

# Freedomcar electrical energy storage system





## Overview

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American Industrial Hygiene Association accelerated rate calorimeter or.

To assist in the further development of advanced transportation technologies, Sandia National Laboratories (SNL) provides expertise in battery abuse testing in cooperation with.

Abuse testing is performed to characterize EESS responses to off-normal conditions or environments. The primary purpose of abuse testing is to gather response information to extent.

This manual defines a complete body of tests that may be used as needed for abuse testing EESSs for EV and HEV applications to determine the response of a given EESS design.

Active Devices Cell Device Under Test ECSS Devices external to the cell, or requiring active external controls, that are intended for protection from or mitigation of abusive, out-of range.

This manual defines a complete body of abuse tests intended to simulate actual use and abuse conditions that may be beyond the normal safe operating limits experienced by electrical energy storage systems used in electric and hybrid electric vehicles. The tests are designed to provide a common framework for.

American Industrial Hygiene Association accelerated rate calorimeter or accelerating rate calorimetry depth of discharge Department of Energy electrochemical storage system electrical energy storage system Environmental Protection Agency.

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What is the FreedomCAR energy storage manual?

This manual was prepared by and for the FreedomCAR Program Electrochemical Energy Storage Team. It is based on the goals established for FreedomCAR energy storage development and is similar (with some important changes) to an earlier manual for the former Partnership for a New Generation of Vehicles (PNGV) program.

What is an electric energy storage test?

The tests described are intended for abuse testing any electrical energy storage system designed for use in electric or hybrid electric vehicle applications whether it is composed of batteries, capacitors, or a combination of the two.

What are the goals of the FreedomCAR program?

The FreedomCAR program defines a number of goals for battery performance over life. (See Table 1 in the body of this manual.) Power and energy capability are evaluated using the HPPC test, while round-trip efficiency and cycle life are evaluated using special pulse profile tests for either Minimum Power Assist or Maximum Power Assist operation.

What is an electric energy storage abuse test?

This manual defines a complete body of abuse tests intended to simulate actual use and abuse conditions that may be beyond the normal safe operating limits experienced by electrical energy storage systems used in electric and hybrid electric vehicles.

What does FreedomCAR do?

**CYCLE LIFE EFFICIENCY CALCULATION** The FreedomCAR program defines a number of goals for battery performance over life. (See Table 1 in the body of this manual.).

How does FreedomCAR calculate available energy?

Since the FreedomCAR discharge and regen pulse power requirements are different, the determination of available energy must account for the ratio of regen to discharge power demand. The graphical method in the manual does this by using different axis scales to plot the discharge and regen power data. For



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### United States Advanced Battery Consortium Battery Abuse

FreedomCAR :electrical energy storage system abuse test manual for electric and hybrid electric vehicle applications. Technical Report · Tue Aug 01 00:00:00 EDT 2006 · OSTI ID: 1838583

### FreedomCAR :electrical energy storage system abuse test ...

FreedomCAR :electrical energy storage system abuse test manual for electric and hybrid electric vehicle applications Doughty, Daniel H. This manual defines a complete body of abuse tests intended to simulate actual use and abuse conditions that may be beyond the normal safe operating limits experienced by electrical energy storage systems used in electric and ...



### SAE J2464 "eV & HEV rechargeable energy storage system

SAE J2464, "Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System (RESS) Safety and Abuse Testing" is one of the premier testing manuals for vehicle

### SNL Abuse Testing Manual

This report describes recommended abuse testing procedures for rechargeable energy storage systems (RESSs) for electric vehicles. This report serves as a revision to the



### FreedomCAR Electrical Energy Storage System Abuse Test Manual for Electric and Hybrid Electric Vehicle Applications (SAND2005-3123).



#### System Topology



### Super Capacitor Energy Storage System Design for Wave Energy ...

FreedomCAR :electrical energy storage system abuse test manual for electric and hybrid electric vehi January 2005 D. H. Doughty Chris C. Crafts This manual defines a complete body of abuse

### Rechargeable Energy Storage Systems for Plug-in Hybrid Electric ...

In this paper, the performances of various lithium-ion chemistries for use in plug-in hybrid electric vehicles have been investigated and compared to several other rechargeable energy storage systems technologies such as lead-acid, nickel-metal hydride and electrical-double layer capacitors. The analysis has shown the beneficial properties of lithium-ion in the ...



51.2V  
200Ah/300Ah  
LiFePO4 battery

### Energy storage devices for future hybrid electric vehicles

Electric energy management actively uses the energy storage system (battery, supercapacitor, etc.) and hence relies on precise status information about this device. A battery monitoring system (BMS) has to deliver these essential inputs to ...





### FreedomCAR :electrical energy storage system abuse test ...

The tests are designed to provide a common framework for abuse testing various electrical energy storage systems used in both electric and hybrid electric vehicle applications.

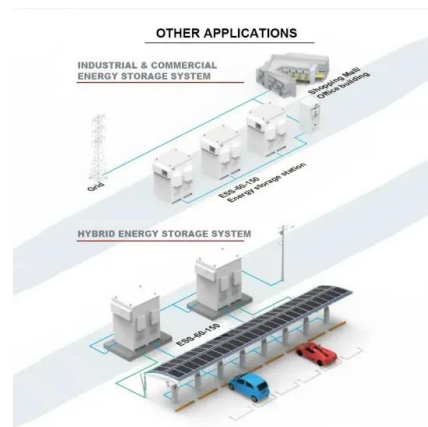


### SNL Abuse Testing Manual. (Technical Report) , OSTI.GOV

The U.S. Department of Energy's Office of Scientific and Technical Information This report describes recommended abuse testing procedures for rechargeable energy storage systems (RESSs) for electric vehicles. This report serves as a revision to the FreedomCAR

### FreedomCAR Program R& D on Energy Storage Systems

Energy Storage R& D Budget 12.6 9 2.4 9.9 9.6 1.9 9.9 9.6 9.5 0 5 10 15 20 25 30 \$, million FY 2002 FY 2003 FY 2004 Presidential Budget \$24M \$21.4M \$29M Long-term Research LBNL, ANL, BNL, Academic Institutions& Industrial Firms Long-term Research



### Electrochemical Energy Storage Technical Team Technology ...

The objective of the team is to complete the development of a high-power energy storage system that meets the FreedomCAR goals of 15-year life with 25kW pulse power and \$20/kW by 2010. The specific technical targets for both general energy storage devices (batteries and



### U.S. Department of Energy Vehicle Technologies Program

provided by David Howell, Energy Storage R& D Manager and Hybrid Electric Systems Team Leader. Comments and questions regarding the manual should be directed to Jon P. Christophersen at the Idaho National Laboratory (jon.ristophersen@inl.gov).



### Freedomcar

INL/EXT-12-27620 (2013), "Battery Test Manual for Low-Energy Energy Storage System for Power-Assist Hybrid Electric Vehicles," Idaho National Laboratory for the U.S. Department of Energy. INL/EXT-12-27920 Rev. 1 (2012), "Battery Technology Life Verification Test Manual," Idaho National Laboratory for the U.S. Department of Energy.

### FreedomCAR Electrical Energy Storage System Abuse Test ...

FreedomCAR Electrical Energy Storage System Abuse Test Manual (?????)-????????????,?????????(? ??200%SOC)????????????EV?HEV??????????????,?EV????????,???



### Recommended Practices for Abuse Testing Rechargeable ...

This report describes recommended abuse testing procedures for rechargeable energy storage systems (RESSs) for electric vehicles. This report serves as a revision to the FreedomCAR ...



Electrical Energy Storage: an introduction

Electrical energy storage systems (EESS) for electrical installations are becoming more prevalent. EESS provide storage of electrical energy so that it can be used later. The approach is not new: EESS in the form of battery-backed uninterruptible power



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**FreedomCAR Electrical Energy Storage System Abuse Test ...**

FreedomCAR Electrical Energy Storage System Abuse Test Manual (?????)-?????????????,?????????(? ??200%SOC)????????????? ???EV ...



**FreedomCAR Electrical Energy Storage System Abuse Test**

????: SANDIA REPORT SAND2005-3123 Unlimited Release Printed August 2006 FreedomCAR Electrical Energy Storage System Abuse Test Manual for Electric and Hybrid Electric Vehicle Applications Daniel H. Doughty and Chris C. Crafts Prepared by Sandia National Laboratories Albuquerque, New Mexico 871 85 and Livermore, California 94550 ...



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FreedomCAR / Electrical energy storage system abuse test manual for electric and hybrid electric vehicle applications ???? ?2 ???/???????????? ???? ???? ISO 12405-1: 2011 ISO 12405-2: 2012 ISO 12405-3: 2014 IEC 62660-2:2010 3:



[Abuse Testing of High Power Batteries](#)

Ref.: Sandia Report SAND 2005-3123, "FreedomCAR Electrical Energy Storage System Abuse Test Manual for Electric and Hybrid Electric Vehicle Applications", Daniel H. Doughty and Chris C. Crafts, May 2005 5 Approach: Most Meaningful Subset of Tests



**FreedomCAR Battery Test Manual For Power-Assist Hybrid ...**

This manual was prepared by and for the FreedomCAR Program Electrochemical Energy Storage Team. It is based on the goals established for FreedomCAR energy storage development and ...



[FreedomCAR Battery Test Manual](#)

Office of Energy Efficiency and Renewable Energy (EERE), Vehicle Technologies Program. It is based on technical targets established for energy storage development projects aimed at meeting system level DOE goals for Plug-in Hybrid Electric Vehicles





### [FreedomCAR 42V Battery Test Manual](#)

It is based on goals established by this technical team for 42V energy storage systems and to some extent derives from earlier hybrid test procedures used by the Partnership for a New ...

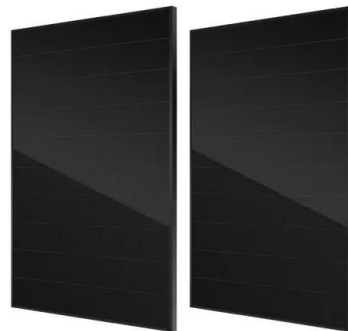


### **Targets for Onboard Hydrogen Storage Systems for Light-Duty ...**

Revision 4.0 Page 4 of 22 As a result of these new developments, the Partnership has revised the assumptions underlying the existing DOE hydrogen storage system targets, and in so doing have established a set of new targets. This document describes the

### **Batteries and Supercapacitors for Electric Vehicles**

1. Introduction Due to increasing gas prices and environmental concerns, battery propelled electric vehicles (BEVs) and hybrid electric vehicles (HEVs) have recently drawn more attention. In BEV and HEV configurations, the rechargeable energy storage system



### **FreedomCAR Electrical Energy Storage System Abuse Test ...**

The tests described are intended for abuse testing any electrical energy storage system designed for use in electric or hybrid electric vehicle applications whether it is ...



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Abuse Test Manual for Electric and Hybrid  
Electric Vehicle Applications ??????????FreedomC  
AR????????????????????(USABC)???,???,Sandia



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