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TEST REPORT
ANSI/CAN/UL 9540A:2019
Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

Report Reference No. ..... :	230400637SHA-002	
Tested by (name + signature) ..... :	Sofm Shen	Sofm Shen .....
Approved by (name + signature) ..... :	Robin Xu	Robin Xu .....
Total number of pages ..... :	67	
Date of issue ..... :	2023-07-22	
Testing Laboratory ..... :	Intertek Testing Services Shanghai	
Address ..... :	Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China	
Testing location/ procedure ..... :	Witness testing	
Testing location/ address ..... :	No. 1065, Beihe Road, Jiading District, Shanghai	
Applicant's name ..... :	Zhejiang Narada Energy Technology Co., Ltd	
Address ..... :	Room 341, Building 3, No. 368, Jinpeng Street, Sandun Town, Xihu District, Hangzhou, Zhejiang,310000, P.R.China	
Test specification:		
Standard ..... :	ANSI/CAN/UL 9540A:2019 (Fourth Edition) + UL CRD's	
Test procedure ..... :	Unit level test (clause 9.1-9.8)	
Non-standard test method…… ..... :	N/A	
Test Report Form No. ..... :	ANSI/CAN/UL 9540A	
Test Report Form(s) Originator ..... :	Intertek	
Master TRF ..... :	N/A	

Test item description ..... :	Lithium-ion battery unit
Trade Mark ..... :	Narada
Manufacturer ..... :	Zhejiang Narada Energy Technology Co., Ltd
Model/Type reference ..... :	166.4NESP280L*8 pcs
Ratings ..... :	280Ah, 1331.2V, 372.736kWh

General disclaimer:

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 video 230400637SHA-002.mp4 was provided in addition to this test report.

Summary of testing:

Thermal Runaway Propagation	:	1 cell vented and thermal runaway due to external heating. 51 cells vented and thermal runaway due to thermal runaway propagation. No thermal runaway propagation from initiating module to other modules in initiating unit. No thermal runaway propagation from initiating unit to other units.
Maximum Target BESS Temperature (°C)	:	96.1
Maximum Wall Surface Temperature (°C)	:	118.8
Maximum Heat Flux on target wall surfaces (kW/m^2)	:	2.75
Maximum Heat Flux on target BESS units (kW/m^2)	:	1.98
Peak Chemical Heat Release Rate (kW)	:	62.50
Peak Convective Heat Release Rate (kW)	:	0
Peak Smoke Heat Release Rate (m^2/s)	:	40.73
Total Smoke Release (m^2)	:	16304.28
Maximum Heat Flux on Egress Path (kW/m^2)	:	--
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