Product Specification

46mm ∅ Hybrid ultracapacitor cell (HUC)– weldable type
Type: H46W-4R2-0006 (4695 6Ah)

- Rated voltage 2.8-4.2VDC
- 6Ah capacity
- Max energy density 73 Wh/kg
- High cycle life of 50'000 cycles at 10C
- Good linear charge and discharge behaviour
- Laser-weldable terminals

APPLICATION

Scope

This product specification applies to the cylindrical HUC type C46W-4R2-0006. Please follow the details and methods given in this specification and contact us if you have any questions or comments about the cells or the test methods, or if you need additional information.

ELECTRICAL SPECIFICATIONS

Item		Value	Note
1 Capacity		6 Ah	1.0 I_1 discharge
2 Median voltage		3.7 V	
3 Internal resistance		≤0.55 mΩ	@25℃, 50% SOC, 1kHz AC
4 Charge cut-off voltage		4.20 V	
5 Discharge cut-off voltage		2.80 V	@25℃, (min voltage 2.5V)
6 Max continuous charge current		120 A	
7 Max 10s charge current		300 A	@25℃, 50% SOC
8 Max continuous discharge current		180 A	
9 Max 10s discharge current		480 A	@25℃, 50% SOC
10 Weight		290 ±10 g	
11 Operating temperature	Charge	-35~+55 °C	
	Discharge	-40~+60 °C	
12 Storage temperature	1 month	-40~+60 °C	50% SOC, recharge once each 3 months
	6 months	-40~+50 °C	50% SOC, recharge once each 3 months

In this specification I_1(A)= 6A, SOC: state of charge, DOD: depth of discharge

APPEARANCE AND DIMENSION			
Appearance	Clean surface, no electrolyte leaking, no obvious scratch and mechanical damage, no deformation, and no other apparent defect.		
Boundary dimension	Diameter	45.6 mm	(25 ±2°C)
	Height	94 mm	(25 ±2°C)

PERFORMANCE

Standard test condition

The test conditions in the product specification except other special requirements is 25 ±2°C and 65 ±2%RH. The room temperature is 25 ±2°C in the specification.

Perform all tests with HUC cells well contacted with the test instrument.

Test equipment

The precision of the measuring equipment should ⩾ 0.01 mm.

The accuracy of the multimeter to measure the voltage and current should not be less than level 0.5, and the internal resistance should not be less than 10kΩ/V.

Internal resistance tester: AC impedance method (1kHz LCR).

The current accuracy of the cell test system should be above ±0.1%, the constant voltage accuracy should be ±0.5%, and the timing accuracy should be not less than ±0.1%.

The accuracy of temperature measuring equipment should not be less than ±0.5°C.

Charge method

The charge method is constant current and then constant voltage charging at 25 ±2℃. The current unit applied for constant current charging is 1I1(A), the cut-off voltage of constant voltage charging is 4.2V.

When the compensating cut-off current drops to 0.05 I1(A) during constant voltage charging, the charging can be terminated. Then the cell shall rest for 1h.

Shelve time

The charge method is constant current and then constant voltage charging at 25 ±2℃. The current unit applied for constant current charging is 1I1(A), the cut-off voltage of constant voltage charging is 4.2V.

When the compensating cut-off current drops to 0.05 I1(A) during constant voltage charging, the charging can be terminated. Then the cell shall rest for 1h.

Initial performance test

Specific test items and standards are shown in the following table.

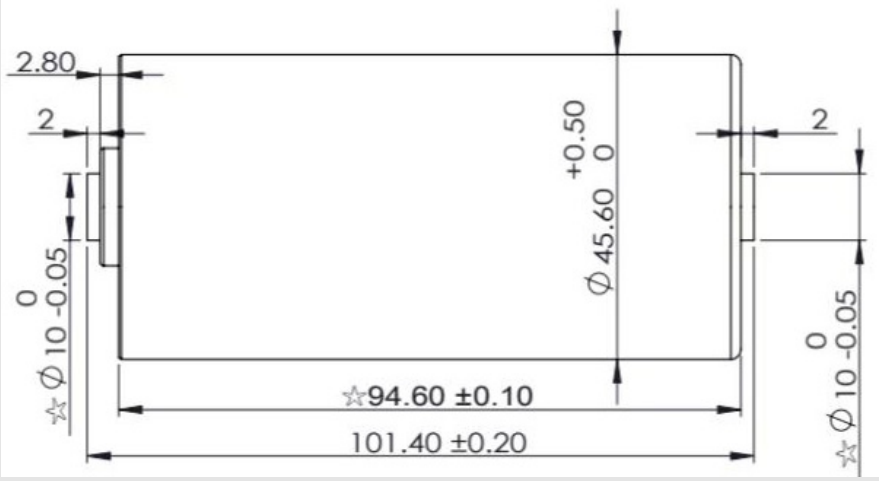
INITIAL PERFORMANCE TEST

No.	Item	Test description and method	Standard
1	Appearance and dimension	Visual inspection and measurement with caliper	No obvious scratch, no deformation, no electrolyte leaking. Dimensions according to the drawing
2	Weight	Measure with an analytical balance	290 ±10g
3	Open-circuit voltage	Charge according to 5.3, measure the open-circuit voltage within 1h after charging	≥4.150V

4	Nominal discharge capacity	Charge according to 5.3 for 1h, discharge to 2.8V with a current of 1 I_1(A) and record capacity. The above cycle is repeated for 5 times. When the range of three consecutive test results is less than 3%, the test can be terminated and the average of the three test results is taken	1 I_1 (A) capacity ≥ nominal capacity
5	Max charge current	Charge according to 5.3, discharge to 2.8V at 1 I_1(A) and record capacity. Constant current charging at n I_1(A) until the voltage reaches 4.2V, followed by constant voltage charging at 4.2V until the current drops to 0.05 I_1(A). 50% SOC: Charge according to 5.3, discharge at 1 I_1(A) for 0.5h. Constant current charging at n I_1(A) until the voltage reaches 4.2V	20 I_1 (A) (continuous charge/discharge) 50 I_1 (A) (10s, 50% SOC)
6	Max discharge current	Charge according to 5.3, discharge to 2.8V at 1 I_1(A) and record capacity. Charging at 1 I_1(A) and discharge to 2.8V at n I_1(A). 50% SOC: Charge according to 5.3, discharge at 1 I_1(A) for 0.5h, discharge at n I_1(A) until the voltage reaches 2.8V	30 I_1 (A) (continuous charge/discharge) 80 I_1 (A) (10s, 50% SOC)
7	Charge/discharge cycle life	Charge according to 5.3, discharge at 1 I_1 (A) until the voltage reaches 2.8V. Cycle for more than 5000 times and record capacity	Surplus capacity ≥80% nominal capacity or energy throughput ≥0.5MWh
8	Charge retention capability	Charge according to 5.3, keep the cell in open circuit at 25 ±2°C for 30d, and then constant current discharge at 1 I_1 (A) until the voltage reaches 2.8V and record capacity. After charging according to 5.3, keep the cell in oven at 60 ±2°C for 7d, then keep the cell at RT for 5h, then discharge at 1 I_1 (A) until the voltage reaches 2.8V and record capacity	Capacity ≥90% of nominal capacity
9	High-temperature capability	Charge according to 5.3, keep the cell in a temperature cabinet at 60 ±2°C for 5h, then discharge at 1 I_1(A) until the voltage reaches 2.8V and record capacity	Capacity ≥95% of nominal capacity
10	Low-temperature capability	Charge according to 5.3, keep the cell in a low-temperature cabinet at -20 ±2°C for 20h, then discharge at 1 I_1(A) until the voltage reaches 2.8V and record capacity	Capacity ≥80% of nominal capacity
11	Low-pressure	Charge according to 5.3, keep the cell for 6h in a low-pressure cabinet at 25 ±2°C and adjust the pressure to 11.6kPa, observe for 1h	No leaking, fire, explosion
12	Short circuit	Charge according to 5.3, then connect the positive and negative poles of cell for 10min by the external circuit. The resistance of the external circuit should be less than 5mΩ, observe for 1h.	No fire, explosion
13	Over-charge	Charge according to 5.3, constant current charging at 1 I_1(A) until the voltage achieves 1.5 times the charging termination voltage specified in the specification or the charging time reaches 1h, observe for 1h	No leaking, fire, explosion
14	Over-discharge	Charge according to 5.3, discharge at 1 I_1(A) for 90min, observe for 1h.	No fire, explosion

15	Over-heating	Charge according to 5.3, put the cell into the temperature cabinet, which increases from RT to 130°C ±2°C at the rate of 5°C/min, then stop heating and keep this temperature for 30min, observe for 1h	No fire, explosion
16	Nail penetration	Charge according to 5.3, put the cell connected with the thermocouple into the fume hood. Use a Φ5.0~Φ8.0mm high temperature resistant steel needle (the cone angle of the needle tip is 45°~60°, and the surface of the needle is smooth, free of rust, oxide layer and Oil pollution). Penetrate the needle at a speed of 25 ±5 mm/s, in the middle of the cell and perpendicular to the cell axis, through the cell. The steel needle stays in the cell, observe for 1h	No fire, explosion
17	Crushing	Charge according to 5.3, put the cell connected with the thermocouple into the fume hood. Use a plate with a semi-cylindrical body with a radius of 75mm and a length greater than the size of the cell. Squeeze the plate by applying pressure, in the middle of the cell and perpendicular to the cell axis at a speed of 5 ±1 mm/s. Stop crushing when the cell voltage reaches 0V or the deformation reaches 30% or the crushing force reaches 200kN. Observe for 1h	No fire, explosion
18	Drop	Charge according to 5.3, the cell is dropped from a height of 1.5 m onto the concrete floor. Observe for 1h	No leaking, fire, explosion
19	Seawater immersion	Charge according to 5.3, keep the cell completely submerged in 3.5wt% NaCl liquid (simulating seawater composition at normal temperature) for 2h. Observe for 1h	No fire, explosion
20	Temperature cycle	Charge according to 5.3, put the cell in a temperature cabinet. The temperature is adjusted according to the requirement in 6.2.10 of GB/T31485-2015, and cycle 5 times. Observe for 1h	No fire, explosion

CELL DIMENSIONS



NOTES

1. Charge

   Overcharging is strictly prohibited and the charging voltage should under no circumstances be higher than 4.3V.
   No reverse polarity charging. 15-35°C is the best temperature for charging. Long-term charging at a temperature below 15°C shall be avoided.

2. Discharge

   Short circuit is not allowed.
   Discharge voltage should under no circumstances be less than 1.8V.
   15-35°C is the best temperature for discharging. Long-term charging at a temperature below 15°C shall be avoided.

3. Storage and use

   For short-time storage (within 1 month), the cell should be placed in a clean environment with a humidity lower than 65% RH and a temperature of -30~60°C. Keep the cell at a charge state of 50% SOC.
   For long-time storage (within 6 months), the cell should be placed in a clean environment with a humidity lower than 65% RH and a temperature of -10~35°C. Keep the cell at a charge state of 50% SOC.
   Recharge once every 3 months.

4. Transportation

   The cell should always be kept at a state of charge of 50% SOC and protected from strong vibration, shock, sunlight and moisture.

5. Quality assurance

   The cell should always be kept at a state of charge of 50% SOC and protected from strong vibration, shock, sunlight and moisture.
   If you wish to operate or use the cell under conditions other than those described in the specification, please contact us in advance.
   We accept no responsibility for accidents caused by using the cell outside the conditions described in the specification.

6. Keep the cell away from children.

WARNING

7. Do not heat, modify or disassemble the cell. This is very dangerous and can cause electrolyte to leak, the cell to overheat, catch fire, explode, etc.

8. Do not expose the cell to extreme heat or fire, and do not put the cell in direct sunlight.

   Do not connect the positive and negative terminals of the cell directly to metal or other wires, as this will cause a short circuit and the cell may catch fire or even explode.

9. Do not inverse cell polarity.

10. Do not immerse the cell in seawater or water, and do not make it hygroscopic.

11. The cell must not be subjected to strong mechanical loads.

    Do not weld the cell directly, as overheating may cause deformation of the cell components (e.g. seals), resulting in deformation, electrolyte leakage, fire and explosion.

12. Do not use cells that are crushed, dropped, shorted, leaking or have any other problem.

13. In a module or cell pack, the housings of adjacent cells should not touch.

14. The cell should be stored and used away from static electricity.

    Do not use HUC cells with other primary cell or secondary cells. Do not use cells of different packages, models or other brands together.

    If the cell becomes hot quickly, smells, discolors, deforms or shows other reactions during use, please stop immediately and take appropriate measures.

    If leaking electrolyte from the cell comes into contact with skin or clothing, then immediately rinse the affected area with water to avoid skin irritation.

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