Product Specifications of IFP20100140A-27Ah Lithium Ion Rechargeable Cell

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Preface

This standard is an enterprise standard uniformly implemented by the company.

The format of this specification is in accordance with the provisions of GB/T 1.1-2009, *Standardization Work Guideline Part 1: Standards Structure and Compilation*.

On the basis of the references of GB/T 31484-2015 *Cycle Life Requirements and Test Methods for Power Cell for Electric Vehicles*, GB/T 31485-2015 *Safety Requirements and Test Methods for Power Cell for Electrical Vehicles*, GB/T 31486-2015 *Electrical Performance Requirements and Test Methods for Power Cell for Electric Vehicles*, Q/GX 60013—2019 *Technical Specification for Lithium Ion Power Cell for Electrical Vehicles*, and with the combination of the actual and test conditions of our company, it is specially formulated the standard of PD000018057 *Product Specification for IFP20100140A-27Ah Lithium Ion Rechargeable Cell*. The test method and criteria is revised and supplemented to guide the manufacturing and approval of IFP20100140A-27Ah lithium ion cell.

1 Scope

This standard sets out the performance requirements, test methods, inspection rules, marking, packaging, transportation and storage requirements for IFP20100140A-27Ah lithium ion rechargeable cell.

This standard is applicable to IFP20100140A-27Ah lithium ion rechargeable cell manufactured by the company.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 31484-2015: Cycle life requirements and test methods for traction batteries of electric vehicle

GB/T 31485-2015: Safety requirements and test methods for traction batteries of electric vehicle

GB/T 31486-2015: Electric performance requirements and test methods for traction batteries of electric vehicle

NJGX-TS-QMD-06: IFP20100140A-27Ah cell appearance standard

Q/GX 60013—2019: Test method for the electrical properties of lithium ion rechargeable cell used in electric vehicles

IEC 62133-2 Secondary batteries and batteries with alkaline and non-acid electrolytes - Safety requirements for portable sealed secondary lithium batteries and their manufacture and portable applications - Part 2: Lithium systems

IEC 62619: Secondary batteries and batteries with alkaline and non-acid electrolytes - Safety requirements for secondary lithium batteries and batteries for industrial use

JIS C 8714 Standards for lithium battery PSE Certification

UL 1642: Safety standard for lithium batteries

UL 1973: Standard for battery applications for stationary, vehicle auxiliary power, and light Electric Track (LER)

UN 38.3: United Nations Recommendations on the transport of dangerous Goods, Part 3, Manual of Tests and Standards, article 38.3

3 Terms and definitions

3.1 Cell: Basic unit device that converts chemical energy directly into electrical energy, including

electrodes, membranes, electrolytes, housing and terminals, and is designed to be rechargeable.

3.2 Multiplier Current: Abbreviation C, 1C means the cell is charged and discharged with A current of 27 A, 0.5C means the cell is charged and discharged with A current of 13.5 A.

3.3 Nominal capacity: Test method see 7.3

3.4 DCIR (direct-current internal resistance): Under the condition of 25 ºC ± 2 ºC and 50% SOC at room temperature, a cell is discharged with the maximum pulse current for 10 s to calculate the voltage and current changes before and after discharge. Then, the difference value of voltage change is divided by the difference value of current change, which is DCIR.

3.5 Maximum continuous charging current: The maximum current allowed for continuous charging of a cell at a specified temperature to ensure the normal operation of the cell.

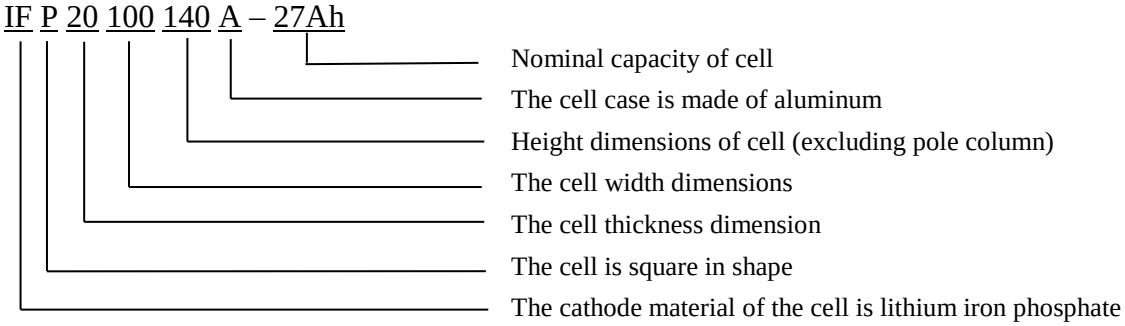
3.6 Maximum continuous discharge current: The maximum current allowed for continuous discharge of a cell at a specified temperature to ensure the normal operation of a cell.

3.7 Ratio of constant-current charging capacity: The ratio between the charging capacity of a cell charged to 3.65V at a certain ratio under the condition of 0% SOC at room temperature and the charging capacity under the standard charging method.

3.8 Cold start power: The maximum discharge power of 2s pulse of a cell at -20 ºC and 50%SOC.

3.9 Cell temperature: The temperature of the cell top cover is measured by the temperature sensor connected to the battery, and the temperature in the battery system is the temperature of the busbar module.

3.10 Meaning of product model:



4 Basic performance

Table 1 basic performance

Items	Specification	Condition/Notes
4.1 Appearance	Refer to document: NJGX-TS-QMD-06	

4.2 Dimension （Thickness×Width×Height）	（21.3±0.9）mm×(100.5±0.5）mm×（144.8±0.5）mm	Including the thickness of the blue film，force binding: 10 kgf, Storage ambient temperature <35 ºC, The goods will arrive within one month, See Appendix A.1, (17%±2%) SOC
	（21.7±0.9）mm×（100.5±0.5）mm×（144.8±0.5）mm	Including the thickness of the blue film，force binding: 10 kgf，Storage ambient temperature <35 ºC, Arrival of goods within 1 ~ 4 months, (17%±2%) SOC
4.3 Weight	605 g±18 g	
4.4 Nominal Voltage	3.2 V	
4.5 AC Resistance	0.9 mΩ±0.3 mΩ	1 kHz, Shipment status
4.6 DC Resistance	≤3.0 mΩ	50% SOC(5C/10 s, 25 ºC)
4.7 Nominal Capacity	27.0 Ah	1C standard charge and discharge, 25 ºC, See 7.3 for the test method
4.8 Operating Voltage	2.0 V～3.65 V	
4.9 Energy Density	≥140 Wh/kg	According to 0.33C discharge energy calibration
4.10 Altitude	≤5000 m	
Remark:（17%±2%）SOC, Storage ambient temperature <35 ºC, It can meet the cell storage within 4 months after the arrival of the power supply		

5 Electrical property

5.1 Charging performance

Table 2 Charging performance

Items	Specification	Notes
5.1.1 Maximum continuous charging current	0.02C	[-10 ºC～0 ºC), 0%SOC～100%SOC
	0.1C	[0 ºC～5 ºC), 0%SOC～100%SOC
	0.2C	[5 ºC～10 ºC), 0%SOC～100%SOC
	0.5C	[10 ºC～15 ºC), 0%SOC～100%SOC
	1.0C	[15 ºC～55 ºC), 0%SOC～100%SOC, The maximum temperature of cell ≤55 ºC
	2.0C	[15 ºC～35 ºC), 0%SOC～90%SOC
5.1.2 Maximum allowable charging voltage	3.9 V	First protection voltage 3.9V, second protection voltage 4.0V
5.1. Maximum permissible charging temperature range	0 ºC～55 ºC	
5.1.4 Optimum charging temperature range	10 ºC～35 ºC	
5.1.5 Constant current charging capacity ratio	≥90%	2C

5.2 Discharge performance

Table 3 Discharge performance

Items	Specification	Notes
5.2.1 Maximum continuous discharge current	4C	Under the condition of 15 ºC ~ 35 ºC，charge at 1C to 3.65V followed by constant voltage charging until current drops down to 0.05C, standing for 1h. discharge at 4C to 2.0V， and the temperature rise of the cell was < 30 ºC
5.2.2 Maximum pulse discharge current	6C,10 s	20 ºC～35 ºC
5.2.3 Minimum permissible discharge voltage	2.0 V	＞0 ºC discharge limit voltage
	1.8 V	≤0 ºC discharge limit voltage
5.2.4 Maximum permissible discharge temperature range	-30 ºC～60 ºC	
5.2.5 Optimal discharge temperature range	10 ºC～35 ºC	
5.2.6 Room temperature discharge capacity	≥27Ah	25 ºC, See 7.3 for the test method
5.2.7 High temperature discharge capacity/energy retention rate	≥100% / ≥100%	55 ºC, 1C, See 7.5 for the test method
5.2.8 Low temperature discharge capacity/energy retention rate	≥90%/≥75%	0 ºC, See 7.6 for the test method
	≥80% /≥60%	-10 ºC, See 7.6 for the test method
	≥60%/≥50%	-20 ºC, See 7.6 for the test method
5.2.9 Discharge capacity/energy ratio	≥96%/92%	25 ºC, 1C/6C, See 7.7 for the test method
5.3.10 Charge and discharge energy efficiency	≥91%	25 ºC, 1C/1C, See 7.8 for the test method
	≥93%	25 ºC, 0.5C/0.5C, See 7.8 for the test method

5.3 Power performance

Table 4 Power performance

Items	Specification	Notes
5.3.1 Mass power density	≥1300 W/kg	50% SOC, 25 ºC
5.3.2 Volume power density	≥2600 W/L	50% SOC, 25 ºC
5.3.3 Maximum discharge power	800 W	50% SOC, 25 ºC, See 7.11 for the test method
5.3.4 Cold start power	40 W	50% SOC, -20 ºC
5.3.5 Continuous discharge power	256 W/15 min	See 7.12 for the test method（20 ºC～40 ºC）

5.4 Battery life

Table 5 Battery Life

Items	Specifications	Notes
5.4.1 Room temperature cycle life	≥2500 times	25 ºC, 1C/1C, （10～40）kgf Clamp force, See 7.13.1 for the test method, 80% EOL
	≥1000 times	25 ºC, 1C/4C, （10～40）kgf Clamp force, See 7.13.1 for the test method, 80% EOL
5.4.2 High temperature cycle life	≥1400 times	45 ºC, 1C/1C, （10～40）kgf Clamp force, See 7.13.2 for the test method
	≥800 times	55 ºC, 1C/1C, （10～40）kgf Clamp force, See 7.13.3 for the test method
5.4.3 Calendar life	≥10 years	30% SOC, 25 ºC, Clamp force, See 7.14 for the test method
5.4.4 Typical working condition life	≥15 years，Life end is 70% capacity retention rate	(25±5) ºC, 1C/1C, No more than 10 discharges per year

5.5 Endurance performance

Table 6 Endurance performance

Items	Specifications	Notes
5.5.1 Storage temperature range	-40 ºC～60 ºC	The cell does not explode, does not fire, and the capacity decreases when stored at high temperature
5.5.2 Optimal storage temperature range	-10 ºC～35 ºC	
5.5.3 Storage capacity recovery rate	≥97%	50% SOC, 25 ºC, 90 d
5.5.4 Room temperature capacity retention Rate/ Capacity recovery rate	≥95%/≥96%	25 ºC, 100%SOC，28 d, See 7.9 for the test method
5.5.5 High temperature capacity retention rate/ capacity recovery rate	≥94%/≥95%	55 ºC, 100%SOC, 7 d, See 7.9 for the test method
5.5.6 Storage capacity recovery rate	≥95%	45 ºC, 50%SOC, 28 d, See 7.10 for the test method
	≥93%	45 ºC, 100%SOC, 28 d, See 7.10 for the test method

6 Safety performance

It has the ability to pass GB/T 31485-2015, IEC62619, IEC62133,UL1642,UN38.3 certification standards, and can provide IEC62619, UL1642, UN38.3 certificates.

7 Test Method

7.1 Test environment

Unless otherwise noted, the cell test environment conditions are: temperature 25 ºC ± 2 ºC, relative humidity (25% ~ 85%) RH, atmospheric pressure 86 kPa ~ 106 kPa; battery charging method is 7.2; cell discharge is 7.3 Method: The room temperature mentioned in this standard refers to 25 ºC ±2 ºC.

7.2 Standard charging

At room temperature, the cell is discharged with a current of 1C to a voltage of 2.0 V and left to stand for 1 h. Then, when the battery is charged with a current of 1C to a voltage of 3.65 V, it is switched to constant voltage charging. When the charging current drops to 0.05C, the charging is stopped. Then let it stand for 1 h.

7.3 Standard discharging

Fully charge according to 7.2. At room temperature, the cell is discharged with a current of 1C to a voltage of 2.0 V and the discharge capacity (Ah) and discharge energy (Wh) are measured.

7.4 DC internal resistance

Charge according to method 7.2. After discharging at 1C current for 30 min at room temperature, let it stand for 1 h, discharge at 5C current for 10 s, calculate the voltage and current changes before and after the discharge, and then divide the difference in voltage change by the difference in current change value.

7.5 High temperature discharge capacity/energy retention rate

First charge according to 7.2 method; store at 55 ºC ± 2 ºC for 5 h at the specified temperature; then discharge at the specified temperature with 1C current, discharge to 2.0 V, measure the discharge capacity (Ah) and discharge energy (Wh), The ratio of that to the discharge capacity and discharge energy (according to 7.3) at room temperature is the capacity/energy retention rate at high temperature. According to this method, the discharge capacity at high temperature is tested.

7.6 Low temperature discharge capacity/energy retention rate

First charge according to 7.2 method; store for 20 h at the specified temperature in 5.2.7 (-20/-10/0 ºC ±2 ºC) or the surface temperature of the cell reaches the target ambient temperature; then discharge at 1C at the specified temperature, discharge to 1.8 V, measure the discharge capacity (Ah) and discharge energy (Wh). The ratio of the two to the discharge capacity and discharge energy (according to 7.3) at room temperature is the capacity/energy retention rate at high temperature. This method tests the discharge capacity at low temperatures.

7.7 Room temperature rate charge and discharge capacity

At room temperature, the cell is discharged by the method 7.3, and the constant current is charged to 3.65 V at the specified rate respectively to obtain the charging capacity (Ah) and charging energy (Wh) at different rates. At room temperature, the cell is charged in the 7.2 method and discharged to 2.0 V at the specified rate to obtain the discharge capacity (Ah) and discharge energy (Wh) at different rates. The ratio of the discharge capacity to the initial capacity is the rate discharge capacity retention rate, the ratio of discharge energy to initial energy is the rate discharge energy retention rate.

7.8 Charge and discharge energy efficiency

At room temperature, the cell is discharged at a current of 1C to a voltage of 2.0 V, left to stand for 1 h, and then charged at a current of 0.5C to a voltage of 3.65 V, and then switched to constant voltage charging. When the charging current drops to 0.05C, the charging stops. Measure the charge capacity (Ah) and the charge energy E1 (Wh) in the constant current stage, and let stand for 1 h after charging; the cell is discharged at a current of 0.5C until the voltage is 2.0 V cut-off, and the discharge capacity (Ah) and discharge energy E2 are measured (Wh), charge and discharge energy efficiency is calculated according to E2/E1×100%.

At room temperature, the cell is charged according to the method 7.2, and the charging capacity (Ah) and the constant current stage charging energy E1 (Wh) are measured; the cell is then discharged with a current of 1C until the voltage is 2.0 V cut-off, and the discharge capacity (Ah) and discharge energy E2 (Wh), 1C standard charge and discharge energy efficiency is calculated according to E2/E1×100%.

7.9 Capacity retention rate, self-discharge rate and capacity recovery rate

First charge according to 7.2 method, store at room temperature for 28 d, or store at 55 ºC ±2 ºC for 7 d, then discharge to 2.0 V with 1C current to obtain the discharge capacity. The ratio to the initial capacity is the c Capacity retention rate; then charge and discharge according to the 7.2 method to obtain the recovery capacity, and the ratio to the initial capacity is the capacity recovery rate; the difference between the room temperature capacity recovery rate and the room temperature capacity retention rate is the battery self-discharge rate.

7.10 Storage capacity recovery rate

First charge according to 7.2 method, discharge at room temperature with 1C current for 30 minutes, then store at 45 ºC ±2 ºC for 28 d; then charge according to 7.2 method, discharge at room temperature with 1C current to 2.0 V , get the discharge capacity, its ratio to the initial capacity is the 50% SOC storage capacity recovery rate.

First charge according to 7.2 method, then store at 45 ºC ± 2 ºC for 28 d; then charge according to 7.2 method and discharge to 2.0 V at room temperature with 1C current to obtain the discharge capacity, which is the ratio of the initial capacity The ratio is the 100% SOC storage capacity recovery rate.

7.11 Maximum discharge power and maximum feedback power

Calculate the discharge capacity at different temperatures according to methods 7.3, 7.5 and 7.6, and use this as the standard for calculating SOC at different temperatures; after charging according to method 7.2, leave it for a corresponding time at the ambient temperature to be tested (> 0 ºC, 5 h ； ≤0 ºC, 20 h), adjust the SOC to 90% with 1C current discharge, after 1 h of standing, discharge with the current temperature maximum pulse current of 6C for 10 s, leave it for 40 s, and adjust the SOC to 80% with 1C current in turn , 70%,… 10%, test the pulse charge and discharge capacity at different SOC, record the process data, and calculate the maximum discharge power at different temperatures and SOC according to the calculation formula of DC internal resistance and pulse power in the HPPC test method.

7.12 Continuous discharge power

Charge according to 7.2 method, and then discharge at a constant power of 256 W. The final voltage is 2.5 V, and the discharge time and temperature rise meet the requirements in 5.3.4.

7.13 Cycle life

7.13.1 Standard cycle life

The cell is charged at a constant current of 1C to 3.65 V at a constant voltage of 25 ºC ± 2 ºC, until the current drops to 0.05C to cut off, stand for 10 minutes, then discharge to 2.0 V with a current of 1C, and stand for 10 min; When repeated 2500 times, the discharge capacity is not less than 80% of the rated capacity.

The cell is charged at a constant current of 1C to 3.65 V at a temperature of 25 ºC ± 2 ºC, and then charged at a constant voltage until the current drops to 0.05C and cut off. Let it stand for 1 h, then discharge to 2.0 V at a current of 4C, and let it stand for 2 h; The discharge capacity shall not be less than 80% of the rated capacity when repeated 1000 times.

7.13.2 45 ºC cycle life

The cell is charged at a constant current of 1C to 3.65 V at a temperature of 45 ºC ± 2 ºC, and then charged at a constant voltage until the current drops to 0.05C. Let it stand for 10 min, then discharge to 2.0 V

at a current of 1C, and stand for 10 min; The discharge capacity is not less than 80% of the rated capacity when repeated 1400 times.

7.13.3 55 ºC cycle life

The cell is charged at a constant current of 1C to 3.65 V at a temperature of 55 ºC ± 2 ºC, and then charged at a constant voltage until the current drops to 0.05C and cut off. Let it stand for 10 minutes, then discharge it to 2.0 V with a current of 1C, and let it stand for 10 minutes ; The discharge capacity is not less than 80% of the rated capacity when repeated 800 times.

7.14 Calendar life

The test method is as follows:

a) Under an environment of 25 ºC ± 2 ºC, discharge the cell to 2.0 V at a constant current of 1C, and let it stand for 30 minutes; charge at a constant current of 1C to 3.65 V and then charge at a constant voltage until the current drops to 0.05C. Let it stand for 30 min; then discharge to 2.0 V at a constant current of 1C, cycle for 3 weeks, and record the average value of the discharge capacity for the 3 weeks as the initial capacity;

b) Shelving: Charge with 1C constant current to 3.65 V and switch to constant voltage charging, until the current drops to 0.05C and stop for 30 minutes; then discharge with 1C constant current, adjust SOC to 30%, and then at 25 ºC ± 2 ºC Shelve for 1 month under the environment;

c) Capacity test: After one month, discharge the cell at a constant current of 1C to 2.0 V under an environment of 25 ºC ± 2 ºC, let it stand for 30 minutes, and then charge at a constant current of 1C to 3.65 V and then charge at a constant voltage until Cut the current down to 0.05C, and finally discharge to 2.0 V at a constant current of 1C, cycle for 1 week, measure the discharge capacity (Ah), and calculate the capacity retention rate;

d) Repeat steps b) ~ c), and repeat this cycle every month until the capacity retention rate is less than 80%, and the life of the cell is terminated.

7.15 Cold start test

Charge according to 7.2 method, discharge to 50% SOC at room temperature with 1C current, put the cell in -20 ºC environment for 20 h, then discharge at -20 ºC at 5 kW power for 2 s, then stand still 10 s, repeat 3 times.

8 Transport

Violent loading and unloading shall be strictly prohibited during transportation to prevent severe vibration, impact or extrusion, and prevent sun and rain.

9 Store

Products without opening the package should be stored in a clean, dry, and ventilated warehouse with an ambient temperature of -40 ºC～60 ºC (to ensure that there is no safety accident for the cell, and the capacity attenuation when stored at high temperature is allowed), and the relative humidity is ≤75%. The warehouse should not contain corrosive gas; the product should be kept away from fire and heat sources.

Cell shipments can meet 2 years of non-recharge when stored at -10 ºC～30 ºC and ≥50% SOC, and can meet 1.5 years of non-charge when stored at 30 ºC～40 ºC and ≥50% SOC.

10 Battery use conditions

10.1 Charge and discharge

The conditions of use are as follows:

a) The charging time, current, voltage and temperature are in accordance with the requirements of this specification (clause 5.1);

b) The discharge time, current, voltage, and temperature are in accordance with the requirements of this specification (clause 5.2).

10.2 Binding force requirement

It is recommended that the pack adopt a cell thickness of 20.95 mm, and the tolerance is recommended to be designed as ±0.2 mm. After the cell is assembled into a module, the initial binding force perpendicular to the general direction is required to be 100 N～1000 N（(17% ±2%) SOC）, under these conditions, meet the life index (clause 5.4, clause 5.5).

10.3 Battery placement direction

After the cell is assembled into a module, the pole should not face down when in use.

10.4 Batteries

The conditions of use are as follows:

a) The batteries used in the same cell should not exceed 4 batches at most (3 batches are recommended), and the difference in cell production time should not exceed 30 d. Different types of batteries should not be mixed into groups, and new and old should not Mixed use of batteries;

b) In the process of forming batteries from a cell, ensure that welding slag or other metal foreign objects produced by welding cannot fall on the surface of the single cell or between the cell and the cell;

c) The cell and the batteries box should be insulated to avoid electrical short circuit;

d) The batteries should have a function that is not easy to cause a short circuit. The batteries should not be used in a high electrostatic environment that may damage the protection device.

10.5 Battery management system

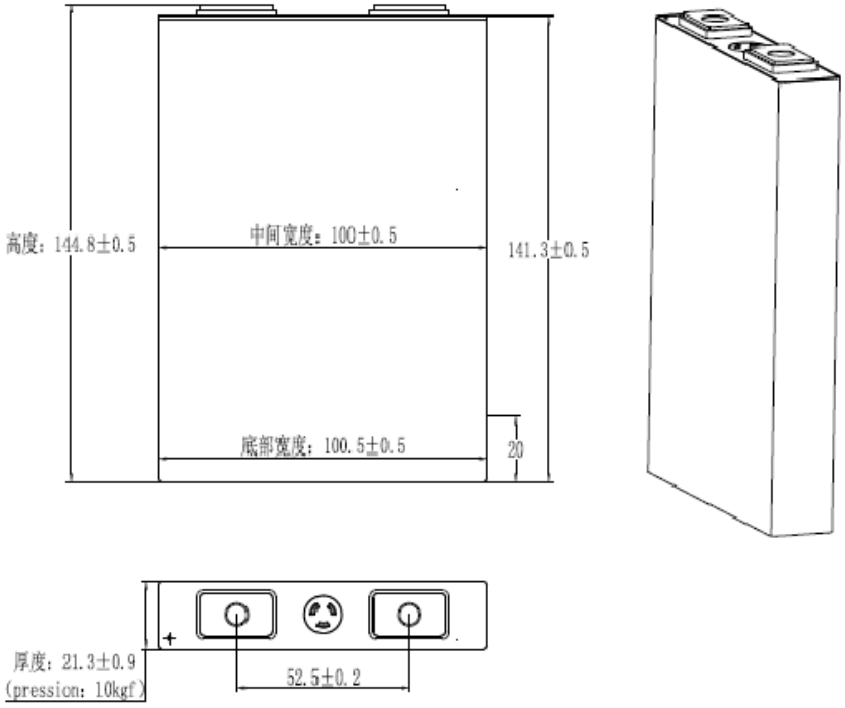
The protection circuit should be able to meet the requirements of the battery to be used under the specified temperature, voltage and current, and should have a warning system for abnormal conditions (over temperature, over voltage, over current).

Appendix A

（Normative appendix）

Cell size/physical picture

A.1 The size of the cell is shown in Figure A.1 (unit: mm).



Note: The height of the cell from the bottom to the top is 20mm, because the blue film coating layer is 5 layers on one side, and the width specification is 100.5±0.5mm.

Figure A.1 Battery size diagram

A.2 See A.2 (reference) for the physical picture of the cell.

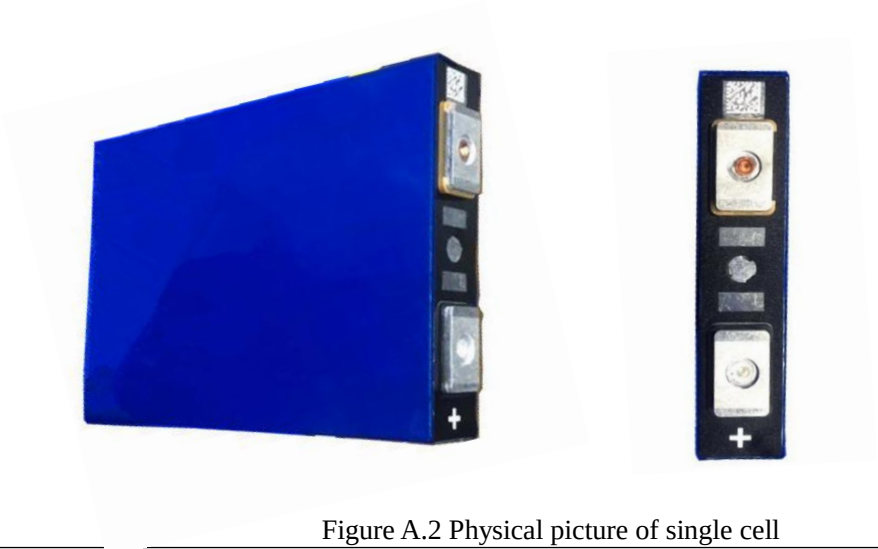


Figure A.2 Physical picture of single cell

Environmental declaration of IFP20100140A-27Ah Lithium battery product

In accordance with EU directive 2015/863, battery instruction requirements in 2006-66-EC，as shown in the following table, a total of 10 substances are included in the RSL, for example Cadmium, Lead, Mercury, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE) and phthalate (PAEs).

Table A.11 List of 10 restricted substances

RoHS restricted substance	**The highest limit（PPM）**	**Discription**
Cadmium(Cd)	20	2006-66-EC Directive Requirement
Lead (Pb)	40	2006-66-EC Directive Requirement
Mercury (Hg)	5	2006-66-EC Directive Requirement
Hexavalent chromium (Cr^{6+})	1000	RoHS 1.0 limited substance
Polybrominated biphenyls (PBB)	1000	RoHS 1.0 limited substance
Polybrominated diphenyl ethers (PBDE)	1000	RoHS 1.0 limited substance
Diphthalate (2-ethylhexyl) ester （DEHP- Di(2-ethylhexyl)Phthalate）	1000	RoHS
Benzyl butyl phthalate （BBP- Benzyl Butyl Phthalate）	1000	RoHS
Dibutyl phthalate （DBP-Di-n-butyl Phtalate）	1000	RoHS
Diisobutyl phthalate （DIBP-Diiso butyl Phthalate）	1000	RoHS

Execute immediately from release date.