.

1.2 Application ESS

1.3 Product Classification Lithium-ion Battery Cell

1.4 Model Name FE105A

2. Nominal Specification

| Item | Condition / Note | Specification |
|---|------------------------------------|---------------------------------|
| 2.1 Capacity | Nominal charge / discharge at 25°C | ≥105 Ah@1C |
| 2.2 Nominal Voltage | Average for nominal discharge | 3.2 V |
| 2.3 Operating Voltage Range | 0%~100% SOC | 2.50 ~ 3.65 V |
| 2.4 Nominal Charge | Constant current | 105 A (1 C) |
| | Constant voltage | 3.65 V |
| | End condition (Cut off) | 5.25 A |
| 2.5 Charge Current I ₁ (25°C) | Fast Continuous Charge current | 105 A (1 C) |
| | Max Continuous Charge Current | 210 A (2C) |
| | Peak (50%SOC, 10s) | 315 A (3C) |
| 2.6 Nominal Discharge | Constant current | 105 A (1C) |
| | End voltage(Cut off) | 2.50 V |
| 2.7 Discharge Current I ₁ (25°C) | Max Continuous Discharge Current | 315 A (3C) |
| | Peak (50%SOC, 10s) | 420 A (4C) |
| 2.8 Weight | / | 2.30±0.15 kg |
| 2.9 Operating Temperature | Charge | 0 ~ 45 °C |
| | Discharge | -20~55 °C |
| 2.10 Storage Temperature | ≤1 M | -10 ~ 35 °C, 50%~80%SOC, ≤45%RH |
| | 1~6 M | -5 ~ 30 °C, 50%~80%SOC, ≤45%RH |
| | ≥6 M | 0~30 °C, 50%~80%SOC, ≤45%RH |
| 2.11 Safety protection voltage | Constant current | 105 A (1 C) |
| | Constant voltage | 3.85V |
| | End condition (Cut off) | 5.25 A |

1) It can be adjusted upon discussion with Narada Power Source because battery life span can be differentiated by user patterns and environment.

2) If no special requirement, the cell will be with 30%SOC for delivery.

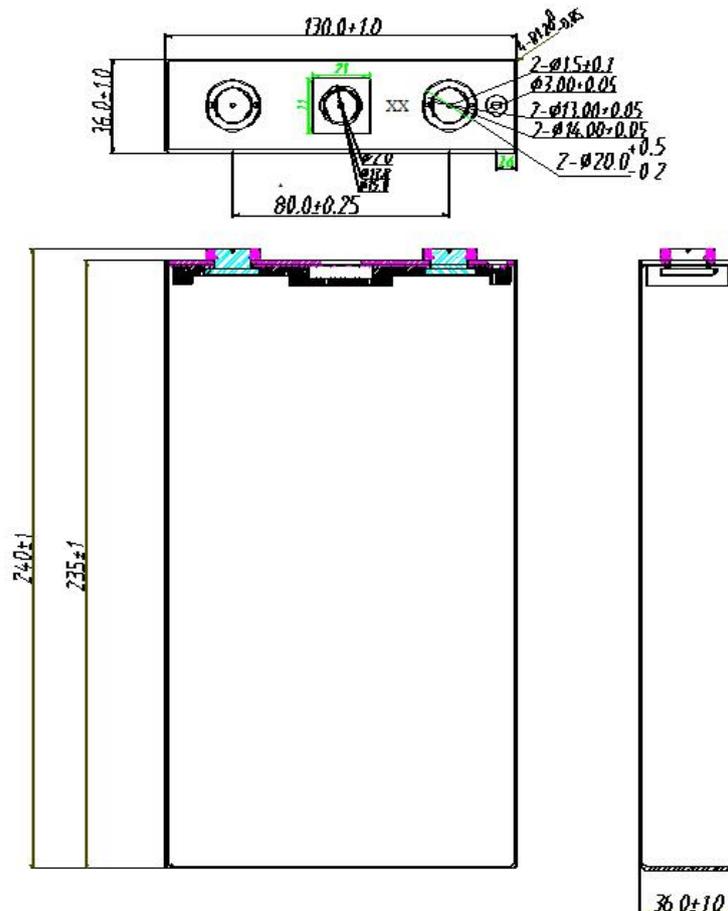
3. Appearance and Dimension

3.1 Appearance

There shall be no such defects as deep scratch, crack, rust, discoloration or leakage, which may adversely affect the commercial value of the cell.

3.2 Dimension

| Items | Overall Dimensions (mm) |
|---|----------------------------|
| Thickness*Width*Height(without terminals) | (36±1) * (130±1) * (235±1) |
| Cell height with terminals | 240±1 |
| Distance of the terminals | 56.8±0.5; Symmetry |
| Center distance of the terminals | 80±0.5 |
| Terminal position | Symmetry |
| Terminal Length*Width*Height | (Φ13±0.05) * (5±1) |
| Flatness of terminals | <0.25 |
| Diameter of OPSD | Φ13 |



4. Performance Specification

4.1 Standard test condition

4.1.1 Nominal Charge

Unless otherwise specified, “Nominal Charge” shall consist of charging at constant current of 105A to 3.65 V. The cell shall then be charged at constant voltage of 3.65 V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 5.25 A. For test purposes, charging shall be performed at $25 \pm 2^\circ\text{C}$.

4.1.2 Nominal Discharge

“Nominal Discharge” shall consist of discharging at constant current of 105 A to 2.5 V. Discharging is to be performed at $25 \pm 2^\circ\text{C}$ unless otherwise noted (such as capacity versus temperature).

4.1.3 Fast Charge Condition

Cells shall be charged at constant current of 105 A to 3.65 V. The cell shall then be charged at constant voltage of 3.65V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 2.5 A. For test purposes, charging shall be performed at $25 \pm 2^\circ\text{C}$.

4.2 Electrical and Environmental Specification

| Item | Condition | Specification | |
|---|--|---|---------------------------------|
| 4.2.1 Initial AC Impedance | Cells shall be measured at 1kHz by internal resistance device. | $\leq 0.6 \text{ m}\Omega$ | |
| 4.2.2 Initial Capacity | Cells shall be full charged per 4.1.1 and discharged per 4.1.2 within 1h after full charge at 25°C . Record discharge capacity. Repeat 5 times. When the range of three consecutive test is less than 3% of Nominal capacity, finish test. Take average of the last 3 times as result. | $\geq 105.0 \text{ Ah}$, $\leq 115.5 \text{ Ah}$ | |
| 4.2.3 Energy efficiency | Cells shall be full charged per 4.1.1, and discharge by 1C, 2.5V cut off within 1h at 25°C , record charge and discharge energy. | Discharge energy/ Charge energy $\geq 92\%$ | |
| 4.2.4 Temperature Discharge Performance | Cells Shall be full charged per 4.1.1 and discharged per 4.1.2 at following temperature. Record discharge capacity. | / | |
| | Charge | Discharge | Capacity (vs. Initial Capacity) |
| | $25 \pm 2^\circ\text{C}$ | - 20°C (2.0V cut off) 25°C 45°C 60°C | 80% 100% 100% 101% |
| 4.2.5 Discharge Ratio Performance at $25 \pm 2^\circ\text{C}$ | Cells Shall be full charged per 4.1.1 and discharged according to following discharge current. Record discharge capacity. | / | |
| | Charge | Discharge | Capacity (vs. Initial Capacity) |

| | | | |
|--|---|-----------------------------------|---|
| | 1C | 1/3 C 1 C 2 C 3 C 5 C | 101% 100% 99% 98% 90% |
| 4.2.6 Cycle Life | Cells shall be full charged per 4.1.3 and discharged per 4.1.2 with 500 cycles at 25 °C. A cycle is defined as one charge and one discharge. | | ≥92 % vs.Initiation Capacity Or ≥ 80 % vs.Initiation Capacity at 3000 cycles |
| | Cells shall be full charged with 0.5C by constant current and voltage, and discharged per 4.1.2 with 500 cycles at 25 °C. A cycle is defined as one charge and one discharge. | | ≥95 % vs.Initiation Capacity |
| 4.2.7 Charge Ratio Performance at 25±2°C | Cells shall be charged by 2C to 3.65V, cut off and discharged per 4.1.2 within 1h at 25°C.Record discharge capacity. | | Capacity (vs. Initial Capacity) ≥ 85% |
| 4.2.8 Storage Performance | After full charge per 4.1.1 at 25°C, stay at 60±2°C constant temperature cabinet for 7 days, then rest in 25±2°C environment for 5h, standard discharge per 4.1.2. Record discharge capacity. Then full charge per 4.1.1 and discharge per 4.1.2, repeat for 3 times. Record the 3rd discharge capacity as recovery capacity. | | Capacity Retention(vs. Initial Capacity) ≥85%, Capacity Recovery(vs. Initial Capacity) ≥90%, |
| | After full charge per 4.1.1 at 25°C, stay at 25±2°C constant temperature cabinet for 28 days, standard discharge per 4.1.2. Record discharge capacity. Then full charge per 4.1.1 and discharge per 4.1.2, repeat for 3 times. Record the 3rd discharge capacity as recovery capacity. | | Capacity Retention(vs. Initial Capacity) ≥90%, Capacity Recovery(vs. Initial Capacity) ≥95%, |

3) Discharge capacity at -20 °C in the product specification refer to the discharge cut-off voltage is 2.0V. According to the requirements of national standard GB-T31486-2015, the cut-off voltage is 80% of the discharge end voltage.

5.Certification

6.Cautions and Prohibitions in Handling

Warning for using the rechargeable lithium-ion battery cell - Mishandling of the battery may cause heat, fire and deterioration in performance. Be sure to observe the following.

6.1 Cautions for Use and Handling

- Before using devices equipped with the battery, refer to the user’s manual.

- Battery cells must be charged and discharged at operating temperature range.
- Battery cells must be charged and discharged below max. power of each operating temperature range.

| Max. Power/W | Operating Temperature Range | | | |
|--------------|---|---|---|---|
| | $\geq -20^{\circ}\text{C}, < 0^{\circ}\text{C}$ | $\geq 0^{\circ}\text{C}, < 5^{\circ}\text{C}$ | $\geq 5^{\circ}\text{C}, \leq 45^{\circ}\text{C}$ | $> 45^{\circ}\text{C}, \leq 60^{\circ}\text{C}$ |
| Charge | 150 | 100 | 500 | 150 |
| Discharge | 250 | 500 | 1000 | 250 |

- Positive (+) and negative (-) direction must be checked before battery pack assembly.
- When a lead plate or wire is connected to the cell for battery pack assembly, check insulation not to make short-circuits.
- Battery cells must be stored separately.
- Battery cells must be stored in a cool, dry place for long-term storage.
- Do not place the battery in direct sunlight or heat.
- Do not use battery cells in high static electricity environment where the protection device can be damaged.
- When rust or odor is detected before initial use, please return the product to the seller immediately.
- Battery cells must be kept away from children or pets
- When cell life span shortens after long usage, please replace with new cell.
- Do insulate between the metal plate and cell or other components not to make an electrical short.
- Battery cells should be handled by and used in Pack / System manufacturing companies only.
- Battery cells should be sold only to Battery Pack Maker(s) or System Integrator(s).
- The cells should not be handled by or sold to individual consumers.
- Be sure to request and confirm the most recent product specifications in advance.

6.2 Prohibitions

- Do not charge with constant current higher than maximum charge current.
- Do not attempt to disassemble or alter battery cells.
- Do not throw or subject the battery to severe impacts.
- Do not puncture or otherwise damage a battery with sharp objects (e.g. nail, knife, pencil, drill)
- Do not use with other batteries or cells.
- Do not directly solder on battery.
- Do not press the battery with overload in manufacturing process, especially while undergoing ultrasonic welding.
- Do not use old and new cells together for battery pack assembly.
- Do not expose the battery to high heat. (such as a fire).
- Do not microwave or put batteries under high pressure.
- Do not use the battery in reverse.
- Do not connect positive(+) and negative(-) terminals with conductive materials (such as metal, wire, etc.)
- Do not immerge or wet batteries with water or sea-water.
- Do not give immoderate heat and force to cell during a welding process of metal plates on it.
- Do not bend or apply excessive force to the welded part of terminals.

6.3 Cautions for the battery and the pack

Pack shall meet under condition to maintain battery safety and last long performance of the rechargeable lithium-ion cells.

6.3.1 Installing the battery into the pack

- . Battery cells should be inspected visually before battery pack assembly
- . Damaged cell should not be used.
- . Different types of cells, or same types but different cell maker's should not be used together.

6.3.2 Design of battery pack

- . The battery pack must be designed to prevent external short circuit.
- . The design of battery pack and its structure should be reviewed physically, mechanically and electrically not to cause cell imbalance.
- . The battery pack for multiple cells should be designed to monitor the voltage.

6.3.3 Charge

- . Charging should be operating under maximum charge voltage and current which is specified in product specification.
- . The battery should be charged under operating temperature specified in product specification. (Refer to 2.9)

6.3.4 Discharge

- . Discharging should be operating under maximum discharge voltage and current which is specified in product specification.
- . Discharging should be done by cut off voltage which is specified in product specification. (Refer to 2.6)
- . The battery should be discharged under operating temperature specified in product specification. (Refer to 2.9)

6.3.5 Protection Circuit

- . The protection circuit should be installed in the battery pack.
- . Battery pack should have voltage sensing system to control over charge or discharge.
- . Battery pack should have warning system for over temperature, over voltage and over current

When battery packs for any applications are assembled with cells, following functions must be designed into the battery packs.

The detailed levels, values, conditions for each following functions should be referring to the contents specified in this Product Specification. If one or more than one function is/are to be omitted, the Packer Company (and/or System Integration Company) must be informing to Narada Power Source's or to Narada Power Source's Marketing Department. Without informing to Narada Power Source, Narada Power Source will not be liable for any field quality issues happened due to exclusion of following functions.

- (1) Over voltage protection circuit
- (2) Under voltage protection circuit
- (3) Over Charge current protection circuit
- (4) Over Discharge current protection circuit
- (5) Short circuit protection
- (6) Over Temperature protection circuit
- (7) 2nd over voltage protection
- (8) Cell imbalance protection circuit (only for battery packs assembled with more than one cell)
- (9) Cell Voltage balancing function (only for battery packs assembled with more than one cell)

7 Exclusion of Liability

The warranty shall not cover defects caused by normal wear and tear, inadequate maintenance, handling, storage, faulty repair, modification to the battery or pack by a third party other than Narada Power Source or Narada Power

Source's agent approved by Narada Power Source, failure to observe the product specification provided herein or improper use of installation, including but not limited to, the following:

- Damage during transport or storage
- Incorrect installation of battery into pack or maintenance
- Use of battery cell or battery pack in inappropriate environment
- Improper, or incorrect charge / discharge, or protection of circuits other than stipulated herein
- Incorrect use or inappropriate use
- Insufficient ventilation
- Ignoring applicable safety warnings and instructions
- Any attempt to alter or repair by unauthorized personnel
- In case of force majeure (Ex. Lightning, Storm, Flood, Fire, Earthquake, etc.)

There are no warranties – implied or express – other than those stipulated herein. Narada Power Source shall not be liable for any consequential or indirect damages arising out of or in connection with the product specification, battery or pack.