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Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems

RTCA DO-311A
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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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- 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

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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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TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 Purpose 1
1.2 Scope 1
1.3 System Overview 1
1.4 Battery Categories 2
1.4.1 Energy Categories 2
1.4.2 Venting Categories 2
1.4.3 Architecture Categories 2
1.5 Regulatory Responsibilities for Installed Equipment 3
1.6 Test Procedures 3
1.7 References 3
1.8 Definition of Terms 4
1.8.1 Acronyms and Abbreviations 7

2 REQUIREMENTS, GUIDELINES, AND TEST PROCEDURES 9

2.1 General Requirements 9
2.1.1 Fire Protection 9
2.1.2 Design Assurance 9
2.1.3 Marking 9
2.1.3.1 Standalone Battery Marking 9
2.1.3.2 Embedded Battery Marking 10
2.1.4 General Safety Requirements 10
2.1.4.1 Battery Protective Features 11
2.1.4.2 Battery Warning Features 11
2.1.5 Charging and Discharging Protection 11
2.1.6 Overdischarge Protection 11
2.1.7 Mitigation of Cell Failures 12
2.1.8 Venting Provisions 12
2.1.9 Shelf Life and Float Life 13
2.1.10 Design Guidelines 13
2.1.10.1 General Guidelines 13
2.1.10.2 Cell Balancing 14
2.1.10.3 State of Health Function 15
2.1.10.4 State of Charge Function 15
2.1.10.5 Built-In-Test 15
2.1.10.6 Parasitic Drain 15
2.1.10.7 Prevention from Bus Back Charging 15
2.1.10.8 Electrical Bonding 15
2.1.10.9 Dissimilar Metals 15
2.1.11 Quality 15
2.1.11.1 Configuration Control 16
2.1.11.2 Workmanship 16

2.1.12 Maintenance Documentation Guidance 16

2.2 Equipment Requirements – Standard Conditions 17
2.2.1 Performance Requirements 17
2.2.1.1 Physical Examination 17
2.2.1.2 Acceptance Test Procedure 17
2.2.1.3 Insulation Resistance 17
2.2.1.4 Handle Strength 18
2.2.1.5 Rated Capacity 18
2.2.1.6 Capacity at Low and High Temperatures 18
2.2.1.7 Constant Voltage Discharge for High Rate Batteries 18
2.2.1.8 Charge Acceptance 18
2.2.1.9 Charge Retention 18
2.2.1.10 Cycling of High Rate Batteries 18
2.2.1.11 Rapid Discharge at Short-Time Operating High Temperature 19
2.2.1.12 Short Circuit Protection 19
2.2.1.13 Overdischarge Protection 19
2.2.1.14 Overcharge Protection 19
2.2.2 Safety Requirements 19
2.2.2.1 Short Circuit without Protection 19
2.2.2.2 Overdischarge without Protection 20
2.2.2.3 Single Cell Thermal Runaway Containment 20
2.2.2.4 Battery Thermal Runaway Containment 20
2.2.2.5 Explosion Containment 20
2.2.2.6 Drop Impact Resistance 20

2.3 Equipment Requirements – Environmental Conditions 21
2.3.1 Environmental Performance Requirements 21
2.3.2 Environmental Test Procedures 22

2.4 Equipment Test Procedures 22
2.4.1 Definitions of Terms and Conditions of Test 22
2.4.2 Test Matrix 23
2.4.3 Test Setup 25
2.4.3.1 Special Electrical Grounding Provision 25
2.4.4 Performance Tests 25
2.4.4.1 Physical Examination (Paragraph 2.2.1.1) 25
2.4.4.2 Acceptance Test Procedure (Paragraph 2.2.1.2) 25
2.4.4.3 Insulation Resistance Test (Paragraph 2.2.1.3) 26
2.4.4.4 Handle Strength Test (Paragraph 2.2.1.4) 26
2.4.4.5 Capacity Test (Paragraph 2.2.1.5) 26
2.4.4.6 Capacity Test at Low and High Temperatures (Paragraph 2.2.1.6) 27
2.4.4.7 Constant Voltage Discharge Test for High Rate Batteries (Paragraph 2.2.1.7) 27
2.4.4.8 Charge Acceptance Test (Paragraph 2.2.1.8) 28
2.4.4.9 Charge Retention Test (Paragraph 2.2.1.9) 29
2.4.4.10 Cycle Test for High Rate Batteries (Paragraph 2.2.1.10) 29
2.4.4.11 Rapid Discharge Test at Short-Time Operating High Temperature (Paragraph 2.2.1.11) 30
2.4.4.12 Short Circuit Test with Protection Enabled (Paragraph 2.2.1.12) 31
2.4.4.13 Overdischarge Test (Paragraph 2.2.1.13) 31
2.4.4.13.1 Test Method for Standalone Batteries 32
2.4.4.13.2 Test Method for Embedded Batteries 32
2.4.4.14 Overcharge Test (Paragraph 2.2.1.14) 33
2.4.5 Safety Tests 34
2.4.5.1 Short Circuit Test of a Cell (Paragraph 2.2.2.1) 34

2.4.5.2 Short Circuit Test of a Battery without Protection (Paragraph 2.2.2.1) 35
2.4.5.3 Overdischarge Test without Protection (Paragraph 2.2.2.2) 36
2.4.5.3.1 Test Method for Standalone Batteries 36
2.4.5.3.2 Test Method for Embedded Batteries 37
2.4.5.4 Single Cell Thermal Runaway Containment Test (Paragraph 2.2.2.3) 38
2.4.5.4.1 Test Method for Single Cell Thermal Runaway via Overcharging 38
2.4.5.4.2 Test Method for Single Cell Thermal Runaway via Overheating 39
2.4.5.5 Battery Thermal Runaway Containment Test (Paragraph 2.2.2.4) 40
2.4.5.5.1 Test Method for Battery Thermal Runaway via Overcharging 41
2.4.5.5.2 Test Method for Battery Thermal Runaway via Overheating 42
2.4.5.6 Explosion Containment Test (Paragraph 2.2.2.5) 42
2.4.5.7 Drop Impact Test (Paragraph 2.2.2.6) 43

3 INSTALLATION CONSIDERATIONS 45

3.1 Manufacturer Considerations 45
3.1.1 Aircraft Warning System 45
3.1.2 Aircraft Environment 45
3.1.3 Failure Protection 45
3.2 Installer Considerations 45
3.2.1 Hazardous Battery Emissions 45
3.2.2 Installation Design 46
3.2.3 Additional Considerations for Installed Equipment 46
3.3 Test Procedures for Installed Equipment 46

4 MEMBERSHIP 47

APPENDIX A: SAFETY GUIDELINES FOR USERS OF RECHARGEABLE LITHIUM BATTERIES A-1

A.1 Electric Burn Hazard A-1
A.2 Electric Shock Hazard A-1
A.3 Thermal Runaway A-1
A.4 Damage to Connectors A-2
A.5 Storage A-2
A.6 Shipping A-2
A.7 Disposal A-2
A.8 Mixing of Cells A-2
A.9 Cell Polarity A-2

APPENDIX B: OPTIONAL TEST METHODS B-1

B.1 Shelf Life Test B-1
B.2 Float Life Test B-1

APPENDIX C: ALTERNATE TEST METHOD FOR BATTERY THERMAL RUNAWAY CONTAINMENT TEST C-1

C.1 Prerequisites C-2

C.2 Test Method C-2

APPENDIX D: RTCA DO-311A DISSENTING OPINION LETTER D-1

APPENDIX E: RESPONSE TO TRUE BLUE DISSENT E-1

TABLE OF TABLES

Table 1–1: Energy Categories 2
Table 2–1: Environmental Tests 21
Table 2–2: Test Matrix 23

TABLE OF FIGURES

Figure 2–1: Internal Test Points for Overcharge Testing 34
Figure 2–2: Internal Test Points for Single Cell Safety Tests 39

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.

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