Propagation test report

Kiwatt

Project 2025-0252502

Report date: 02-07-2025
Test date: 22-04-2025
Test laboratory: Mlab Testing
Doejenburg
144N 40 5.1.2e ,
Maurik The
Netherlands

Test location: Brandweertrainingscentrum Kleefse
Waard 5.1.2e
5.1.2e
Arnhem The
Netherlands

Tests performed by: 5.1.2e 5.1.2e

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1. General information

1.1 Customer information

Kiwatt B.V.

5.1.2e

5.1.2e Ede

Netherlands

www.kiwatt.nl

1.2 Equipment Under Test (EUT)

The EUT is a LiFePO4 battery cabinet designed for use as an energy storage system. The EUT holds several cabinets in which LiFePO4 battery packs are placed. The EUT also contains power electronics and a BMS to control the battery strings.

The battery packs can be equipped with cells of different capacity but similar size and manufacturer.

Cell type	Specifications	Size (HxLxD)
EVE LF280	280 Ah; 3,2 Vdc nominal	Approx. 204 x 173 x 71 mm
EVE LF314	314 Ah; 3,2 Vdc nominal	Approx. 204 x 173 x 71 mm

For the testing purpose the battery packs are located in the cabinet.

Figure 1 - Overview of battery pack.

Figure 2 – Cabinet prepared for propagation test.

Figure 3 – Side view.

1.3 EUT Specifications

Brand	Kiwatt
Model	PowerCabinet
Nominal voltage	5.1.2f Vdc (battery) – 512 Vdc PowerCabinet
Battery size (LxWxH)	Approx. 629 x 178 x 215 mm
Battery weight approx.	Approx. 45 kg

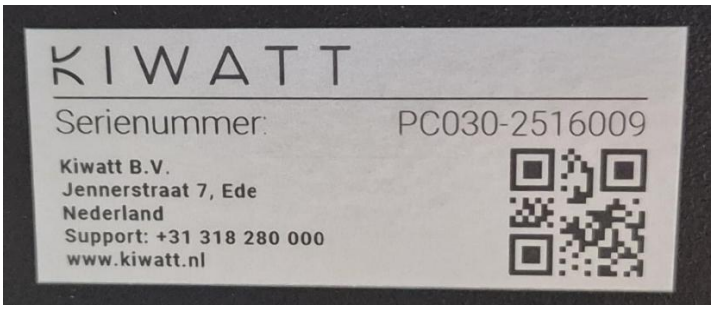


Figure 4 – Example marking label of a battery pack in which the EUT can be placed.

1.4 Applied standard

The propagation test is performed according to IEC/EN 62619:2022 clause 7.3.3

1.5 Report history

Report revision	Dated	Remarks
2025-0252502	02-07-2025	Initial report

2 Propagation test according to IEC/EN 62619:2022

2.1 Test description

7.3.3 Propagation test (battery system)

a) Requirement

This test evaluates the ability of a battery system to withstand a single cell thermal runaway event so that a thermal runaway event does not result in the battery system fire.

b) Test

The battery system is fully charged and then left until the cells stabilize in an ambient temperature of 25 °C ± 5 °C. One cell in the battery system (hereafter target cell) is e.g. heated by laser until the cell enters into thermal runaway.

After thermal runaway in the cell is initiated, the triggering source is turned off and battery system is observed for 8 h. See Annex B for an example test procedure by laser.

Other methods than the laser to initiate thermal runaway in one cell are allowed. See Annex C.

The battery system may be modified to facilitate the thermal runaway of the target cell. The modification should be minimized and it shall not affect the thermal properties of the battery system.

The method used to initiate a thermal runaway in the target cell shall be described in the test report.

c) Acceptance criteria

No external fire from the battery system, no battery system case rupture. If the battery system has no outer covering, the manufacturer shall specify the area for fire protection.

NOTE Fire or battery system case rupture caused by the target cell is acceptable because the first thermal runaway is intentionally made for the test purpose as a trigger.

2.2 Test method

- For each test the trigger cell is overcharged to 3,9 Vdc and is surrounded by fully charged cells (100% SoC).
- The cells are placed in the battery pack as in normal use.
- Thermal runaway is triggered by penetration of a metal pin via the top of the trigger cell.
- A set of thermocouples are placed near and around the trigger cell to monitor temperature rises during the thermal runaway event.
- An additional thermocouple is placed on the bottom battery pack to measure temperature rises.

A total of 3 tests were performed:

Test-1: Nail penetration of 280 Ah center cell with all doors of the cabinet closed.
Test-2: Nail penetration of 280 Ah corner cell with front door of the cabinet opened.
Test-3: Nail penetration of 314Ah center cell with front door of the cabinet opened.

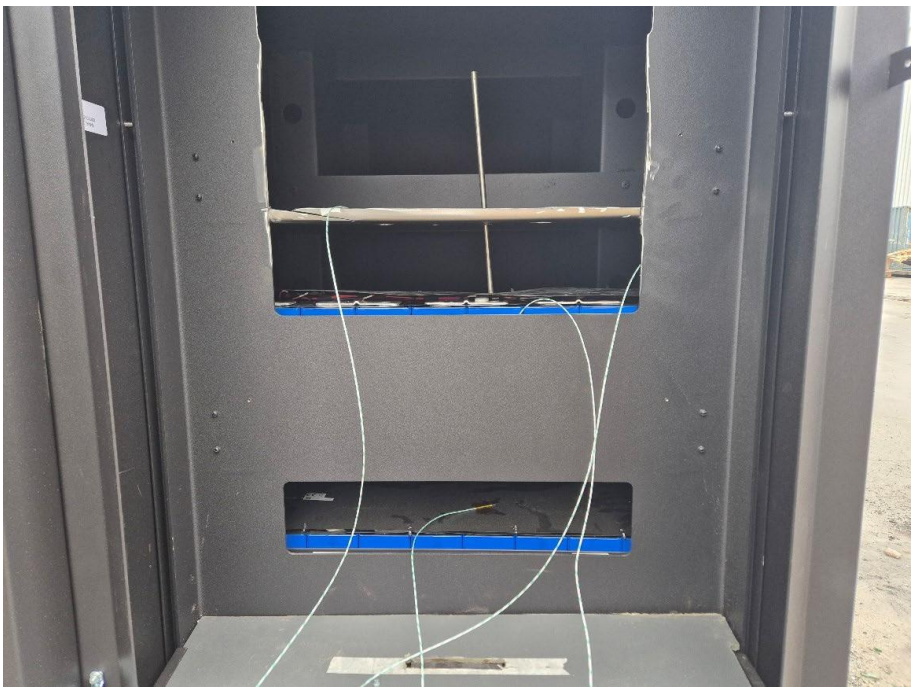
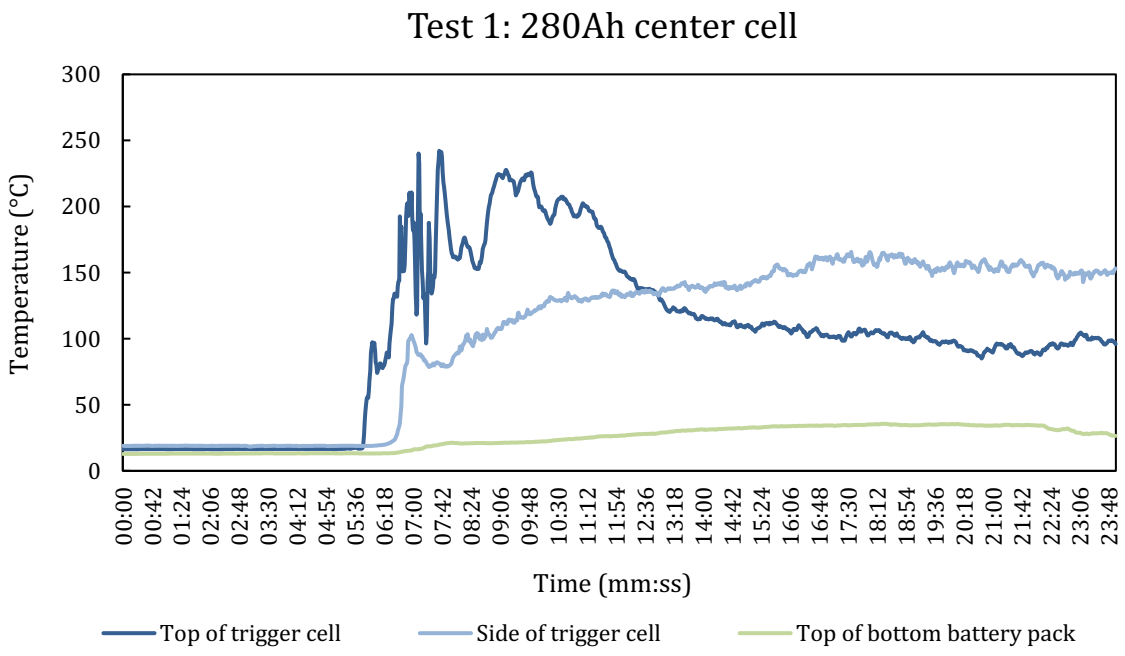


Figure 5 – Test setup.

3 Test 1: 280Ah center cell

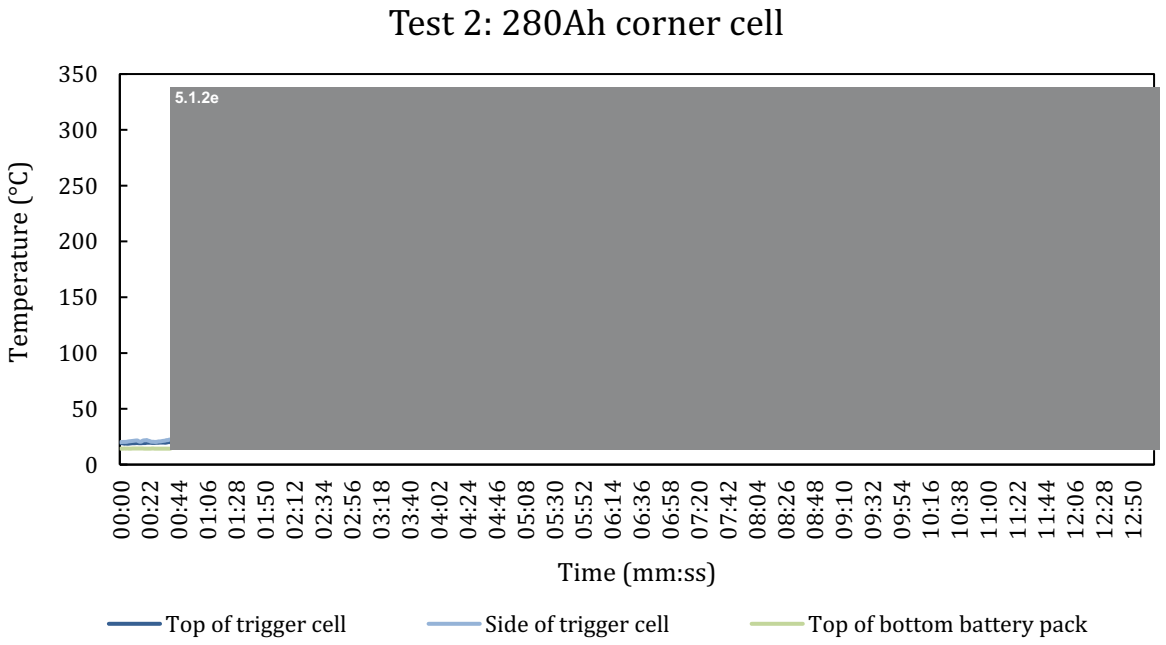
Figure 6 - Thermal runaway.



Graph 1 - Temperature development thermal runaway 280Ah center cell.

4 Test 2: 280Ah corner cell

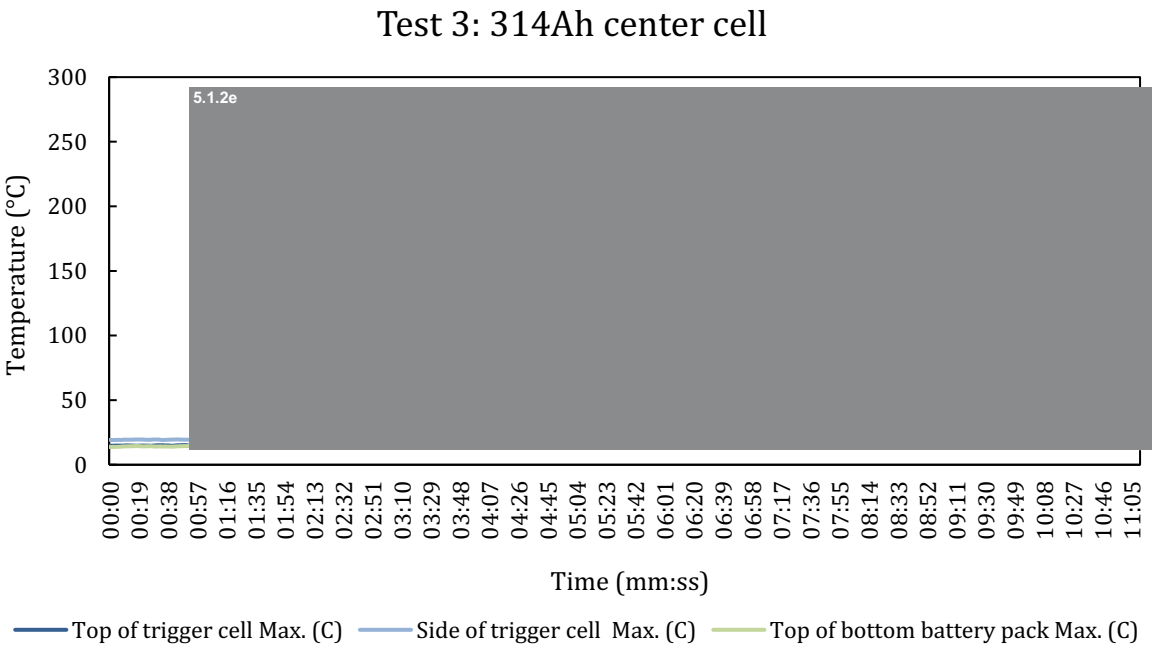
Figure 7 – Thermal runaway



Graph 2 – Temperature development thermal runaway 280Ah corner cell.

5 Test 3: 314Ah center cell

Figure 9 – Thermal runaway.



Graph 3 - Temperature development thermal runaway 314 center cell.

6 Observations

6.1 Maximum temperatures

Test	Top of trigger cell (°C)	Side of trigger cell (°C)	Top of bottom battery pack (°C)
1	242,1	165,6	35,6
2	298,6	228,7	38,1
3	279,6	232,5	36,3

6.2 Visual observations

- Large amount of flammable and toxic gases was omitted from the trigger cell during approx. 10 minutes after the thermal runaway was initiated.
- No fire was observed within 8 hours of the test
- No explosion was observed within 8 hours of the test
- No cell-cell propagation was observed. The surrounding cells were intact.

Figure 9 - 280Ah cells after test 1 and 2.

7 Conclusion

7.1 General

The conclusion based on the performed tests and their results is that when the trigger cell is put into thermal runaway (by means of nail penetration) it did not lead to fire, explosion or propagation within 8 hours of the test.

No cell-cell propagation has occurred and the other battery pack did not see any high temperatures which could lead to failure of this battery pack.

7.2 IEC/EN 62619:2022 results

The test results are in compliance with the criteria set in IEC 62619:20222 (see clause 3.1 of this report).
No external fire from the battery system (cabinet), no battery system case (cabinet) rupture. No cell- cell propagation.

8 PGS37-1 compliance

M9 of PGS37-1 states that a fire propagation test must be successfully completed according to EN 62933-5-2 or UL9540A.

The EN 62933-5-2 standard refers to the IEC 62619 standard for performing the fire propagation test:

8.2.5 Fire hazards (propagation)

Category "C-A" electrochemical accumulation subsystems shall be tested and validated in accordance with the requirements of IEC 62619:2017, 7.3.3.

Since the fire propagation test is performed according to clause 7.3.3 of EN 62619 standard with a positive result, the requirements from PGS 37-1 M9 are met.

Note: the **IEC** 62619:2022 and **EN** 62619:2022 standards are fully identical.

9 Used Test Equipment

9.1 Equipment used

Equipment Number	Description	Brand	Type	Calibration date	Calibration due date
0033	Temperature/ Datalogger	Pico	USB TC-08	12-07-2024	12-07-2025

9.2 Environmental conditions

Unless otherwise stated, all tests are performed withing the below given ranges:

Temperature	Relative Humidity Range
15°C – 25°C	30% - 80%

END OF TEST REPORT

Legenda toegepaste uitzonderingsgrondslagen

In dit document zijn gegevens definitief geanonimiseerd op grond van:

Wet	Artikel	Omschrijving	Pagina's
Wet open overheid	Art. 5.1 lid 2 sub e	De eerbiediging van de persoonlijke levenssfeer	1, 3, 9, 10
Wet open overheid	Art. 5.1 lid 2 sub f	De bescherming van andere dan in het eerste lid, onderdeel c, genoemde concurrentiegevoelige bedrijfs- en fabricagegegevens	5