

FUDS Cycle Test

1.0 PURPOSE

For simulated driving cycle testing of USABC batteries, a variable power discharge cycle based on the Federal Urban Driving Schedule (FUDS) may be applied to the battery. The USABC FUDS is scaled to a percentage of the maximum rated power or USABC power goal for a given technology. In general the FUDS maximum power is likely to be 80% of the USABC peak power goal for a technology; however, the specific value to be used in this procedure is specified (in watts or kilowatts) in the test plan.

Figure 5A-1 shows a graphical representation of the USABC FUDS 1372 second test profile, which is applied repetitively over a complete battery discharge. Table 5A-1 is the tabular listing of the USABC FUDS power profile; this listing may be obtained in computer readable form from the Idaho National Engineering Laboratory (208-526-1847).

Note: All references to the term 'battery' in this procedure refer to the unit to be tested, which may be a single cell, a multi-cell module, a battery pack, or a complete battery system.

2.0 PREREQUISITES

- 2.1 A Battery Test Plan or other test requirements document is required for testing using this procedure. The test plan specifies the values to be used for the FUDS. These values include battery A·h ratings, peak discharge power to be applied during FUDS testing, charge/discharge termination criteria, charging procedure, test temperature limitations, safety precautions, and any special handling/testing instructions specified by the manufacturer and/or the USABC.
- 2.2 Prior to the performance of this procedure, USABC Test Procedures No. 1A, Battery Pre Test Preparation, and No. 1B, Readiness Review, should normally have been completed. These activities are not a part of this procedure. This procedure may be executed as a stand-alone test activity or as part of a sequence of tests (e.g. a life-cycle test regime) provided that the information required by 2.1 above is available.

3.0 TEST EQUIPMENT

The equipment required to perform the FUDS consists of (a) a battery charge-discharge tester capable of achieving the scaled power-time profile shown in Figure 5A-1; and (b) a data system capable of acquiring the data specified in Section 6.0 at intervals of 1 second or less. The steps in this profile are only 1 second long, and the maximum permissible transition time between power steps is thus 1 second or less. The transition times are included in the overall profile length (i.e. a FUDS profile is always 1372 seconds long.)

Electric Vehicle Battery Test Procedures Manual

Jan Swart, Jody Leber



Electric Vehicle Battery Test Procedures Manual:

USABC Electric Vehicle Battery Test Procedures Manual. Revision 2 ,1996 This manual summarizes the procedural information needed to perform the battery testing being sponsored by the United States Advanced Battery Consortium USABC This information provides the structure and standards to be used by all testing organizations including the USABC developers national laboratories or other relevant test facilities

Battery & Ultracapacitor Test Procedures Manuals:

USABC electric vehicle battery test procedures manual (Revision 2), Jan. 1996 ,1996

Electric Vehicle Battery Systems Sandeep Dhameja,2001-10-30 Electric Vehicle Battery Systems provides operational theory and design guidance for engineers and technicians working to design and develop efficient electric vehicle EV power sources As Zero Emission Vehicles become a requirement in more areas of the world the technology required to design and maintain their complex battery systems is needed not only by the vehicle designers but by those who will provide recharging and maintenance services as well as utility infrastructure providers Includes fuel cell and hybrid vehicle applications Written with cost and efficiency foremost in mind Electric Vehicle Battery Systems offers essential details on failure mode analysis of VRLA NiMH battery systems the fast charging of electric vehicle battery systems based on Pb acid NiMH Li ion technologies and much more Key coverage includes issues that can affect electric vehicle performance such as total battery capacity battery charging and discharging and battery temperature constraints The author also explores electric vehicle performance battery testing 15 core performance tests provided lithium ion batteries fuel cells and hybrid vehicles In order to make a practical electric vehicle a thorough understanding of the operation of a set of batteries in a pack is necessary Expertly written and researched Electric Vehicle Battery Systems will prove invaluable to automotive engineers electronics and integrated circuit design engineers and anyone whose interests involve electric vehicles and battery systems Addresses cost and efficiency as key elements in the design process Provides comprehensive coverage of the theory operation and configuration of complex battery systems including Pb acid NiMH and Li ion technologies Provides comprehensive coverage of the theory operation and configuration of complex battery systems including Pb acid NiMH and Li ion technologies

Electric Vehicles and Advanced Battery R&D United States. Congress. House. Committee on Science, Space, and Technology. Subcommittee on Energy,1995 Distributed to some depository libraries in microfiche

Lithium-Ion Batteries Hazard and Use Assessment Celina Mikolajczak,Michael Kahn,Kevin White,Richard Thomas Long,2012-03-23 Lithium Ion Batteries Hazard and Use Assessment examines the usage of lithium ion batteries and cells within consumer industrial and transportation products and analyzes the potential hazards associated with their prolonged use This book also surveys the applicable codes and standards for lithium ion technology Lithium Ion Batteries Hazard and Use Assessment is designed for practitioners as a reference guide for lithium ion batteries and cells Researchers working in a related field will also find the book valuable

Battery Test Manual For Electric Vehicles, Revision 3 ,2015 This battery test procedure manual was prepared for the United

States Department of Energy DOE Office of Energy Efficiency and Renewable Energy EERE Vehicle Technologies Office It is based on technical targets for commercial viability established for energy storage development projects aimed at meeting system level DOE goals for Electric Vehicles EV The specific procedures defined in this manual support the performance and life characterization of advanced battery devices under development for EVs However it does share some methods described in the previously published battery test manual for plug in hybrid electric vehicles Due to the complexity of some of the procedures and supporting analysis future revisions including some modifications and clarifications of these procedures are expected As in previous battery and capacitor test manuals this version of the manual defines testing methods for full size battery systems along with provisions for scaling these tests for modules cells or other subscale level devices The DOE United States Advanced Battery Consortium USABC Technical Advisory Committee TAC supported the development of the manual Technical Team points of contact responsible for its development and revision are Chul Bae of Ford Motor Company and Jon P Christophersen of the Idaho National Laboratory The development of this manual was funded by the United States Department of Energy Office of Energy Efficiency and Renewable Energy Vehicle Technologies Office Technical direction from DOE was 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.christophersen@inl.gov

Advances in Battery Technologies for Electric Vehicles Bruno Scrosati, Jürgen Garche, Werner Tillmetz, 2015-05-25 Advances in Battery Technologies for Electric Vehicles provides an in depth look into the research being conducted on the development of more efficient batteries capable of long distance travel The text contains an introductory section on the market for battery and hybrid electric vehicles then thoroughly presents the latest on lithium ion battery technology Readers will find sections on battery pack design and management a discussion of the infrastructure required for the creation of a battery powered transport network and coverage of the issues involved with end of life management for these types of batteries Provides an in depth look into new research on the development of more efficient long distance travel batteries Contains an introductory section on the market for battery and hybrid electric vehicles Discusses battery pack design and management and the issues involved with end of life management for these types of batteries

Encyclopedia of Automotive Engineering, 2015-03-23 Erstmals eine umfassende und einheitliche Wissensbasis und Grundlage für weiterführende Studien und Forschung im Bereich der Automobiltechnik Die Encyclopedia of Automotive Engineering ist die erste umfassende und einheitliche Wissensbasis dieses Fachgebiets und legt den Grundstein für weitere Studien und tiefgreifende Forschung Weitreichende Querverweise und Suchfunktionen ermöglichen erstmals den zentralen Zugriff auf Detailinformationen zu bewährten Branchenstandards und verfahren Zusammenhängende Konzepte und Techniken aus Spezialbereichen lassen sich so einfacher verstehen Neben traditionellen Themen des Fachgebiets beschäftigt sich diese Enzyklopädie auch mit neuen Technologien dem Übergang von der Mechanik zur Elektronik und den Möglichkeiten zur

Herstellung sicherer effizienterer Fahrzeuge unter weltweit unterschiedlichen wirtschaftlichen Rahmenbedingungen Das Referenzwerk behandelt neun Hauptbereiche 1 Motoren Grundlagen 2 Motoren Design 3 Hybrid und Elektroantriebe 4 Getriebe und Antriebssysteme 5 Chassis Systeme 6 Elektrische und elektronische Systeme 7 Karosserie Design 8 Materialien und Fertigung 9 Telematik Zuverlässige Darstellung einer Vielzahl von Spezialthemen aus dem Bereich der Automobiltechnik Zugängliches Nachschlagewerk für Jungingenieure und Studenten die die technologischen Grundlagen besser verstehen und ihre Kenntnisse erweitern möchten Wertvolle Verweise auf Detailinformationen und Forschungsergebnisse aus der technischen Literatur Entwickelt in Zusammenarbeit mit der FISITA der Dachorganisation nationaler Automobil Ingenieur Verbände aus 37 Ländern und Vertretung von über 185 000 Ingenieuren aus der Branche Erhältlich als stets aktuelle Online Ressource mit umfassenden Suchfunktionen oder als Print Ausgabe in sechs Bänden mit über 4 000 Seiten Ein wichtiges Nachschlagewerk für Bibliotheken und Informationszentren in der Industrie bei Forschungs und Schulungseinrichtungen Fachgesellschaften Regierungsbehörden und allen Ingenieurstudenten Richtet sich an Fachingenieure und Techniker aus der Industrie Studenten höherer Semester und Studienabsolventen Forscher Dozenten und Ausbilder Branchenanalysen und Forscher

Lithium-Ion Battery Standards Jan Swart, Jody Leber, 2024-11-30 Lithium Ion Battery Standards is an essential guide for understanding Lithium ion batteries and the standards that govern them This comprehensive resource covers everything from the basics of Lithium ion battery systems to the intricacies of safety design and regulatory requirements The book explains the differences between Lithium ion batteries and other battery systems highlighting the critical importance of system integration and design It offers insights into battery system architectures terminology and the safety features that can be specified for Lithium ion cells The reader will find a detailed exploration of safety concerns including failure modes in electronic components and high voltage systems as well as an in depth discussion on the differences between standards and regulatory requirements both in the U S and internationally The book also covers industry specific standards providing a comprehensive list of applicable regulations for various battery system architectures Additionally it includes practical information on the shipping and labeling of Lithium ion batteries with special attention to prototype and damaged batteries This is the go to resource for understanding and navigating the complex world of Lithium ion battery standards and regulations

U.S. Department of Energy Vehicle Technologies Program, 2014 This battery test procedure manual was prepared for the United States Department of Energy DOE Office of Energy Efficiency and Renewable Energy EERE Vehicle Technologies Office It is based on technical targets for commercial viability established for energy storage development projects aimed at meeting system level DOE goals for Plug in Hybrid Electric Vehicles PHEV The specific procedures defined in this manual support the performance and life characterization of advanced battery devices under development for PHEVs However it does share some methods described in the previously published battery test manual for power assist hybrid electric vehicles Due to the complexity of some of the procedures and supporting analysis

future revisions including some modifications and clarifications of these procedures are expected As in previous battery and capacitor test manuals this version of the manual defines testing methods for full size battery systems along with provisions for scaling these tests for modules cells or other subscale level devices The DOE United States Advanced Battery Consortium USABC Technical Advisory Committee TAC supported the development of the manual Technical Team points of contact responsible for its development and revision are Renata M Arsenault of Ford Motor Company and Jon P Christophersen of the Idaho National Laboratory The development of this manual was funded by the United States Department of Energy Office of Energy Efficiency and Renewable Energy Vehicle Technologies Office Technical direction from DOE was 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.christophersen@inl.gov

Battery Test Manual For Plug-In Hybrid Electric Vehicles, 2010 This battery test procedure manual was prepared for the United States Department of Energy DOE 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 PHEV The specific procedures defined in this manual support the performance and life characterization of advanced battery devices under development for PHEV s However it does share some methods described in the previously published battery test manual for power assist hybrid electric vehicles Due to the complexity of some of the procedures and supporting analysis a revision including some modifications and clarifications of these procedures is expected As in previous battery and capacitor test manuals this version of the manual defines testing methods for full size battery systems along with provisions for scaling these tests for modules cells or other subscale level devices

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Batteries for Electric Vehicles David Anthony James Rand,R. Woods,Ronald Dell,1998 Provides an information guide to the use of rechargeable batteries in electric vehicle propulsion The application of battery driven vehicles in service on the site and on the road is included in the book **Applied Energy and Environment Technologies and Materials** Seung Bok Choi,2015-03-02 Selected peer reviewed papers from the 2014 International Forum on Applied Energy and Environment IFAEE 2014 November 28 29 2014 Shenzhen China **Battery Safety and Abuse Tolerance** Daniel H. Doughty,2008-03 Safety of batteries and electrochemical capacitors has taken on more importance for battery manufacturers government regulators as well as system integrators Papers in this issue describe all aspects of battery and electrochemical capacitor safety including new materials and their reactivity decomposition reactions that generate heat and gas the role of separators in abuse response and battery pack design **Electric and Hybrid Vehicles** ,1995 **Battery State Estimation and Control for Power Buffering Applications** Herman L. N. Wiegman,1999 **SAE Surface Vehicle Emissions Standards Manual** ,1998 Proceedings of the 30th Intersociety Energy Conversion Engineering Conference ,1995 *Proceedings of the 31st Intersociety Energy Conversion Engineering Conference* ,1996

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