Lithium-ion Battery Product Specification

Model：DLP71173207-280Ah

EES-LIB-LFP/C-L-HS-Cell-3.2V-476W-448W-952W • h-896W • h-DLP71173207

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Signature：					

Customer Approval	Company	
	Signature	
	Company signet	

1. Purpose

The specification sheet is designed to build up and improve technical documentation so as to instruct production and product shipment and consequently guarantee product quality. At the same time, it is convenient for to confirm product specifications with customers and finally reach an agreement.

2. Scope

This product specification describes the type, size, structure, electrochemistry performance, safety characteristics, warning and cautions of the cell. This specification only applies to the cell that supplied by Hunan Desay Battery Co., Ltd.

3.Battery Specification

3.1

Model : DLP71173207-280Ah

3.2

Specification: EES-LIB-LFP/C-L-HS-Cell-3.2V-476W-448W-952W • h-896W • h-DLP71173207

Remarks: Specification marking rules: EES(Electrical energy storage)-LIB(Lithium ion battery)-A1/A2(Battery positive/negative material)-A3(Electrolyte morphology)-A4(Shell type)-Level (Hierarchy(Cell/Module/Cluster))-U_{nom}(Nominal voltage)-P_{rc}(Rated charging power)-P_{rd}(Rated Discharging power)-E_{rc}(Rated charging energy)-E_{rd}(Rated discharging energy)-A5(Battery model)

4.Battery Property

Item	Specification
Nominal capacity	285Ah(25±2℃，P_{rc}/P_{rd}，3.65-2.5V，BOL)
Rated capacity	280Ah(25±2℃，P_{rc}/P_{rd}，3.65-2.5V，BOL)
Rated charging energy	952Wh(25±2℃，P_{rc}/P_{rd}，3.65-2.5V，BOL)
Rated discharging energy	896Wh(25±2℃，P_{rc}/P_{rd}，3.65-2.5V，BOL)
Mass energy density	165Wh/kg (P_{rc}/P_{rd}，BOL)
Volume energy density	350Wh/L (P_{rc}/P_{rd}，BOL)
Charging cut-off voltage	3.65V
Discharging cut-off voltage	2.5V(> 0℃)，2.0V(≤0℃)
Nominal voltage	3.2V
Rated charging power	476W(P_{rc})
Rated discharging power	448W(P_{rd})
Maximum pulse discharging current	560A (2.0C/30s，SOC≥30%)
Cell Weight	5.47±0.15 kg

Cell Dimension	Thickness:71.8±0.5mm Width: 173.7±0.5mm Height: 206.9±0.5mm
Operating Temperature	Charge: 0 ~ 55℃ Discharge: -20 ~ 55℃
Storage Temperature	-30～60℃ (if the battery is expected to be stored for more than 30 days, the SOC should be adjusted to 50% every three months)
Storage humidity	≤ 95% ROH, no condensation
Altitude	≤4500m
Shipment status	17~40%SOC
Residual capacity loss	Per month ≤3.0%(30~50% SOC，25±2℃)

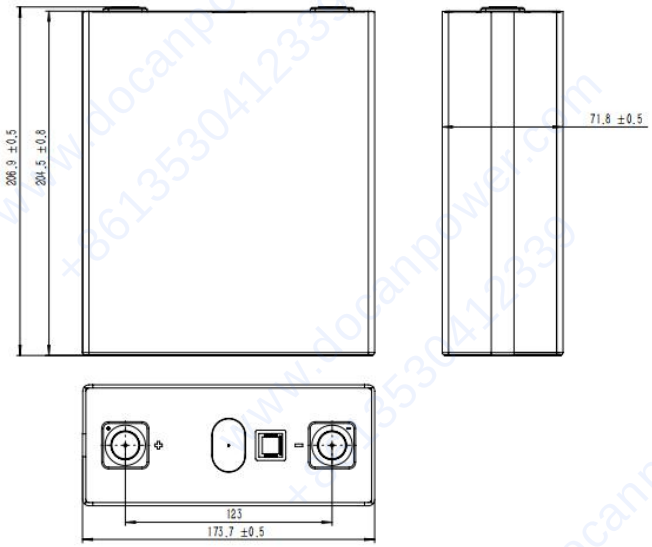
5. External interface parameters of battery

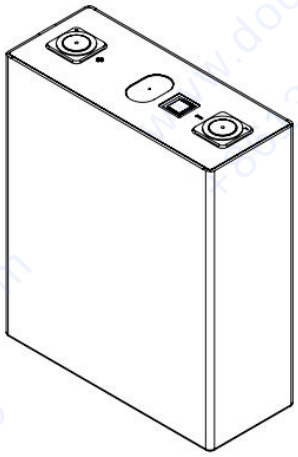
Item	Specification
Diameter of pole	16±0.2mm

Pole welding area boundary	Welding area: φ2.8~φ14.0mm Maximum penetration: 2.2mm Welding temperature: 150℃, time≤5s Change in compression of the sealing ring before and after welding: ≤10% Melting of plastic at the pole is strictly prohibited during welding.
Requirements for pole location hole	Diameter 2.8 ± 0.2mm cylindrical bore + diameter 2.8±0.2mm tapered bore
Extrusion pressure requirement for the pole	+Z direction Max: 500N -Z direction Max: 500N
Shear pressure requirements for the pole	X Y direction Max: 500N
Torsion requirements for the pole	≤6 Nm
	The pressure for the battery top: 500N Max
Preload requirements for assembly	500~5000N, no deformation of the shell with uniform stress on the battery
Preload requirements during the cycle	200~300Kgf
The expansion pressure of the battery (life cycle)	The maximum expansion pressure of the battery ≤ 36KN, fading to 80% The maximum expansion pressure of the battery ≤ 50KN, fading to 70%
The maximum expansion pressure of the	64KN

Battery QR code level	⩾C class

6.Appearance and Dimension (Unit: mm)





Appearance and Dimension of cell

#	Note	Size	tolerance	note
1	H	206.9	±0.5	
2	W	173.7	±0.5	
3	T	71.8	±0.5	
4	Center distance	123	±0.5	
Note: Use a flat plate thickness gauge, measuring pressure 2kN, 3sec				

There shall be no such defect as leakage, scratch, damaged, obvious scratch which may adversely affect commercial.

7. Standard Test Conditions

Standard environmental conditions: Unless otherwise specified, all tests stated in this specification are conducted at temperature 25±2℃, humidity 15%~90% and air pressure between 86kPa to 106kPa.

8. Performances and Test Method

8.1

Standard charging：Charge the cell with constant power P_{rc} to 3.65V，rest 10min.

Standard discharging：Discharging the cell with constant power P_{rd} to 2.5V，rest 10min.

Initialized charging： Leave the cell at 25±2 ℃ for 5h, the cell according to standard discharge then according to standard charge.

Initialized discharging： Leave the cell at 25±2 ℃ for 5h, the cell according to standard charge then according to standard discharge.

8.2 Electrochemistry performance

No	Item	Criteria	Test Method and Condition
1	Rated Capacity	≥280Ah	The battery was charged and discharged according to the standard method, repeated 3 times, to test three times the mean discharge capacity for results.
2	ACR	≤0.3 mΩ	AC impedance of the cell is measured at 1kHz and 50%SOC after standard charging.
3	Initialized charging/discharging performance	Initialized charging energy ≥ Rated charging energy Initialized discharging energy ≥ Rated discharging energy 5℃ Energy efficiency ≥80% 25℃ Energy efficiency ≥93% 45℃ Energy efficiency ≥93%	25±2°C initialized charge/discharge performance: 1)Initialized discharge the battery; 2)Charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 3)Discharge the battery to the termination voltage at a constant power of P_{rd}, and rest for 10min. 45±2°C initialized charge/discharge performance: 1)Initialized discharge the battery; 2)The battery is left to rest for 16h at 45±2°C; 3)At 45±2°C, charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 4)At 45±2°C, discharge the battery to the

				termination voltage at a constant power of P_{rd}, and rest for 10min. 5±2°C initialized charge/discharge performance: 1)Initialized discharge the battery; 2)The battery is left to rest for 20h at 5±2°C; 3)At 5±2°C, charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 4)At 5±2°C, discharge the battery to the termination voltage at a constant power of P_{rd}, and rest for 10min.
	4	Initialized charging/discharging performance in high altitude（Suitable for high altitude）	Initialized charging energy ≥ Rated charging energy Initialized discharging energy≥ Rated discharging energy Energy efficiency ≥93%	1)Initialized discharge the battery; 2)Place the battery in a low-pressure test device, set the test pressure, and left it to rest for 6h at 25±2°C; 3)Charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 4)Discharge the battery to the termination voltage at a constant power of P_{rd}, and rest for 10min.
	5	Power characteristic	Under different charging/ discharging power conditions: Charging energy ≥Rated charging energy Discharging energy ≥ Rated discharging energy Energy efficiency≥93%	1)The battery is left to rest for 5h at 25±2°C; 2)Discharge the battery to the termination voltage at a constant power of 100%P_{rd}, and rest for 10min; 3)Charge the battery to the termination voltage at a constant power of 100%P_{rc}, and rest for 10min; 4)Discharge the battery to the termination voltage at a constant power of 100%P_{rd}, and rest for 10min.; 5)Repeat steps 2) ~ 4), take 5% of the rated charging/discharging power as a step, reduce the charging/discharging power to 5% of the rated charging/discharging power one by one.

	6	Rate charging/ discharging performance	$2P_{rc}/P_{rc}$ Charge energy retention rate ≥95% $2P_{rd}/P_{rd}$ discharge energy retention rate ≥95% $2P_{rc}/2P_{rd}$ energy efficiency ≥90%	1)Initialized discharge the battery; 2)Charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 3)Discharge the battery to the termination voltage at a constant power of P_{rd}, and rest for 10min; 4)Charge the battery to the termination voltage at a constant power of $2P_{rc}$, and rest for 10min; 5)Charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 6)Discharge the battery to the termination voltage at a constant power of $2P_{rd}$, and rest for 10min; 7)Discharge the battery to the termination voltage at a constant power of P_{rd} and rest for 10min; 8)Charge the battery to the termination voltage at a constant power of $2P_{rc}$, and rest for 10min; 9)Discharge the battery to the termination voltage at a constant power of $2P_{rd}$.
	7	Energy retention and energy recovery	Retention rate of energy ≥95% Recovery rate of charging energy ≥ 95% Recovery rate of discharging energy ≥ 95%	1)Initialized charge the battery; 2)The battery is left to rest for 30d at 45±2°C; 3)The battery is left to rest for 5h at 25±2°C; 4)Disharge the battery to the termination voltage at a constant power of P_{rd}, and rest for 10min; 5)Charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 6)Disharge the battery to the termination voltage at a constant power of P_{rd}.

8	Low temperature adaptability	Charging energy ≥ Rated charging energy Discharging energy ≥ Rated discharging energy Energy efficiency ≥93%	1)Initialized charge the battery; 2)The battery is left to rest for 24h at -30±2°C; 3)The battery is left to rest for 24h at 25±2°C; 4)Disharge the battery to the termination voltage at a constant power of P_{rd}, and rest for 10min; 5)Charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 6)Disharge the battery to the termination voltage at a constant power of P_{rd}.
9	High temperature adaptability	Charging energy ≥ Rated charging energy Discharging energy ≥ Rated discharging energy Energy efficiency ≥93%	1)Initialized charge the battery; 2)The battery is left to rest for 24h at 50±2°C; 3)The battery is left to rest for 12h at 25±2°C; 4)Disharge the battery to the termination voltage at a constant power of P_{rd}, and rest for 10min; 5)Charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 6)Disharge the battery to the termination voltage at a constant power of P_{rd}.
10	Cycle Life	6000 cycles, Remaining capacity≥196Ah	25℃，Under the pressure condition of 200±20 kgf, the battery was charged and discharged standardly, Circular 6000 times. Test batteries current capacity. Under (25±2) ℃, the current capacity calibration test according to the following steps: a) Cell with 0.5C current to constant exile electric voltage, let stand for 30 min. b) Charge at a constant current and voltage of 0.5C to the termination voltage, with a cut-off current of 0.05C, let stand for 30 min. c) Battery in 0.5C current to constant exile electric voltage, let stand for 30 min, record the capacity of current capacity.

No.	Item	Criteria	Test Method and Condition
11	Storage	Recovery rate of charging energy ≥ 96.5% Recovery rate of discharging energy ≥ 96.5%	1)Initialized charge the battery; 2)Disharge the battery to 50% of the initialized discharging energy at a constant power of P_{rd}; 3)The battery is left to rest for 30d at 50±2°C; 4)The battery is left to rest for 5h at 25±2°C; 5)Disharge the battery to the termination voltage at a constant power of P_{rd}, and rest for 10min; 6)Charge the battery to the termination voltage at a constant power of P_{rc}, and rest for 10min; 7)Disharge the battery to the termination voltage at a constant power of P_{rd}.
8.3 Safety Performances			
1	Crush Test	No leakage, no smoke, no fire, no explosion, no damage occurred at locations other than valves or leak points.	After Initialized charging, the battery shall be operated as follows： Crush direction: perpendicular to the largest surface of the battery Indenter type: a semi-cylinder with a radius of 75 mm and a length greater than the size of the extruded surface of the core Crush speed: 5 mm/s Crush extent: the battery is extruded until the extrusion pressure reach 50 kN, keep the pressure for 10min, stop crushing and observe for 1 h.
2	Short circuit Test	No fire, no explosion, no damage occurred at locations other than valves or leak points.	Initialized charge the battery, the short-circuit test device is connected to the positive and negative poles of the battery, and the resistance of the device is adjusted to 0.8~1.0mΩ. The device is then activated to create a current loop between the positive and negative poles of the battery for 10 min. Afterward, the current loop is disconnected, and observe for 1h.
3	Drop Test	No smoke, no fire, no explosion, no damage occurred at locations other than valves or leak points.	Initialized charge the battery, the battery tab down from 1.5 m high free fall to the cement ground with the tab towards the ground,observe for 1 h.

4	Overcharge Test	No fire, no explosion, no damage occurred at locations other than valves or leak points.	Initialized charge the battery, charge the battery to 1.5 times of the termination voltage or charging time reach 1h with the constant current of $I=P_{rc}/U_{nom}$, observe for 1 h.
5	Overdischarge Test	No leakage, no smoke, no fire, no explosion, no damage occurred at locations other than valves or leak points.	Initialized discharge the battery, discharge the battery to 0V or discharging time reach 1h with the constant current of $I=P_{rd}/U_{nom}$, observe for 1 h.
6	Overload performance	No leakage, no smoke, no fire, no explosion, no damage occurred at locations other than valves or leak points.	1)Initialized discharge the battery; 2)Charge the battery to the termination voltage at a constant power of $4P_{rc}$, and rest for 10min; 3)Discharge the battery to the termination voltage at a constant power of $4P_{rd}$, and observe for 1 h.
7	Adiabatic temperature rise characteristic	1)When the surface temperature of the battery temperature the highis at or below primary alarm temperature, thetemperature rise rates ＜0.02℃/min; 2)no fire, no explosion, no damage occurred at locations other than valves or leakpoints.	1)The battery is placed in the tester after initial charging; 2)Heat the battery until the surface temperature reaches 40℃, and maintain this temperature for 5h; 3)Increase the temperature to 45℃, and maintain it for 1h; 4)Keep the device at the current temperature for 20 min; 5)Repeat steps 3)~4) in 5℃ increments until the battery surface temperature reaches 130℃.

8	Thermal runaway	No fire, no explosion, no damage occurred at locations other than valves or leak points.	1)The battery is placed in the thermal runaway tester after initial charging; 2)Charge the battery with the constant current of $I=P_{rc}/U_{nom}$, and heating; 3)Trigger the judgement conditions of thermal runaway or when the temperature reaches 300℃ or the test time reaches 4h, stop charging and heating, observe for 1h; 4)Determination conditions of thermal runaway: three successive temperature rise rates ≥3℃/s or fire or explosion.

Remark: The cell safety performance meet GB/T 36276-2023 standard requirement.

9.Warning and Caution

Cells must be applied in strict accordance with the specification. Abused of a battery may cause the battery to get heat, ignite, or explode and cause serious injury. Hunan Desay battery Co.,Ltd has no legal liability on any overheat, fire, explosion or other situations when the cells are used not according to the specifications. Be sure to abide by the safety rules as following:

*Do not disassemble cells; Do not put cells in water or fire.

*Please charge the cells with specified charger and follow the specifications

The cells can only be used in the specified equipment. It's not allowed for other applications.

*If the battery gives off an odor, generates heat, becomes discolored or deformed, or in any way appear abnormal during usage, recharging or storage, immediately remove it from the device or battery charger and stop using it.

*Cell can't be placed or used near fire or where it is over 60℃ or stored in such area.

*Do not connect the positive (+) and negative (-) terminals with a metal object; Do not put the cells together with necklace, hairpin, coins or screws or other metal.

Please be careful and not damage the cells with sharp objects.

Please read the operation manual carefully. Any improper operation may lead to overheat, fire, explosion, damage or loss of capacity.

10.Application conditions

*Customer shall ensure that the following application conditions in connection with the products are strictly observed:

*Customers should configure a battery management system to closely monitor, manage and protect each battery. When the cell is first used, it must be fully charged and discharged for activating it and giving fully capacity.

*Customer shall provide detailed information of the BMS, including but not limited to its design, features, and data file format to DESAY for design review and record keeping.

*Once the detailed information of the BMS has been reviewed and agreed by DESAY, customer shall not modify or change the design, features, setting or data file format of the BMS without the prior written agreement by DESAY.

*Customer shall keep relevant records of the BMS monitoring data throughout the entire service life of each product, including keeping record of number of occurrence of rush charge, which could be used in the determination and judgment of any product warranty and liability claim entitlement. No warranty or liability claim should be considered without BMS diagnosis records (at a regular basis, esp. during maintenance) of the relevant product.

*The BMS shall include the following monitoring and control features as a minimum requirement.

Parameter	Specification	Action
Stop charging	3.65V	Stop charging when cell voltage reaches 3.65 V
First overcharge protection	≥3.69V	Stop charging when cell voltage reaches 3.69 V
Second overcharge protection	≥3.8V	When the battery voltage reaches 3.8V, the BMS is forced to terminate charging, and the BMS should be locked until technicians solve the problem.
Stop discharge	最小 2.8V Minimum 2.8V	Minimize the discharging current when cell voltage reaches 2.8V.
First over discharge protection	Minimum 2.7V	Stop discharging when cell voltage reaches 2.7V
Second over discharge protection	Minimum 2.2V	When the cell voltage is less than 2.2V, the cell should be charged back to 50% SOC at 0.1C in time, and the BMS should be locked until technicians solve the problem.
Short circuit protection	No short circuit allowed	)When a short circuit occurs, the battery (cell) is disconnected by the overcurrent protection device.
Over current protection	Reference charge and discharge current requirements	Control discharge current by BMS to values within specification
Over temperature protection	Charge: 55℃ Discharge:55℃	Stop charging and discharging when temperature exceeds specification
Charging time out limit	Charging completes within 8 hours	If the charging time is longer than 8 hours, the charging will be terminated

Note: The above first/second level overcharge/discharge protection are the warning clause, draw the attention of customers: When the battery reaches any of the terms described in the above, means that the battery has been used beyond the specifications, the customer shall take protective measures on the battery in accordance with the "protection action" and other relevant provisions of this specification. At the same time, the DESAY shall not take any responsibility for the damage in connection therewith.

The heat dissipation of the battery should be fully considered during the use of the battery. DESAY does not take the responsibility due to the overheating of the cell or batteries caused by the thermal design problem.

During the use of the battery cell, the waterproof and dustproof problems of the battery cell should be fully considered. All designs meet the waterproof and dustproof grade stipulated by the relevant national standards. The DESAY does not take the responsibility due to damage to the cell or batteries (such as corrosion, rust, etc.) caused by water and dust.

11.Shipment and Storage

Without special instructions，the cell should be shipment about 17~40%SOC, and do a good job for anti-vibration protection measures. Cells should be stored where it is cool, no light and away from heat sources and hazardous chemical, we advise the cells storage about 30~50%SOC, prevent overdischarge, please charge the cells every three months. Otherwise, we are not liable for warranty.

12.Others

Any other which are not covered in this specification shall be agreed by both parties.