



Designation: F3235 – 22

Standard Specification for Aircraft Storage Batteries¹

This standard is issued under the fixed designation F3235; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers electrical storage battery aspects of airworthiness and design for aeroplanes. The material was developed through open consensus of international experts in general aviation. This information was created by focusing on Normal Category aeroplanes. The content may be more broadly applicable; it is the responsibility of the Applicant to substantiate broader applicability as a specific means of compliance. The topics covered within this document are electrical storage batteries, Nickel Cadmium Batteries, and Rechargeable Lithium Batteries.

1.2 An applicant intending to propose this information as Means of Compliance for a design approval must seek guidance from their respective oversight authority (for example, published guidance from applicable civil aviation authorities (CAAs)) concerning the acceptable use and application thereof. For information on which oversight authorities have accepted this standard (in whole or in part) as an acceptable Means of Compliance to their regulatory requirements (hereinafter “the Rules”), refer to the ASTM Committee F44 web page (www.astm.org/COMMITTEE/F44.htm). **Annex A1** maps the Means of Compliance described in this specification to EASA CS-23, amendment 5, or later, and FAA 14 CFR Part 23, amendment 64, or later.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This specification is under the jurisdiction of ASTM Committee F44 on General Aviation Aircraft and is the direct responsibility of Subcommittee F44.50 on Systems and Equipment.

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2. Referenced Documents

2.1 Following is a list of external standards referenced throughout this specification; the earliest revision acceptable for use is indicated. In all cases, later document revisions are acceptable if shown to be equivalent to the listed revision, or if otherwise formally accepted by the governing civil aviation authority; earlier revisions are not acceptable.

2.2 *ASTM Standards:*²

F3060 Terminology for Aircraft

F3061/F3061M Specification for Systems and Equipment in Aircraft

2.3 *EASA Standard:*³

CS-23 Normal, Utility, Aerobatic and Commuter Aeroplanes

2.4 *FAA Standard:*⁴

14 CFR Part 23 Airworthiness Standards: Normal Category Airplanes

2.5 *RTCA Standard:*

RTCA/DO-311A Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems⁵

3. Terminology

3.1 Terminology specific to this specification is provided below. For general terminology, refer to Terminology F3060.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aircraft type code, n*—an Aircraft Type Code (ATC) is defined by considering both the technical considerations regarding the design of the aircraft and the airworthiness level established based upon risk-based criteria; the method of defining an ATC applicable to this specification is defined in Specification F3061/F3061M.

4. Electrical Storage Batteries

NOTE 1—Table 1 provides correlation between various Aircraft Type Codes and the individual requirements contained within this section; refer

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

³ Available from European Union Aviation Safety Agency (EASA), Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany, <https://www.easa.europa.eu>.

⁴ Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, <http://www.faa.gov>.

⁵ Available from Radio Technical Commission for Aeronautics (RTCA), 1150 18th NW, Suite 910, Washington, DC 20036, <https://www.rtca.org>.

TABLE 1 ATC Compliance Matrix, Section 4

Section	Airworthiness Level				Number of Engines		Type of Engine(s)		Stall Speed			Cruise Speed		Meteorological Conditions			Altitude		Maneuvers	
	1	2	3	4	S	M	R	T	L	M	H	L	H	D	N	I	L	H	N	A
4																				
4.1																				
4.1.1																				
4.1.2																				
4.1.2.1																				
4.1.2.2																				
4.1.2.3																				
4.2																				
4.2.1																				
4.2.2																				
4.2.3																				
4.2.4																				
4.2.5																				
4.2.6																				
4.2.7																				
4.2.8																				
4.2.9																				
4.2.10																				
4.2.11																				
4.2.12																				
4.2.13																				
4.2.14																				

to 3.2.1. For each subsection, an indicator can be found under each ATC character field; three indicators are used:

An empty cell () in all applicable ATC character field columns indicates that an aircraft must meet the requirements of that subsection.

A white circle (○) in multiple columns indicates that the requirements of that subsection are not applicable to an aircraft *only* if all such ATC character fields are applicable.

A mark-out (×) in any of the applicable ATC character field columns indicates that the requirements of that subsection are not applicable to an aircraft if that ATC character field is applicable.

Example—An aircraft with an ATC of 1SRLLDLN is being considered. Since all applicable columns are indicated for 4.1.1, that subsection is applicable to the aircraft.

4.1 Nickel Cadmium Batteries:

4.1.1 Each nickel cadmium battery installation capable of being used to start an engine or auxiliary power unit must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

4.1.2 Nickel cadmium battery installations capable of being used to start an engine or auxiliary power unit must meet the requirements of either 4.1.2.1, 4.1.2.2, or 4.1.2.3.

4.1.2.1 If the requirements of either 4.1.2.2 or 4.1.2.3 are not met, nickel cadmium battery installations capable of being used to start an engine or auxiliary power unit must have a system to control the charging rate of the battery automatically so as to prevent battery overheating.

4.1.2.2 If the requirements of either 4.1.2.1 or 4.1.2.3 are not met, nickel cadmium battery installations capable of being used to start an engine or auxiliary power unit must have a battery temperature sensing and over-temperature warning system with a means for disconnecting the battery from its charging source in the event of an over-temperature condition.

4.1.2.3 If the requirements of either 4.1.2.1 or 4.1.2.2 are not met, nickel cadmium battery installations capable of being used to start an engine or auxiliary power unit must have a

battery failure sensing and warning system with a means for disconnecting the battery from its charging source in the event of battery failure.

4.2 Rechargeable Lithium Batteries:

4.2.1 The provisions of 4.2.2 – 4.2.14 apply only to rechargeable lithium batteries.

4.2.2 Safe cell temperatures and pressures must be maintained during any foreseeable charging or discharging condition.

4.2.3 Safe cell temperatures and pressures must be maintained during any failure of the charging or battery monitoring system not shown to be extremely remote.

4.2.4 The rechargeable lithium battery installation must preclude explosion in the event of any failure of the charging or battery monitoring system not shown to be extremely remote.

4.2.5 Design of the rechargeable lithium batteries must preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.

4.2.6 No explosive or toxic gases emitted by any rechargeable lithium battery in normal operation may accumulate within the aircraft in such quantities as would cause risk of fire/explosion or be harmful to the aircraft occupants, or both.

4.2.7 No explosive or toxic gases emitted by any rechargeable lithium battery as the result of any failure, not shown to be extremely remote, of the battery charging system, battery monitoring system, or battery installation may accumulate within the aircraft in such quantities as would cause risk of fire/explosion or be harmful to the aircraft occupants, or both.

4.2.8 No corrosive fluids or gases that may escape from any rechargeable lithium battery may damage surrounding structure or any adjacent systems, equipment, or electrical wiring of the airplane in such a way as to cause a major or more severe failure condition.

4.2.9 Each rechargeable lithium battery installation must have provisions to prevent any hazardous effect on structure or essential systems caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

4.2.10 The lithium battery system must have a capability to control the charging rate of the battery automatically, so as to prevent battery overheating or overcharging, and the requirements of either 4.2.10.1 or 4.2.10.2 must be met.

4.2.10.1 A battery temperature sensing and over-temperature warning system with a means for automatically disconnecting the battery from its charging source in the event of an over-temperature condition must be provided.

4.2.10.2 A battery failure sensing and warning system with a means for automatically disconnecting the battery from its charging source in the event of battery failure may be provided.

4.2.11 Any rechargeable lithium battery installation, the function of which is required for safe operation of the aircraft, must incorporate a monitoring and warning feature that will provide an indication to the appropriate flight crewmembers whenever the state-of-charge of the batteries has fallen below levels considered acceptable for dispatch of the aircraft.

4.2.12 Internal and external materials of the rechargeable lithium battery and battery system shall meet the applicable certification flammability requirements of the installation.

4.2.13 Installations of rechargeable lithium batteries must meet the applicable Flammable Fluid Fire Protection requirements of Specification **F3061/F3061M**.

4.2.14 RTCA/DO-311A provides a method for demonstrating compliance to 4.2.2 – 4.2.11.

5. Keywords

5.1 batteries; battery; cadmium; lithium; nicad; nickel

ANNEX

(Mandatory Information)

A1. CORRELATION OF STANDARD – CONTENT AND THE RULES

A1.1 Means of Compliance Correlation Sorted by Standard Section

NOTE A1.1—The specification sections shown in the specification column will be at the highest level at which everything below that level is the same as the level shown.

[ASTM F3235-22](https://standards.iteh.ai/)

<https://standards.iteh.ai/catalog/standards/sist/169d8bbb-c7f6-4c3f-b736-6ee0b24bee66/astm-f3235-22>

TABLE A1.1 Means of Compliance Correlation Sorted by Standard Section

Std	Rev	Section	Subpart	14 CFR Part 23	Subpart	CS-23
F3235	22	4.1	...	N/A	...	N/A
F3235	22	4.1.1	F	23.2500(a)(1)	F	23.2500(b)
F3235	22	4.1.1	F	23.2500(a)(1)	F	23.2505(a)
F3235	22	4.1.2	F	23.2500(a)(1)	F	23.2500(b)
F3235	22	4.1.2	F	23.2500(a)(1)	F	23.2505(a)
F3235	22	4.2	...	N/A	...	N/A
F3235	22	4.2.1	...	N/A	...	N/A
F3235	22	4.2.2	F	23.2500(a)	F	23.2500(b)
F3235	22	4.2.2	F	23.2500(a)	F	23.2505(a)
F3235	22	4.2.3	F	23.2500(a)(1)	F	23.2500(b)
F3235	22	4.2.3	F	23.2500(a)(1)	F	23.2505(a)
F3235	22	4.2.3	F	23.2500(a)(1)	F	23.2510(a)
F3235	22	4.2.4	F	23.2500(a)(1)	F	23.2500(b)
F3235	22	4.2.4	F	23.2500(a)(1)	F	23.2505(a)
F3235	22	4.2.4	F	23.2500(a)(1)	F	23.2510(a)
F3235	22	4.2.5	F	23.2500(a)	F	23.2500(b)
F3235	22	4.2.6	F	23.2500(a)	F	23.2500(b)
F3235	22	4.2.6	F	23.2500(a)	F	23.2505(a)
F3235	22	4.2.7	F	23.2500(a)	F	23.2500(b)
F3235	22	4.2.7	F	23.2500(a)	F	23.2505(a)
F3235	22	4.2.8	F	23.2500(a)	F	23.2500(b)
F3235	22	4.2.8	F	23.2500(a)	F	23.2505(a)
F3235	22	4.2.8	F	23.2500(a)	F	23.2510(a)
F3235	22	4.2.9	F	23.2500(a)(1)	F	23.2500(b)
F3235	22	4.2.9	F	23.2500(a)(1)	F	23.2505(a)
F3235	22	4.2.10	F	23.2500(a)(1)	F	23.2500(b)
F3235	22	4.2.10	F	23.2500(a)(1)	F	23.2505(a)
F3235	22	4.2.11	F	23.2500(a)(1)	F	23.2500(b)
F3235	22	4.2.11	F	23.2500(a)(1)	F	23.2505(a)
F3235	22	4.2.12	F	23.2500(a)(1)	F	23.2500(b)
F3235	22	4.2.12	F	23.2500(a)(1)	F	23.2505(a)
F3235	22	4.2.13	F	23.2500(a)(1)	F	23.2500(b)
F3235	22	4.2.13	F	23.2500(a)(1)	F	23.2505(a)
F3235	22	4.2.14	...	N/A	...	N/A

A1.2 Means of Compliance Correlation Sorted by FAA 14 CFR Part 23 Rule
TABLE A1.2 Means of Compliance Correlation Sorted by FAA 14 CFR Part 23 Rule

Subpart	14 CFR Part 23	Std	Rev	Section
F	23.2500(a)	F3235	22	4.2.2
F	23.2500(a)	F3235	22	4.2.5
F	23.2500(a)	F3235	22	4.2.6
F	23.2500(a)	F3235	22	4.2.7
F	23.2500(a)	F3235	22	4.2.8
F	23.2500(a)(1)	F3235	22	4.1.1
F	23.2500(a)(1)	F3235	22	4.1.2
F	23.2500(a)(1)	F3235	22	4.2.3
F	23.2500(a)(1)	F3235	22	4.2.4
F	23.2500(a)(1)	F3235	22	4.2.9
F	23.2500(a)(1)	F3235	22	4.2.10
F	23.2500(a)(1)	F3235	22	4.2.11
F	23.2500(a)(1)	F3235	22	4.2.12
F	23.2500(a)(1)	F3235	22	4.2.13