TEST REPORT

Sample name &Model	Rechargeable $LiFePO_4$ Battery R-LFP12.8V20Ah
Applicant	HENGYANG RICH POWER CO., LTD
Manufacturer	HENGYANG RICH POWER CO., LTD

深圳诚测检测技术有限公司

Shenzhen CCJC Technology Co., Ltd

TEST REPORT
IEC 62133-2

Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications

Report Number. .....:	CCJC2022A296301
Date of issue.....:	2023-04-12
Total number of pages .....:	17 pages
Applicant's name .....:	HENGYANG RICH POWER CO., LTD
Address .....:	Xinzhu Village Songmu Town, Shigu District, Hengyang 421005, China
Manufacturer's name .....:	HENGYANG RICH POWER CO., LTD
Address .....:	Xinzhu Village Songmu Town, Shigu District, Hengyang 421005, China
Factory's name .....:	HENGYANG RICH POWER CO., LTD
Address .....:	Xinzhu Village Songmu Town, Shigu District, Hengyang 421005, China
Test specification:	
Standard	IEC 62133: 2012
Test procedure .....:	Test Report
Non-standard test method .....:	N/A
Test item description.....:	Rechargeable $LiFePO_4$ Battery
Trade Mark..... :	RITAR®
Model/Type reference.....:	R-LFP12.8V20Ah,R-LFP12.8V12AH,R-LFP12.8V18AH, R-LFP12.8V24AH,R-LFP12.8V50AH,R-LFP12.8V200AH
Ratings..... :	12.8V, 20Ah, 256Wh

Testing procedure and testing location:

Testing Laboratory:

Testing location/ address..... : Shenzhen CCJC Technology Co.,Ltd.

1-3/F.,Building 101, No.135-3, Shasong Road, Houting, Shajing Street, Bao'an District, Shenzhen,Guangdong, China

Tested by (name + signature)..... : Zhao NanNan .....

Approved by (name + signature)..... : Roc Cheng .....

List of Attachments:

Appendix 1: 3 pages of Photo Documentation

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
cl.7.2.1 External short-circuit test (cell or cell block); cl.7.2.2 Impact test (cell or cell block); cl.7.2.3 Drop test (cell or cell block, and battery system); cl.7.2.4 Thermal abuse test (cell or cell block); cl.7.2.6 Forced discharge test (cell or cell block); cl.7.3.2 Internal short-circuit test (cell); cl.8.2.2 Overcharge control of voltage (battery system); cl.8.2.3 Overcharge control of current (battery system); cl.8.2.4 Overheating control (battery system) The samples comply with the requirement of IEC 62133: 2022.	Shenzhen CCJC Technology Co.,Ltd. 1-3/F.,Building 101, No.135-3, Shasong Road, Houting, Shajing Street, Bao'an District, Shenzhen,Guangdong, China

Summary of compliance with National Differences

N/A

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.

Rechargeable $LiFePO_4$ Battery
R-LFP12.8V20Ah
12.8V 20Ah 256Wh
IFpR33/71[4P4S]M/-10+40/90
HENGYANG RICH POWER CO., LTD
20230201 Made in China

Test item particulars.....:	
Classification of installation and use .....:	To be defined in final product
Supply Connection.....:	DC supply
.....:	--
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 ..... :	2022-03-28
Date (s) of performance of tests..... :	2022-03-28 to 2022-04-12

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(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 point is used as the decimal separator.

General product information:

This battery system is constructed with sixteen Li-ion cells (4S4P), and has overcharge, over-discharge, over current and short-circuits proof circuit.

The main features of the battery system are shown as below:

Product name	Li-ion cell	Li-ion Battery Pack
Model	32700	R-LFP12.8V20Ah
Rated capacity	5.5Ah	20Ah
Nominal voltage	3.2V	12.8V
Nominal Charge Current	2.75A	10A
Maximum Charge Current	5.5A	20A
Nominal Discharge Current	5.5A	20A
Maximum Discharge Current	5.5A	20A
Maximum Charge Voltage	3.65V	14.6V
Cut-off Voltage	2.0V	11.2V
Upper charge temperature	60°C	55°C
Lower charge temperature	0°C	0°C
Upper discharge temperature	60°C	60°C
Lower discharge temperature	-20°C	-20°C
Storage temperature range	0°C to 50°C	0°C to 50°C
Recommend charging method declared by the manufacturer	Charging the cell with 2.75A constant current until 3.65V, then constant voltage untill the charge current reduces to 0.275A at ambient 25°C±5°C.	Charging the battery with 10A constant current until 14.6V, then constant voltage untill the charge current reduces to 0.5A at ambient 25°C±5°C.
Charging procedure for internal short-circuit test	Charging the cell with 5.5A constant current until 3.65V, then constant voltage untill the charge current reduces to 0.275A at ambient 25°C±5°C.	--
Recommend discharging method declared by the manufacturer	Discharged at 25±5 ºC at a constant current 5.5A down to 2.0V.	Discharged at 25±5 ºC at a constant current 2A down to 11.2V
Nominal mass (kg):	0.14kg	2.83kg
External dimensions (mm):	32.5*70.5(D*H)	75.0*179.0*166.0(T*W*H)

IEC 62133			
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..... :		P
5.2	**Insulation and wiring**		**P**
	Voltage, current, altitude, and humidity requirements		P
	Adequate clearances and creepage distances between connectors		P
	The mechanical integrity of internal connections		P
5.3	**Venting**		**P**
	Pressure relief function	Venting mechanism exists on narrow side of the pouch cell.	P
	Encapsulation used to support cells within an outer casing	No such construction.	N/A
5.4	**Temperature/voltage/current management**		**P**
	The design prevents abnormal temperature-rise		P
	Voltage, current, and temperature limits of the cells		P
	Specifications and charging instructions for equipment manufacturers		P
5.5	**Terminal contacts of the battery pack and/or battery system**		**P**
	Polarity marking(s)		P
	Capability to carry the maximum anticipated current		P
	External terminal contact surfaces		P
	Terminal contacts are arranged to minimize the risk of short circuits		P
5.6	**Assembly of cells, modules, or battery packs into battery systems**		**P**
5.6.1	General		P
	Independent control and protection method(s)		P
	Recommendations of cell operating limits by the cell manufacturer		P
	Batteries designed for the selective discharge of a portion of their series connected cells		P

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict
	Protective circuit component(s) and consideration to the end-device application		P
5.6.2	Battery system design		P
	The voltage control function		P
	The voltage control for series-connected batteries		P
5.7	**Operating region of lithium cells and battery systems for safe use**		**P**
	The cell operating region..... :	Specify in cell user manual.	N/A
	Designation of battery system to comply with the cell operating region		P
5.8	**Quality plan**		**P**
	Manufacturing quality plan (for example: ISO9001, etc.) prepared and implemented..... :	Complied. ISO 9001: 2015 certificate provided.	P
	The process capabilities and the process controls		P
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 IEC62133)		P
	Capacity confirmation of the cells or batteries		P
	Default ambient temperature of test, 25 °C ± 5 °C		P
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.....:		P
7.2	**Reasonably foreseeable misuse**		**P**
7.2.1	External short-circuit test (cell or cell block)		P
	Short circuit with total resistance of 30 mΩ ± 10 mΩ 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

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict
	Results: no fire, no explosion.		
7.2.3	Drop test (cell or cell block, and battery system)		
7.2.3.1	General		
7.2.3.2	Whole drop test (cell or cell block, and battery system)		
	Description of the Test Unit .....:	Cell	—
	Mass of the test unit (kg).....:	Approx. 0.14kg	—
	Height of drop (m) .....:	1.0m	—
	Results: no fire, no explosion		
7.2.3.3	Edge and corner drop test (cell or cell block, and battery system)		
	Description of the Test Unit .....:	Battery	—
	Mass of the test unit (kg).....:	Approx. 2.83kg	—
	Height of drop (cm).....:	10cm	—
	Results: no fire, no explosion		
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)		N/A
	For those battery systems that are provided with only a single protection for the charging voltage control	The battery has two protections for charging voltage control	—
	Results: no fire, no explosion.....:		N/A
7.2.6	Forced discharge test (cell or cell block)		P
	Upper limit charge voltage of the cell .....:	3.65V	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.....:	-3.65V applied.	P
	Maximum discharge current of the cell, I_m .....:	5.5A	P
	Discharge current for forced discharge, 1.0 It.....:	5.5A	P
	Discharging time, t = (1 It / I_m) x 90 (min.) .....:	90min	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

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict
	Samples preparation procedure: a), in accordance with 8.3.9 of IEC62133:2012; or b), the nickel particle inserted before charging, or c), the nickel particle was inserted before electrolyte filling .....:	a)	P
	Tested according to Cl. 8.3.9 of IEC 62133:2012 test method, except all tests were carried out in an ambient temperature of 25 °C ± 5 °C.		P
	The appearance of the short-circuit location recorded by photograph or other means..... :		—
	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	800N	P
	Results: no fire, no explosion.....:	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 :		N/A
	Results: No external fire from the battery system or no battery case rupture .....:		N/A
8	**BATTERY SYSTEM SAFETY (CONSIDERING FUNCTIONAL SAFETY)**		**P**
8.1	**General requirements**		P
	Functional safety analysis for critical controls		P
	Conduct of a process hazard, risk assessment and mitigation of the battery system		P
8.2	**Battery management system (or battery management unit)**		P
8.2.1	Requirements for the BMS		P
	The safety integrity level (SIL) target of the BMS		P
	The charge control evaluated by tests in clauses 8.2.2 to 8.2.4		P
8.2.2	Overcharge control of voltage (battery system)		P
	The exceeded charging voltage applied to the whole battery system		P
	The exceeded charging voltage applied to only a part of the battery system, such as the cell(s) ....:		P
	Results: no fire, no explosion.....:	See Table 8.2.2.	P
	The BMS interrupted the overcharging before reaching 110% of the upper limit charging voltage		P
8.2.3	Overcharge control of current (battery system)		P

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict
	Results: no fire, no explosion.....:	See Table 8.2.3	P
	The BMS detected the overcharging current and controlled the charging to a level below the maximum charging current		P
8.2.4	Overheating control (battery system)		P
	The cooling system, if provided, was disconnected		P
	Elevated temperature for charging, 5 °C above maximum operating temperature.....:		P
	Results: no fire, no explosion..... :	See Table 8.2.4	P
	The BMS detected the overheat temperature and terminated charging		N/A
	The battery system operated as designed during test		P
9	**INFORMATION FOR SAFETY**		**P**
	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.	Specific in batttery system user manual.	P
10	**MARKING AND DESIGNATION (REFER TO CLAUSE 5 OF IEC 62133)**		**P**
	The marking items shown in Table 1 in IEC 62133 indicated on the cell, battery system or instruction manual.		P
	Cell or battery system has clear and durable markings		P
	Cell designation		N/A
	Battery designation	IFpR33/71[4P4S]M/-10+40/90	P
	Battery structure formulation		P
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		P

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict
A.6	Low temperature range		P
A.7	Discharging conditions for safe use		P
A.8	Example of operating region		P
ANNEX B	**PROCEDURE OF 7.3.3 PROPAGATION TEST**		**N/A**
B.1	General		N/A
B.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 ..... :		—
B.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 ..... :		—
ANNEX C	**PACKAGING**		**P**
	The materials and pack design chosen in such a way as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants		P

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**
C01#	25.6	3.46	28.4	53.2	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 case temperature declines by 80% of the maximum temperature rise
F - Other (Please explain):____

7.2.5	TABLE: Overcharge test (cell or cell block)					N/A
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**

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): _____

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 It, (A)**	**Total Time for Reversed Charge Application (min)**	**Results**
C06#	2.81	-3.65	5.5	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
C07#	3.46	1	800	A,E
C08#	3.45	1	800	A,E
C09#	3.46	1	800	A,E
C10#	3.45	1	800	A,E
C11#	3.47	1	800	A,E

Supplementary information:

[1)] 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 800/400N pressure was reached and 50 mV voltage drop was not achieved
F – Test was concluded when fire or explosion occurred
G - Other (Please explain): ___

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:

1) Cell can be failed through applied heat, overcharge, nail penetration or combinations of these failures or other acceptable methods. See supporting documentation for details on cell failure method

2) If the battery system has no outer covering, the manufacturer is required to specify the area for fire protection.

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): ___

8.2.2	TABLE: Overcharge control of voltage (battery system)				P
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**
B01#	3.09	20.0	16.06	3.46	A,D,F
			Charge Voltage Applied Battery System: 1)		
			Whole	**Part**	
			YES	NO	

Supplementary information:

1. 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 62133, 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)			P
Sample No.	**OCV at start of test, (V dc)**	**Max. Charging Current, (A)**	**Max. Charging Voltage, (V dc)**	**Results**
B02#	12.49	24.0	14.6	A,D,F

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): _____

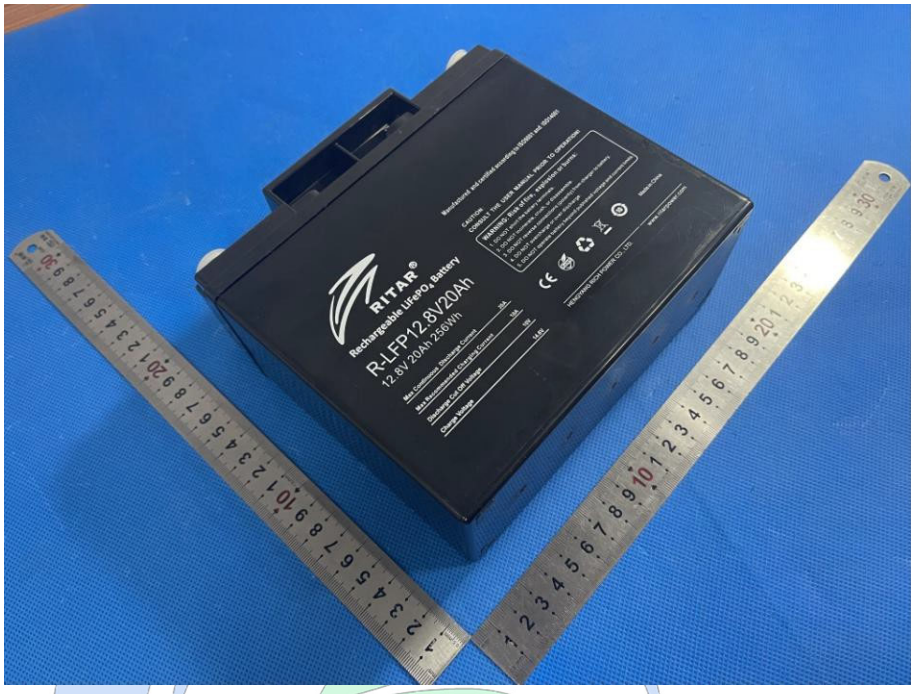
8.2.4	TABLE: Overheating control (battery system)		P
Model No.	**OCV at start(SOC 50%) of test, V dc**	**Maximum Charging Current, A**	**Maximum Charging Voltage, V dc**
B03#	13.38	20.0	14.6
Maximum Specified Temperature of Battery System, °C		**Maximum Measured Cell Case Temperature, °C**	**Results**
45		46.6	A,D,F

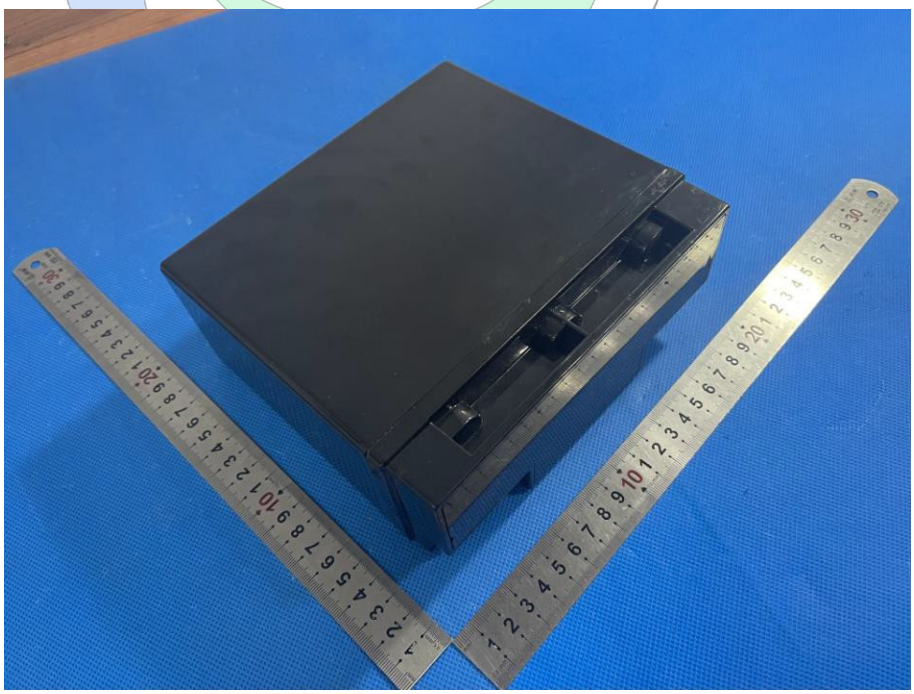
Supplementary information:

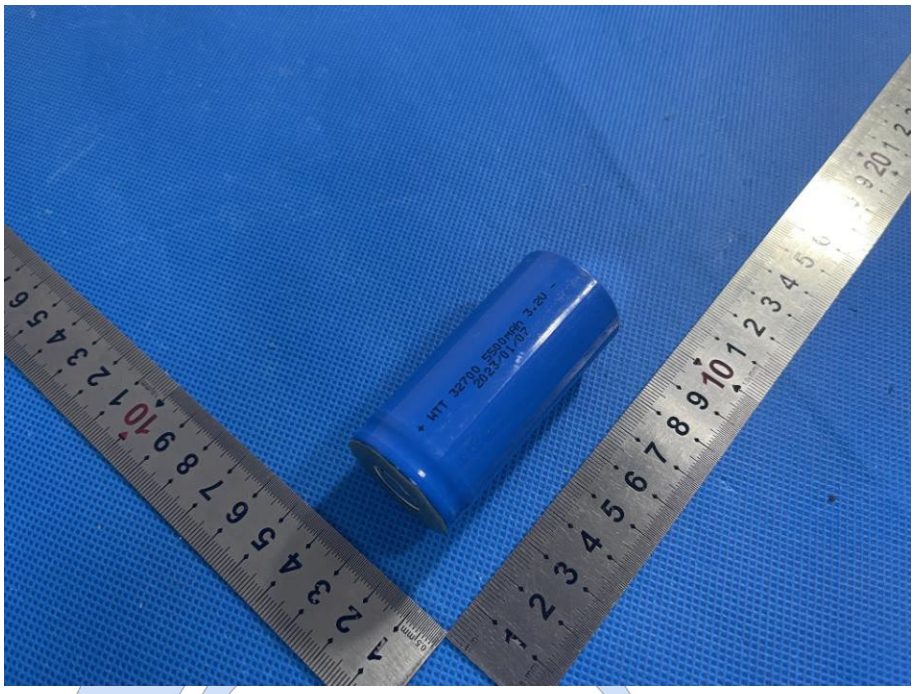
Results:
A – No fire or Explosion
B – Fire
C – Explosion
D - Temperature sensing function of BMU did operate and then charging stopped
E - Temperature sensing function of BMU did not operate and then charging stopped
F - All function of battery system did operate as intended during the test.
G - All function of battery system did not operate as intended during the test.
H - Other (Please explain): _____

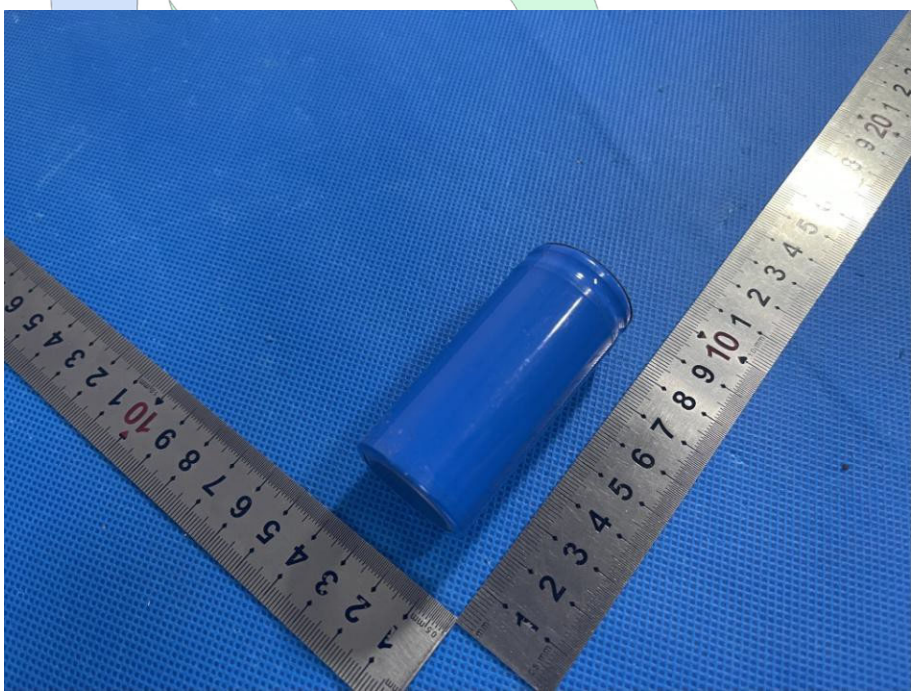
Appendix 1

Photo Documentation

Details of:	Fig.1– Front view of battery system
	

Details of:	Fig. 2 Back view of battery system
	

Details of:	Fig. 3 Back view of cell
	

Details of:	Fig. 4 Back view of cell
	

---End of Test Report---