



U.S. Department
of Transportation
**Federal Aviation
Administration**

Policy Statement

Subject: Special Condition on Installed Rechargeable Lithium Batteries and Battery Systems on Aircraft

Date: 05/20/15

Policy No:
PS-AIR-20-130-02-01

Initiated By:
AIR-133

Summary

This policy statement provides direction to Directorates on the requirement and implementation of the special conditions for installation of rechargeable lithium batteries and battery systems on Title 14 of the Code of Federal Regulations (14 CFR) parts 23, 25, 27, and 29 aircraft. Rechargeable lithium batteries and battery systems are referred to as lithium batteries hereafter. This document provides a typical list of special conditions to enable standardization for all parts 23, 25, 27 and 29 aircraft.

Current Regulatory

1. The special condition requirements in this policy are in addition to the existing §§ 23/25/27/29.1353 requirements which do not address installations of lithium batteries.
2. Certification engineers developed the special conditions for each project to define the necessary requirements for a safe installation of lithium batteries on aircraft.
3. The applicant shall meet these special conditions in addition to all other applicable airworthiness regulations.

Policy

The attached special condition requirements will enable certification engineers to provide the applicants a standardized method for certifying lithium batteries.

Effect of Policy

This policy will be in effect for certification projects involving the installation of lithium batteries on aircraft initiated after the release of this policy statement.

Implementation

Existing certified systems containing lithium batteries and not a subject of an Airworthiness Directive need not follow this policy. Otherwise, the following paragraphs apply:

1. The special condition attached to this policy statement is applicable for projects that involve new installation of lithium batteries.
2. A means of compliance issue paper is required for each lithium battery project. An advisory circular (AC) will be published to provide compliance guidance to these special conditions. The AC can be used for showing compliance in lieu of the required issue paper to meet these special conditions. The means of compliance may vary based on the directorate evaluation of the risk and criticality for the particular product.

Conclusion

The Federal Aviation Administration (FAA) has concluded it is appropriate to use the special condition to maintain the product's level of safety with the current regulations.



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Attachment

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**TYPICAL SPECIAL CONDITION (SC) AND INTENT FOR EACH SC
FOR PARTS 23/25/27/29 AIRCRAFT**

The following nine special conditions address potential hazards and mitigations when installing rechargeable lithium batteries and battery systems in aircraft.

Special Condition Requirement #1: Safe cell temperatures and pressures must be maintained during all foreseeable charging or discharging condition and during any failure of the charging or battery monitoring system not shown to be extremely remote. The rechargeable lithium battery installation must mitigate all hazards associated with those failures.

The intent of this SC requirement:

The cells within the rechargeable lithium battery system shall be designed to minimize the impact of self-sustained, uncontrolled increases in cell temperature or pressure, which may result from all foreseeable charging or discharging condition. The probability of this event must be shown to be extremely remote (one event in 10 million (1×10^{-7}) flight hours). The rechargeable lithium battery installation must mitigate all hazards associated with those failures.

Special Condition Requirement #2: Design of the rechargeable lithium batteries must preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.

The intent of this SC requirement:

The rechargeable lithium battery system shall be designed to minimize the impact of self-sustained, uncontrolled increases in temperature or pressures as a result of all failures within the battery. The probability of impact must be extremely improbable (one event in 1000 million (1×10^{-9}) flight hours).

Special Condition Requirement #3: No explosive or toxic gases emitted by any rechargeable lithium battery in normal operation, or as the result of a failure of the battery charging system, monitoring system, or battery installation which is not shown to be extremely remote, may accumulate in hazardous quantities within the aircraft.

The intent of this SC requirement:

The battery system shall not emit any flammable, toxic, or corrosive gases, smoke, or fluids during normal operation.

Battery systems shall be capable of containing or safely relieving the maximum pressure buildup that can occur under worst-case failure conditions. If the battery system is not capable of containing the maximum pressure, then the appropriate provisions shall be included to relieve pressure from the battery. Emissions shall only escape through designed pressure relief provisions.

Hazardous emissions may be flammable, explosive, corrosive, or toxic in certain concentrations. The installer should work with the manufacturer to quantify and mitigate the effects of hazardous

emissions. Ensure that the aircraft installation is compatible with the emissions and temperatures that the battery or battery system may generate during any failure condition.

Accommodate all venting provisions on the battery or battery system installation as a mitigation provision.

Provide containment or safe venting of electrolyte leakage, toxic or explosive gases, and debris (while installed) as a mitigation provision.

The probability of this failure must be shown to be extremely remote (one event in 10 million (1×10^{-7}) flight hours).

Special Condition Requirement #4: Installations of rechargeable lithium batteries must meet the requirements of Title 14 of the Code of Federal Regulations (14 CFR) 23/25/27/29.863(a) through (d) for part 23, 25, 27, and 29 aircraft.

The intent of this SC requirement:

Internal and external materials of the rechargeable lithium battery and battery system shall meet the applicable certification flammability requirements of the installation. They must meet the requirements of §§ 23/25/27/29.863(a) through (d).

Special Condition Requirement #5:

For Part 23:

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 aircraft in such a way as to cause a major or more severe failure condition, in accordance with § 23.1309(c) and applicable regulatory guidance.

The intent of this SC requirement:

There shall be no damage to surrounding structure or any adjacent systems, equipment, or electrical wiring from the fluids or gases emitted from the battery. The design assurance level (DAL) must meet the requirement of § 23.1309(c) and any other applicable airworthiness regulations.

For Part 25:

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 aircraft in such a way as to cause a major or more severe failure condition, in accordance with § 25.1309(b) and applicable regulatory guidance.

The intent of this SC requirement is:

There shall be no damage to surrounding structure or any adjacent systems, equipment, or electrical wiring from the fluids or gases emitted from the battery. The DAL must meet the requirement of § 25.1309(b) and any other applicable airworthiness regulations.

For Part 27:

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 aircraft in such a way as to cause a major or more severe failure condition, in accordance with §§27.1309(b) and (c), and applicable regulatory guidance.

The intent of this SC requirement:

There shall be no damage to surrounding structure or any adjacent systems, equipment, or electrical wiring from the fluids or gases emitted from the battery. The DAL must meet the requirement of §§ 27.1309(b) and (c), and any other applicable airworthiness regulations.

For Part 29:

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 aircraft in such a way as to cause a major or more severe failure condition, in accordance with § 29.1309(b) and all other applicable regulatory guidance.

The intent of this SC requirement:

There shall be no damage to surrounding structure or any adjacent systems, equipment, or electrical wiring from the fluids or gases emitted from the battery. The DAL must meet the requirement of § 29.1309(b) and any other applicable airworthiness regulations.

Special Condition Requirement #6: 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.

The intent of this SC requirement:

The rechargeable lithium battery system shall be designed to minimize the impact of self-sustained, uncontrolled increases in temperature or pressure, as a result of cell failures (e.g., internal cell short circuit) or a short circuit of the battery. It shall prevent any hazardous effect on adjacent or nearby structures or essential systems during this failure.

Special Condition Requirement #7: 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 either—

- (i) 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, or
- (ii) 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.

The intent of this SC requirement:

The lithium battery system shall have protective features to prevent unsafe conditions during operation.

The monitoring and protective system shall control the charging rate of the battery automatically in order to prevent any overcharging or overheating. The charging function should automatically disconnect when this particular fault occurs.

Special Condition Requirement #8: All 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.

The intent of this SC requirement:

Any aircraft that uses a rechargeable lithium battery or battery system whose function is necessary for safe operation shall require the incorporation of a monitoring and warning feature that will provide an accurate 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.

Special Condition Requirement #9: The instructions for continued airworthiness (ICA) required by §§ 23/25/27/29.1529 must contain maintenance requirements to assure that the battery is sufficiently charged at appropriate intervals specified by the battery manufacturer and the equipment manufacturer that contain the rechargeable lithium battery or rechargeable lithium battery system. This is required to ensure that lithium rechargeable batteries and lithium rechargeable battery systems will not degrade below specified ampere-hour levels sufficient to power the aircraft system, for intended applications. The ICA must also contain procedures for the maintenance of batteries in spares storage to prevent the replacement of batteries with batteries that have experienced degraded charge retention ability or other damage due to prolonged storage at a low state of charge.

Replacement batteries must be of the same manufacturer and part number as approved by the FAA. Precautions should be included in the ICA maintenance instructions to prevent mishandling of the rechargeable lithium battery and rechargeable lithium battery systems, which

could result in short-circuit or other unintentional impact damage caused by dropping or other destructive means that could result in personal injury or property damage.

The intent of this SC requirement:

The ICA shall contain maintenance requirements to assure proper maintenance and operation of the rechargeable lithium batteries and battery system. All the above-mentioned requirements must be addressed including any mandatory requirement listed in the Airworthiness Limitation Section of the ICA, if applicable. Order 8110.54 provides guidance for the compliance.