



TEST REPORT

Applicant : Guangzhou Felicity Solar Technology Co., Ltd
Address : No.23 Xingfu Street, Donghua Industrial Zone, Renhe Town, Baiyun District, Guangzhou, 510445 Guangdong, P.R. China
Manufacturer : Guangzhou Felicity Solar Technology Co., Ltd
Address : No.23 Xingfu Street, Donghua Industrial Zone, Renhe Town, Baiyun District, Guangzhou, 510445 Guangdong, P.R. China
Product Name : Lithium iron phosphate cell
trademark : 
Model No. : FLS-LFP54150112-140Ah
Ratings : See the copy of marking plate on page 3
Standard : Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications
IEC 62619:2022
Date of Receiver : November 02, 2022
Date of Test : November 02, 2022 to November 26, 2022
Date of Issue : November 30, 2022
Test Report Form No : NTCS-IEC 62619-1-A1
Test Result : Pass *

This Test Report is Issued Under the Authority of :

Compiled by

Iring Su / Engineer

Approved by



Han song / Manager

***Remarks:**

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of Shenzhen Nore Testing Center Co., Ltd. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

List of Attachments (including a total number of pages in each attachment):
Attachment 1: Photo documentation (1 pages).

Summary of testing:

Tests performed (name of test and test clause):

cl.7.2.1 External short circuit test (cell);
cl.7.2.2 Impact test (cell);
cl.7.2.3.2 Whole drop test (cell);
cl.7.2.4 Thermal abuse (cell);
cl.7.2.5 Overcharging (cell);
cl.7.2.6 Forced discharge (cell);
cl.7.3.2 Internal short-circuit test (cell);

The samples comply with the requirement of IEC 62619: 2022.

Testing location:

ATS Electronic Technology Co., Ltd.

3/F, Building A, No. 1 Hedong Three Road, Jinxia Community, Changan, Dongguan , Guangdong, China

Summary of compliance with National Differences (List of countries addressed):

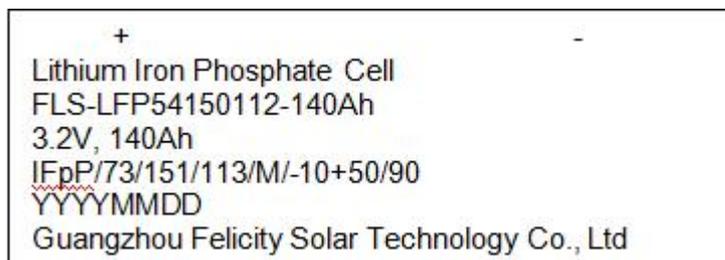
No EU Group Differences

The product fulfils the requirements of EN IEC 62619:2022

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

The markings below are indicated on the Cell.



The disposal instructions are indicated in the battery manual:

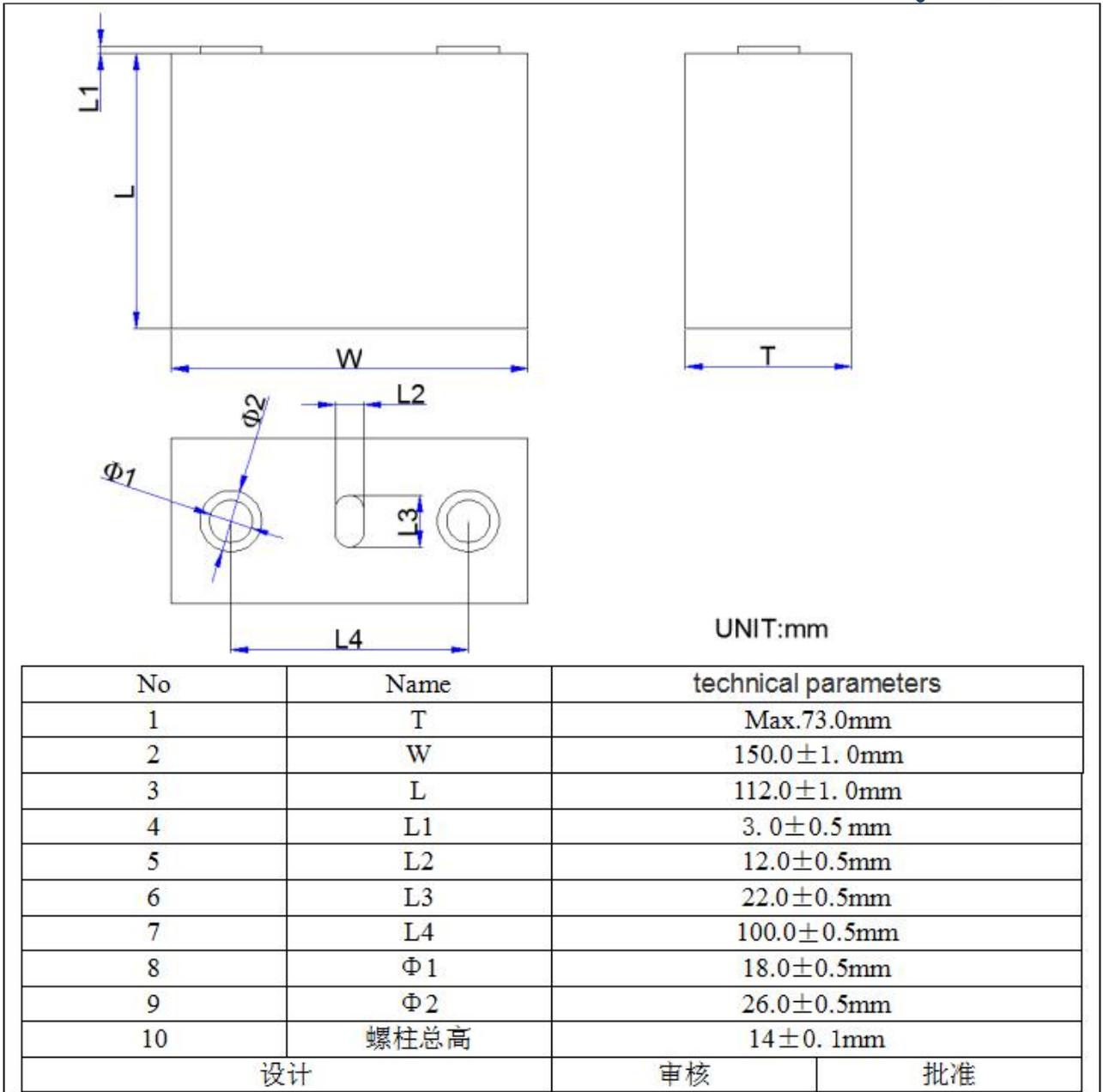
- Disposal of batteries should follow local regulations.

Test item particulars :	
Classification of installation and use :	To be defined in final product
Supply Connection :	Not directly connected to mains
..... :	
Possible test case verdicts:	
- test case does not apply to the test object..... :	N/A
- test object does meet the requirement..... :	P (Pass)
- test object does not meet the requirement..... :	F (Fail)
Testing :	
Date of receipt of test item :	2022-11-02
Date (s) of performance of tests :	2022-11-05 to 2022-11-26
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.	
Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.	
Name and address of factory (ies) : Guangzhou Felicity Solar Technology Co., Ltd No.23 Xingfu Street, Donghua Industrial Zone, Renhe Town, Baiyun District, Guangzhou, 510445 Guangdong, P.R. China	

General product information and other remarks:	
The main features of the battery are shown as below:	
Product name	Lithium Iron Phosphate Cell
Model	FLS-LFP54150112-140Ah
Rated capacity	140Ah
Nominal voltage	3.2V
Recommended Charge Current	28A

Maximum Charge Current	140A
Recommended Discharge Current	28A
Maximum Discharge Current	140A
Maximum Charge Voltage	3.7V
End-of-discharge Voltage	2.5V
Charge temperature Range	0 to 60°C
Discharge temperature Range	-20 to 65°C
Recommended charging method declared by the manufacturer	At 25°C±2°C, Constant-current charge to 3.65V at 28A, constant voltage charge to stop until 7A.
Charging procedure for internal short-circuit test	Constant-current charge to 3.7V at 140A, constant voltage charge to stop until 7A.
Nominal mass	Approx. 2.45kg
External dimensions (mm).....	Thickness x Wide x Height: Max. 73.0mm x 150.0mm±1.0mm x 112.0mm±1.0mm
Cell designation	IFpP/73/151/113/M/-10+50/90

Construction (Unit: mm):



IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
4	PARAMETER MEASUREMENT TOLERANCES		P
	Parameter measurement tolerances		P
5	GENERAL SAFETY CONSIDERATIONS		P
5.1	General		P
	Cells and batteries are safe under conditions of both intended use and reasonably foreseeable misuse....:	See also table 5.1 for Critical component information	P
	Reduce the risk of injuries from moving parts		P
5.2	Insulation and wiring		N/A
	Voltage, current, altitude, and humidity requirements		N/A
	Adequate clearances and creepage distances between connectors and live parts at different voltages or between live parts and non-current-carrying accessible parts		N/A
	Protect from hazardous live parts, including during installation		N/A
	The mechanical integrity of internal connections		N/A
5.3	Venting		P
	Pressure relief function	Vent design in cell	P
	Encapsulation used to support cells within an outer casing		P
5.4	Temperature/voltage/current management		N/A
	The design prevents abnormal temperature-rise	Cell only	N/A
	Voltage, current, and temperature limits of the cells		N/A
	Specifications and charging instructions for equipment manufacturers		N/A
5.5	Terminal contacts of the battery pack and/or battery system		N/A
	Polarity marking(s)	Cell only	N/A
	Polarity marking not provided for keyed external connector		N/A
	Capability to carry the maximum anticipated current		N/A
	External terminal contact surfaces		N/A
	Terminal contacts are arranged to minimize the risk of short circuits		N/A
5.6	Assembly of cells, modules, or battery packs into battery systems		N/A
5.6.1	General	Cell only	N/A

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
	Independent control and protection method(s)		N/A
	Recommendations of cell operating limits, mounting advice, storage conditions and other design recommendations by the cell manufacturer		N/A
	Batteries designed for the selective discharge of a portion of their series connected cells		N/A
	Protective circuit component(s) and consideration to the end-device application		N/A
5.6.2	Battery system design	Cell only	N/A
	The voltage control function		N/A
	Maximum charging/discharging current of the cell are not exceeded		N/A
5.7	Operating region of lithium cells and battery systems for safe use		P
	The cell operating region.....:	Information mentioned in manufacturer's specification	P
	Designation of battery system to comply with the cell operating region		N/A
5.8	System lock (or system lock function)		N/A
	Non-resettable function to stop battery operation	Cell only	N/A
	Manual with procedure for resetting of battery operation		N/A
	Emergency battery final discharge		N/A
5.9	Quality plan		N/A
	Manufacturing quality plan (for example: ISO9001, etc.) prepared and implemented.....:	Not request by client	N/A
	The process capabilities and the process controls		N/A

6	TYPE TEST CONDITIONS		P
6.1	General		P
6.2	Test items		P
	Cells or batteries that are not more than six months old (See Table 1 of IEC 62619)		P
	Capacity confirmation of the cells or batteries		P
	Default ambient temperature of test, 25 °C ± 5 °C	Tests were carried out in an ambient temperature of 25 ± 5°C	P

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
7	SPECIFIC REQUIREMENTS AND TESTS		P
7.1	Charging procedure for test purposes		P
	The battery discharged to a specified final voltage prior to charging		P
	The cells or batteries charged using the method specified by the manufacturer.....:	The method mentioned in manufacturer's specifications	P
7.2	Reasonably foreseeable misuse		P
7.2.1	External short-circuit test (cell or cell block)	Test report approved cell used.	P
	Short circuit with total resistance of 30 m ± 10 m at 25 °C ± 5 °C		P
	Results: no fire, no explosion	See Table 7.2.1	P
7.2.2	Impact test (cell or cell block)		P
	Cylindrical cell, longitudinal axis impact		N/A
	Prismatic cell, longitudinal axis and lateral axis impact	Prismatic cell	P
	Results: no fire, no explosion.		P
7.2.3	Drop test (cell or cell block, and battery system)		P
7.2.3.1	General		P
7.2.3.2	Whole drop test (cell or cell block, and battery system)		P
	Description of the Test Unit.....:	LiFePo4 Prismatic cell	—
	Mass of the test unit (kg).....:	2.45kg	—
	Height of drop (m).....:	1.0	—
	Results: no fire, no explosion		P
7.2.3.3	Edge and corner drop test (cell or cell block, and battery system)	The mass of cell is less than 20 kg	N/A
	Description of the Test Unit.....:		—
	Mass of the test unit (kg).....:		—
	Height of drop (m).....:		—
	Results: no fire, no explosion		N/A
7.2.4	Thermal abuse test (cell or cell block)		P
	Results: no fire, no explosion		P
7.2.5	Overcharge test (cell or cell block)		P
	For those battery systems that are provided with only a single protection for the charging voltage control		—

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
	Results: no fire, no explosion..... :	See Table 7.2.5.	P
7.2.6	Forced discharge test (cell or cell block)		P
	Cells connected in series in the battery system..... :		N/A
	Redundant or single protection for discharge voltage control provided in battery system..... :		N/A
	Target Voltage..... :	-3.7 applied	P
	Maximum discharge current of the cell, Im..... :	1 It A	P
	Discharge current for forced discharge, 1.0 It..... :	1 It A	P
	Discharging time, t = (1 It / Im) x 90 (min.)..... :	90mins, test with 1It A	P
	Results: no fire, no explosion..... :	See Table 7.2.6.	P
7.3	Considerations for internal short-circuit – Design evaluation		P
7.3.1	General		P
7.3.2	Internal short-circuit test (cell)		P
	Samples preparation procedure: In accordance with Clause A.5 and A.6 of IEC 62133-2:2017		P
	Tested per 7.3.2 b) in an ambient temperature of 25 °C ± 5 °C.		P
	The appearance of the short-circuit location recorded by photograph or other means..... :	See Attachment 1:Photo documentation	—
	The pressing was stopped - When a voltage drop of 50 mV was detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) was reached	400N	P
	Results: no fire..... :	See Table 7.3.2	P
7.3.3	Propagation test (battery system)	7.3.2 was selected	N/A
	Method to create a thermal runaway in one cell :	See Annex B	N/A
	Results: No external fire from the battery system, no battery case rupture..... :	See results in Table 7.3.3	N/A

8	BATTERY SYSTEM SAFETY (CONSIDERING FUNCTIONAL SAFETY)		N/A
8.1	General requirements		N/A
	Functional safety analysis for critical controls		N/A
	Conduct of a process hazard analysis for both the cell manufacturing process and the battery system manufacturing process		N/A

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
	Conduct of risk assessment and mitigation of the battery system		N/A
8.2	Battery management system (or battery management unit)		N/A
8.2.1	Requirements for the BMS	Cell only	N/A
	The safety integrity level (SIL) target of the BMS		N/A
	The charge control evaluated by tests in clauses 8.2.2 to 8.2.4		N/A
8.2.2	Overcharge control of voltage (battery system)	Cell only	N/A
	The exceeded charging voltage applied to the whole battery system		N/A
	The exceeded charging voltage applied to only a part of the battery system, such as the cell(s)..... :		N/A
	Results: no fire, no explosion..... :		N/A
	The BMS terminated the charging before exceeding the upper limit charging voltage		N/A
8.2.3	Overcharge control of current (battery system)	Cell only	N/A
	Results: no fire, no explosion..... :		N/A
	The BMS detected the overcharging current and controlled the charging to a level below the maximum charging current		N/A
8.2.4	Overheating control (battery system)	Cell only	N/A
	The cooling system, if provided, was disconnected		N/A
	Elevated temperature for charging, 5 °C above maximum operating temperature..... :		N/A
	Results: no fire, no explosion..... :		N/A
	The BMS detected the overheat temperature and terminated charging		N/A
	The battery system operated as designed during test		N/A
9	EMC		N/A
	Battery system fulfil EMC requirements of the end-device application..... :		N/A
10	INFORMATION FOR SAFETY		P

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
	The cell manufacturer provides information about current, voltage and temperature limits of their products		P
	The battery system manufacturer provides information regarding how to mitigate hazards to equipment manufacturers or end-users.		N/A

11	MARKING AND DESIGNATION (REFER TO CLAUSE 5 OF IEC 62620)		P
	The marking items shown in Table 1 in IEC 62620 indicated on the cell, battery system or instruction manual.	See page 4	P
	Cell or battery system has clear and durable markings		P
	Cell designation	IFpP/63/281/83/M/-10+50/90	P
	Battery designation		N/A
	Battery structure formulation		N/A

12	PACKAGING AND TRANSPORT		N/A
	Refer to Annex D		N/A

ANNEX A	OPERATING REGION OF CELLS FOR SAFE USE		P
A.1	General		P
A.2	Charging conditions for safe use		P
A.3	Consideration on charging voltage		P
A.4	Consideration on temperature		P
A.5	High temperature range	Charging high temperature limit 55°C	P
A.6	Low temperature range	Charging low temperature limit 0°C	P
A.7	Discharging conditions for safe use	-22~60°C	P
A.8	Example of operating region		P

ANNEX B	PROCEDURE OF 7.3.3 PROPAGATION TEST BY LASER IRRADIATION		N/A
B.1	General		N/A

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
B.2	Test conditions		N/A
B.2.1	Cell test (preliminary test)		—
	The cell fully charged according to the manufacturer recommended conditions..... :		—
	Laser irradiation point on the cell..... :		—
	Output power of laser irradiation..... :		—
	Tested in an ambient temperature of 25 °C ± 5 °C		N/A
	Repeat of cell test for 3 times		N/A
B.2.2	Battery system test (main test)		N/A
	The battery system fully charged according to the manufacturer recommended conditions..... :		—
	Target cell to be laser irradiated..... :		—
	The irradiation point on the target cell same or similar as that on the cell test		
	Output power of laser irradiation..... :		—
	Tested in an ambient temperature of 25 °C ± 5 °C		

ANNEX C	PROCEDURE OF 7.3.3 PROPAGATION TEST BY METHODS OTHER THAN LASER		N/A
C.1	General		N/A
C.2	Test conditions:		N/A
	– The battery fully charged according to the manufacturer recommended conditions..... :		—
	– Target cell forced into thermal runaway..... :		—
	– A specially prepared sample (e.g. a heater or a hole for nail penetration provided) used for ease of testing..... :		—
C.3	Method used for initiating the thermal runaway. 1) Heater (Heater, Burner, Laser, Inductive heating 2) Overcharge 3) Nail penetration of the cell 4) Combination of above methods 5) Other methods..... :		—

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
ANNEX D	PACKAGING AND TRANSPORT		N/A
	The materials and pack design chosen in a way as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants		N/A
	Regulations concerning international transport of secondary lithium batteries		N/A

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

5.1 TABLE: Critical components information					
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity ¹⁾
Cell	Guangzhou Felicity Solar Technology Co.,Ltd	FLS-LFP622808 2-194Ah	3.2V, 194Ah	IEC 62619: 2022	Tested with appliance
- Positive electrode	--	--	LiFePO ₄	--	Tested with appliance
- Negative electrode	--	--	Artificial graphite	--	Tested with appliance
-Separator	--	--	PE	--	Tested with appliance
-Electrolyte	--	--	LiPF ₆ +EC/EMC/DEC/DMC	--	Tested with appliance
-Shell	--	--	AL3003	--	Tested with appliance

Supplementary information:

¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.1	TABLE: External short-circuit test (cell or cell block)					P
Sample No.	Ambient (at 25°C ± 5°C)	OCV at start of test (V dc)	Resistance of Circuit (mΩ)	Maximum Case Temperature Rise ΔT (°C)	Results	
C1#	25.1	3.369	29.11	35.4	A,E	
C2#	25.1	3.371	29.36	33.9	A,E	
C3#	25.1	3.370	29.22	34.2	A,E	

Supplementary information:
A – No fire or Explosion
B – Fire
C – Explosion
D – The test was completed after 6 h
E – The test was completed after the cell casing cooled to 20% of the maximum temperature rise
F – Other (Please explain): ____

7.2.5	TABLE: Overcharge test (cell or cell block)					P
Sample No.	OCV at start of test (V dc)	OCV at end of test (V dc)	Measured Maximum Charging Current (A)	Measured Maximum Charging Voltage (V dc)	Max. Cell Case Temperature, (°C)	Results
C16#	2.712	3.425	140	4.07	51.1	A,E
C17#	2.718	3.431	140	4.07	56.2	A,E
C18#	2.716	3.461	140	4.07	53.0	A,E

Supplementary information:
Results:
A – No fire or Explosion
B – Fire
C – Explosion
D – Test concluded when temperature reached a steady state condition
E – Test concluded when temperature returned to ambient
F – Other (Please explain): ____

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.6	TABLE: Forced discharge test (cell or cell block)					P
Sample No.	OCV before applying reverse charge, (V dc)	Target Voltage (V dc)	Measured Reverse Charge Current I _t , (A)	Total Time for Reversed Charge Application (min)	Results	
C19#	2.752	-3.7	140	90	A	
C20#	2.750	-3.7	140	90	A	
C21#	2.749	-3.7	140	90	A	

Supplementary information:
Results:
A – No fire or Explosion
B – Fire
C – Explosion
D – Other (Please explain): ____

7.3.2	TABLE: Internal short-circuit test (cell)				P
Sample No.	OCV at start of test, (V dc)	Particle location ¹⁾	Maximum applied pressure, (N)	Results	
C22#	3.369	1	400	A,E	
C23#	3.365	1	400	A,E	
C24#	3.373	1	400	A,E	
C25#	3.372	1	400	A,E	
C26#	3.370	1	400	A,E	

Supplementary information:
8)..... Identify one of the following:
1: Nickel particle inserted between positive and negative (active material) coated area.
2: Nickel particle inserted between positive aluminium foil and negative active material coated area.

Results:
A – No fire or explosion
B – Fire
C – Explosion
D – Test concluded when 50 mV voltage drop occurred prior to reaching force limit
E – Test concluded when 800/400 N pressure was reached and 50 mV voltage drop was not achieved
F – Test was concluded when fire or explosion occurred
G – Other (Please explain): ____

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.3	TABLE: Propagation test (battery system)					N/A
Sample No.	OCV of Battery System Before Test, (V dc)	OCV of Target Cell Before Test, (V dc)	Maximum Cell Case Temperature, (°C)	Maximum DUT Enclosure Temperature, (°C)	Results	
--	--	--	--	--	--	
--	--	--	--	--	--	
Method of cell failure ¹⁾		Location of target cell		Area for fire protection (m ²)		
--		--		--		
Supplementary information:						
<p>1) Cell can be failed through laser exposure, applied heat, overcharge, nail penetration or combinations of these failures or other acceptable methods. See supporting documentation for details on cell failure method</p> <p>2) If the battery system has no outer covering, the manufacturer is required to specify the area for fire protection.</p> <p>Results: A – No fire external to DUT enclosure or area for fire protection or no battery case rupture B – Fire external to DUT enclosure or area for fire protection C – Explosion D – Battery case rupture E – Other (Please explain): __</p>						

8.2.2	TABLE: Overcharge control of voltage (battery system)					N/A
Sample No.	OCV at start of test for Cell/Cell Blocks, (V dc)	Maximum Charging Current, (A)	Max. Charging Voltage, (V dc)	Max. Voltage of Cell/Cell Blocks, (V dc)	Results	
--	--	--	--	--	--	
			Charge Voltage Applied Battery System: 1)			
			Whole		Part	
			--		--	

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information:

8. The exceeded voltage can be applied to only a part of the system such as the cell(s) in the battery system per Figure 6 of IEC 62619, if it is difficult to do it in using the whole battery system.

Results:

A – No Fire or Explosion

B – Fire

C – Explosion

D – The voltage of the measured cells or cell blocks did not exceed the upper limit charging voltage

E – The voltage of the measured cells or cell blocks did exceed the upper limit charging voltage

F – All function of battery system did operate as intended during the test.

G – All function of battery system did not operate as intended during the test.

H – Other (Please explain): ____

8.2.3	TABLE: Overcharge control of current (battery system)				N/A
Sample No.	OCV at start of test, (V dc)	Max. Charging Current, (A)	Max. Charging Voltage, (V dc)	Results	
--	--	--	--	--	
--	--	--	--	--	

Supplementary information:

Results:

A – No fire or Explosion

B – Fire

C – Explosion

D – Overcurrent sensing function of BMU did operate and then charging stopped

E – Overcurrent sensing function of BMU did not operate and then charging stopped

F – All function of battery system did operate as intended during the test.

G – All function of battery system did not operate as intended during the test.

H – Other (Please explain): ____

8.2.4	TABLE: Overheating control (battery system)			N/A
Model No.	OCV at start(SOC 50%) of test, V dc	Maximum Charging Current, A	Maximum Charging Voltage, V dc	
--	--	--	--	
Maximum Specified Temperature of Battery System, °C		Maximum Measured Cell Case Temperature, °C	Results	
--		--	--	

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information:

Results:

A – No fire or Explosion

B – Fire

C – Explosion

D – Temperature sensing function of BMU did operate and then charging stopped

E – Temperature sensing function of BMU did not operate and then charging stopped

F – All function of battery system did operate as intended during the test.

G – All function of battery system did not operate as intended during the test.

H – Other (Please explain): _____

9	TABLE: EMC	N/A			
Standard used for EMC test:					
Sample No.	EMC Test Item	Battery Condition	EMC Test Level/ Parameters	Compliance Criteria	Results
--	--	--	--	--	--
--	--	--	--	--	--

Supplementary information:

Battery Condition During EMC test

1 – In Operation Mode, [] Supplied at _____, [] Load at _____

2 – In non-operation Mode, Battery state of charge (SOC) before test at around _____

Compliance Criteria and Test Results:

A – No fire or Explosion

B – Fire

C – Explosion

D – Battery system did operate as intended during the test.

E - All function of battery system did operate as intended after the test.

F - All function of battery system did not operate as intended during the test, (Please explain): _____

G - Other (Please explain): _____

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

Photo documentation:

Product: LiFePo4 Cell

Type Designation: FLS-LFP54150112-140Ah

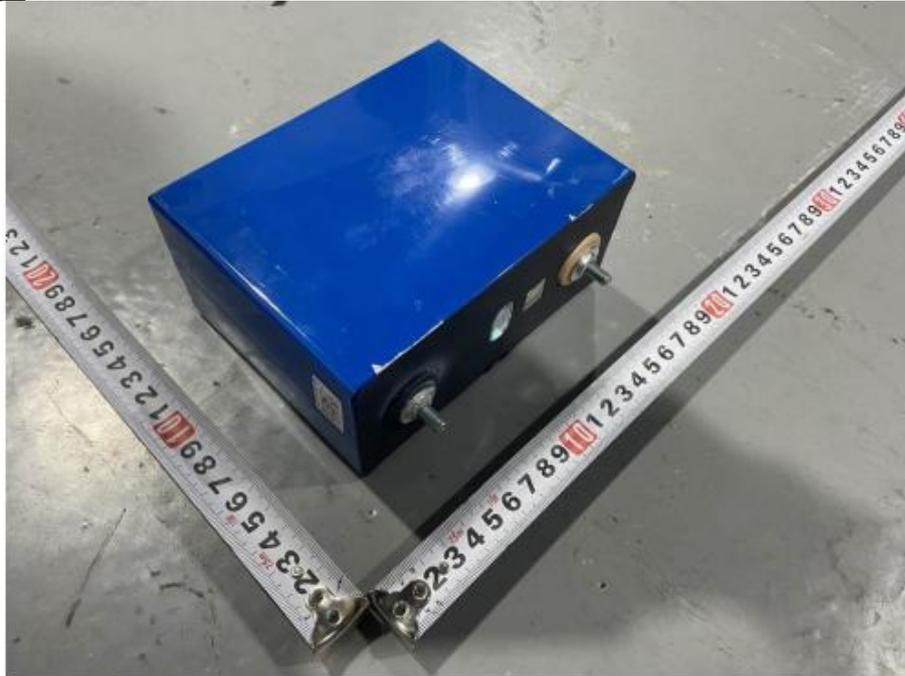


Figure 1 Overall view 1 of Cell

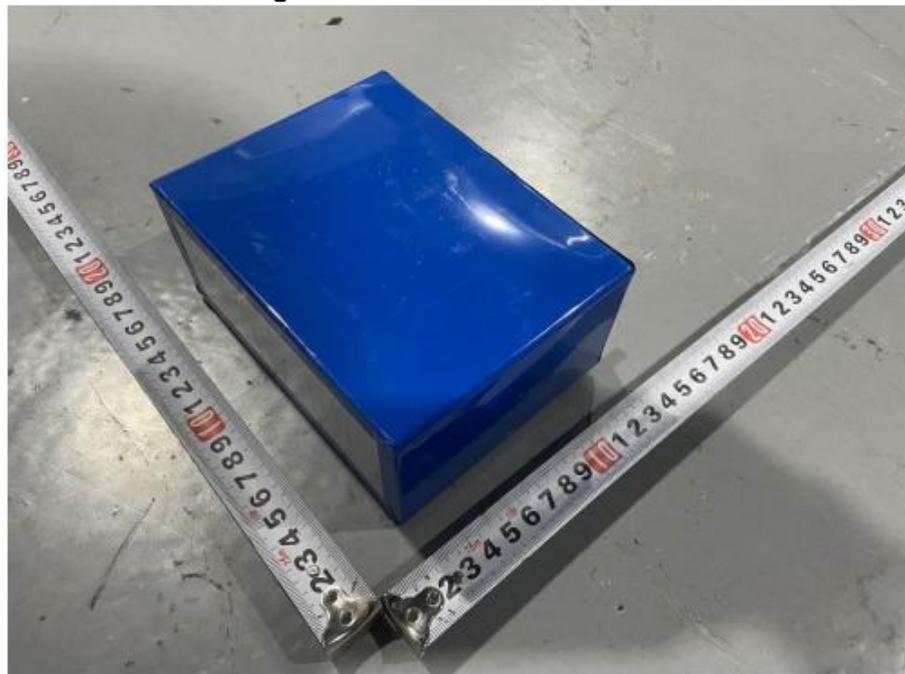


Figure 1 Overall view 2 of Cell

--- END OF TEST REPORT---