REPORT

For

Sterling PBES Energy Solutions Ltd.

606-1200 W 73rd Ave.
Vancouver, BC, V6P 6G5
Canada

Date:	March 29, 2021
Report No.:	40.00.20251-1
Revision No.:	0
Project No.:	20251
Equipment:	Battery
Model No.:	BBU

ONE STOP GLOBAL CERTIFICATION SOLUTIONS

205 - 8291 92nd Street, Delta, BC
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TABLE OF CONTENTS

TEST REPORT

Fire Survivability Testing

Report reference No. .....:	40.00.20251-1
Report Revision History:	0
Tested, Report Compiled and Evaluated by (printed name and signature) .....:	Ovidiu Harpa
Reviewed by (printed name and signature) .....:	Dan Ichim
Date of issue .....:	March 29, 2021

Note: By signing this report, both the Testing Technician and the Reviewer hereby declare to abide by the applicable LabTest policies:
1.) Statement of Independence # 3014 (LabTest Employees),
2.) Independence, Impartiality, and Integrity #1039, clause 11 (Engineering Service Subcontractors), or
3.) Independence, Impartiality, and Integrity #1019, clause 3.5 (Testing Subcontractors).

Testing Laboratory Name .....:	LabTest Certification Inc.
Address .....:	205 – 8291 92nd Street, Delta, BC V4G 0A4, Canada
Test Location Name .....:	N/A
Address .....:	2665 176 Street, Surrey, BC, V3S 9V4, Canada
Applicant's Name .....:	Sterling PBES Energy Solutions Ltd.
Address .....:	606 - 1200 W 73rd Ave, Vancouver, BC, V6P 6G5, Canada
Test specification	
Standards .....:	➢ N/A
Test procedure .....:	➢ Battery BBU Fire Survivability
Non-standard test method .....:	SPBES procedure DOC-0306
Test item description .....:	Battery
Trademark .....:	N/A
Manufacturer .....:	Sterling PBES Energy Solutions Ltd.
Model and/or type reference .....:	BBU
Serial number .....:	N/A
Rating(s) .....:	N/A
Sampling Plan Used.....:	N/A

Particulars: test item vs. test requirements

Equipment mobility ..... :	Permanent connection
Operating condition ..... :	N/A
Mass of equipment (Kg) ..... :	90
Protection against ingress of water ..... :	N/A

Test case verdicts

Test case does not apply to the test object :	(N)/A
Test item does meet the requirement ..... :	(P)ass
Test item does not meet the requirement .. :	(F)ail

Testing

Date of receipt of test item ..... :	March 23, 2021
Date(s) of performance of test ..... :	March 24, 2021

General remarks

"This report is not valid as a CB Test Report unless appended by an approved CB Testing Laboratory and appended to a CB Test Certificate."

The test result presented in this report relate only to the object(s) 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 comma is used as the decimal separator.

☒ Throughout this report a period is used as the decimal separator.

General product information:

Model BBU - DC Ratings: 77-100V, Nominal 88.8V, Capacity 75 Ah, Energy 6.5kWh, RMS continuous current 225A, Max discharge current 450A, Max charge current 225A, Efficiency (1C)>98%, Self discharge per month <2%, Electrical isolation open circuit when not in operation, Weight 90kg, Dimensions L 580mm x H 380mm x W 320mm.

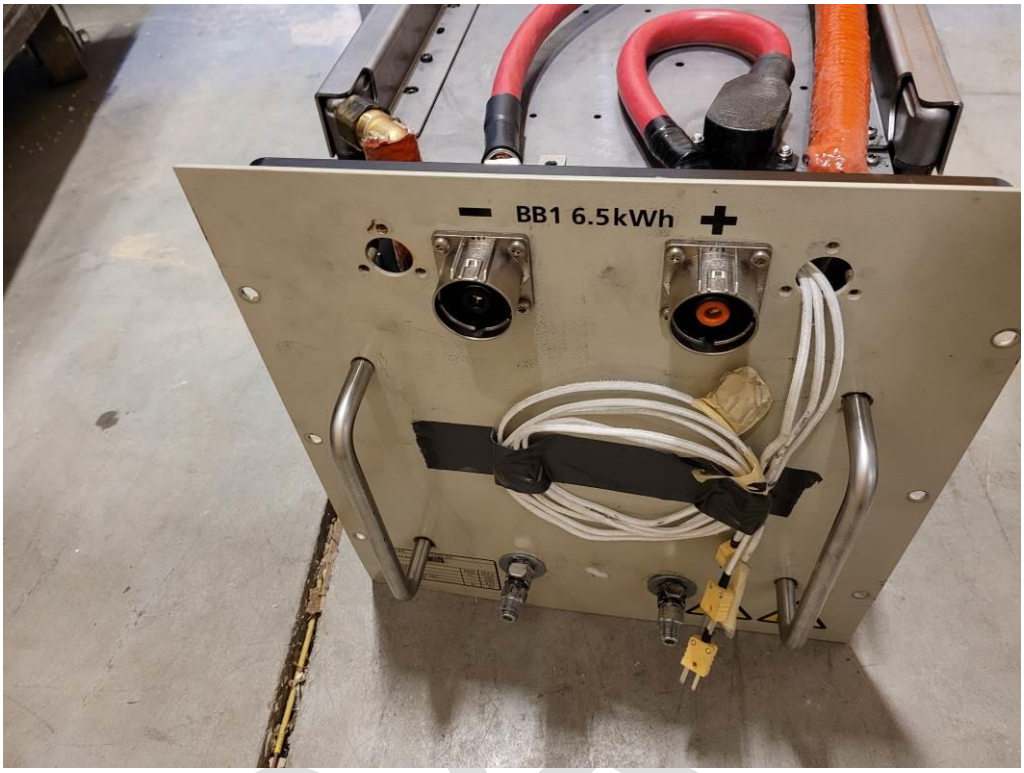
SUMMARY OF TESTING

	Test	Description of Test	Verdict
1	**Fire Resistance at 215°C Test**	• This test is to verify that the BBU cooling system in a 215°C chamber can keep the cell temperature below 150°C for 60 minutes.	Pass
2	**Fire Resistance at 950°C Test**	• This test is to determine how long the BBU cooling system in a 950°C chamber can keep the cell temperature below 150°C for 60 minutes.	Pass

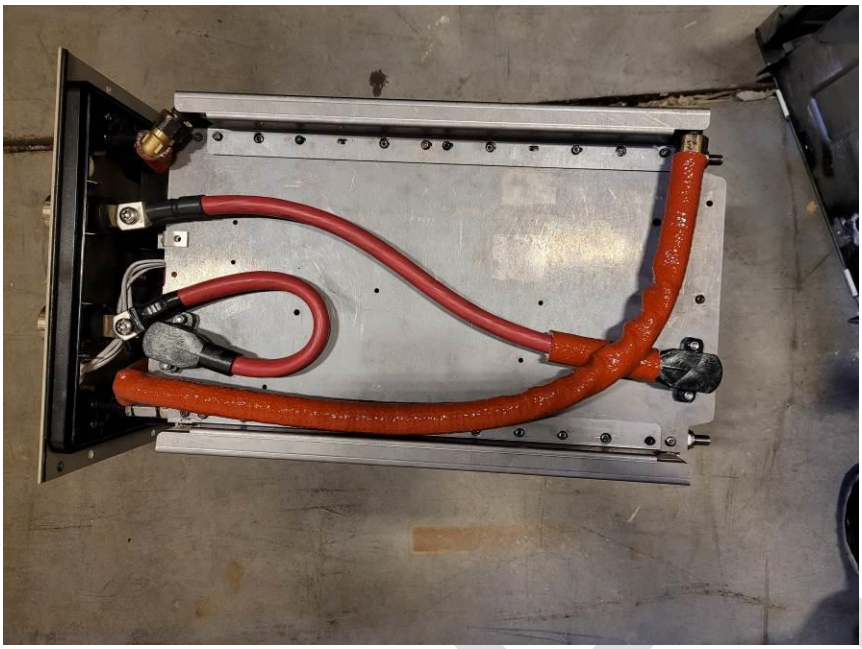
TEST EQUIPMENT USED

Item	Type	Equipment No.	Calibration Due Date	Calibration Laboratory
1	Environmental Logger	695	June 18, 2021	Tektronix
2	Multiplexer Module	722	Calibrated with asset 725	—
3	Data Acquisition Unit	725	December 11, 2021	Wescan Calibration
4	Test Chamber	-	Used with asset 722 and 725	—
5	Stopwatch	1461	November 06, 2021	Wescan Calibration

PICTURES



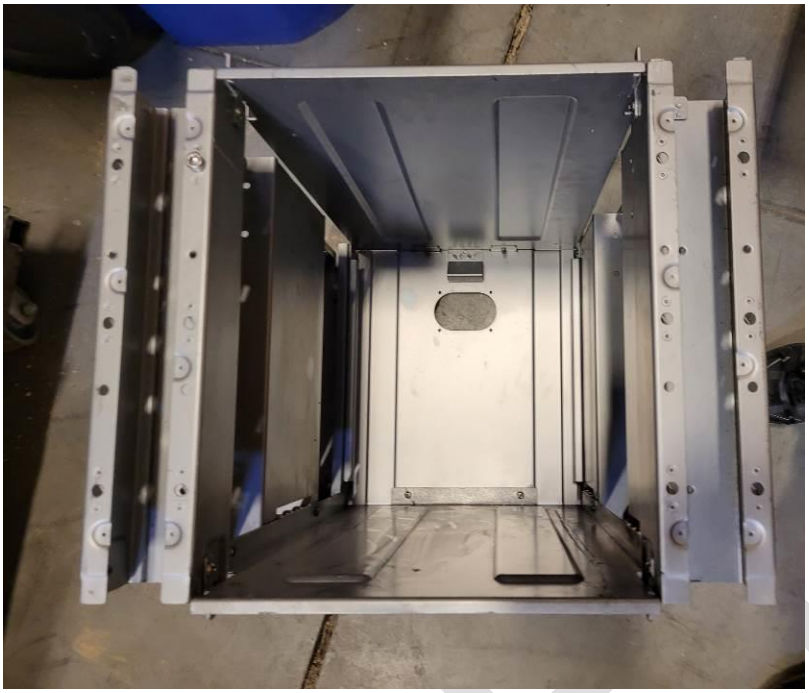
Picture 1 – Unit BBU – Front View



Picture 2 – Units BBU – Top View

Picture 3 – Unit BBU – Side View

Picture 4 – Unit BBU – Side View



Picture 5 – Unit BBU – Rack Internal View

Picture 6 – Unit BBU – Unit Installed in the Rack

Picture 7 – Unit BBU – Unit Installed in the Chamber

Picture 8 – Unit BBU – Unit After Exposure at 215°C

Picture 9 – Unit BBU – Unit After Exposure at 950°C

APPENDIX A – TEST DATA SECTION

Project No.:	**20251**	**Date:**	**March 24, 2021**
Equipment ID#:	**695; 722; 725; 1461; Test Chamber**	**Room Temp/Humidity:**	**11.2 ºC / 48.9 %RH**
Model No(s):	**BBU**	**Barometric Pressure:**	**100.8 kPa**
Sample No(s):	**6075**	**Serial No(s):**	**N/A**

USE A SEPARATE DATA SHEET FOR EACH MODEL. ALL TEST RESULTS MUST BE TRACEABLE TO THE SN# OF THE TESTED UNIT

Note: By signing the below, both the Issuer and the Reviewer hereby declare to abide by the applicable LabTest policies:
1.) Statement of Independence # 3014 (LabTest Employees), or
2.) Independence, Impartiality, and Integrity #1019, clause 3.5 (Testing Subcontractors).

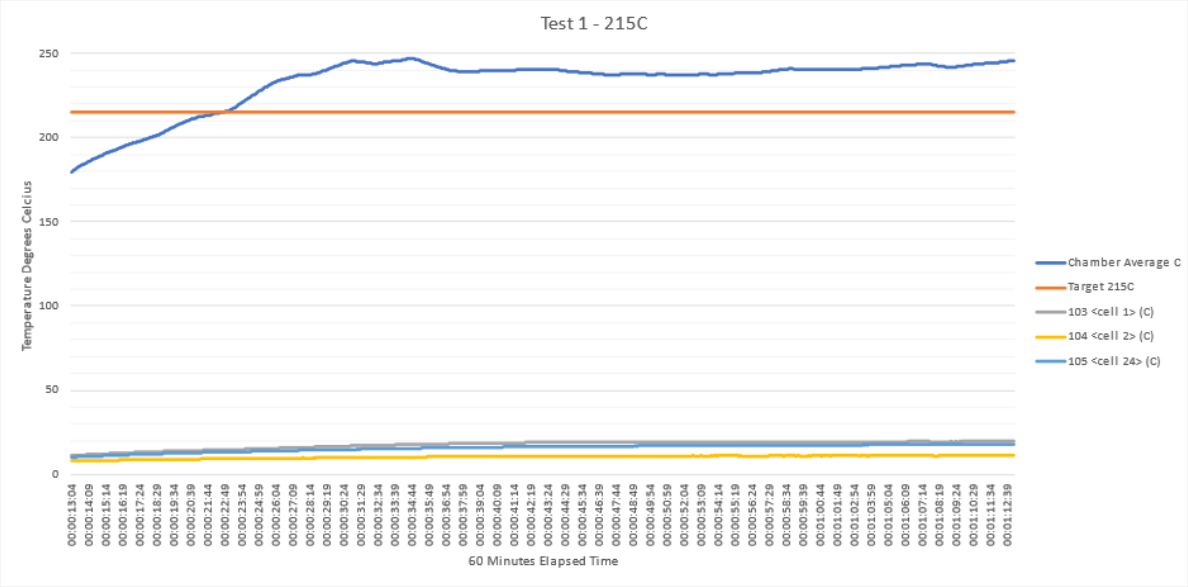
Tested By:	**Ovidiu Harpa**	
	Print	Signature
Reviewed by:	**Dan Ichim**	
	Print	Signature

Test Data:

Test No.1

The Testing chamber was heated up to 215°C and mantained for 1 hour to verify that the BBU cooling system can keep the cell temperature below 150°C for 60 minutes.
The cooling system was supplied water at ambient temperature at a minimum of 8 litres/min.
No safety issues or damage to the cooling system was observed at conclusion of test.

215°C Temperature Test			
	Cell 1	**Cell 2**	**24**
Maximum temperature measured (°C)	19.708	11.238	17.985
Safety Issues (fire, smoke)	No		
Damage to cooling system (leakage)	No		



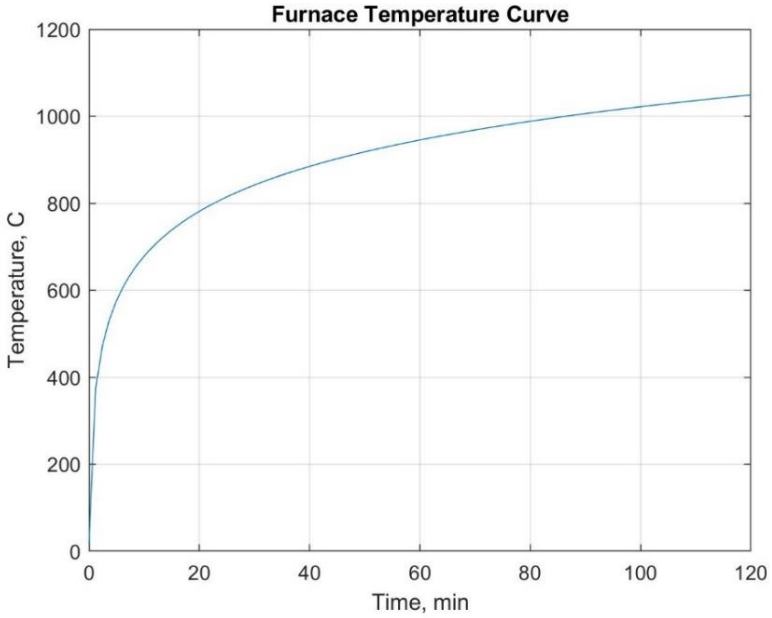
215°C Test Temperature Graph

Test No.2

The Testing Chamber was set to heat up to 950°C and intended to be mantained for 1 hour to verify that the BBU cooling system can keep the cell temperature below 150°C for 60 minutes and the colling systems is not damaged.

The cooling system was supplied water at ambient temperature at a minimum of 8 litres/min.

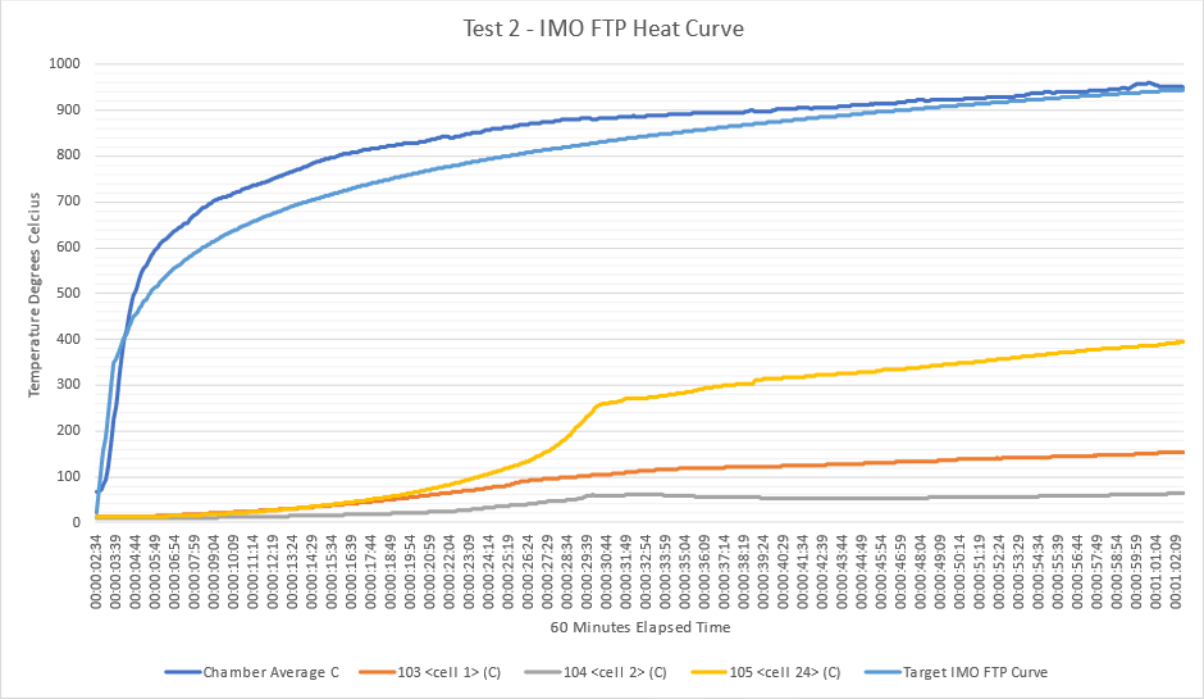
The 950C test furnace heating followed the IMO FTP Code temperature curve, $T=345\log_{10}(8t+1)+20$, as seen in the figure below, to a maximum of 945°C at 60 minutes test duration. The actual maximum heat chamber temperature reached during the test was 959.8°C.



Furnace Temperature Curve

950°C Temperature Test			
	Cell 1	**Cell 2**	**24**
Maximum temperature measured (°C)	156.426	63.655	398.048
Safety Issues (fire, smoke)	No		
Damage to cooling system (leakage)	No		

The plastic fittings within the battery were melted and destroyed by the heat. Cell #1 temperature was recorded up to 156 deg.C, with cell #24 reaching 398 deg.C, however this was due to melted plastics within the battery module reaching the thermocouple sensors. Cell #2 recorded a more realistic maximum temperature of 64 deg.C after 60 minutes.



950°C Test Temperature Graph

Observation:

Final Result: Pass – Test 1
Pass – Test 2

APPENDIX B – ISO 17025:2005 ACCREDITATION CERTIFICATE

For complete scope of certification https://www.iasonline.org/wp-content/uploads/2017/05/TL-367.pdf

END OF REPORT