

December 17, 2025

Mr, Neelesh Thakkar
ZincFive Inc.
20170 SW 112th Ave
Tualatin, OR, 97062 US

Project Number: 4791867702

Subject: Letter Report on Large-scale Fire Testing, ZincFive's Nickel-Zinc Batteries and Battery Energy Storage Systems, UL Certifications and UL 9540A Test Results, and How They Relate to NFPA 855 and IFC Requirements

Dear Mr. Thakkar,

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

Unless otherwise noted, the following safety standards were used as the basis for this investigation or were referenced in this letter.

- ANSI/CAN/UL 9540A:2019, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, Edition 4, Revision Date 11/12/2019
- ANSI/CAN/UL 9540A:2025, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, Edition 5, Issue Date 03/12/2025
- ANSI/CAN/UL 1973:2022, Batteries for Use in Stationary and Motive Auxiliary Power Applications, Edition 3, Issue Date: 02/25/2022
- ANSI/CAN/UL 9540:2025, Energy Storage Systems and Equipment, Edition 3, Issue Date: 03/07/2025
- ICC International Fire Code
- NFPA 855, Standard for the Installation of Stationary Energy Storage Systems, 2026 Edition
- International Fire Code (IFC), 2024 Edition

In addition to the standards listed above, applicable codes that apply to Energy Storage Systems (ESS) are also referenced. These include NFPA 855, Standard for the Installation Stationary Energy Storage Systems and Chapter 12 of the ICC International Fire Code (IFC).

UL Solutions Headquarters
333 Pfingsten Road
Northbrook
Illinois, 60062

T +1.847.272.8800

UL.com/Solutions

UL LLC © 2025. All rights reserved.



The information in this letter is based on the documented test results from ZincFive's UL 9540A Cell Level Test Reports that were issued by UL Solutions. This information is also based on ZincFive's ANSI/CAN/UL 1973 Listing (File Number MH62563) for their battery systems and ANSI/CAN/UL 9540 Listing (File Number E540538) for their Energy Storage Equipment Subassembly - DC ESS that utilize ZincFive's nickel-zinc monobloc batteries and were issued by UL Solutions.

ZincFive manufactures nickel-zinc monobloc batteries for use in stationary applications. Their monobloc batteries were submitted for the UL 9540A Cell Level Test. The batteries were subjected to the following cell abuse methods of UL 9540A to achieve a thermal runaway condition: external thin film heating, nail penetration, overcharge, overdischarge, and short-circuit. After each of the methods, the monobloc batteries did not go into thermal runaway. Based on these results, continued testing under UL 9540A is not required.

The 2026 edition of NFPA 855 exempts aqueous nickel-based batteries as well as lead-acid and aqueous metal-air batteries that are vented or are listed to UL 1973 from UL 9540A testing and large-scale fire testing. ZincFive's nickel-zinc monobloc batteries have an aqueous electrolyte that meets this exemption. Additionally, any battery energy storage system (BESS) or uninterruptible power supply (UPS) or other energy storage application that utilizes this chemistry are exempt from UL 9540A and large-scale fire testing.

The off-gassing from the monoblocs when subjected to the ANSI/CAN/UL 9540A Cell Level Test showed a concentration of hydrogen greater than the LFL (Lower Flammability Limit) of 4.0%. The high concentration of hydrogen is due to the fact that the electrolyte is water-based, and hydrogen is a byproduct of the internal chemical reaction.

As previously mentioned, battery energy storage systems that employ the nickel-zinc monobloc batteries are Listed to ANSI/CAN/UL 1973 and to ANSI/CAN/UL 9540. Both standards require battery systems to employ ventilation openings having a minimum opening area to prevent accumulation of flammable gases within an enclosure. Specifically mentioned is hydrogen gas, due to electrolysis of aqueous electrolytes for applicable battery technologies, such as vented or valve regulated lead acid and nickel batteries.

Chapter 12 of the International Fire Code covers Electrical Energy Storage Systems (ESS). Section 1207.6, "Electrochemical ESS technology-specific protection", addresses requirements for exhaust ventilation in a room or area with electrochemical ESS. NFPA 855, Paragraph 9.7.6, "Technology-Specific Requirements" also highlights requirements for exhaust ventilation for electrochemical ESS that employ nickel-zinc battery chemistry.



Based on the IFC and NFPA 855, design of an adequate ventilation system shall be coordinated with the site designer to ensure that the exhaust ventilation for the ZincFive battery systems is capable of maintaining a flammable gas concentration below a maximum concentration of 25% of the LFL of hydrogen.

ANSI/CAN/UL 9540A (cell, module, and unit) testing and large-scale fire testing are not required for battery systems that utilize nickel-zinc batteries as indicated in NFPA 855. The ANSI/CAN/UL 9540A Cell Level Test previously conducted on the nickel-zinc monobloc batteries have demonstrated the inability of this chemistry to experience a thermal runaway event.

This concludes the work anticipated for this investigation and we are closing this project with this letter. No samples were provided for this investigation.

If you have any questions on the information provided in this letter or about UL processes, do not hesitate to contact the undersigned.

Sincerely,

A handwritten signature in black ink, reading 'LaTanya Schwalb'.

LaTanya Schwalb
Principal Engineer
Energy & Industrial Automation
UL Solutions
LaTanya.Schwalb@ul.com

Reviewed by:

A handwritten signature in black ink, reading 'Joseph M Bablo'.

Joe Bablo
Principal Engineer Manager
Energy & Industrial Automation
UL Solutions