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Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems

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Prepared by: SC-225

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FOREWORD

This document was prepared by Special Committee 225 (SC-225) and approved by the RTCA Program Management Committee (PMC) on December 19, 2017. It supersedes RTCA DO-311 dated March 13, 2008. It also supersedes DO-347 Certification Test Guidance for Small and Medium Sized Rechargeable Lithium Batteries and Battery Systems, dated December 18, 2013.

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- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity and efficiency;

- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and

- assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunication Union and other appropriate international organizations can be based.

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EXECUTIVE SUMMARY

This document was prepared by RTCA Special Committee SC-225. Members of this committee included representatives from battery and cell manufacturers, avionics manufacturers, aircraft manufacturers, aircraft operators, pilot and flight attendant associations, regulatory and other government agencies, and related industry associations.

The SC-225 committee reviewed and considered regulatory requirements, multiple standards, and resources associated with rechargeable lithium batteries in developing this standard. These include FAA Special Conditions related to rechargeable lithium batteries and battery systems, RTCA/DO-311, RTCA/DO-347, UL 1642, UL 2054, UN Section 38.3, and IEC 62133.

This standard provides design, testing, and installation guidance for rechargeable lithium battery systems that are permanently installed on aircraft including standalone and embedded batteries. It addresses all sizes of rechargeable lithium battery systems regardless of energy content (watt-hours). Batteries or battery systems that are less than two watt-hours are exempt from this standard if they have met the requirements of applicable UL or IEC standards. Otherwise, the requirements of this standard apply.

Section 1 (Introduction) identifies battery categories by energy content, venting provisions, and architecture.

Section 2 (Qualification Requirements and Test Procedures) contains the requirements and test procedures that are performed on rechargeable lithium battery systems. They include general, performance, safety, and environmental requirements and tests.

Section 3 (Installation Considerations) provides installation considerations that may impact the design of the battery system. It also provides installation considerations for the installer. Section 3 does not contain requirements.

Three appendices are included. Appendix A provides additional safety considerations pertinent to storage, shipping, handling and disposal of rechargeable lithium batteries and battery systems. Appendix B provides optional methods of testing shelf life and float life. Appendix C provides an alternate test method for the battery thermal runaway containment test. FAA has not acknowledged Appendix C as an acceptable means of compliance, or an alternate equivalent test for section 2.4.5.5.

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1 INTRODUCTION

1.1 Purpose

This Minimum Operational Performance Standard (MOPS) is for rechargeable lithium batteries and battery systems permanently installed on aircraft. It provides design, analysis, testing, and installation guidance for rechargeable lithium batteries and battery systems. The tests defined in this document provide a standardized method for verification (i.e. pass/fail) and characterization (i.e. report results) of the safety and performance of batteries and battery systems.

This standard is intended for designers and manufacturers of rechargeable lithium batteries and battery systems, aircraft manufacturers, aircraft equipment installers, and users within the aviation community. Meeting the requirements of this standard provides a means of assuring that the batteries and battery systems will perform their intended function(s) safely under conditions encountered in aeronautical operations. To ensure safe operation on the aircraft, it is imperative that users of this standard thoroughly understand the aircraft performance requirements and the capabilities and limitations of the batteries and battery systems. It is the equipment installers' responsibility to ensure that the batteries and battery systems meet the certification and installation requirements of the aircraft. Any regulatory application of this standard is the responsibility of the applicable government agency.

1.2 Scope

This standard applies to rechargeable lithium batteries and battery systems that are permanently installed on aircraft. For the purpose of this standard, a battery or battery system is considered permanently installed equipment when it is included as part of the type design of the aircraft (or supplemental/amended type design). This standard also applies to rechargeable lithium batteries contained within Portable Electronic Devices (PEDs) that are part of the type design. This standard does not apply to primary (non-rechargeable) lithium batteries.

***Note**: Rechargeable lithium batteries within PEDs that are not part of the type design are outside the scope of this standard; these PEDs fall under the purview of Federal Aviation Administration (FAA) Flight Standards Division and are regulated by operational rules under Title 14 of the Code of Federal Regulations (CFR). PEDs that are not part of the type design, especially those being recharged on the flight deck, present similar hazards as permanently installed equipment.*

This standard does not require individual cell level testing or characterization of cell/battery aging. Other standards such as UL, IEC, and UN may be used to perform cell level testing or to characterize aging effects of the cell/battery.

1.3 System Overview

Rechargeable lithium batteries and battery systems of various chemical compositions, sizes, and construction details are being widely promoted for aircraft applications. Among their desirable characteristics are high energy content per unit weight, relatively constant voltage during discharge, and long cycle life. Rechargeable lithium batteries and battery systems can provide power throughout the aircraft, including engine or Auxiliary Power Unit (APU) starting, avionics, emergency, and other systems. Because of their high specific energy/power and potential thermal instability, they can present hazards if improperly designed, assembled, tested, installed, used, handled, or stored.

