Declaration

Product: Li-ion battery cell, model LFP71173205E-280Ah
Party A: [redacted]
Party B: BlauHoff BV

This declaration is issued under the sole responsibility of [redacted]
After friendly negotiation between Party A and Party B, Party A allows Party B to use the following UL9540A Test Report (Report: 80122570). Party B shall use this authorization declaration reasonably and shall not cause any negative impact on Party A. If it causes negative impact or loss to Party A, Party A has the right to terminate this agreement.

This declaration will take effect immediately after it is signed and sealed by both parties.

Party A: [redacted]
Sign and Stamp:
Date: February 19th,2024

Party B: BlauHoff BV
Sign and Stamp:
Date: February 19th,202[redacted]

CSA GROUP

CSA GROUP
Laboratory Test Data - UL 9540A

Master Contract: *N/A*
Report: *80122570*
Project: *80122570*

Nov. 3rd, 2022

[redacted]
Quality Director
[redacted]

Subject: *Li-ion battery cell, model LFP71173205E-280Ah (UL 9540A Test Report)*

Dear [redacted],

We are pleased to inform you that testing of your product per UL 9540A has been completed. Applicable test(s) was witnessed at CSA partner lab Shanghai Huahui Testing Co.,Ltd . Cell level of test(s) was conducted on the sample you provided and the results are enclosed in the test report.

Note: This Test Report is not an Authorization to apply the CSA Mark to the product. The results contained in the report(s) provided are contingent upon the characteristics of the actual sample(s) used in the investigation. In the absence of a continuing inspection service, CSA provides no assurance, expressed or implied, that the contents of the report are applicable to reproductions of the sample(s). Use or reproduction of the CSA name, logo, or trademark is not permitted without the prior written consent of CSA. No references can be made to this report when using the results of this investigation for the purposes of advertising, promotion or litigation, without the prior written consent of CSA.

Please examine the enclosed documents and contact me if you have any questions or would like us to make any changes.

On behalf of CSA, I would like to thankyou for your business and offer our services for your future needs.

Yours truly,

[redacted]
CSA -*CCIC-CSA International Certification Co., Ltd. Kunshan Branch*
Building 8, Tsinghua Science Park, No. 1666 Zu chongzhi Rd (S) , Kunshan, Jiangsu (215347)

Encl. *[UL 9540A Test Report]*
Att.1 - Cell UL 1973 certification
Att.2 - Cell charge/discharge conditioning graphs
Att.3 - Photos
Att.4 - Cell temperature/voltage graph during testing
Att.5 - Cell gas analysis report
Att.6 - Test Video

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Laboratory Test Data - UL 9540A Checklist and Test Result (Cell Level)

ORIGINAL TEST DATA

The results relate only to the items tested.
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Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 1 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Standard(s): ANSI/CAN/UL 9540A:2019 Fourth Edition, Dated November 12, 2019 - Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

Testing Laboratory Name: CCIC-CSA International Certification Co., Ltd. Kunshan Branch

Address: Building 8, Tsinghua Science Park, No. 1666 Zu chongzhi Rd (S), Kunshan, Jiangsu (215347)

Testing Program: **Custom Test** : Cover Latter ☐, Testing Only ☒

If tests were performed at another facility, then described below:

Testing Laboratory Name: Shanghai Huahui Testing Co.,Ltd

Address: No. 158, Changbangcun Road, Fengxian District, Shanghai, China

Facility Qualification Number: N/A

Customer: *As above / or describe otherwise*
Jiangsu Higee Energy Co., Ltd

Address: No.55 JianShe Road, YunTing street, Wuxi, Jiangsu 214422 China

Tested By: [redacted] Technician, Huahui)
Name, Title

[redacted] 2022-04-25~2022-05-16
Signature *Date (YYYY-MM-DD)*

☒ **Reviewed by:** [redacted] (Certifier, CSA)
☒ **Witnessed by:** *Name, Title*

[redacted] 2022-04-25~2022-05-16
Signature *Date (YYYY-MM-DD)*

Version6.1 : 2022-08-02

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Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 2 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Cell Level Test Summary	
Manufacturer:	Jiangsu Higee Energy Co., Ltd
Brand name / Trademark:	N/A
Model number:	LFP71173205E-280Ah
Nominal cell voltage, (V)	3.2V
Cell capacity, (Ah)	280Ah
Cell chemistry:	LFP
Physical format of cell:	Prismatic
Approximate dimension, (mm)	(W*H*T) 173.8±0.5 mm *205.1±0.6mm*71.5±0.5mm
Mass, (g)	5174
Cell certification available?, (Yes/No)	Yes
Standard(s) used to certify product:	UL 1973, 2nd Edition
Certification organization name and its certificate number:	UL file No. MH63242
Method used to initiate thermal runaway:	Film Heater
Average temperature at which cell first vented excluding gas collection sample, (°C)	266.9
Average temperature prior to thermal runaway excluding gas collection sample, (°C)	270.6
Location of maximum temperature:	Cell surface under heater
Flammable gas generation, (Liter)	193.5
Total gas generation, (Liter)	265.0
Lower flammability limit (LFL) at ambient temperature (34 ±1°C), (%)	5.4%
Lower flammability limit (LFL) at average gas vent temperature (207 ±4°C), (%)	4.6%
Burning velocity, (Cm/Sec)	104.3
Maximum pressure P_{max}, (psig)	111.76
Gas composition: see below table:	

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Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 3 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Cell Level Test Summary

Gas Component	Gas Type	Gas Volume in percentage (%)
Carbon Monoxide	CO	6.9
Carbon Dioxide	CO2	18.71
Hydrogen	H2	62.255
Methane	CH4	4.72
Ethane	C2H6	1.22
Ethylene	C2H4	3.00
Propane	C3H8	0.39
Propylene	C3H6	2.01
n-Butane	C4H10	0.07
I-Butane	C4H10	0.21
I-Pentane	C5H12	0.015
n-pentane	C5H12	0.50
Total	---	100

Additional Information:	Film heater to cover the two large surface of the cell

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Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 4 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Performance - Cell Level Test

Requirement	Comments	Verdict
Thermal runaway cannot be induced in the cell.	Thermal runaway induced on cell using film heater	F
Cell does not present a flammability hazard when mixed with any volume of air, as determined in accordance with ASTM E918 at both ambient and vent temperature.	Cell presented flammability hazard when tested in accordance with ASTME918, module and unit level test required.	F

Summary of Result:

Module level testing is required based on above performance condition indicated in Section 7.7 of UL 9540A 4th Edition.

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)

The results relate only to the items tested.
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Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 5 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Clause	Requirement + Test	Result - Remark	Verdict
	Construction		
5	**General**	---	---
5.1	**Cell**	---	---
5.1.1	Cell chemistry:	Lithium iron phosphate (LFP)	---
	Physical format of cell:	Prismatic	---
	Nominal voltage rating, (V)	3.2	---
	Nominal capacity rating, (Ah)	280	---
	Approximate dimension, (mm)	W:173.8±0.5mm; T:71.5±0.5mm; H:205.1±0.6mm	---
	Mass, (g)	≤5500	---
5.1.2	Cell certification available?, (Yes/No)	Yes	---
	Standard(s) used to certify product:	UL1973	---
5.1.3	Cell Level Test Report	See below	---
	Performance		
7	**Cell Level**	---	---
7.1	**General**	---	---
7.1.1	Establish effective method by forcing a cell into a thermal runaway in a repeatable manner.	Test Method: film heater	P
	Vent gas composition was gathered and analyzed.	See below	P
	Cell temperature was monitored to determine the temperature when cell vents.	See below	P
	Cell temperature was monitored to determine thermal runaway as defined in UL 9540A 4th Edition.	See below	P
7.2	**Sample**	---	---
7.2.1	Prior to testing, cell samples were conditioned for minimum 2 charge (100% SOC) - discharge (Specified end of discharge voltage) cycle as per manufacturer specified method.	See attachment 1 for details	P
	Cells were functional after minimum 2 charge discharge cycle.	Confirmed	P
	During conditioning a relationship between open circuit voltage and SOC was determined through measurement of voltage and SOC.	Fully charged condition was considered achieved by charging the cells in accordance with the client specified charging procedure.	P
	Ambient temperature during cell conditioning.	See table 2 for details	P

Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 6 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Clause	Requirement + Test	Result - Remark	Verdict
7.2.2	The tested cells had 100% SOC at the start of the test. The samples were allowed to stabilize for a minimum of one hour and a maximum of 8 h before the start of the test.	Confirmed, see table 2 for detail	P
7.2.3	Cells with flexible laminate casings were constrained during test in manner that simulate constraint in the BESS module to prevent excessive swelling during test.	Prismatic cell was constraint when testing	P
7.3	**Determination of thermal runaway methodology**	---	---
7.3.1	General	See below	P
7.3.1.1	Ambient temperature during cell testing.	See table 3	P
7.3.1.2	Propensity of cell to exhibit thermal runaway demonstrated by externally applied film heater.	Heater type: Film Heater Heater dimension (mm): (H*W)199mm*168mm, 220Vac, 501.5W Number of heaters used: 2 for each cell	P
	A surface heating rate of 4°C (7.2°F) to 7°C (12.6°F) per minute shall be applied to the cell.	☒ 5.5 。C/min heating ramp was used for testing	P
	Maximum surface temperature endpoint criteria was determined based on cell design and cell chemistry.	Considered	P
	Thermal runaway method used, when external heating with flexible heater was not able to cause the cell to exhibit thermal runaway.	☐ Mechanical: ☐ Electrical Stress: ☐ Alternate heating sources: ☐ Other(explain):	N/A
7.3.1.3	Detail of thermal runaway test method when another method used as reference in 7.3.1.2.	Film heater was used for testing	N/A
7.3.1.4	Monobloc battery such as lead acid or nickel cadmium, was treated as individual cell for this testing.	Lithium iron phosphate cell	N/A
7.3.1.5	Surface temperature at which internal short circuiting within the cell will occur that could lead to thermal runaway.	See below	N/A
	Surface temperature hold point. For lithium ion cell, hold point was between 5°C (9°F) and 15°C (27°F) greater than the melting temperature of the cell separator material as determined from differential scanning calorimetry	Cell was heated directly until thermal runaway initiated following UL 9540A Certification Requirement Decision	N/A

Clause	Requirement + Test	Result - Remark	Verdict
	(DSC) data of the separator in accordance with UL 2591 (UL 746A).		
	If thermal runaway is not achieved at holding temperature after period of 4h, heating rate according to 7.3.1.3 was reestablished.	See above	N/A
7.3.1.6	If cell is susceptible to thermal runaway by external heating, cell was heated until thermal runaway has occurred.	Confirmed, film heater method used for testing	P
	If cell is not susceptible to thermal runaway by external heating, another method included in 7.3.1.2 was used.	See above	N/A
	If using another external heating method, temperature ramp and maximum surface temperature as outlined in 7.3.1.2 and 7.3.1.5 was used.	See above	N/A
7.3.1.7	Cell's exterior surface temperature was measured continuously, averaging over every 60 seconds	Confirmed	P
	The maximum of these averages was documented for each thermocouple location.	Confirmed	P
	Location of thermocouple during test.	☒ Below the heater film at centre of cell surface: T2, T3, TKK(same location as T2 for feedback) ☒ Near positive cell terminal: T7 ☐ Other(explain): Cell vent: T4 cell surface without heater: T5 Ambient temperature: T8 See figure 7 for details	P
7.3.1.8	The temperature at which the cell case vents due to internal pressure rise.	Refer to table 3 and Attachment 3	P
	The thermocouple located below the heater film at the center of the cell surface is used for this measurement.	Confirmed	P
	If using the other cell abuse methods, the thermocouples would be located at the same locations on the cells as noted in 7.3.1.7.	Confirmed	P
7.3.1.9	The temperature at the onset of thermal runaway was documented.	Refer to table 3 and Attachment 3	P
	Onset of thermal runaway was determined by the point at which the rate of change of	See above	P

Clause	Requirement + Test	Result - Remark	Verdict
	the surface temperature of the cell exceeds that of the externally applied heat input if utilizing the external heater method.		
	In cases where cell venting may occur first, cell was heated continuously until thermal runaway occurs.	Confirmed	P
	With other stress methods, it was necessary to continue applying the stress such as mechanical or electrical stress until onset of thermal runaway occurs.	Film heater method used	N/A
	Separator information was available or at the manufacturer's discretion, the thermal ramp was conducted continuously without a hold point until thermal runaway.	Thermal ramp was conducted continuously without holding point considered	P
7.3.1.10	When using methods other than the heater method, the stresses (i.e. electrical or mechanical) were applied to the cell until thermal runaway occurs.	Film heater method used	N/A
7.3.1.11	If the cell exhibits thermal runaway behavior (using any method), 3 additional samples were tested using the same method and exhibit thermal runaway to demonstrate repeatability.	Considered, see table 3	P
	The vent temperature and thermal runaway onset temperatures were averaged over the tested samples (Excluding the gas vent capture sample).	Considered, see table 3	p
7.3.2	Flow battery thermal runaway determination tests	Lithium iron phosphate cell	N/A
7.4	**Cell vent gas composition test**	---	---
7.4.1	Cell vent gas was generated and captured by forcing a cell into thermal runaway with the methodology developed in 7.3, inside a pressure vessel, which is large enough to accommodate cells, but not so large as to influence measurement of the gas composition.	Confirmed 82 L pressure vessel used for testing	P
	The test was initiated with an initial condition of atmospheric pressure and less than 1% oxygen by volume.	Refer to table 4	P
	The initial atmospheric conditions prior to testing was noted.	Refer to table 4	P

Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 9 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Clause	Requirement + Test	Result - Remark	Verdict
7.4.2	Cell vent gas composition was determined using Gas Chromatography (GC)	GC with FID and TCD detector was used to measure the vented gas composition	P
	Hydrogen gas was measured with a sensor capable of measuring in excess of 30% by volume.	GC-TCD was used to measure hydrogen which was capable of measuring in excess of 30% by volume	P
	The initial atmospheric conditions prior to testing was noted.	Refer to table 4 for details	P
7.4.3	The lower flammability limit of the cell vent gas was determined in accordance with ASTM E918, testing at both ambient and cell vent temperatures.	Refer to table 4 for details	P
7.4.4	The burning velocity of the cell vent gas was determined in accordance with Annex in ISO 817.	Refer to table 4 for details	P
7.4.5	The P_{max} of the cell vent gas was determined in accordance with EN 15967.	Refer to table 4 for details	P
7.5	**Off gas composition for flow battery systems.**	---	---
7.5.1	The off gas composition from the flow battery testing of 7.3.2 shall be determined by conducting the test method of 7.3.2.2: 1. In a closed container and capturing the off gasses generated, and 2. By collecting the off gasses generated at vent openings and vent ducts during the overcharge and short circuit testing of 7.3.2.4 and 7.3.2.6 as applicable to the flow battery technology	Lithium-ion phosphate cell	N/A
	Composition of these captured gases and their flammability limit shall be determined through the methods outlined in 7.4.2 and 7.4.3 at both ambient temperature and the maximum temperature measured.	Lithium-ion phosphate cell	N/A
7.5.2	The volume of flammable gases measured during the testing were scaled to the maximum energy reservoir for the intended flow battery system.	Lithium-ion phosphate cell	N/A
7.6	**Cell level test report**	---	---
7.6.1	Cell level report include information indicated in item a) through m)	Confirmed	P

Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 10 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Clause	Requirement + Test	Result - Remark	Verdict
7.6.2	Flow battery report include information indicated in item a) through k)	Lithium iron phosphate cell	N/A

Table 1 - Cell charge/discharge specification

Charging method	CC-CV	Discharging method	CC
Charge current, (Adc)	140	Discharge current, (Adc)	140
Charge voltage, (Vdc)	3.65	---	---
Charge end current, (Adc)	5	Discharge end voltage, (Vdc)	2.5
Manufacturer recommended charge temperature, (°C)	25±2	Manufacturer recommended discharge temperature, (°C)	25±2

Table 2 - Cell rest duration

Sample Number	Final charge end time		Test start time	
	Date (YYYY-MM-DD)	Time (HH:MM AM/PM)	Date (YYYY-MM-DD)	Time (HH:MM AM/PM)
2022040003-1	2022-04-25	10:05:54AM	2022-04-25	12:43:08AM
2022040003-2	2022-04-25	10:17:41AM	2022-04-25	16:58:46AM
2022040003-4	2022-04-26	11:03:43AM	2022-04-26	13:46:47AM
2022040003-5	2022-04-27	08:36:50AM	2022-04-27	10:14:44AM
2022040003-6	2022-05-16	07:03:41AM	2022-05-16	11:12:10AM

Ambient temperature during cell conditioning	
Ambient Lab Temperature, (°C)	Relative Humidity, (%RH)
24.1 to 26.7	47 to 53

Table 3 - Determination of thermal runaway methodology

Sample Number	Note 1				Note 2
	2022040003-1	2022040003-2	2022040003-4	2022040003-5	2022040003-6
Open circuit voltage before test, (Vdc)	3.426	3.421	3.418	3.464	3.479
Cell charge capacity after final charge cycle, (Ahr)	287.289	290.034	289.362	289.089	288.181
External film heater ramp rate, (°C/min)	5.5	5.5	5.5	5.5	5.5
Temperature at which gases are first vented, (°C)	267.8	272.9	265.5	261.2	282.0
Temperature prior to thermal runaway, (°C)	270.3	275.2	269.5	267.3	283.1
Location of maximum temperature prior to thermal runaway	Cell surface under heater	Cell surface under heater	Cell surface under heater	Cell surface under heater	Cell surface under heater

Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 11 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Table 3 - Determination of thermal runaway methodology		
Average temperature at which gases are first vented, (°C)	266.9	---
Average temperature prior to thermal runaway, (°C)	270.6	---
Other method used to initiate thermal runaway: N/A		
Ambient temperature during cell testing		
Ambient Lab Temperature, (°C)	Relative Humidity, (%RH)	
24.2 to 26.5	47 to 53	
Note 1: Sample tested outside pressure vessel Note 2: Sample tested inside pressure vessel for cell vent gas composition test		

Table 4 - Cell vent gas composition test	
Sample Number:	2022040003-6
Pressure vessel volume (liter):	82L
An initial condition of atmospheric pressure (kPa):	101
An initial condition of oxygen by volume (%):	0.600%
Flammable gas generation volume(Liter):	193.5
Total gas generation volume (Liter):	265.0
LFL limit at ambient temperature (34 ±1°C), (%)	5.4%
LFL limit at cell vent temperature (207 ±4°C), (%)	4.6%
Burning velocity (cm/sec):	104.3
Maximum pressure P_{max} (psig):	111.76
Ambient temperature during cell testing	
Ambient Lab Temperature, (°C)	Relative Humidity, (%RH)
23.1	61
Gas composition	

Gas Component		Volume Released (After thermal runaway) (%)
Carbon Monoxide	CO	6.9
Carbon Dioxide	CO2	18.71
Hydrogen	H2	62.255
Methane	CH4	4.72

Table 4 - Cell vent gas composition test

Ethane	C2H6	1.22
Ethylene	C2H4	3.00
Propane	C3H8	0.39
Propylene	C3H6	2.01
n-Butane	C4H10	0.07
I-Butane	C4H10	0.21
I-Pentane	C5H12	0.015
n-pentane	C5H12	0.50
Total	---	100

The results relate only to the items tested.
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Attachments

Index of Attachments

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5	Cell gas analysis report	29
6	Test Video	MP4

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Attachment 1 - Cell UL 1973 certification

CERTIFICATE OF COMPLIANCE

Certificate Number UL-US-2232399-0
Report Reference MH63242-20220804
Date 10-Aug-2022

Issued to Jiangsu Higee Energy Co.,Ltd
NO.55 Jianshe Road,Yunling Town Jiangyin, Jiangsu
214400
China

This is to certify that representative samples of BBGA2 - Battery Cells for Use in Stationary and/or Transport Applications - Component

See Addendum Page for Product Designation(s)

Have been evaluated by UL in accordance with the component requirements in the Standard(s) indicated on this Certificate. UL Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for installation in complete equipment submitted for investigation to UL LLC

Standard(s) for Safety ANSI/CAN/UL 1973 2022, 3rd Ed., Issue Date: 2022-2-25

Additional Information See the UL Online Certifications Directory at https://iq.ulprospector.com for additional information

This Certificate of Compliance indicates that representative samples of the product described in the certification report have met the requirements for UL certification. It does not provide authorization to apply the UL Recognized Component Mark. Only the Authorization Page that references the Follow Up Services Procedure for ongoing surveillance provides authorization to apply the UL Mark.

Only those products bearing the UL Recognized Component Mark should be considered as being UL Certified and covered under UL's Follow Up Services.

Look for the UL Recognized Component Mark on the product.

[redacted]

Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 15 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Attachment 1 - Cell UL 1973 certification

CERTIFICATE OF COMPLIANCE

Certificate Number UL-US-2232399-0
Report Reference MH63242 20220804
Date 10-Aug-2022

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements

Model	Category Description
LFP71173205E 280Ah	Battery cell

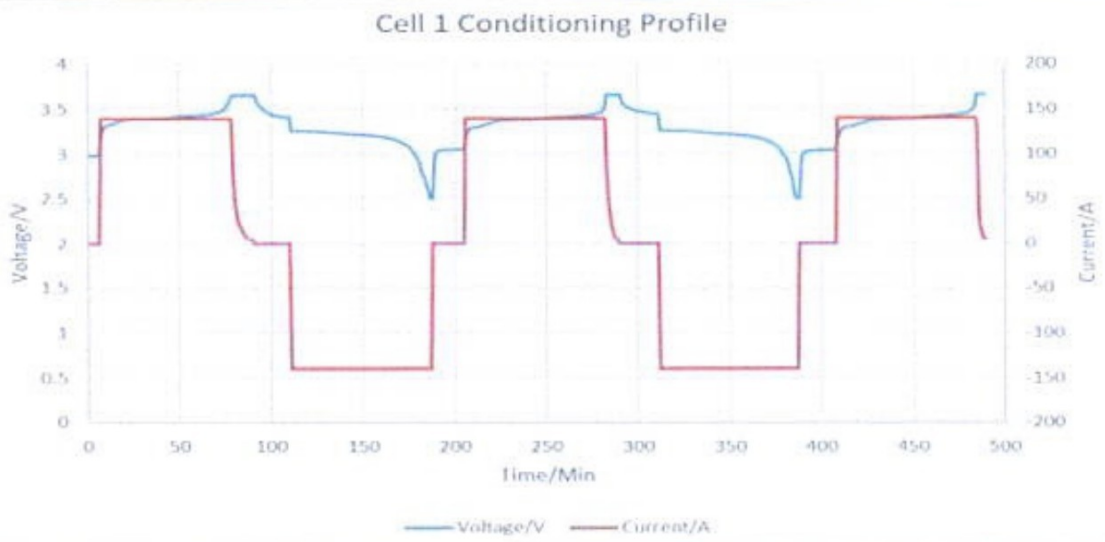
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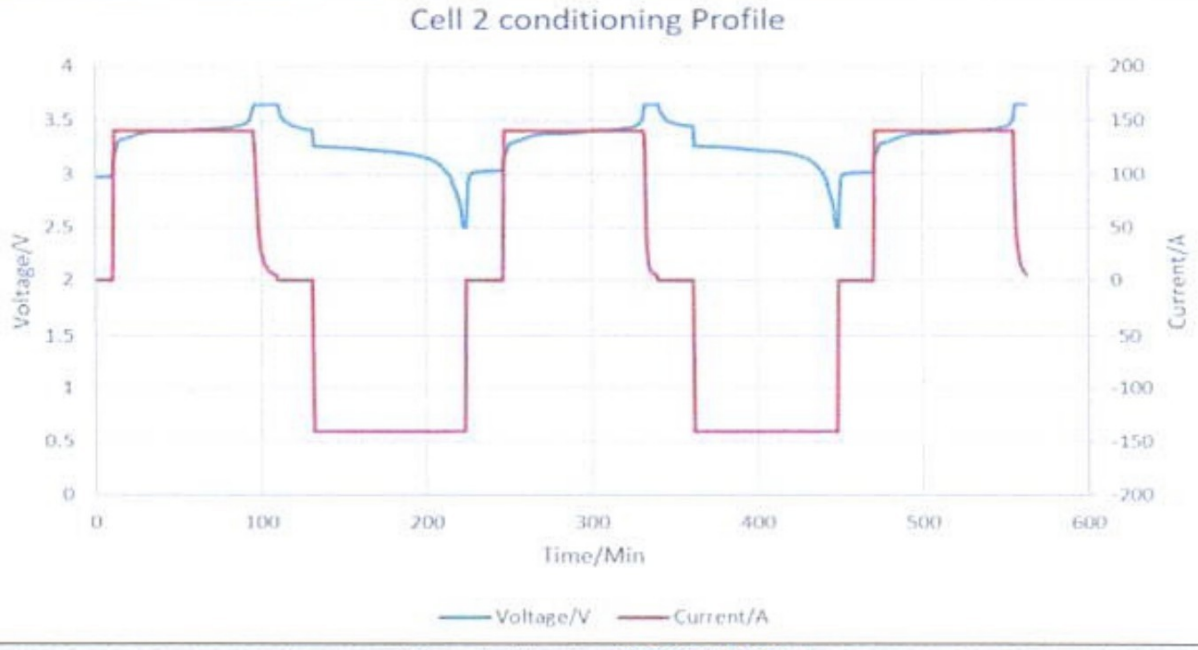
Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 16 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Attachment 2 - Cell charge/discharge conditioning graphs

Sample Number: 2022040003-1



Sample Number: 2022040003-2

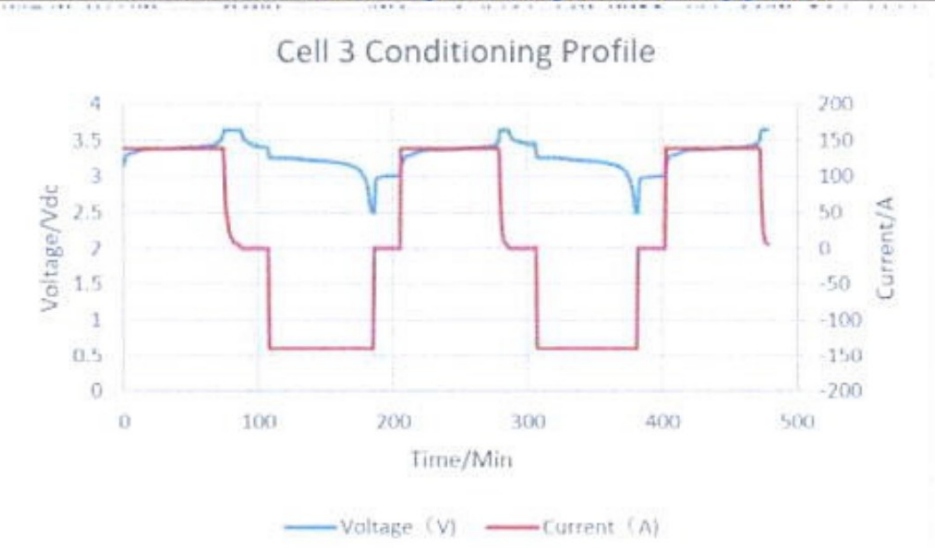


Sample Number: 2022040003-4

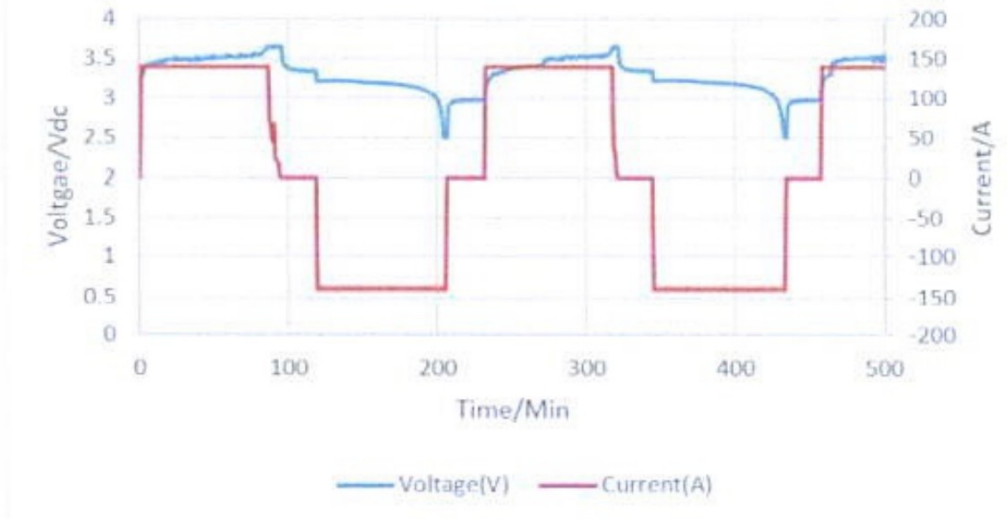
The results relate only to the items tested.
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Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 17 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Attachment 2 - Cell charge/discharge conditioning graphs



Sample Number: 2022040003-5

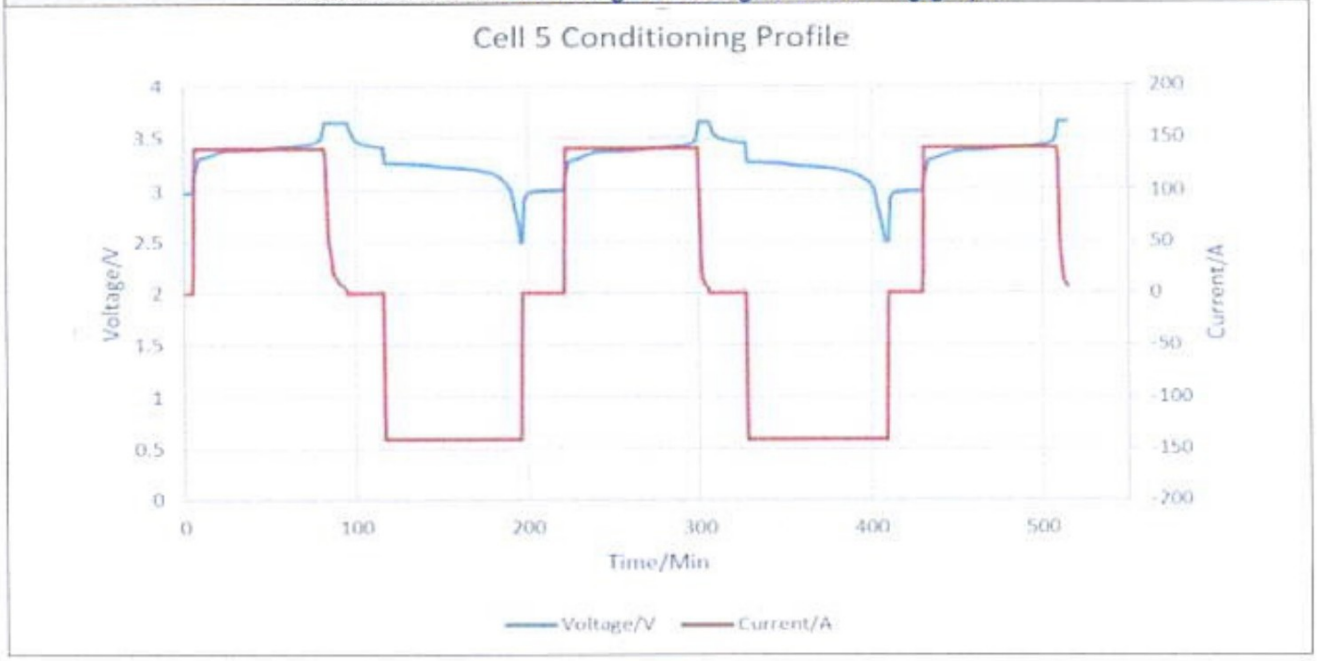


Sample Number: 2022040003-6

The results relate only to the items tested.
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Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 18 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Attachment 2 - Cell charge/discharge conditioning graphs



Attachment 3 - Photos

General sample photos

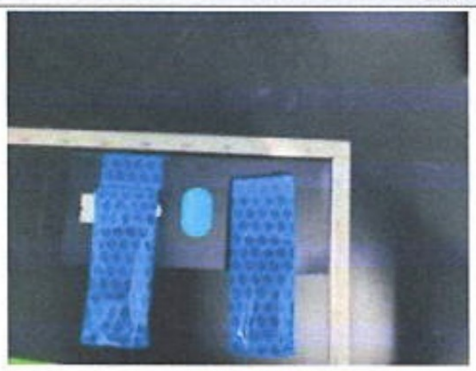


Figure 1 : DUT External View

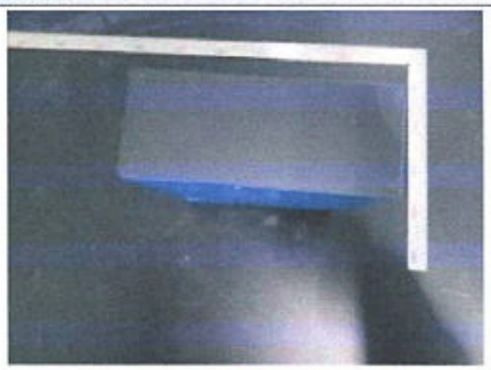


Figure 2: DUT External View

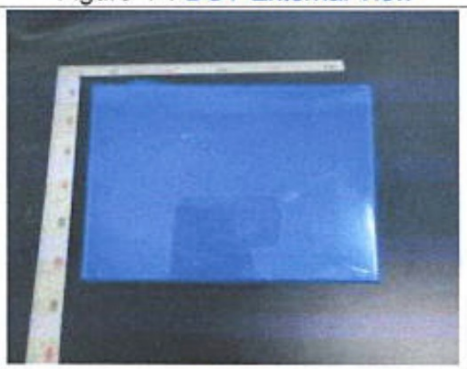


Figure 3: DUT External View

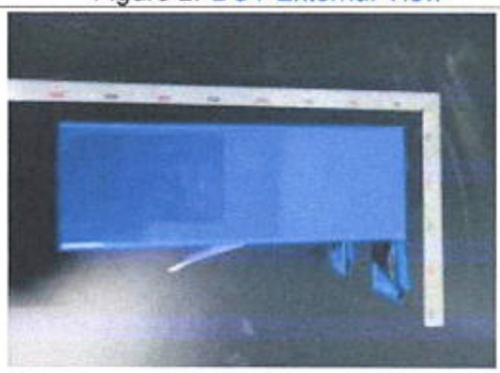


Figure 4: DUT External View

Photos with heater and thermocouple installation

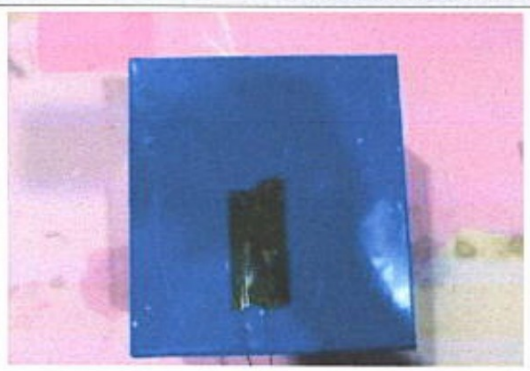


Figure 5 : TC Wire Location

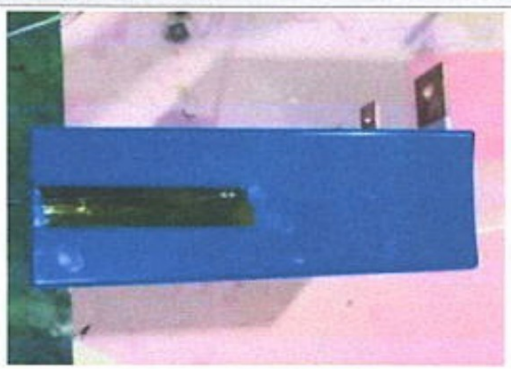


Figure 6 : Test Setup

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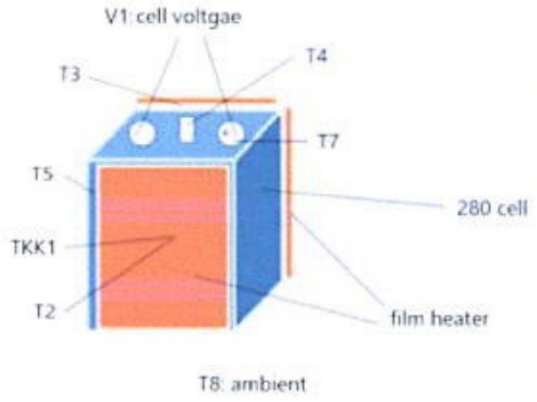


Figure 7 : Test Setup

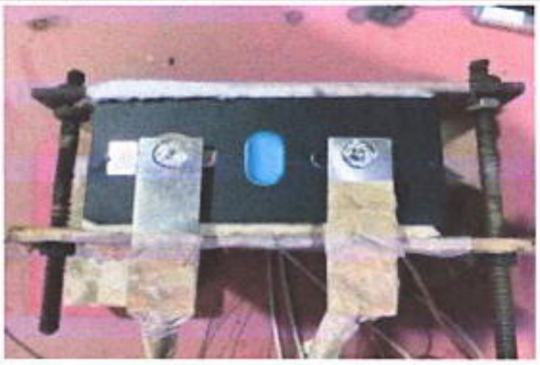


Figure 8 : TC Wire Location

Sample Number: 2022040003-1

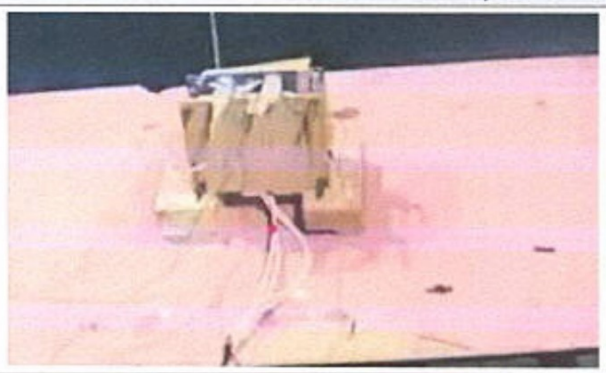


Figure 9: At test start (Time in 12:43)

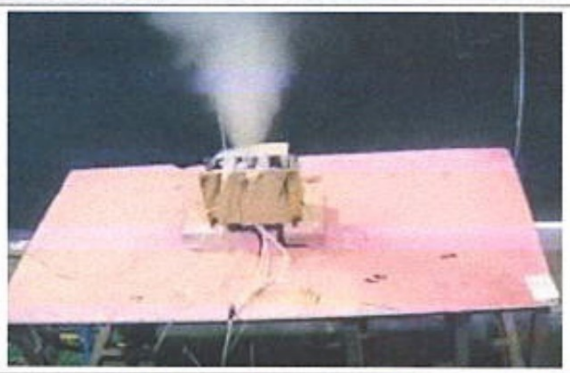
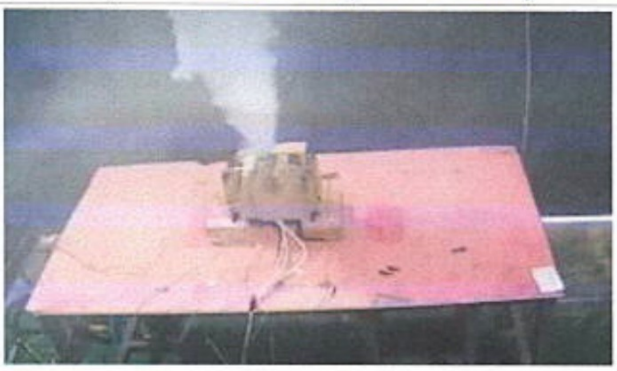
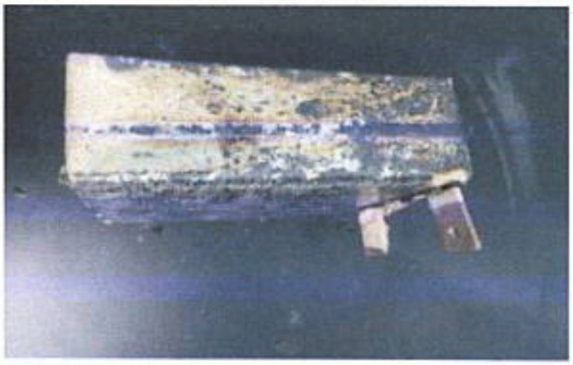


Figure 10: During cell venting (Time in 13:27)





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Attachment 3 - Photos

Figure 11: During thermal runaway (Time in 13:33)



Figure 12: After thermal runaway-1



Figure 13: After thermal runaway-2

Figure 14: After thermal runaway-3

Sample Number: 2022040003-2

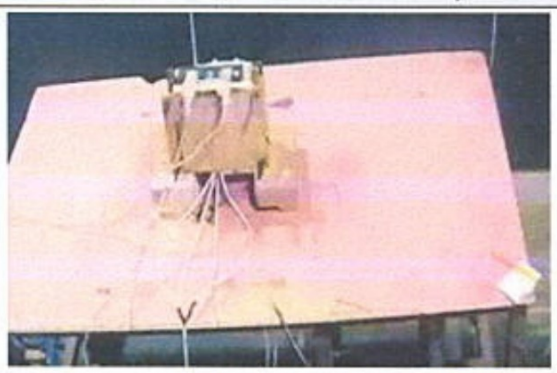


Figure 15: At test start (Time in 16:58)

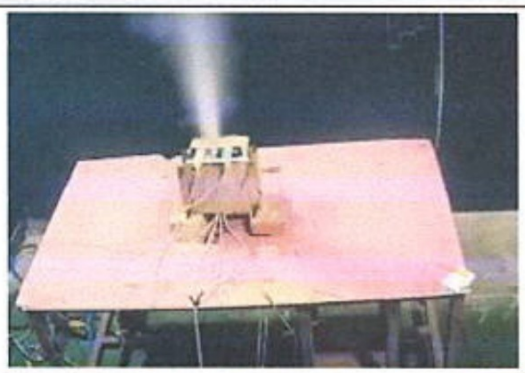


Figure 16: During cell venting (Time in 17:44)



Figure 17: During thermal runaway (Time in 17:46)



Figure 18: After thermal runaway-1

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Attachment 3 - Photos



Figure 19: After thermal runaway-2

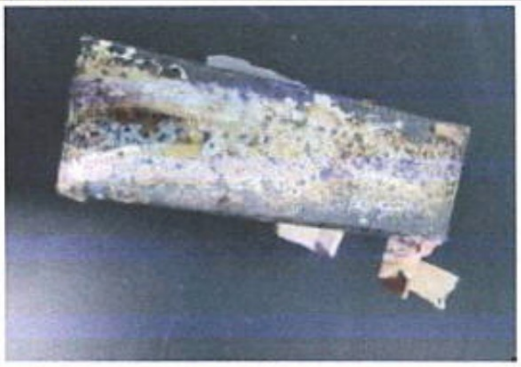


Figure 20: After thermal runaway-3

Sample Number: 2022040003-4

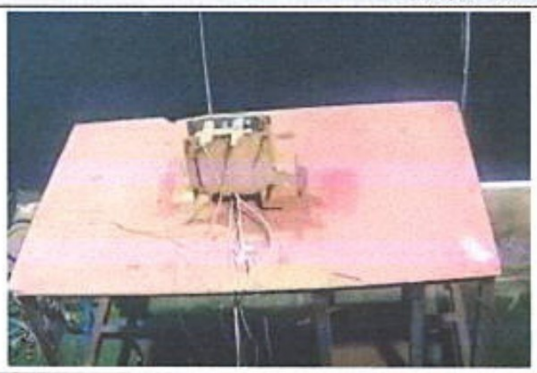


Figure 21: At test start (Time in 13:46)

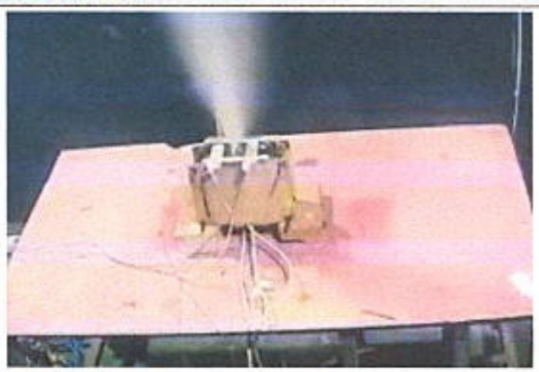


Figure 22: During cell venting (Time in 14:31)

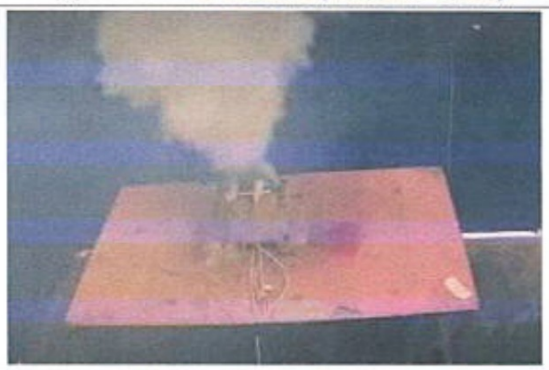


Figure 23: During thermal runaway (Time in 14:33)

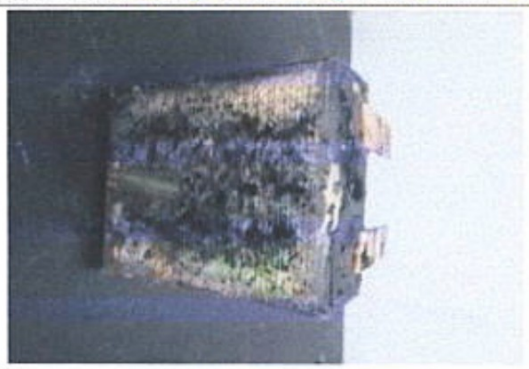


Figure 24: After thermal runaway-1

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Attachment 3 - Photos



Figure 25: After thermal runaway-2

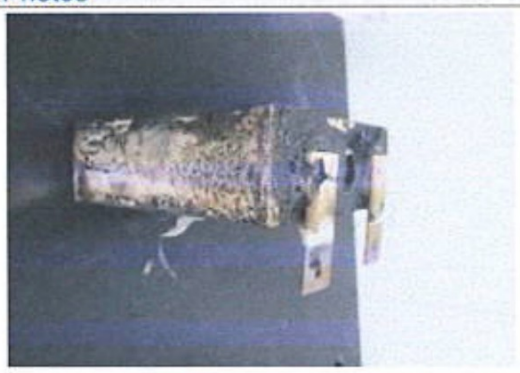


Figure 26: After thermal runaway-3

Sample Number: 2022040003-5

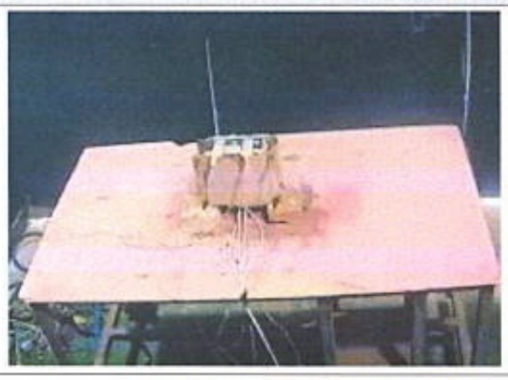


Figure 27: At test start (Time in 10:14)

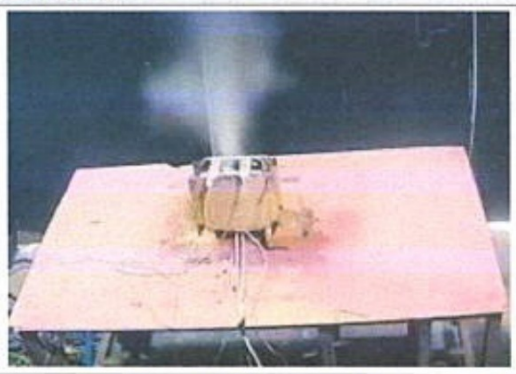


Figure 28: During cell venting (Time in 10:58)

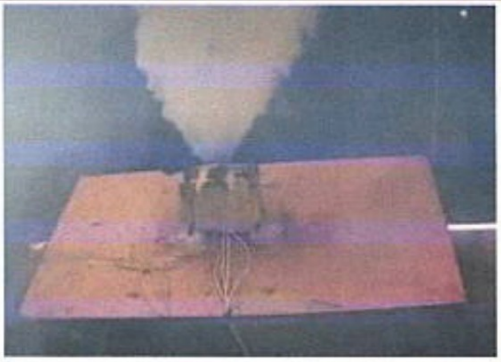


Figure 29: During thermal runaway (Time in 11:01)

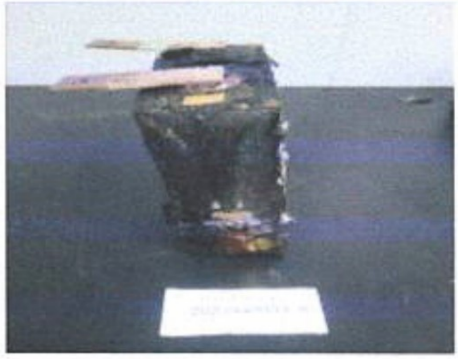


Figure 30: After thermal runaway-1

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Figure 31: After thermal runaway-2



Figure 32: After thermal runaway-3

Sample Number: 2022040003-6

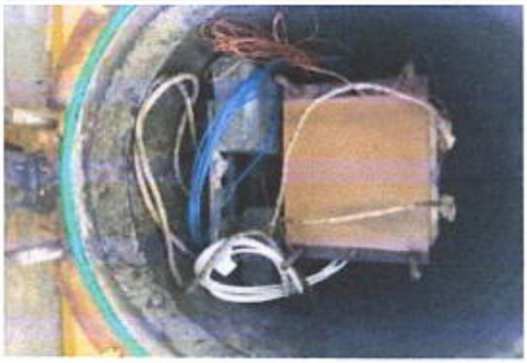


Figure 33: At test start (Time in 16:58)

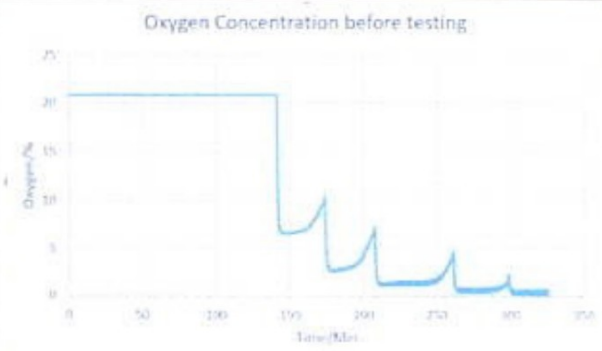


Figure 34: Oxygen Concentration before testing

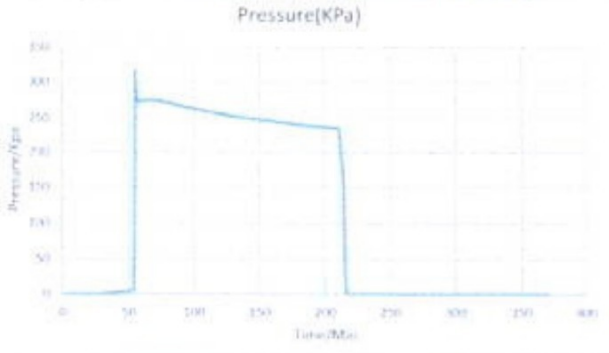


Figure 35: Pressure inside the vessel



Figure 36: After thermal runaway-1

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Figure 37: After thermal runaway-2



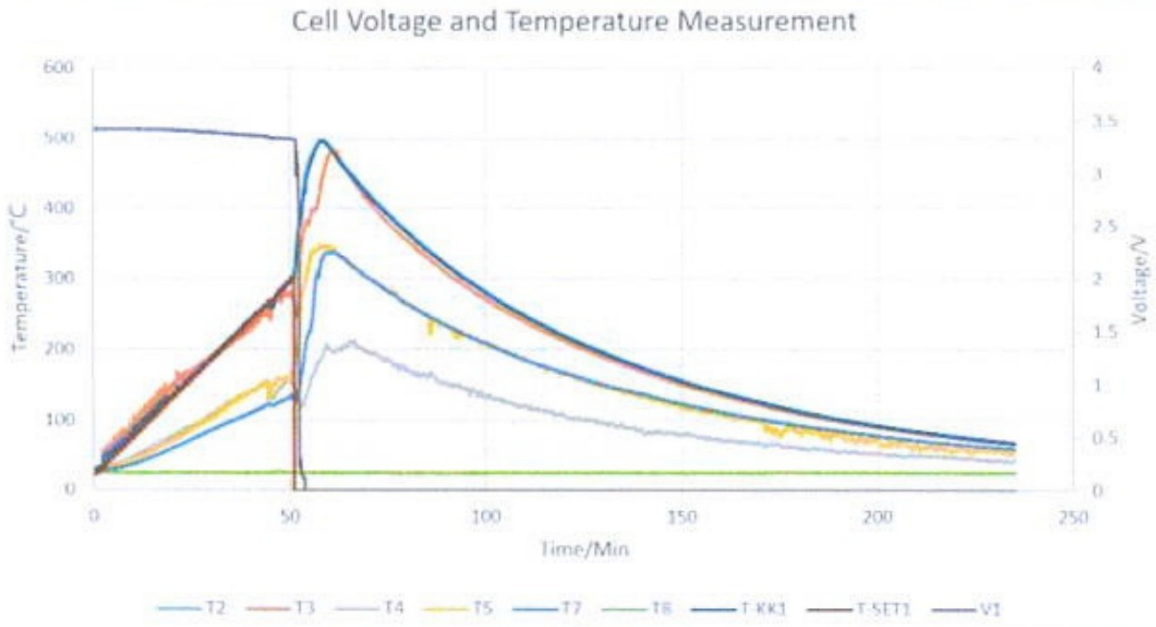
Figure 38: After thermal runaway-3

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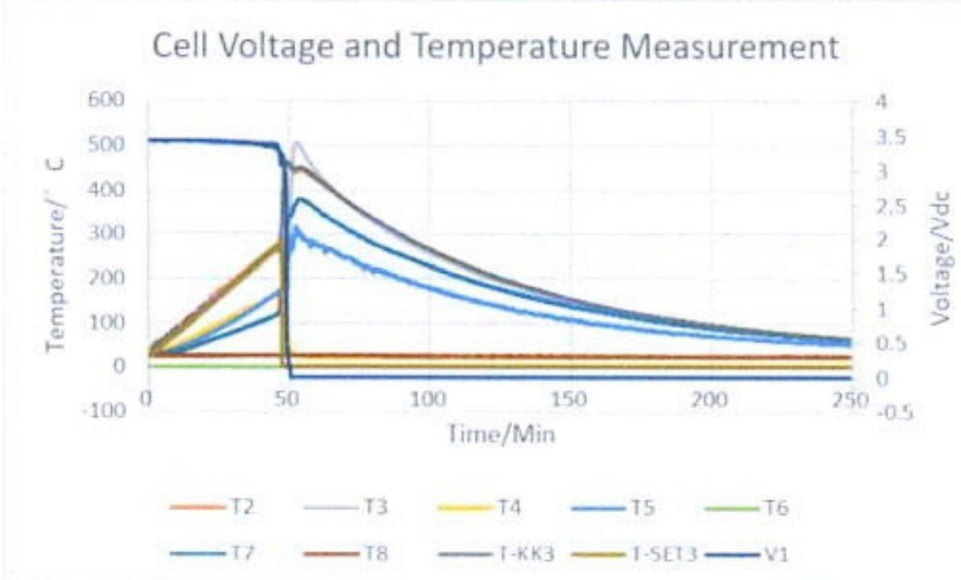
Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 26 of 30
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Attachment 4 - Cell temperature/voltage graph during testing

Sample Number: 2022040003-1



Sample Number: 2022040003-2

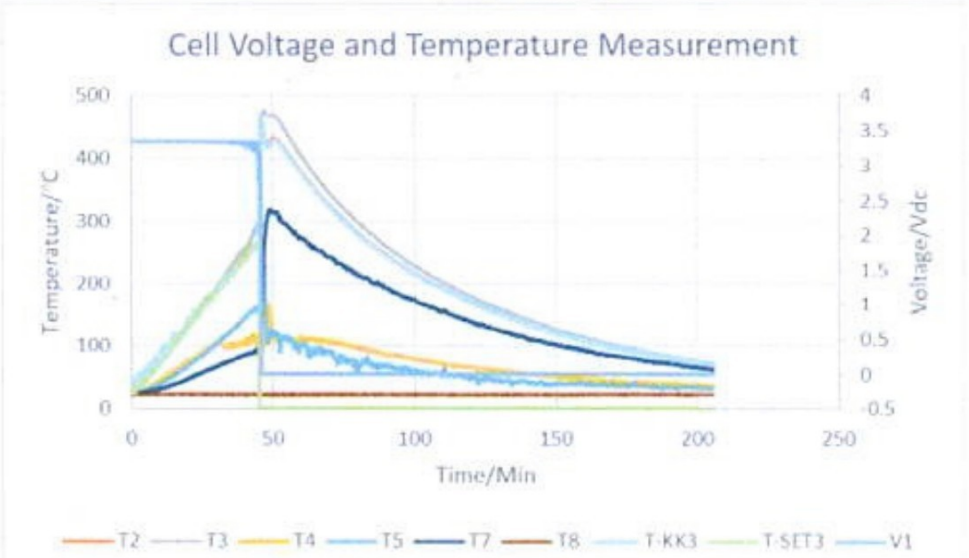


The results relate only to the items tested.
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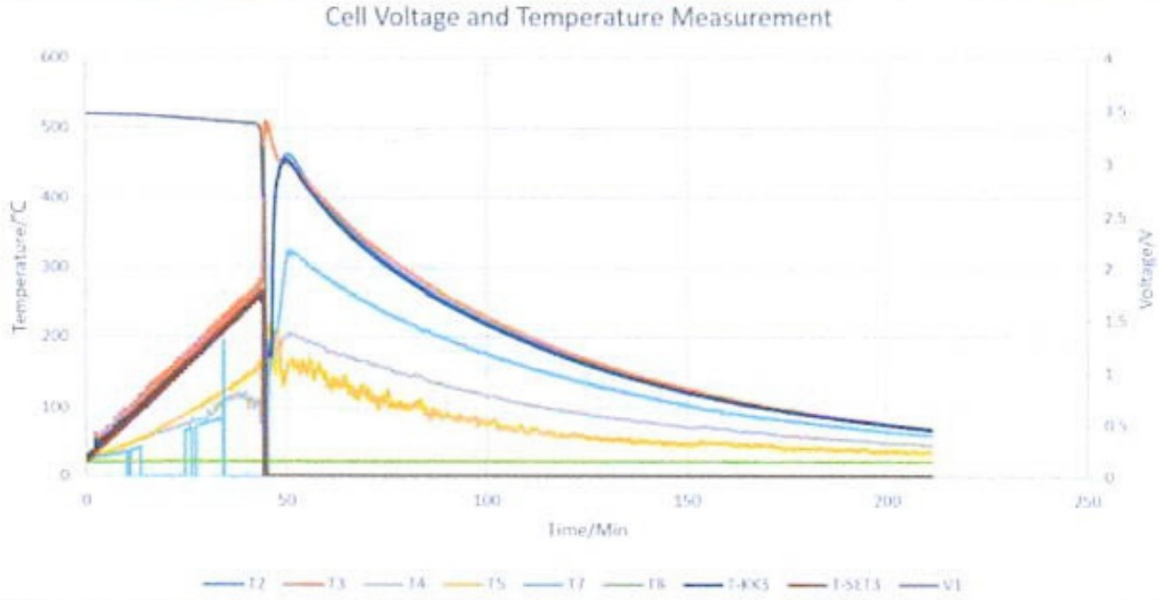
Master Contract:	N/A	Model:	LFP71173205E-280Ah	Page number 27 of 30
Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Attachment 4 - Cell temperature/voltage graph during testing

Sample Number: 2022040003-4



Sample Number: 2022040003-5

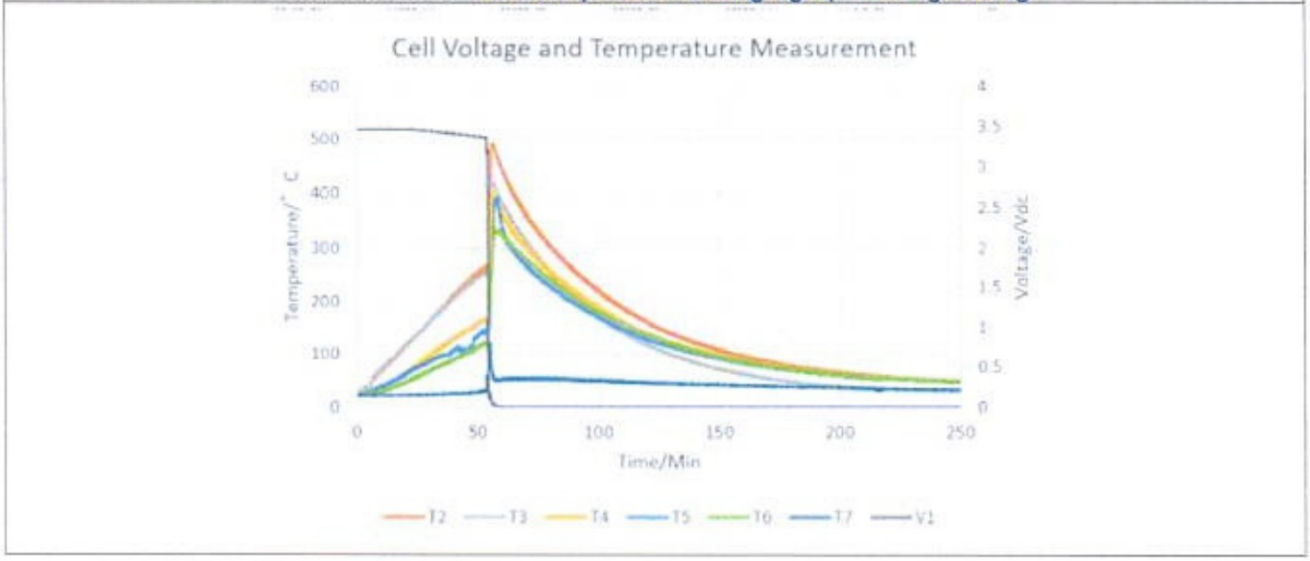


Sample Number: 2022040003-6

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Attachment 4 - Cell temperature/voltage graph during testing



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Attachment 5 - Cell gas analysis report

Sample Number:1622070143

序号 No.	检测项目名称 Name of Test	标准条款号 Clause of Standard	检测结果 Test Result	备注 Remark
1	气体/蒸气燃烧（爆炸）极限—下限 Flammable (explosion) limits of gas and vapours - LFL	ASTM E918-19	初始温度 34(±1)℃，初始压力 101(±3)kPa 条件下，LFL=5.4%。 LFL=5.4% at 34(±1)℃ and 101(±3)kPa.	详见附表 3 和 4。 See Attached Table 3 and 4
2	气体/蒸气燃烧（爆炸）极限—下限 Flammable (explosion) limits of gas and vapours - LFL	ASTM E918-19	初始温度 207(±4)℃，初始压力 101(±2)kPa 条件下，LFL=4.6%。 LFL=4.6% at 207(±4)℃ and 101 (±2) kPa.	详见附表 5 和 6。 See Attached Table 5 and 6
3	可燃气体燃烧速度 Burning velocity of flammable gases	ISO 817:2014	在室温和大气压条件下，S_u = 1.043m/s。 S_u = 1.043m/s at room temperature and atmospheric pressure.	详见附表 7 和 8。 See Attached Table 7 and 8
4	气体/蒸气的最大爆炸压力 Maximum explosion pressure of gases and vapours	EN 15967:2011	初始温度 21(±2)℃，初始压力 101(±3)kPa 条件下，p_{max}=0.77MPa。 p_{max}=0.77MPa at 21(±2)℃ and 101(±3)kPa.	详见附表 9 和 10。 See Attached Table 9 and 10.
5	以下空白 Intentionally Left Blank			
6				
检测环境条件 Test Environment Condition			环境温度：19~36℃，相对湿度：51~70% Ambient Temperature: 19~36℃, Relative Humidity: 51~70%	
备注 Remarks			本检测报告的测试数据仅对某种特定情况下的样品有效。若需将这些测试结果运用于产品的生产、加工、运输及储存等过程中的风险评估，请征求有关专家的意见。 This report is effective under the specific condition; please seek for the advice of expert for risk assessment in producing, processing, transportation and storage.	

Note: Test result for LFL at 34 deg.C was considered to representative of results at ambient temperature, as there is no significant impact on the test results (tested results at 34 deg.C: 5.4%,

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Project / Network:	80122570	Description:	Lithium iron phosphate cell	

Attachment 5 - Cell gas analysis report

calculated results 5.44% at ambient 25 deg.C. The calculation was referenced to the research material Experimental study on the effect of temperature-pressure coupling on methane explosion limit by Rongjun Si.

End of Report ....