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NATIONAL STANDARD

ANSI/CAN/UL 9540A:2026

STANDARD FOR SAFETY

Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

Approved American National Standard

ANSI/UL 9540A-2026

SCC FOREWORD

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UL Standard for Safety for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, ANSI/CAN/UL 9540A

Sixth Edition, Dated March 13, 2026

Summary of Topics

This new Sixth Edition of ANSI/CAN/UL 9450A dated March 13, 2026, revised the Installation Level Testing to update requirements for large scale fire testing:

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated June 27, 2025 and November 7, 2025.

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MARCH 13, 2026

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March 13, 2026

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The most recent designation of ANSI/UL 9540A as an American National Standard (ANSI) occurred on March 13, 2026. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This Standard has been designated as a National Standard of Canada (NSC) on March 13, 2026.

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Preface

This is the Sixth Edition of the ANSI/CAN/UL 9540A, Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems.

ULSE is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL 9540A Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

Annexes A and B, identified as Informative, are for information purposes only.

Annex C is identified as Normative, as such, form mandatory parts of this Standard.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

This Sixth Edition joint American National Standard and National Standard of Canada is based on, and now supersedes, the Fifth Edition of UL 9540A.

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This list represents the TC 9540 membership when the final text in this Standard was balloted. Since that time, changes in the membership may have occurred.

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INTRODUCTION

1 Scope

1.1 The test methodology in this Standard determines the capability of a battery technology to undergo thermal runaway and then evaluates the fire and explosion hazard characteristics of those battery energy storage systems that have demonstrated a capability to undergo thermal runaway.

1.2 The data generated will be used to support the manufacturer's installation instructions with regards to separation between individual battery energy storage systems and determine the fire and explosion protection required for an installation of a battery energy storage system intended for installation, operation and maintenance in accordance with:

a) The Standard for the Installation of Stationary Energy Storage Systems, NFPA 855;

b) The National Electrical Code® (NEC®), NFPA 70®;

c) The Fire Code, NFPA 1;

d) The Standard for Energy Storage Systems and Equipment, UL 9540;

e) The Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, CSA C22.1;

f) The General Requirements – Canadian Electrical Code, Part II, CSA C22.2 No. 0;

g) The National Electrical Safety Code, IEEE C2;

h) The International Fire Code, ICC IFC;

i) The International Residential Code, ICC IRC; and

j) Other codes affecting energy storage systems.

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1.3 Fire protection requirements not related to battery energy storage system equipment are covered by appropriate installation codes.

1.4 See Figure 1.1 for a schematic of the test sequence in this Standard. See Annex A which explains:

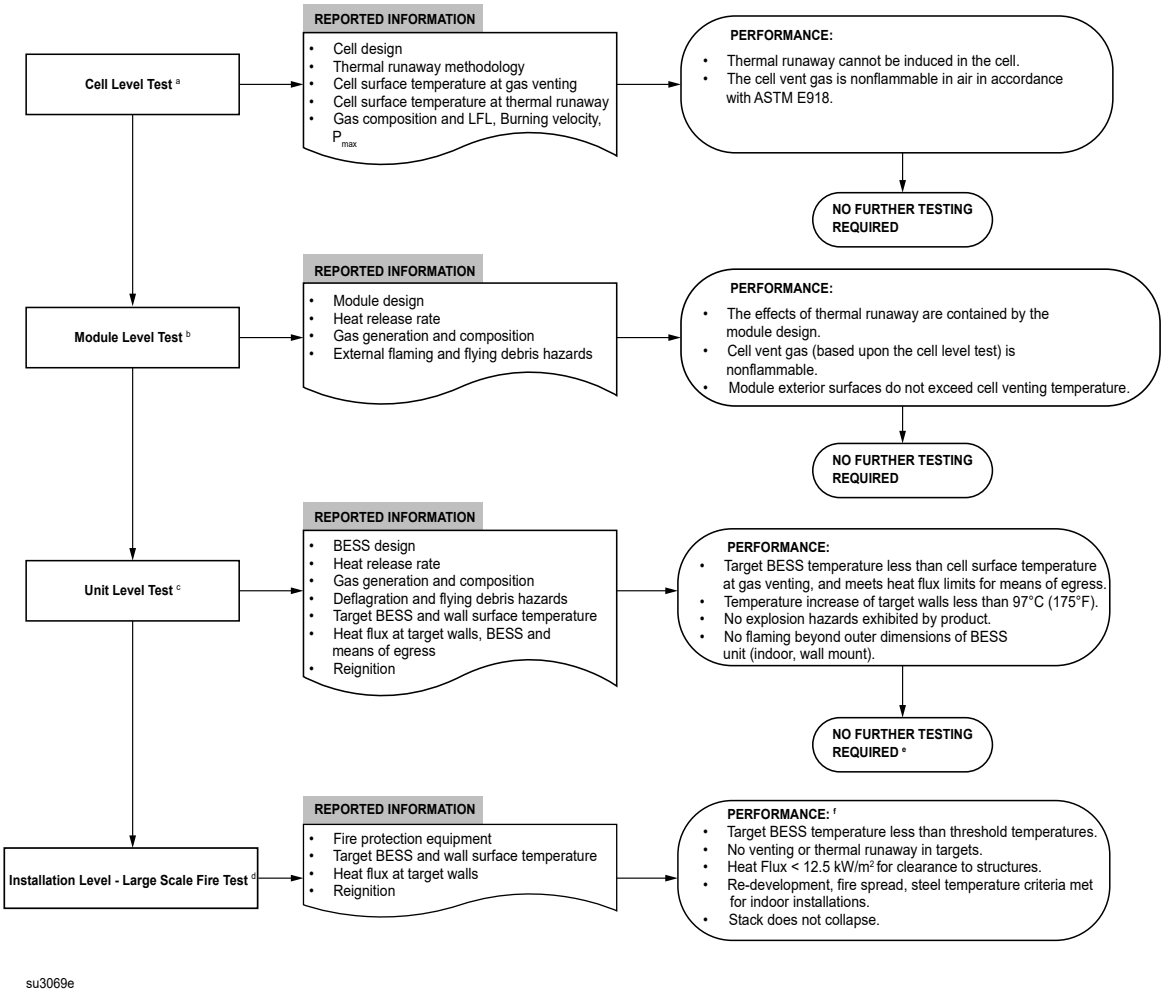
a) The purpose of the tests included in this Standard;

b) Explanation of individual tests; and

c) Interpretation and application of the results.

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Figure 1.1
Schematic of Test Sequence



[a] See Section 7.
[b] See Section 8.
[c] See Section 9. Unit Level testing may not be required if Installation Level testing is conducted. See 9.1.1.
[d] See Section 10. Some chemistries are exempted from Installation Level Testing. See 10.1.8.
[e] No further testing may be required for residential BESS only. See 9.8.1 and 10.1.7.
[f] See 10.10.1 and 10.10.2.

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2 Units of Measurement

2.1 Values stated without parentheses are the requirement. Values in parentheses are a soft conversion from SI to IP units of the requirement.

3 Normative References

3.1 Any undated reference to a code or standard appearing in the requirements of this Standard shall be interpreted as referring to the latest edition of that code or standard.

3.2 The following model codes or standards are referenced in this Standard.

ASHRAE 34, *Designation and Safety Classification of Refrigerants*

ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*

ASTM D3828, *Standard Test Methods for Flash Point by Small Scale Closed Cup Tester*

ASTM E502, *Standard Test Method for Selection and Use of ASTM Standards for the Determination of Flash Point of Chemicals by Closed Cup Methods*

ASTM E918, *Standard Practice for Determining Limits of Flammability of Chemicals at Elevated Temperature and Pressure*

CSA C22.1, *Canadian Electrical Code, Part I Safety Standard for Electrical Installations*

CSA C22.2 No. 0, *General Requirements – Canadian Electrical Code, Part II*

EN 15967, *Determination of Maximum Explosion Pressure and the Maximum Rate of Pressure Rise of Gases and Vapours*

ICC IFC, *International Fire Code (IFC)*

ICC IRC, *International Residential Code*

IEEE 1635/ASHRAE Guide 21, *Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications*

IEEE C2, *National Electrical Safety Code (NESC)*

ISO 817, *Refrigerants – Designation and Safety Classification*

NFPA 1, *Fire Code*

NFPA 2, *Hydrogen Technologies Code*

NFPA 68, *Standard on Explosion Protection by Deflagration Venting*

NFPA 69, *Standard on Explosion Prevention Systems*

NFPA 70®, *National Electrical Code® (NEC®)*

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NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*

NFPA 101, *Life Safety Code*

NFPA 220, *Standard on Types of Building Construction*

NFPA 855, *Installation of Stationary Energy Storage Systems*

UL/ULC 199, *Automatic Sprinklers for Fire-Protection Service*

UL 746A, *Polymeric Materials – Short Term Property Evaluations*

UL 864, *Control Units and Accessories for Fire Alarm Systems*

UL 1973, *Batteries for Use in Stationary and Motive Auxiliary Power Applications*

UL 2556, *Wire and Cable Test Methods*

UL 9540, *Energy Storage Systems and Equipment*

UL 2591, *Battery Cell Separators*

4 Glossary

4.1 For the purpose of these requirements, the following definitions apply.

4.2 ACTIVE FIRE PROTECTION SYSTEMS – A fire protection system that requires mechanical or electrical activation to perform an action such as detecting, notifying, or suppressing fire. These systems are installed and maintained in accordance with an installation standard or the governing fire code (e.g. a National Fire Protection Association (NFPA) installation standard or International Fire Code).

4.3 ACTIVE THERMAL RUNAWAY PROPAGATION PREVENTION SYSTEMS – A system that uses mechanical or electrical activation to mitigate or prevent thermal runaway propagation within a battery system. Direct injection systems installed within a module are an example of active thermal runaway propagation prevention systems.

4.4 BATTERY ENERGY STORAGE SYSTEM (BESS) – Stationary equipment that receives electrical energy and then utilizes batteries to store that energy to supply electrical energy at some future time. The BESS, at a minimum consists of one or more modules, a power conditioning system (PCS), battery management system (BMS) and balance of plant components.

a) INITIATING BATTERY ENERGY STORAGE SYSTEM UNIT (INITIATING BESS) – A BESS unit which has been equipped with resistance heaters in order to create the cell to cell thermal runaway propagation necessary for the installation level test (Section 9).

b) TARGET BATTERY ENERGY STORAGE SYSTEM UNIT (TARGET BESS) – The enclosure and/or rack hardware that physically supports and/or contains the components that comprise a BESS. The target BESS unit does not contain energy storage components but serves to enable instrumentation to measure the thermal exposure from the initiating BESS.

NOTE: For flow battery systems the energy is stored within one or more electrolyte storage tanks.

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