Product Specifications

(Rechargeable Lithium-Ion Battery Cell)

Model: E603A

Department	Title	Name	Date	Signature
Cell Development	**Team Leader**	**C.S. Lee**	**2023-01-17**	이찬섭
Quality Assurance	**Team Leader**	**D.C. Seo**	**2023-01-17**	

51, Jong-ro, Jongno-gu, Seoul 03161, Republic of Korea
http://www.sk-on.com

Revision History

Revision	Date	Originator	Description
0.0.0	2023-01-17	W.J. Jang	First Release
1.0.0	2023-05-02	M.Y. Yoon	Revised version (Change in cycle life and C-rate)

Contents

1. General 4
1.1. Scope 4
1.2. Product 4
2. Nominal Specifications 4
2.1. Electrical Specifications 4
2.2. Mechanical Specifications 5
2.3. Safety Specifications (EUCAR* hazard level) 5
3. Performance Specifications 6
3.1. Standard Test Condition 6
3.2. Electrical Performance 6
3.3. C-Rate Characteristic 6
4. Proper Use and Handling of Lithium-ion Battery Cells 7
4.1. General Description 7
4.2. Reverse Connection 7
4.3. Charging 7
4.4. Discharging 7
4.5. Cycle life 8
4.6. Calendar life 8
4.7. Storage 8
4.8. Battery Pack Assembly 9
4.9. Transportation 9
4.10. Others 9
5. Caution and Prohibition 10
5.1. Caution 10
5.2. Prohibition 10
Appendix . Cell Drawing 12

1. General

1.1. Scope

1.1.1. This product specification has been prepared to specify the rechargeable lithium-ion battery cell to be supplied to the customer by SK on. (hereinafter referred to as SKO)

1.1.2. This product specification explains the characteristic of E603A cell and precautions of battery cell.

1.1.3. Before using this product, please read carefully this document.

1.2. Product

Item	Classification	Item	Classification
Classification	Rechargeable Lithium-Ion Battery Cell	Type	Pouch
Model Name	E603A	Applications	Electric Vehicle

2. Nominal Specifications

2.1. Electrical Specifications

Item	Spec.	Unit	Condition/ Remark
2.1.1. Capacity	≥ 60.3	Ah	Std. Charge (3.1.1) / Std. discharge (3.1.2)
2.1.2. Energy	≥ 219	Wh	Std. Charge (3.1.1) / Std. discharge (3.1.2)
2.1.3. Nominal Voltage	3.66	V	Avg. voltage during Std. discharge (3.1.2)
2.1.4. Nominal Shipping SOC	60	%	
2.1.5. Standard Charge Voltage	4.2	V	-
2.1.6. Maximum Charge Voltage	4.3	V	-
2.1.7. Over Voltage Protection	4.31	V	-
2.1.8. Standard Discharge Voltage	2.5	V	-
2.1.9. Minimum Discharge Voltage	2.0	V	-
2.1.10. Under Voltage Protection	1.7	V	
2.1.11. Maximum Charge Current	40.2	A	For continuous usage
2.1.12. Maximum Discharge Current	60.3	A	
2.1.13. Operating Temperature	-30~60	ºC	Recommend operating at 25±3 ºC
2.1.14. Storage Temperature	-40~70	ºC	Recommend storage at 25±3 ºC

2.2. Mechanical Specifications

Item	Specification	Descriptions
2.2.1. Feature		Pouch type
2.2.2. Weight	748 ± 10 g	-
2.2.3. W*H*T	354(mm) X 101(mm) X 9.5(mm)	Nominal value of cell dimension Excluding tabs

2.3. Safety Specifications

Abuse Type	Item	Test Condition	Result	EUCAR* Hazard Level
Mechanical	2.3.1. Penetration	Pin Ø1mm, Speed 0.1mm/sec 2mm depth@ 25℃, SOC 100% with 15T Al Jig	≤ L4	L0: No Effect L1: Passive protections activated L2: Defect/ Damage L3: Leakage L4: Venting L5: Fire or Flame L6: Rupture L7: Explosion
	2.3.2. Crush	15% or 100kN Crush @ SOC 100%		
	2.3.3. Impact	Ø15.8±0.1mm bar, 9.1kg rigid mass from 61± 2.5cm @ 25℃, SOC 100% with 1.5T SUS plate		
	2.3.4. Immersion	0.6M NaCl in water for 2hr @ 25℃, SOC 100%		
	2.3.5. Drop	1.5m height onto concrete floor 3 times @25℃, shipping SOC		
Thermal	2.3.6. Heating	130℃ for 1hr @ SOC 100% (Heating rate 5℃/min) with 10T Al Jig		
Electrical	2.3.7. Over-discharge	Discharge 1C for 1hr @ SOC 0%, 25℃ with 10T Al Jig		
	2.3.8. Over-charge	20.1A, 5.0V cut-off or SOC200% @ 25℃ with 10T Al Jig		
	2.3.9. External short	Short circle with 5mΩ for 10min @25℃, SOC 100%, with 10T Al Jig		

* EUCAR: European Council for Automotive R&D

3. Performance Specifications

3.1. Standard Test Condition

Item	Condition
3.1.1. Standard Charge	1/3C Charge to 4.2V / 0.02C Cut-off @ 25±3 ºC, Ambient Humidity.
3.1.2. Standard Discharge	1/3C Discharge to 2.5V @ 25±3 ºC. Ambient Humidity.
3.1.3. Standard Cycle	1/3C Charge to 4.2V/ 0.1C Cut-off @45ºC with 10T Al Jig, Ambient Humidity. 1/3C Discharge to 2.5V @ 45ºC with 10T Al Jig, Ambient Humidity.
3.1.4. Calendar Life	Store cell for 24 weeks @ 35℃, SOC97%

3.2. Electrical Performance

Item	Condition	Spec.
3.2.1. Initial Capacity	Cells shall be charged with Std. charge condition(3.1.1) and discharged with Std. discharged condition(3.1.2)	≥ 60.3 Ah
3.2.2. Cycle Life	Repeat standard cycle[1] (by 3.1.3)	≥ 1,500 cycles @ SOH 70%[2], EOL
3.2.3. Calendar Life	Recovery capacity (by 3.1.4) (SOC 97%, 35ºC @ 24wks)	≥ SOH70% @ 24wks

1) Cycle: One cycle is defined as one charge and one discharge. Rest time between charge and discharge is 30 minutes.
2) SOH: Status of Health, Capacity retention compare to BOL

3.3. C-Rate Characteristic

3.3.1. Charge Capacity

- Test Conditions

  -. Discharge (CC): 1/3C, 2.5 V cut-off @ 25ºC

  -. Charge (CC): Various C-rate, 4.2 V cut-off @ 25ºC

C-Rate	1/3C	0.5C	1C	1.5C	2.0C
Charge Capacity, [CC]%	100%	≥ 93%	≥ 83%	≥ 75%	≥ 70%

3.3.2. Discharge Capacity

- Test Conditions
  -. Charge (CC/CV): 1/3C, 4.2 V / 0.02C cut-off @ 25ºC
  -. Discharge (CC): Various C-rate, 2.5 V cut-off @ 25ºC

Temperature	1/3C	0.5C	1C	1.5C	2.0C
Discharge Capacity	100%	≥ 95%	≥ 93%	≥ 90%	≥ 87%

4. Proper Use and Handling of Lithium-ion Battery Cells

4.1. General Description

- This document has been prepared to describe the appropriate use and handling of lithium-ion battery cell.
- For safety, rechargeable lithium-ion battery cells are shipped in low SOC (voltage).
- Please charge the cells before using the cell.
- To obtain optimal performance and safety, comply with recommended specifications and the instructions below.

4.2. Reverse Connection

- The cell shall be connected, confirming that its poles are correctly aligned.
- Inverse connection shall be strictly prohibited. If the cell is connected improperly, it may be damaged.

4.3. Charging

4.3.1. Charging Current

- Charging current shall be less than maximum charge current specified in the product specifications.

4.3.2. Charging Voltage

- Charging shall be done by voltage less than that specified in the product specifications.
- Over Charge voltage may cause loss of performance characteristics of cell.

4.3.3. Charging Temperature

- The cell shall be charged within a range of specified temperatures in the specifications.

4.4. Discharging

4.4.1. Discharging Current

- The cell shall be discharged continuously at less than maximum discharge current specified in the product specifications. In case of the higher discharge current should be set, it shall be discussed together with SKO.

4.4.2. Discharging Voltage

- The system should equip with a device to prevent further discharging exceeding discharging cut-off

voltage specified in the product specifications.

- Over-discharging may cause loss of performance characteristics of cell.
- Over-discharging may occur by self-discharge if the cell is left for a very long time without any use.

4.4.3. Discharging Temperature

- The cell shall be discharged within a range of temperatures specified in the product specifications. Otherwise, it may cause loss of performance characteristics

4.5. Cycle life

4.5.1. Cycle life performance

- The cell can be charged & discharged repeatedly up to times specified in the product specifications with a certain level of capacity specified in the product specifications.
- Cycle life may be determined by conditions of charging, discharging, operating temperature and/or storage.

4.6. Calendar life

4.6.1. Calendar life performance

- Calendar life may be determined by conditions of storage temperature, SOC and voltage.
- The remaining capacity is maintained up to a certain level and periods specified in the product specifications.

4.7. Storage

4.7.1. General Description

- Store the cell at low temperature between 0~25℃ is recommended, low humidity, no dust and no corrosive gas atmosphere.

4.7.2. Humidity

- The cell is recommended to be stored and used (treated) under low humidity (<= 60% RH).
- High humidity surrounding may cause loss of performance characteristics of cell.

4.7.3. Temperature

- The cell should be stored within a range of temperatures specified in the product specifications. Otherwise, it may cause loss of performance characteristics, leakage and/or rust.

4.7.4. Long-term Storage

- The cell should be used within a short period after charging because long-term storage (over 6 months) may cause loss of capacity by self-discharge.
- If long-term storage is necessary, the cell should be stored at lower voltage within a range specified in the product specifications, because storage with higher voltage may cause more loss of performance characteristics.
- When store the cell for long term, Check the cell voltage or SOC. If voltage or SOC is very low, charge

the cell to prevent cell from loss of performance.

4.8. Battery Pack Assembly

4.8.1. Prohibition of Usage of Damaged Cell

- The cell shall be inspected before packaging from SKO, and not be delivered if any defects are detected.
- The cell should be inspected visually by customer before cell assembly.
- The cell should not be used if scratch, rust, discoloration, dirt, leakage, deformation and/or electrolyte-smell are detected.

4.9. Transportation

- If the equipment (cell and/ or product including cell) is necessary to be transported to such as the customer, other place and/ or third parties etc., careful precautions should be taken to avoid damage of cell.

4.10. Others

4.10.1. Disassembly

- The cell should not be dismantled.
- Internal short-circuit caused by disassembly may lead to heating generation and/or bulging.
- When the electrolyte is coming in contact with the skin or eyes, flush immediately with fresh water and seek medical advice.

4.10.2. Short-circuiting

- Short-circuit results in very high current which leads to heat generation.
- An appropriate circuitry should be employed to protect accidental short-circuiting.

4.10.3. Incineration

- Incinerating and disposing of the cell in fire are strictly prohibited, because it may cause rupture and explosion.

4.10.4. Immersion

- Soaking the cell in water is strictly prohibited, because it may cause corrosion and leakage of components to be damaged to functions

4.10.5. Mixing Use

- Different types, different capacity, or same types but different cell manufacturer's shall not be used, which may lead to cell imbalance, cell rupture or damage to system due to the different characteristics.

4.10.6. Operation

- Before operating (treating and/ or using) the equipment (cell and/ or product including the cell), confirm the voltage, temperature, humidity and connection state etc.

5. Caution and Prohibition

Inaccurate handling of this rechargeable lithium-ion battery cell may cause leakage, heat, smoke, an explosion, or fire. This could cause deterioration of performance or failure. Please be sure to follow instructions carefully.

5.1. Caution

- The cell used in this system may present a risk of fire or chemical burn if mistreated.
- When using the application equipped with the cell, refer to the user's manual before usage.
- Please read the specific charger manual before charging.
- When the cell is not charged after long exposure to the charger, discontinue charging.
- Cell must be charged and/or discharged at operating temperature range and low humidity.
- Cell must be stored at storage temperature range and low humidity.
- Check the positive (+) and negative (-) direction before packing (assembling).
- Cell must be stored separately.
- Cell must be stored in a dry area with low temperature for long-term storage.
- When rust or smell is detected on first use, please return the product to the seller immediately.
- When cell life span shortens after long usage, please exchange to new cells.
- Replace cell with those of SKO only. Use of another cell may cause a risk of fire or explosion.
- The cell must be away from children, babies or pets (animals).
- Cover terminals (+,-) with proper insulating material (such as insulating tape) before disposal.

5.2. Prohibition

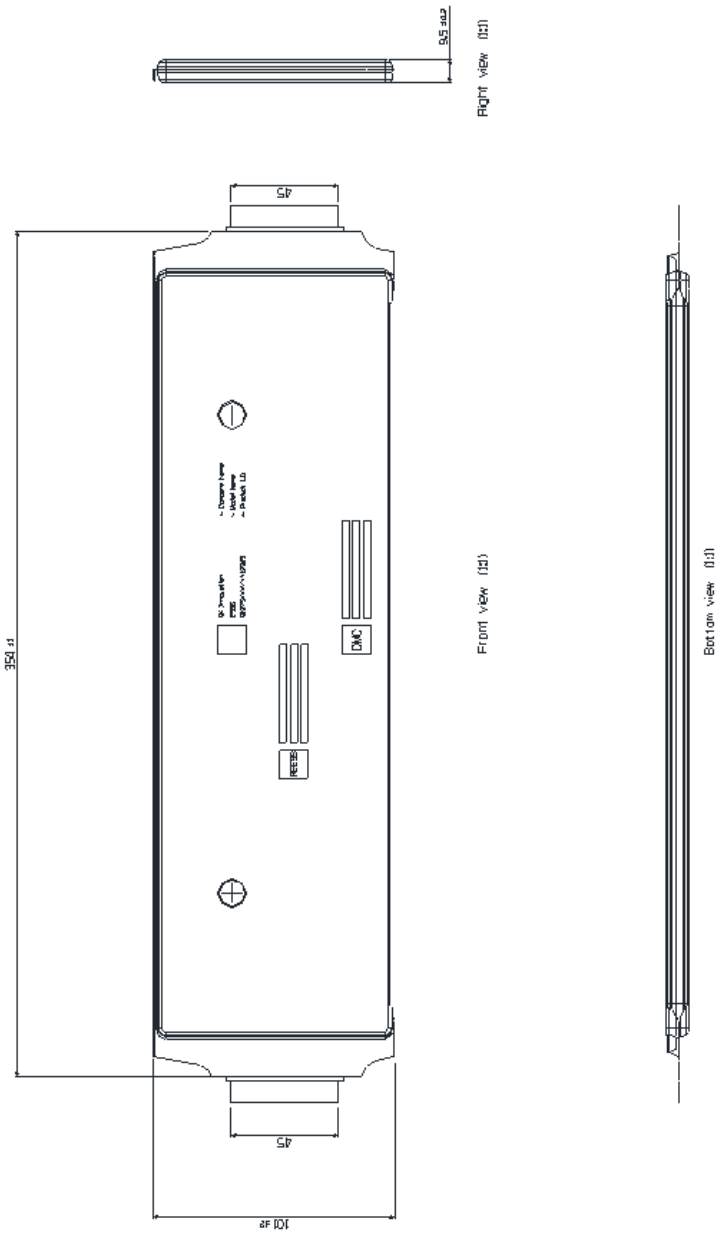
- Do not use or assemble the cell with other manufacturer`s cell.
- Do not use or assemble the cell with different types and/ or model of cell.
- Do not charge or discharge with constant current more than maximum charge/discharge current.
- Do not disassemble or reconstruct the cell.
- Do not use the cell reversed.
- Do not connect directly positive (+) and negative (-) terminal with conductive materials (such as metal, wire, etc.)
- Do not store cell with conductive materials (metallic objects) such as key, tolls, coins, screw, etc.
- Do not solder on cell directly.
- Do not use old and new cells together.
- Do not use with other batteries or cells.
- Do not hit with heavy objects such as a hammer, weight.

- Do not press the cell with overload in manufacturing process and/ or storage etc.
- Do not twits or bend the cell.
- Do not pierce a hole in the cell with sharp things. (such as nail, knife, pencil, drill, awl etc.)
- Do not throw and impact cell.
- Do not use the cell unilaterally without protection device and or logic.
- Do not use the cell in high static energy environment where the protection device can be damaged.
- Do not use (treat) and/or store the cell in high humidity (> 60% RH).
- Do not throw the cell into the fire.
- Do not place the cell in direct sunlight and near high heat (energy) and/or fire.
- Do not put the cell into a microwave or high pressure container.
- Do not allow the cell to be immerged in or wetted with water or sea-water.
- Do not treat (use, assemble, operate) the cell without protection equipment such as insulating gloves, insulation shoes, goggles and etc.

PRODUCT SPECIFICATIONS

Confidential

Appendix. Cell Drawing



End of the Document