

Safety Standard for Electric and Hybrid Vehicle Propulsion Battery Systems Utilizing Lithium-based Rechargeable Cells

RATIONALE

Previously existing propulsion battery system safety documents define evaluation methods and make recommendations for battery system performance. They do not define specific pass/fail safety performance criteria. In order to provide consistency within the industry which supports innovation and public confidence, such criteria are necessary.

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1. SCOPE

This SAE Standard defines a minimum set of acceptable safety criteria for a lithium-based rechargeable battery system to be considered for use in a vehicle propulsion application as an energy storage system connected to a high voltage power train. While the objective is a safe battery system when installed into a vehicle application, this Standard is primarily focused, wherever possible, on conditions which can be evaluated utilizing the battery system alone. As this is a minimum set of criteria, it is recognized that battery system and vehicle manufacturers may have additional requirements for cells, modules, packs and systems in order to assure a safe battery system for a given application.

A battery system is a completely functional energy storage system consisting of the pack(s) and necessary ancillary subsystems for physical support and enclosure, thermal management, and electronic control.

1.1 Purpose

This SAE Standard should assure that a battery system can safely be integrated into an electric or hybrid vehicle. Specifically, it is designed to assure that a single point fault will not result in fire, explosion, battery enclosure rupture or high voltage hazard. This Standard includes tests that simulate “normal” conditions and “off-normal” conditions that, although infrequent, may occur during service life. Pass/fail criteria are assigned to each test.

1.2 Future Considerations

As lithium-based rechargeable battery systems expand in their usage, new information related to safety will become available and additional international regulatory standards will be developed. This new information may result in the need to add, change or remove evaluation conditions and / or requirements in this document. Future revisions of this Standard will be developed based on this new information.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1715	Hybrid Electric Vehicle (HEV) & Electric Vehicle (EV) Terminology
SAE J1766	Recommended Practice for Electric and Hybrid Electric Vehicle Battery Systems Crash Integrity Testing
SAE J2344	Guidelines for Electric Vehicle Safety
SAE J2380	Vibration Testing of Electric Vehicle Batteries
SAE J2464	Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System (RESS) Safety and Abuse Testing

2.1.2 IEC Publications

Available from International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41-22-919-02-11, www.iec.ch.

IEC60068-2-30 Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle). Third Edition, 2005-08-01

2.1.3 ISO Publications

Available from International Organization for Standardization, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland, Tel: +41-22-749-01-11, www.iso.org.

ISO 20653 Road vehicles - Degrees of protection (IP-Code) - Protection of electrical equipment against foreign objects, water and access. First Edition, 2005-08-15

ISO 6469-1 Electrically propelled road vehicles - safety specifications - Part 1: On-board rechargeable energy storage systems (RESS). Second Edition, 2009-09-15

ISO 6469-3:2011 Electrically propelled road vehicles - safety specifications - Part 3: Protection of persons against electric shock. Second Edition, 2011.

ISO 12405-1 Electrically propelled road vehicles - Test specification for lithium-ion traction battery packs and systems - Part 1: High-power applications - First Edition, 2011.

ISO 12405-2 Electrically propelled road vehicles - Test specification for lithium-ion traction battery systems - Part 2: High energy applications.

2.1.4 UNECE Publications

Available from UN Economic Commission for Europe, Information Service, Palais des Nations, CH-1211 Geneva 10, Switzerland, Tel: +41-0-22-917-44-44, www.unece.org.

Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, 5th Revised Edition, 2009. ST/SG/AC.10/11/Rev. 5

ECE 10-03 Uniform Provisions Concerning the Approval of Vehicles with Regard to Electromagnetic Compatibility, Add.9/Rev.3/Amend.1, January 12, 2011

2.1.5 United States Publications

Available from National Highway Traffic Safety Administration-Department of Transportation, 1200 New Jersey Avenue, SE, West Building, Washington, DC 20590, Tel. 1-888-327-4236, www.nhtsa.gov.

FMVSS 305 Federal Motor Vehicle Safety Standard No. 305 Electric-Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection, June 14, 2010

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1113-21 Electromagnetic Compatibility Measurement Procedure for Vehicle Components - Part 21: Immunity to Electromagnetic Fields, 30 MHz to 18 GHz, Absorber-Lined Chamber

SAE J1739 Potential Failure Mode and Effects Analysis in Design (Design FMEA), Potential Failure Mode and Effects Analysis in Manufacturing and Assembly Processes (Process FMEA)

SAE J2579 Technical Information Report for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles

2.2.2 UL Publications

Available from Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-664-3480, www.ul.com.

UL 1642 Standard for Lithium Batteries, 4th Edition, September 19, 2005

UL 2580 Standard for Safety for Batteries for Use in Electric Vehicles, 1st Edition, October 13, 2011

2.2.3 IEC Publications

Available from International Electrotechnical Commission, IEC Central Office, 3, rue de Varembé, P.O. Box 131, 1211 Geneva 20 Switzerland, Tel: + 41 22 919 02 11, webstore.iec.ch.

IEC62660-2 Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 2: Reliability and abuse testing, 1st Edition, December 1, 2010.

2.2.4 UNECE Publications

Available from UN Economic Commission for Europe, Information Service, Palais des Nations, CH-1211 Geneva 10, Switzerland, Tel: +41-0-22-917-44-44, www.unece.org.

Regulation No. 34 Uniform Provisions Concerning the Approval of Vehicles with Regard to the Prevention of Fire Risks, February 19, 2010

2.2.5 United States Publications

Available from National Highway Traffic Safety Administration-Department of Transportation, 1200 New Jersey Avenue, SE, West Building, Washington, DC 20590, Tel. 1-888-327-4236, www.nhtsa.gov.

FMVSS 304 Federal Motor Vehicle Safety Standard No. 304 Compressed Natural Gas Fuel Containers, October 30, 2000

2.2.6 Other Regional or National Publications

Korean Motor Vehicle Safety Standards, 18-3 (Traction Battery); Attachment 48 (Driving Battery Safety Test).