



**TEST REPORT**  
**ANSI/CAN/UL 9540A:2025**  
**Test Method for Evaluating Thermal Runaway Fire Propagation**  
**in Battery Energy Storage Systems**

Report Reference No..... : 241212104GZC-001

Tested by  
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Testing location/ procedure ..... : Lab test

Testing location/ address..... : Intertek Testing Services Shenzhen Ltd. Zengcheng Branch  
 C2-1, Heping Xu, Yongning Street, Zengcheng District, Guangzhou, China

Applicant's name ..... : SURRETTE BATTERY COMPANY LTD.

Address..... : 58 LISGAR STREET SPRINGHILL, NOVA SCOTIA, B0M 1X0, CANADA

Test specification:

Standard ..... : ANSI/CAN/UL 9540A:2025 (Fifth Edition)

Test procedure..... : Unit level test (clause 9.1-9.8)

Non-standard test method..... : N/A

Test Report Form No..... : ANSI/CAN/UL 9540A\_2025 Unit

Test Report Form(s) Originator ..... : Intertek

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Test item description ..... : LITHIUM BATTERY

Trade Mark ..... : ROLLS BATTERY ENGINEERING

Manufacturer..... : [REDACTED]

Address ..... : [REDACTED]

Model/Type reference..... : See Unit information on page 14-15

Ratings..... : See Unit information on page 14-15

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**List of attachments:**

- Attachment 1 – Photos
- Attachment 2 – Sample preparation
- Attachment 3 – Arrangement of the unit
- Attachment 4 – Thermal runaway preparation
- Attachment 5 – Observations and records
- Attachment 6 – Temperature measurements
- Attachment 7 – Heat flux measurements
- Attachment 8 – Chemical heat release rate measurement
- Attachment 9 – Convective heat release rate measurement
- Attachment 10 – Gas generation measurement
- Attachment 11 – Smoke release rate measurement
- Attachment 12 – Equipment list

Test videos 20250528-1.mp4 to 20250528-5.mp4 were provided in addition to this test report.

**Summary of testing:**

Thermal Runaway Propagation.....	1 cell (Cell 7) went to thermal runaway due to external heating. 1 cell (Cell 6) vented and thermal runaway due to thermal runaway propagation in the initiating module. No thermal runaway propagation from initiating module to other modules in initiating unit.
Maximum Target BESS Temperature (°C) .....	26.2°C
Maximum Wall Surface Temperature (°C) .....	34.5°C
Maximum Heat Flux on target wall surfaces (kW/m <sup>2</sup> )....	0.193kW/m <sup>2</sup>
Maximum Heat Flux on target BESS units (kW/m <sup>2</sup> ) .....	0.013kW/m <sup>2</sup>
Peak Chemical Heat Release Rate (kW) .....	10.26kW
Peak Convective Heat Release Rate (kW) .....	0kW
Peak Smoke Heat Release Rate (m <sup>2</sup> /s) .....	0.0766 m <sup>2</sup> /s
Total Smoke Release (m <sup>2</sup> ) .....	100.75 m <sup>2</sup>
Maximum Heat Flux on Egress Path (kW/m <sup>2</sup> ) .....	0.014kW/m <sup>2</sup>
External Flaming from BESS .....	Not observed
Flying debris or explosive discharge of gases .....	Not observed
Sparks, electrical arcs, or other electrical events.....	Not observed
Re-ignitions .....	Not observed

**Conclusion:**

The performance criteria of the unit level test as indicated in 9.8 of UL 9540A 5th edition has been met. Potential for deflagration from gas generation rates should be evaluated by deflagration analysis to determine if the installation level test is required or not. (reference to UL9540A Figure A.1 BESS Fire Propagation Assessment Flow Chart).

**Possible test case verdicts:**

- test case does not apply to the test object.....: N/A
- test object was not evaluated for the requirement.....: N/A
- test object does meet the requirement.....: Pass (P)
- test object does not meet the requirement .....: Fail (F)

**Testing:**

Date of receipt of test items .....: 27 May 2025  
Date(s) of performance of tests .....: 27 May 2025 – 29 May 2025

**General remarks:**

"(see Attachment #)" refers to additional information appended to the report.  
"(see appended table)" refers to a table appended to the report.  
The tests 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 testing laboratory.  
List of test equipment must be kept on file and available for review.  
Additional test data and/or information provided in the attachments to this report.  
Throughout this report a  comma /  point is used as the decimal separator.  
Determination of the test results includes consideration of measurement uncertainty from the test equipment and methods.

**Name and address of factory (ies) .....**: [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

**General product information:**

This test unit is a residential indoor floor mounted battery system.



<b>Unit information</b>				
Manufacturer.....	[REDACTED]			
Address.....	[REDACTED]			
Model.....	S48-100LFP STACK-LV, S48-200LFP STACK-LV, S48-300LFP STACK-LV, S48-400LFP STACK-LV, S48-500LFP STACK-LV, S48-600LFP STACK-LV, S48-700LFP STACK-LV, S48-800LFP STACK-LV			
Test Model.....	S48-800LFP STACK-LV			
Type of system.....	<input checked="" type="checkbox"/> Battery System (BS)		<input type="checkbox"/> Battery ESS	
Intended use location.....	<input checked="" type="checkbox"/> Residential		<input type="checkbox"/> Non-residential	
	<input type="checkbox"/> Non-residential rooftop			
	<input type="checkbox"/> Non-residential open garage use			
Type of installation.....	<input checked="" type="checkbox"/> Indoor floor mounted		<input type="checkbox"/> Outdoor ground mounted	
	<input type="checkbox"/> Indoor wall mounted		<input type="checkbox"/> Outdoor wall mounted	
Enclosure material.....	<input checked="" type="checkbox"/> Metal		<input type="checkbox"/> Non-metal	
	<input type="checkbox"/> Open rack			
Spacing between modules.....	17mm			
Integrated fire protection system in the unit.....	No fire detection and suppression system installed for the unit level test			
If the unit compliance with UL 1973 or UL 9540.....	Compliance / UL 1973 Report No. 241213059GZC-001			
<b>Electrical rating:</b>				
Model:	S48-100LFP STACK-LV	S48-200LFP STACK-LV	S48-300LFP STACK-LV	S48-400LFP STACK-LV
Rated Capacity (Ah):	100	200	300	400
Rated energy (kWh):	5.12	10.24	15.36	20.48
Nominal voltage (V):	51.2	51.2	51.2	51.2
Weight(kg):	69.0	118.2	167.4	216.6
Dimensions (D*W*H)	600(±1) mm x 450(±1) mm x 320(±5) mm	600(±1) mm x 450(±1) mm x 480(±5)mm	600(±1) mm x 450(±1) mm x 640(±5)mm	600(±1) mm x 450(±1) mm x 800(±5) mm
Module series and/or parallel configuration:	1S1P	1S2P	1S3P	1S4P
Total number of cells:	16	32	48	64
<b>Standard charge method:</b>				
Standard Charge current (A):	50	100	150	200
Max Charge current (A):	100	160	240	320
<b>End of charge voltage (V):</b>	56.8			
<b>Standard discharge method:</b>				
Standard Discharge current (A):	50	100	150	200
Max Discharge current (A):	100	160	240	320
<b>End of discharge voltage (V):</b>	48			

<b>Electrical rating(Con't):</b>				
Model:	S48-500LFP STACK-LV	S48-600LFP STACK-LV	S48-700LFP STACK-LV	S48-800LFP STACK-LV
Rated Capacity (Ah):	500	600	700	800
Rated energy (kWh):	25.60	30.72	35.84	40.96
Nominal voltage (V):	51.2	51.2	51.2	51.2
Weight(kg):	265.8	315.0	364.2	413.4
Dimensions (D*W*H)	600(±1) mm x 450(±1) mm x 960(±5)mm	600(±1) mm x 450(±1) mm x 1120(±5)mm	600(±1) mm x 450(±1) mm x 1280(±5)mm	600(±1) mm x 450(±1) mm x 1440(±5) mm
Module series and/or parallel configuration:	1S5P	1S6P	1S7P	1S8P
Total number of cells:	80	96	112	128
<b>Standard charge method:</b>				
Standard Charge current (A):	250	300	350	400
Max Charge current (A):	400	400	400	400
End of charge voltage (V):	56.8			
<b>Standard discharge method:</b>				
Standard Discharge current (A):	250	300	350	400
Max Discharge current (A):	400	400	400	400
<b>End of discharge voltage (V):</b>	48			
Rest time between charge and discharge	30min			

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Clause	Requirement – Test	Result - Remark	Verdict
<b>5</b>	<b>Construction – General</b>		
<b>5.1</b>	<b>Cell</b>		
5.1.1	The cell info associated with the BESS includes:		Pass
	• cell chemistry (e.g. NMC, LFP);	LiFePO <sub>4</sub>	Pass
	• the physical format of the cell;	Prismatic	Pass
	• the cell electrical rating in capacity and nominal voltage;	104Ah, 3.2V	Pass
	• the overall dimensions of the cell, and weight.		Pass
5.1.2	The cells associated with the BESS comply with ANSI/CAN/UL 1973 or not.	Certificate provided.	Pass
5.1.3	Further details included in the cell level test report.		Pass
<b>5.2</b>	<b>Module</b>		
5.2.1	The modules info associated with the BESS includes:		Pass
	• the generic enclosure material;	Metal	Pass
	• the general layout of the module contents;		Pass
	• the electrical configuration of the cells in the modules and the modules in the BESS.	1P16S	Pass
5.2.2	The modules associated with the BESS comply with UL 1973 or not.		N/A
5.2.3	Further details included in the module level test report.		N/A
<b>5.3</b>	<b>Battery energy storage system unit</b>		
5.3.1	The BESS unit info includes:		--
	• the units comply with UL 9540 or not;		N/A
	• the manufacturer and model number;		Pass
	• electrical ratings;		Pass
	• energy capacity of all BESS.		Pass
5.3.2	For BESS units, which UL 9540 compliance cannot be determined, to include:		--
	• the number of modules in the BESS;	8	Pass
	• electrical configuration of the module;		Pass
	• physical layout of the modules in the BESS;		Pass
	• battery management system (BMS); and		Pass
	• other major components of the BESS;		Pass
	• the BESS enclosure overall dimensions and generic material;		Pass
	• battery system(s) may be tested as representative of the BESS;		Pass
	• battery system complies with UL 1973 or not.		Pass
5.3.3	Any fire detection and suppression systems that are an integral part of the BESS.	No fire detection and suppression system installed for the unit level test	N/A
5.3.4	Further details included in the unit level and if applicable, installation level test reports.		Pass
<b>5.4</b>	<b>Flow Batteries</b>		

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Clause	Requirement – Test	Result - Remark	Verdict
5.4.1	For flow batteries, to include the following info:		N/A
	<ul style="list-style-type: none"> <li>the chemistry;</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>a generic description of the electrolyte (s);</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>the overall dimensions of the individual stack;</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>the electrical rating in capacity and nominal voltage of the cell stack.</li> </ul>		N/A
	And the Information of the complete flow battery system:		N/A
	<ul style="list-style-type: none"> <li>the manufacturer's name and model number of the system;</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>the electrical rating in volts and rated storage capacity in Ah or Wh;</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>the number of cells and stacks in the system;</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>the maximum volume of electrolyte(s) for the system.</li> </ul>		N/A
5.4.2	The flow battery system complies with UL 1973 or not.		N/A
5.4.3	Further details included in the flow battery thermal runaway determination level test report.		N/A
<b>6</b>	<b>Performance – General</b>		
6.1	The tests in this Standard are extreme abuse conditions conducted on electrochemical energy storage devices that can result in fires, explosions, smoke, off gassing of flammable and toxic materials, exposure to toxic and corrosive liquids, and potential exposure to hazardous voltages and electrical energy.		Pass
6.2	At the conclusion of testing, samples discharged in accordance with the manufacturer' specifications.		Pass
	All samples disposed of in accordance with local regulations.		Pass
6.3	Temperatures on parts and surfaces shall be measured continuously, taking the average over every 60 seconds through the test with a thermocouple junction formed from 24-gauge or smaller, Type-K thermocouple wire unless noted otherwise in the specific test. The maximum of these averages shall be documented for each thermocouple location. Cell surface temperatures shall be measured continuously, but not averaged over every 60 seconds as the other temperature measurements are.		Pass
6.4	When heat flux measurements are taken, they shall be measured continuously, taking the average over every 60-second interval. The maximum of these averages shall be documented for each gauge location.		Pass
<b>9</b>	<b>Unit Level</b>		
<b>9.1</b>	<b>Sample and test configuration</b>		Pass
9.1.1	The unit level test shall be conducted with BESS units installed as described in the manufacturer's instructions and this section.		Pass

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Clause	Requirement – Test	Result - Remark	Verdict
9.1.2	The unit level test requires one initiating BESS unit, in which a thermal runaway condition resulting in cell to cell thermal runaway propagation in accordance with the module level test in 8.2.4 is initiated, and adjacent target BESS units representative of an installation.	An internal thermal runaway propagation condition as in the module level test is initiated.	Pass
	Tests conducted for indoor floor mounted installations for residential BESS may be considered representative of both indoor floor mounted and outdoor ground mounted installations. Tests shall be conducted indoors with fire propagation hazards and separation distances between initiating and target units representative of the installation. The results of such tests for residential BESS may be considered to also represent an outdoor installation.		Pass
	Exception: Testing can be conducted outdoors for outdoor only installations with controlled environment.		N/A
9.1.3	For outdoor non-residential use High Temperature Batteries installed in a container, the unit level test is waived as there is no additional information to be collected at the unit level for this technology when it is utilized for outdoor use only. Instead, the installation level test shall be conducted in accordance with 10.9.	Not High Temperature Batteries.	N/A
9.1.4	For installations, where the high temperature battery modules are not installed on racks but rather within separate compartments within the container, the module is considered the test unit for the test of 10.9. See 10.2.3 and 10.2.4.	Not High Temperature Batteries.	N/A
9.1.5	Depending upon the configuration and design of the BESS (e.g. the BESS is composed of multiple separate parts within separate enclosures), this testing to determine fire characterization can be done at the battery system level. The suitability of this approach shall be determined based upon the overall design of the BESS and an analysis of the battery system as representative of the overall BESS for fire characterization concerns.		Pass
9.1.6	Where the manufacturer's instructions indicate that the BESS can be installed outdoors and in open parking garages less than 3 m (10 feet) from the means of egress or other exposures, testing shall be conducted as described in this Section.		N/A
9.1.7	The initiating BESS unit shall contain components representative of a BESS unit in a complete installation. Combustible components that interconnect the initiating and target BESS units shall be included.		Pass
9.1.8	Target BESS units shall include the outer cabinet (if part of the design), racking, module enclosures, and components that retain cells components. The target BESS units may also include one live, populated module at the location of the highest anticipated temperature in the enclosure. The remaining target BESS unit module enclosures do not need to contain cells.		Pass

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Clause	Requirement – Test	Result - Remark	Verdict
9.1.9	The initiating BESS unit shall be brought to the maximum operating state of charge (MOSOC) in accordance with the manufacturer's specifications and allowed to rest for a minimum of 1 hour at room ambient before the start of the test.		Pass
9.1.10	Prior to initiating the test, the voltage of the initiating module shall be measured and recorded. If the voltage drop is greater than 0.1 % of the fully charged voltage of the module, then the initiating BESS shall be charged again as noted in 9.1.9 and the voltage of the initiating BESS shall be recorded.		Pass
9.1.11	If a BESS unit includes an integral fire suppression system, there is an option of providing this with the DUT. If the BESS unit is provided with an optional integral fire suppression system, the system shall not be provided on the DUT.		N/A
9.1.12	Electronics and software controls such as the battery management system (BMS) in the BESS are not relied upon for this testing. This does not include a fire suppression control in accordance with UL 864 that is external to the BESS, but provided as part of an integral fire suppression system per 9.1.11.	BMS function disabled and the BESS not include an integral fire suppression system.	Pass
<b>9.2</b>	<b>Test method – Indoor floor mounted BESS units</b>		Pass
9.2.1	During the test, the test room environment shall be controlled to prevent drafts that may affect test results. At the start of the test, the room ambient temperature shall not be less than 10°C nor more than 32°C.	See attachment 5	Pass
9.2.2	Any access door(s) or panels on the initiating BESS unit and adjacent target BESS units shall be closed, latched and locked at the beginning and duration of the test.		Pass
9.2.3	The initiating BESS unit shall be positioned adjacent to two instrumented wall sections.	See attachment 3	Pass
9.2.4	Instrumented wall sections shall extend not less than 0.49 m (1.6 feet) horizontally beyond the exterior of the target BESS units.		Pass
9.2.5	Instrumented wall sections shall be at least 0.61-m (2-feet) taller than the BESS unit height, and not less than 2.13 m (7 feet) in height above the floor.		Pass
9.2.6	The surface of the instrumented wall sections shall be covered with gypsum wall board and painted flat black. An incremental visual reference shall be provided on the instrumented wall sections for scale so that flame extension can be accurately measured if applicable. The gypsum wall board shall be 13-mm (1/2-inch) thick at minimum.		Pass
9.2.7	The initiating BESS unit shall be centered underneath an appropriately sized smoke collection hood of an oxygen consumption calorimeter.		Pass
9.2.8	The light transmission in the calorimeter's exhaust duct shall be measured for the duration of the test, and the smoke release rate shall be calculated.		Pass
9.2.9	The chemical and convective heat release rates shall be measured for the duration of the test, respectively.		Pass

ANSI/CAN/UL 9540A			
Clause	Requirement – Test	Result - Remark	Verdict
9.2.10	The heat release rate measurement system shall be calibrated using flows of 3.8, 7.6, 11.4 and 15.2 L/min (1, 2, 3 and 4 gpm) of heptane.		Pass
9.2.11	The convective heat release rate shall be measured using a thermopile, a velocity probe, and a Type K thermocouple, located in the exhaust system of the exhaust duct.		Pass
9.2.12	The convective heat release rate shall be calculated using the following equation: $HRR_c = V_e A \frac{353.22}{T_e} \int_{T_s}^T C_p dT$	See attachment 9	Pass
9.2.13	The physical spacing between BESS units (both initiating and target) and adjacent walls shall be representative of the intended installation.	See attachment 3	Pass
9.2.14	Separation distances shall be specified by the manufacturer for distance between:		Pass
	a) The BESS units and the instrumented wall sections; and	See attachment 3	Pass
	b) Adjacent BESS units.	See attachment 3	Pass
9.2.15	Wall surface temperatures shall be measured in vertical array(s) at 152-mm (6-inch) intervals for the full height of the instrumented wall sections using No. 24-gauge or smaller, Type-K exposed junction thermocouples. The thermocouples for measuring the temperature on wall surfaces shall be horizontally positioned in the wall locations anticipated to receive the greatest thermal exposure from the initiating BESS unit. Temperatures shall be measured continuously, averaging over every 60-second interval per 6.3. The maximum of these averages shall be documented for each thermocouple location.		Pass
9.2.16	Thermocouples shall be secured to gypsum surfaces by the use of staples placed over the insulated portion of the wires. The thermocouple tip shall be depressed into the gypsum so as to be flush with the gypsum surface at the point of measurement and held in thermal contact with the surface at that point by the use of pressure-sensitive paper tape.		Pass
9.2.17	Heat flux shall be measured with the sensing element of at least two water-cooled Schmidt-Boelter or Gardon gauges at the surface of each instrumented wall as follows in (a) - (c). Heat flux shall be measured continuously, averaging over every 60-second interval per 6.4. The maximum of these averages shall be documented for each gauge location.		Pass
	a) Both are collinear with the vertical thermocouple array;		Pass
	b) One is positioned at the elevation estimated to receive the greatest heat flux due to the thermal runaway of the initiating module; and		Pass
	c) One is positioned at the elevation estimated to receive the greatest heat flux during potential propagation of thermal runaway within the initiating BESS unit.		Pass
	Exception: If (b) and (c) are deemed to be at the same location based on a construction review, only one gauge is required.		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
9.2.18	Heat flux shall be measured with the sensing element of at least two water-cooled Schmidt-Boelter or Gardon gauges at the surface of each adjacent target BESS unit that faces the initiating BESS unit as follows in (a) and (b). Heat flux shall be measured continuously, averaging over every 60-second interval per 6.4. The maximum of these averages shall be documented for each gauge location.		Pass
	a) One is positioned at the elevation estimated to receive the greatest heat flux due to the thermal runaway of the initiating module within the initiating BESS; and		Pass
	b) One is positioned at the elevation estimated to receive the greatest surface heat flux due to the thermal runaway of the initiating BESS.		Pass
	Exception: If (a) and (b) are deemed to be at the same location based on a construction review, only one gauge may be installed on the target unit for the measurement.		N/A
9.2.19	For BESS intended for installation outdoors or in open parking garages covered by 9.1.6, heat flux shall be measured with the sensing element of at least one water-cooled Schmidt-Boelter or Gardon gauge positioned at the mid height of the initiating unit at the minimum horizontal distance from the BESS specified by the manufacturer or the point where the majority of off-gas venting is expected from the initiating unit. Heat flux shall be measured continuously, averaging over every 60-second interval per 6.4.		N/A
9.2.20	No. 24-gauge or smaller, Type-K exposed junction thermocouples shall be installed to measure the temperature of the surface proximate to the cells and between the cells and exposed face of the initiating module. Each non-initiating module enclosure within the initiating BESS unit shall be instrumented with at least one No. 24-gauge or smaller Type-K thermocouple(s) to provide data to monitor the thermal conditions within non-initiating modules. Additional thermocouples shall be placed to account for convoluted enclosure interior geometries. Temperatures shall be measured continuously, averaging over every 60-second interval per 6.3. The maximum of these averages shall be documented for each thermocouple location.		Pass
9.2.21	For residential use BESS, the DUT shall be covered with a single layer of cheese cloth ignition indicator.		Pass
9.2.22	Cell to cell thermal runaway propagation in accordance with the module level test in 8.2.4 shall be established within a single module in the initiating BESS unit:		Pass
	a) The position of the module shall be selected to present the greatest thermal exposure to adjacent modules (e.g. above, below, laterally), based on the results from the module level test; and		Pass

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Clause	Requirement – Test	Result - Remark	Verdict
9.2.23	The composition, velocity and temperature of the initiating BESS unit vent gases shall be measured within the calorimeter's exhaust duct as outlined in 8.2.12. The hydrocarbon content of the vent gas shall be measured using flame ionization detection. Hydrogen gas shall be measured with a palladium-nickel thin-film solid state analyzer. Composition, velocity and temperature instrumentation shall be collocated with heat release rate calorimetry instrumentation.		Pass
9.2.24	The hydrocarbon components of the vent gas composition may additionally be measured using a Fourier-Transform Infrared Spectrometer with a minimum resolution of 1 cm <sup>-1</sup> and a path length of at least 2 m, or an equivalent gas analyzer.		Pass
9.2.25	The test shall be terminated if:		Pass
	a) There are three consecutive temperature readings measured inside each module within the initiating BESS unit that are determined to be falling over 15-minute intervals;		N/A
	b) The modules return to a temperature less than 60°C;		Pass
	c) The fire propagates to adjacent units or to adjacent walls;		N/A
	d) A condition hazardous to test staff or the test facility requires mitigation; or		N/A
	e) Flaming outside the test room is observed.		N/A
9.2.26	For residential use systems, the gas collection data gathered in 9.2 shall be compared to the smallest room installation specified by the manufacturer to determine if the flammable gas collected exceeds 25 % LFL in air.	The smallest volume of installation room: 6.50m <sup>3</sup>	Pass
<b>9.3</b>	<b>Test method – Outdoor ground mounted units</b>		N/A
9.3.1	Outdoor ground mounted non-residential use BESS being evaluated for installation in close proximity to buildings and structures shall use the test method described in 9.2. If intended for outdoor use only installations, including rooftop installations, the smoke release rate, the convective and chemical heat release rate and content, velocity and temperature of the released vent gases need not be measured.		N/A
9.3.2	Outdoor ground mounted residential use BESS being evaluated for installation in close proximity to buildings and structures shall use the test method described in 9.2 except as noted in 9.3.3 and 9.3.4. If intended for outdoor use only installations, the smoke release rate, the convective and chemical heat release rate and content, velocity, and temperature of the released vent gases need not be measured.		N/A
9.3.3	Test samples shall be installed as shown in Figure 9.2 in proximity to an instrumented wall section.		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	The sample shall be mounted on a support substrate and spaced from the wall in accordance with the minimum separation distances specified by the manufacturer.		N/A
	Exception: If the manufacturer requires installation against non-flammable material, the test setup may include manufacturer recommended backing material between the unit and plywood wall.		N/A
9.3.4	Target BESS shall be installed on each side of the initiating BESS in accordance with the manufacturer's installation specifications. The physical spacing between BESS units (both initiating and target) shall be the minimum separation distances specified by the manufacturer.		N/A
<b>9.4</b>	<b>Test Method – Indoor wall mounted units</b>		<b>N/A</b>
9.4.1	Testing of indoor wall mounted BESS shall be in accordance with Section 9.2, except as modified in this section.		N/A
9.4.2	BESS intended for wall mount installations shall only be tested using instrumented wall sections not less than 2.44 m (8 feet) in height and width, and with a 0.3-m (1-foot) wide horizontal ceiling as shown in Figure 9.3. The walls and ceiling shall be constructed with gypsum wall board installed on wood studs and painted flat black. The gypsum wall board shall be 13-mm (1/2-inch) thick at minimum. The instrumented wall shall extend not less than 0.49-m (1.6-feet) horizontally beyond the exterior of the target BESS units.		N/A
9.4.3	When BESS are tested in accordance with 9.4.2, the initiating BESS unit shall be positioned with the center located 1.22-m (4-feet) above the floor or at a height in accordance with the manufacturer's installation instructions, and halfway between adjacent walls.		N/A
9.4.4	Target BESS shall be installed on the wall on each side of the initiating BESS, at the same height above the floor as the initiating BESS. The physical spacing between BESS units (both initiating and target) shall be the minimum separation distances specified by the manufacturer.		N/A
9.4.5	The wall on which the initiating and target BESS units are mounted shall be instrumented.		N/A
9.4.6	For residential use systems, the gas collection data gathered in 9.2 shall be compared to the smallest room installation specified by the manufacturer to determine if the flammable gas collected exceeds 25% LFL in air.		N/A
9.4.7	For residential use BESS, the DUT shall be covered with a single layer of cheese cloth ignition indicator.		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
<b>9.5</b>	<b>Test Method – Outdoor wall mounted units</b>		<b>N/A</b>
9.5.1	Testing of outdoor wall mounted residential and non-residential BESS shall be in accordance with Section 9.2, except as modified in this section.		N/A
	If intended for outdoor use only wall mount installations, the smoke release rate, the convective and chemical heat release rate; and the content, velocity and temperature of the released vent gases need not be measured.		N/A
9.5.2	Test samples shall be mounted on an instrumented wall section that is a minimum of 3.66-m (12-feet) tall with a 0.3-m (1-foot) wide horizontal soffit (undersurface of the eave shown in Figure 9.3. The wall and soffit shall be constructed with 19.05-mm (3/4-inch) plywood installed on wood studs and painted flat black. An optional substrate of 13-mm (1/2-inch) or 16-mm (5/8-inch) exterior gypsum sheathing shall be permitted to be installed on the plywood. The instrumented wall shall extend not less than 0.49-m (1.6-feet) horizontally beyond the exterior of the target BESS units.		N/A
9.5.3	The initiating BESS unit shall be positioned on the instrumented wall, with its center located 1.22-m (4-feet) above the floor, and halfway between wall edges.		N/A
9.5.4	Target BESS shall be installed on the wall on each side of the initiating BESS, at the same height above the floor as the initiating BESS. The physical spacing between BESS units (both initiating and target) shall be the minimum separation distances specified by the manufacturer.		N/A
9.5.5	The wall on which the initiating and target BESS units are mounted, and the soffit in the case of residential use BESS, shall be instrumented in accordance with 9.2.		N/A
9.5.6	For residential use BESS, the DUT shall be covered with a single layer of cheese cloth ignition indicator.		N/A
<b>9.6</b>	<b>Rooftop and open parking garage installations</b>		<b>N/A</b>
9.6.1	Testing of BESS intended for non-residential use rooftop or open parking garage installations shall be in accordance with 9.2.		N/A
9.6.2	If intended for rooftop and open parking garage use only installations, the smoke release rate, the convective and chemical heat release rate and content, velocity, and temperature of the released vent gases need not be measured.		N/A
9.6.3	BESS intended for installation on combustible roofs shall be mounted on constructed with 13-mm (1/2-inch) gypsum wall board painted flat black, or the mounting surface recommended by the manufacturer, also painted flat black.		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
9.6.4	Temperatures on the surface of the combustible roof assembly shall be measured under the center of the BESS and in horizontal array(s) at 152-mm (6-inch) intervals for a minimum 1 m (3.3 feet) from the edge of the initiating BESS unit using No. 24-gauge or smaller, Type-K exposed junction thermocouples. The thermocouples for measuring the temperature on roof surfaces shall be positioned in the roof locations anticipated to receive the greatest thermal exposure from the initiating BESS unit.		N/A
9.6.5	If the BESS is intended to be installed on combustible roof assemblies beneath PV panels, combustible materials, or other obstructions, the test shall be conducted with the ESS mounted underneath the obstructions, as specified by the manufacturer. The type of overhead obstruction used in the test shall be that which is anticipated to provide the greatest fire challenge. The vertical distances between the rooftop and the ESS, and between the ESS and the overhead obstruction shall be the minimum specified by the manufacturer. The overhead obstruction shall extend horizontally a minimum 2 m (6.6 feet) in all directions from the edges of the target BESS, unless lesser distances are specified by the manufacturer's installation instructions.		N/A
<b>9.7</b>	<b>Unit level test report</b>		--
9.7.1	The report on the unit level testing shall identify the type of installation being tested, as follows:		Pass
	a) Indoor floor mounted non-residential use BESS;		N/A
	b) Indoor floor mounted residential use BESS;		Pass
	c) Outdoor ground mounted non-residential use BESS;		N/A
	d) Outdoor ground mounted residential use BESS;		N/A
	e) Indoor wall mounted non-residential use BESS;		N/A
	f) Indoor wall mounted residential use BESS;		N/A
	g) Outdoor wall mounted non-residential use BESS;		N/A
	h) Outdoor wall mounted residential use BESS;		N/A
	i) Rooftop installed non-residential use BESS; or		N/A
	j) Open garage installed non-residential use BESS.		N/A
9.7.2	If testing is intended to represent more than one installation type, this shall be noted in the report.		N/A
9.7.3	The report shall include the following, as applicable:		Pass
	a) Unit manufacturer name and model number (and whether UL 9540 compliant);		Pass
	b) Number of modules in the initiating BESS unit;	8	Pass
	c) The construction of the initiating BESS unit per 5.3;		Pass
	d) Fire protection features/detection/suppression systems within unit;		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	e) Module voltage(s) corresponding to the tested SOC;	See Attachment 2	Pass
	f) The thermal runaway initiation method used;	See Attachment 4	Pass
	g) Location of the initiating module within the BESS unit;	See Attachment 3	Pass
	h) Diagram and dimensions of the test setup including mounting location of the initiating and target BESS units, and the locations of walls, ceilings, soffits as applicable, and thermocouples;	See Attachment 3	Pass
	i) Observation of any flaming outside the initiating BESS enclosure and the maximum flame extension;	See Attachment 5	Pass
	j) Chemical and convective heat release rate versus time data;	See Attachment 8 and Attachment 9	Pass
	k) Separation distances from the initiating BESS unit to target walls (e.g. distances A and C in Figure 9.1) and target heat flux gauges;	See Attachment 3	Pass
	l) Separation distances from the initiating BESS unit to target BESS units (e.g. distances D and H in Figure 9.1);		Pass
	m) The maximum wall surface and target BESS temperatures achieved during the test and the location of the measuring thermocouple;	See Attachment 6	Pass
	n) The maximum ceiling or soffit surface temperatures achieved during the indoor or outdoor wall mounted test and the location of the measuring thermocouple;	See Attachment 6	Pass
	o) The maximum incident heat flux on target wall surfaces and target BESS units;		Pass
	p) The maximum incident heat flux on target ceiling or soffit surfaces achieved during the indoor or outdoor wall mounted test;		N/A
	q) Gas generation and composition data if conducted indoors;	See Attachment 10	Pass
	r) Peak smoke release rate and total smoke release data if conducted indoors;	See Attachment 11	Pass
	s) Indication of the activation of integral fire protection systems and if activated the time into the test at which activation occurred;		N/A
	t) Observation of flying debris or explosive discharge of gases unless mitigated by an engineered deflagration protection system;	See Attachment 5	Pass
	u) Observation of re-ignition(s) from thermal runaway events;	See Attachment 5	Pass
	v) Observation(s) of sparks, electrical arcs, or other electrical events;	See Attachment 5	Pass
	w) Observations of the damage to:	See Attachment 1	Pass
	1) The initiating BESS unit;	See Attachment 1	Pass
	2) Target BESS units;		Pass
	3) Adjacent walls, ceilings, or soffits;	See Attachment 1	Pass

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Clause	Requirement – Test	Result - Remark	Verdict
	x) Photos and video of the test;	See Attachment 1 and 20250528-1.mp4 to 20250528-5.mp4	Pass
	y) If the test is terminated in accordance with 9.2.25, the circumstances of the termination; and	The modules return to a temperature less than 60°C.	Pass
	z) Module level test report summary and cell level test report summary.		Pass
<b>9.8</b>	<b>Performance at unit level testing</b>		--
9.8.1	Installation level testing in Section 10 is not required if the performance conditions outlined in Table 9.1 are met during the unit level test.		Pass
	<b>Non-Residential Installations</b>		--
Indoor Floor Mounted	a) Flaming outside the initiating BESS unit is not observed;		N/A
	b) Surface temperatures of modules within the target BESS units adjacent to the initiating BESS unit do not exceed the temperature at which thermally initiated cell venting occurs, as determined in 7.3.1.10;		N/A
	c) Surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient;		N/A
	d) Explosion hazards are not observed, including deflagration or detonation.	Not observed.	N/A
Outdoor Ground Mounted	a) Surface temperatures of modules within the target BESS units adjacent to the initiating BESS unit do not exceed the temperature at which thermally initiated cell venting occurs, as determined in 7.3.1.10;		N/A
	b) For BESS units intended for installation near exposures, surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient;		N/A
	c) Explosion hazards are not observed, including deflagration or detonation; and		N/A
	d) Heat flux measured at the minimum distance to a means of egress specified by the manufacturer shall not exceed 1.3 kW/m <sup>2</sup> .		N/A
Indoor Wall Mounted	a) Flaming outside the initiating BESS unit is not observed;		N/A
	b) Surface temperatures of modules within the target BESS units adjacent to the initiating BESS unit do not exceed the temperature at which thermally initiated cell venting occurs, as determined in 7.3.1.10;		N/A
	c) Surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient;		N/A
	d) Explosion hazards are not observed, including deflagration or detonation.		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
Outdoor Wall Mounted	a) Surface temperatures of modules within the target BESS units adjacent to the initiating BESS unit do not exceed the temperature at which thermally initiated cell venting occurs, as determined in 7.3.1.10;		N/A
	b) Surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient;		N/A
	c) Explosion hazards are not observed, including deflagration or detonation; and		N/A
	d) Heat flux measured at the minimum distance to a means of egress specified by the manufacturer shall not exceed 1.3 kW/m <sup>2</sup> .		N/A
Rooftop and Open Parking Garages	a) Surface temperatures of modules within the target BESS units adjacent to the initiating BESS unit do not exceed the temperature at which thermally initiated cell venting occurs, as determined in 7.3.1.10;		N/A
	b) Surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient;		N/A
	c) For BESS units intended for installation on combustible roof constructions, surface temperature measurements on roof surfaces do not exceed 97°C temperature rise above ambient per 9.6.5;		N/A
	d) Explosion hazards are not observed, including deflagration or detonation; and		N/A
	e) For BESS units intended for installation in open parking garages, heat flux measured at the distance from the BESS to the means of egress shall not exceed 1.3 kW/m <sup>2</sup> .		N/A
	<b>Residential Installations</b>		--
Indoor Floor Mounted	a) Charring or ignition of the cheesecloth indicator is not observed;		Pass
	b) Surface temperatures of modules within the target BESS units adjacent to the initiating BESS unit do not exceed the temperature at which thermally initiated cell venting occurs, as determined in 7.3.1.10;		Pass
	c) Surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient;		Pass
	d) Explosion hazards are not observed, including deflagration or detonation; and		Pass
	e) The concentration of flammable gas does not exceed 25 % LFL in air for the smallest specified room installation size.	The smallest volume of installation room: 6.50m <sup>3</sup>	Pass

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Clause	Requirement – Test	Result - Remark	Verdict
Outdoor Ground Mounted	a) Flaming outside the initiating BESS unit is not observed.		N/A
	b) Surface temperatures of modules within the target BESS units adjacent to the initiating BESS unit do not exceed the temperature at which thermally initiated cell venting occurs, as determined in 7.3.1.10;		N/A
	c) For BESS units intended for near exposures, surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient;		N/A
	d) Explosion hazards are not observed, including deflagration or detonation; and		N/A
	e) Heat flux measured at the minimum distance to a means of egress shall not exceed 1.3 kW/m <sup>2</sup> .		N/A
Indoor Wall Mounted	a) Flaming outside the initiating BESS unit is not observed as demonstrated by no flaming or charring of the cheesecloth indicator;		N/A
	b) Surface temperatures of modules <sup>3)</sup> within the target BESS units adjacent to the initiating BESS unit do not exceed the temperature at which thermally initiated cell venting occurs, as determined in 7.3.1.10;		N/A
	c) Surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient;		N/A
	d) Explosion hazards are not observed, including deflagration or detonation; and		N/A
	e) The concentration of flammable gas does not exceed 25 % LFL for the smallest intended room installation size.		N/A
Outdoor Wall Mounted	a) Charring or ignition of the cheesecloth indicator is not observed;		N/A
	b) Surface temperatures of modules within the target BESS units adjacent to the initiating BESS unit do not exceed the temperature at which thermally initiated cell venting occurs, as determined in 7.3.1.10;		N/A
	c) Surface temperature measurements on wall surfaces do not exceed 97°C of temperature rise above ambient;		N/A
	d) Explosion hazards are not observed, including deflagration or detonation; and		N/A
	e) Heat flux measured at the minimum distance to a means of egress shall not exceed 1.3 kW/m <sup>2</sup> .		N/A