

## 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

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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

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Test item description ..... : Lithium-ion battery unit

Trade Mark ..... :



Manufacturer ..... : Zhejiang Narada Energy Technology Co., Ltd

Model/Type reference ..... : 166.4NESP280L\*8 pcs

Ratings ..... : 280Ah, 1331.2V, 372.736kWh

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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 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 <sup>2</sup> ) ....	: 2.75
Maximum Heat Flux on target BESS units (kW/m <sup>2</sup> ) .....	: 1.98
Peak Chemical Heat Release Rate (kW) .....	: 62.50
Peak Convective Heat Release Rate (kW) .....	: 0
Peak Smoke Heat Release Rate (m <sup>2</sup> /s) .....	: 40.73
Total Smoke Release (m <sup>2</sup> ) .....	: 16304.28
Maximum Heat Flux on Egress Path (kW/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