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| Dazzle Robotics Private Limited | |
| GenX Pro+ Solid-State Lithium-ion Battery Product Specification | Product: Genx Pro+ 4S1P 30Ah |
| | Release Date: 22-06-2024 |
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Content

1. Scope Application
2. Product Model
3. Product Details
4. Product Specification
5. Battery Performance
6. Visual Inspection
7. Standard Environmental Test Condition
8. Storage and Others
9. Warranty Period and Product Liability
10. Validity Period of Documents

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|--|------------------------------|
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1.Scope Application

This product specification describes the performances and indicators of Solid-State Lithium- ion Batteries produced by Dazzle Robotics Private Limited. Note: The solid-state lithium-ion batteries described in this specification refers to a lithium- ion battery with solid-state technology (based on mixed solid liquid electrolyte).

2.Product Model

GenX Pro+ 14.8V 4S1P 30000Mah

3.Product Details

| Item | Specs |
|---------------------------|------------------------------|
| Length | 203mm |
| Width | 89mm |
| Height | 45mm |
| Connector Cable | UL3135 8AWG |
| Balance Connector Cable | UL3239 22AWG |
| Balance Connector | JST-XH-5P |
| Discharge Connector | XT90-S |
| Cell Specs | 3.7V 30Ah Solid State Li-Ion |
| Cell Configuration | 4S1P |
| External Metal Protection | Optional Not standard |
| Packing | Heat Shrink Sleeve |

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4. Product Specification

| NO. | Items | Specifications |
|-----|-----------------------|---|
| 1 | Nominal Capacity | 30Ah (0.5C) |
| 2 | Nominal Voltage | 14.8V |
| 3 | Charging Voltage | 16.8V |
| 4 | Cut-Off Voltage | 11.2V |
| 5 | Charging Method | Ultrafast 2C(60A) constant current (CC) charge to 16.8V, then constant voltage (CV) charge till charge current decline to $\leq 0.02C(0.6A)$. |
| | | Fast 1C(30A) constant current (CC) charge To 16.8V, then constant voltage (CV) charge till charge current decline to $\leq 0.02C(0.6A)$. |
| | | Standard 0.5C(15A) constant current (CC) charge to 16.8 V, then constant voltage (CV) charge till charge current decline to $\leq 0.02C(0.6A)$. |
| 6 | Dis-Charging Method | Pulse 10C (220A, duration $\leq 10s$) |
| | | High Rate 5C-7C (150A-210A) |
| | | Fast 3C (90A) |
| | | Standard 0.5C (15A) |
| 7 | Cycle Life | 800 Cycles (0.5C/0.5C; 100%DOD) |
| | | 500 Cycles (0.5C/3C; 100%DOD) |
| | | 300 Cycles (0.5C/5C; 80%DOD) |
| 8 | Operating Temperature | Charge: 0°C~45°C Discharge: -20°C~55°C |
| 9 | Storage Temperature | Short-term(one month): -20°C~45°C Long-term(six months): -10°C~35°C |
| 10 | Store Humidity | < 75%RH |
| 11 | Energy Density | Weight Specific Energy: > 270Wh/Kg(0.5C/0.5C) Volume Specific Energy: > 560Wh/L (0.5C/0.5C) |
| 12 | Internal Resistance | 5±0.5mΩ |
| 13 | Weight | 1.7kg±50g |

5. Battery Performance

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| 5.1 Electrochemical Characteristics of cell level | | | |
|---|---|---|---|
| NO. | Items | Criteria | Test Methods |
| 1 | Discharge Performance at Room Temperature | Discharge Capacity/ Nominal Capacity $\times 100\%$ $0.5C \geq 100\%$ $3C \geq 95\%$ $5C \geq 90\%$ | Standard charge (0.5C) under the condition of 1 atm, $20 \pm 5^\circ\text{C}$ and $\leq 75\%$ RH, discharge at 0.5C/3C/5C to 2.75V; Charge/discharge can be cycled for 3 times before meeting the standards. |
| 2 | Capacity Retention | Residual Capacity \geq Nominal Capacity $\times 90\%$ Restore Capacity \geq Nominal Capacity $\times 95\%$ | Standard charge (0.5C, CC-CV) and store for 28 days, then discharge to 2.75V at 0.5C, then measure residual capacity. 0.5C/0.5C measure restore capacity. Charge /discharge cycle can be conducted for 3 times before meeting the standards. |
| 3 | Cycle Life | Capacity \geq Initial Capacity $\times 80\%$ | Conduct 0.5C/0.5C cycle for 800 times. The discharge capacity shall be measured after 800 cycles. Conduct 0.5C/3C cycle for 500 times. The discharge capacity shall be measured after 500 cycles. Conduct 0.5C/5C cycle for 300 times. The discharge capacity shall be measured after 300 cycles. |
| 4 | Discharge Performance at Low Temperature | Capacity \geq Nominal Capacity $\times 80\%$ | Standard charge (0.5C, CC-CV) and rest for 8h at -20°C , then discharge to 2.75V at 0.5C, measure the final capacity. |
| 5 | Discharge Performance at High Temperature | Capacity \geq Nominal Capacity $\times 98\%$ | Standard charge (0.5C, CC-CV) and rest for 4h at 55°C , then discharge to 2.75V at 0.5C, measure the final capacity. |
| 6 | Storage Performance | Capacity \geq Nominal Capacity $\times 100\%$; 3 months $\geq 90\%$; 6 months $\geq 85\%$; 12 months $\geq 80\%$ | Measure initial status and initial capacity. Standard charge and store for 3 months, 6 months and 1 year respectively. Measure the final capacity, then charge and discharge at capacity. |

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5.2 Electrochemical Characteristics

| NO. | Items | Criteria | Test Methods |
|-----|---------------------|---|---|
| 1 | Overcharge | No fire No explosion | Charge to 4.6V at 1.5C after standard discharge at 0.5C: stop charging if charging duration ≥ 7 h or the surface temperature of battery is 20% lower than of the peak value. |
| 2 | Forced-Discharge | No fire No explosion No leakage | Reverse charge at 1C for 90min after standard discharge at 0.5C, then observe for at least 1h. |
| 3 | Short Circuit | No fire No explosion Temperature $\leq 150^{\circ}\text{C}$ | After standard charge (0.5C, CC-CV), put the battery into a ventilation cabinet and connect the positive and negative terminals directly by a $80 \pm 20\text{m}\Omega$ wire for 1h at $20 \pm 5^{\circ}\text{C}$, stop testing when the battery temperature is 20% lower than the peak value, or the short-circuit duration ≥ 24 h. |
| 4 | Low Pressure | No fire No explosion No leakage | After 0.5C standard constant current and constant voltage charging, put the battery in a $20 \pm 5^{\circ}\text{C}$ empty chamber. Vacuum until the internal pressure drops to 11.6kPa, then keep for 6h. |
| 5 | Temperature Cycling | No fire No explosion No leakage | <ol style="list-style-type: none"> 1. The battery is charged according to the standard charging method: 2. Put the battery in a room temperature box, and do the following steps: <ul style="list-style-type: none"> >The temperature box was heated up to 75°C within 30 min and kept for 6h; >Temperature box temperature was cooled down to -40°C within 30min and kept for 6h. >Repeat the above steps for 10 times. |
| 6 | Dropping | No fire No explosion No leakage | After the battery is charged at 0.5C with standard constant current and constant voltage, the battery is dropped onto a concrete slab form 1m height. The battery is dropped for 6 times so as to obtain impactcs from every surface/side. |

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| | 7 | Crushing | No fire No explosion | 1.The battery shall be charged according to 0.5C standard charging method 2.The crushing method is as follows: The crushing direction is vertical to the plate direction; The size of the plane pressing plate is larger than the battery surface; 3.The crushing pressure is $13\pm 0.78\text{kN}$; Stop crushing when the pressure reaches the specific value. |
| | 8 | Vibration | No fire No explosion | After standard charging at 0.5C, the battery is set on the vibrating table under the condition of $20\pm 5^{\circ}\text{C}$ for 1h.The test equipment is adjusted according to the following vibration frequency and corresponding amplitude.The frequency of vibration in each direction of X. Y and Z is cyclically swept from 10Hz to 55Hz for 30min, and the frequency sweeping rate of 1oct/min: A) Vibration frequency: 10Hz~ 30Hz; Displacement amplitude (single amplitude): 0.38mm; B) Vibration frequency: 30Hz~55Hz; Displacement amplitude (single amplitude): 0.19mm; After frequency scanning, test the final state of the battery and observe the changes of the battery appearance. |
| | 9 | Thermal Abuse | No fire No explosion | Rest for 1h at $20\pm 5^{\circ}\text{C}$ after standard charge (0.5C, CC-CV) of the battery.Then ,Put the battery into an oven and heating from room temperature to $130\pm 2^{\circ}\text{C}$ at the rate of $5\pm 2^{\circ}\text{C}/\text{min}$.After keeping the temperature for 30 min, the heating was stopped and then observe for 1h. |

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6. Visual Inspection

There shall be no such defects as scratch, flaw, crack, and leakage, which may adversely affect the commercial value of the battery.

7. Standard Environmental Test Condition

Unless otherwise specified, all tests stated in this Product Specification are conducted at below condition: Temperature : $20\pm 5^{\circ}\text{C}$, Humidity : $\leq 75\%RH$
Atmosphere : 86KPa ~ 106KPa

8. Storage

8.1 Long Time Storage : If the battery is to be stored for a long time (over 3 months), the battery should be stored in dry and cool place.

The battery should be charged and discharged every six month. The battery's storage voltage should be 3.6~3.75V and the battery is to be stored at the condition as NO.7.

8.2 Others : Any matters which have not been covered in this specification should be conferred between the customer and Others

9. Warranty Period and Product Liability

(1) Warranty period of this product is 3 months from the production date.

(2) Dazzle Robotics Private Limited is not responsible for the troubles caused by Mishandling of the battery which is clearly against the instructions in this specification.