

NEMA Standards Publication BS 7000-2021

Lithium-Ion Battery Fires Guidance Document

Published by:

National Electrical Manufacturers Association

1300 North 17th Street, Suite 900
Roanoke, Virginia 22209

www.nema.org

© 2021 National Electrical Manufacturers Association. All rights including translation into other languages, reserved under the Universal Copyright Convention, the Berne Convention for the Protection of Literary and Artistic Works, and the International and Pan American Copyright Conventions.

NOTICE AND DISCLAIMER

The information in this publication was considered technically sound by the consensus of persons engaged in the development and approval of the document at the time it was developed. Consensus does not necessarily mean that there is unanimous agreement among every person participating in the development of this document.

NEMA Standards and guideline publications, of which the document contained herein is one, are developed through a voluntary consensus Standards development process. This process brings together volunteers and/or seeks out the views of persons who have an interest in the topic covered by this publication. While NEMA administers the process and establishes rules to promote fairness in the development of consensus, it does not write the document and it does not independently test, evaluate, or verify the accuracy or completeness of any information or the soundness of any judgments contained in its Standards and guideline publications. NEMA disclaims liability for any personal injury, property, or other damage of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document.

NEMA disclaims and makes no guaranty or warranty, express or implied, as to the accuracy or completeness of any information published herein, and disclaims and makes no warranty that the information in this document will fulfil any of your particular purposes or needs. NEMA does not undertake to guarantee the performance of any individual manufacturer or seller's products or services by virtue of this Standard or guide.

In publishing and making this document available, NEMA is not undertaking to render professional or other services for or on behalf of any person or entity, nor is NEMA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. Information and other Standards on the topic covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.

NEMA has no power, nor does it undertake to police or enforce compliance with the contents of this document. NEMA does not certify, test, or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of compliance with any health or safety-related information in this document shall not be attributable to NEMA and is solely the responsibility of the certifier or maker of the statement.

Acknowledgment

This document is based on the Fire Industry Association (UK)'s *Guidance on Li Ion Battery Fires*. Portions reproduced with permission.

Fire Industry Association
Tudor House
Kingsway Business Park
Oldfield Rd
Hampton
Middlesex TW12 2HD
Tel: +44 (0)20 3166 5002
email: info@fia.uk.com

Currently in preview, click buy full version

Contents

Acknowledgment.....	i
1 Introduction	1
2 Scope.....	1
3 Terms and Definitions	1
3.1 Battery	1
3.2 Lithium-Ion Battery	1
3.3 Energy Storage	1
3.4 Energy Storage System	1
3.5 Electric Vehicle.....	1
3.6 Battery Management System (BMS)	1
3.7 Thermal Runaway	1
3.8 Thermal Propagation.....	1
3.9 Fire Tetrahedron	2
3.10 Off-Gassing	2
4 Battery Types.....	2
5 Fire Issues.....	2
6 Codes and Standards for Li-Ion Batteries and Energy Storage Systems	3
7 Fire Solutions	3
7.1 General.....	3
7.2 Protection	3
7.2.1 Containment	3
7.3 Gas Detection.....	4
7.4 Fire Detection	4
7.5 Suppression and Extinguishing.....	5
7.5.1 Fixed Systems.....	5
7.5.2 Portable Fire Extinguishers	9
8 Post-Fire Management.....	10
8.1 Batteries	10
8.2 Media.....	10
9 Conclusions.....	10
10 References	11

1 Introduction

This document has been developed based on one prepared by the FIA Li-ion battery SIG, which comprises FIA Members and other interested parties and organizations. The SIG is open to FIA Members and others with an interest in increasing the understanding of the issue of lithium-ion battery fires and protecting people and property from consequences of these fires.

This document represents the current understanding of the industry and will be updated as more information becomes available.

2 Scope

This guidance paper provides information on the issues related to:

- a. The use of lithium-ion batteries
- b. How fires start in batteries
- c. How fires may be detected, controlled, suppressed, and extinguished

It also provides guidance on post-fire management. Excluded from the scope are expansion and ventilation issues.

3 Terms and Definitions

3.1 Battery

A container consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power.

3.2 Lithium-Ion Battery

A rechargeable battery that uses lithium-ions as the primary component of its electrolyte.

3.3 Energy Storage

The capture of energy produced at one time for use at a later time.

3.4 Energy Storage System

Collection of batteries used to store energy.

3.5 Electric Vehicle

Vehicle that uses one or more electric motors for propulsion.

3.6 Battery Management System (BMS)

Electronic system that manages a rechargeable battery.

3.7 Thermal Runaway

Exothermic chemical reaction generating more heat than is being dissipated.

Note: This can be characterized where a self-heating rate of 18°F/min (10°C/min) or greater occurs.

3.8 Thermal Propagation

Where a single battery cell thermal runaway spreads to neighboring cells.