



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No.FAA-2014-0365; Notice No. 25-554-SC]

Special Conditions: Embraer S.A., Model EMB-550 Airplane; Installation of Rechargeable Lithium Batteries

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Embraer S.A. Model EMB-550 airplanes. This airplane will have a novel or unusual design feature associated with the installation of a satellite communication system that uses rechargeable lithium battery technology. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: The effective date of these special conditions is **[insert date of publication in the Federal Register]**. We must receive your comments by **[insert date 30 days after date of publication in the Federal Register]**.

ADDRESSES: Send comments identified by docket number FAA-2014-0365 using any of the following methods:

- Federal eRegulations Portal: Go to <http://www.regulations.gov/> and follow the online instructions for sending your comments electronically.

- Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, D.C., 20590-0001.
- Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.
- Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the *Federal Register* published on April 11, 2000 (65 FR 19477-19478), as well as at <http://DocketsInfo.dot.gov/>.

Docket: Background documents or comments received may be read at <http://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.

FOR FURTHER INFORMATION CONTACT: Stephen Slotte, FAA, Airplane and Flight Crew Interface Branch, ANM-111, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington, 98057-3356; telephone 425-227-2315; facsimile 425-227-1149.

SUPPLEMENTARY INFORMATION:

The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions is impracticable because these procedures would significantly delay issuance of the design approval and thus delivery of the affected aircraft. In addition, the substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon publication in the *Federal Register*.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive on or before the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On May 14, 2009, Embraer S.A. applied for a type certificate for its new Model EMB-550 airplane. The Model EMB-550 airplane is the first of a new family of jet airplanes designed for corporate flight, fractional, charter, and private owner operations. The airplane has a configuration with low wing and T-tail empennage. The primary structure is metal with composite empennage and control surfaces. The Model EMB-550 airplane is designed for eight (8) passengers, with a maximum of twelve (12) passengers. It is equipped with two Honeywell AS907-3-1E medium bypass ratio turbofan engines mounted on aft fuselage pylons. Each engine produces approximately 6,540 pounds of thrust for normal takeoff.

The Model EMB-550 will have a novel or unusual design feature associated with a satellite communication system that uses rechargeable lithium battery technology. Rechargeable lithium batteries are a novel or unusual design feature in transport category airplanes. This type of battery has certain failure, operational, and maintenance characteristics that differ significantly from those of the nickel-cadmium and lead-acid rechargeable batteries currently approved for installation on transport category airplanes. Because of rapid improvements in airplane technology, the applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature.

Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) 21.17, Embraer S.A. must show that the Model EMB-550 meets the applicable provisions of part 25 as amended through Amendments 25-1 through 25-127 thereto.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Model EMB-550 airplane because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same or similar novel or unusual design feature, the special conditions would also apply to the other model.

In addition to the applicable airworthiness regulations and special conditions, the Model EMB-550 airplane must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36, and the FAA must issue a

finding of regulatory adequacy under § 611 of Public Law 92 574, the “Noise Control Act of 1972.”

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.17(a)(2).

Novel or Unusual Design Features

The Model EMB-550 airplane will incorporate the following novel or unusual design feature: A satellite communication system that uses rechargeable lithium battery technology. Rechargeable lithium batteries are a novel or unusual design feature in transport category airplanes for which the applicable airworthiness regulations do not contain adequate or appropriate safety standards. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Discussion

These special conditions provide additional safety standards to accommodate the unique features of rechargeable lithium battery technology. This type of battery has certain failure, operational, and maintenance characteristics that differ significantly from those of the nickel-cadmium and lead-acid rechargeable batteries currently approved for installation on transport category airplanes.

The current regulations governing installation of batteries in transport category airplanes were derived from Civil Air Regulations (CAR) part 4b.625(d) as part of the re-codification of CAR 4b that established 14 CFR part 25 in February 1965. The new battery requirements, 14 CFR 25.1353(c)(1) through (c)(4), basically reworded the CAR requirements.

Increased use of nickel-cadmium batteries in small airplanes resulted in increased incidents of battery fires and failures that led to additional rulemaking affecting transport category airplanes as well as small airplanes. On September 1, 1977, and March 1, 1978, respectively, the FAA issued § 25.1353(c)(5) and (c)(6), governing nickel-cadmium battery installations on transport category airplanes. At Amendment 25-123, effective December 10, 2007, the FAA issued a revised § 25.1353, which moved the battery requirements to § 25.1353(b)(1) through (b)(6).

The proposed use of rechargeable lithium batteries for equipment and systems on the Model EMB-550 has prompted the FAA to review the adequacy of these existing regulations. Our review indicates that the existing regulations do not adequately address several failure, operational, and maintenance characteristics of rechargeable lithium batteries that could affect the safety of the airplane and its passengers and crew.

At present, there is limited experience with use of rechargeable lithium batteries in applications involving commercial aviation. However, other users of this technology, ranging from wireless telephone manufacturers to the electric vehicle industry, have noted safety problems with rechargeable lithium batteries. These problems include overcharging, over-discharging, and flammability of cell components.

1. Overcharging

In general, lithium batteries are significantly more susceptible to internal failures that can result in self-sustaining increases in temperature and pressure (i.e., thermal runaway) than their nickel-cadmium or lead-acid counterparts. This is especially true for overcharging, which causes heating and destabilization of the components of the cell, leading to the formation (by plating) of highly unstable metallic lithium. The metallic lithium can ignite, resulting in a self-sustaining

fire or explosion. Finally, the severity of thermal runaway due to overcharging increases with increasing battery capacity due to the higher amount of electrolyte in large batteries.

2. Over-discharging

Discharge of some types of lithium batteries beyond a certain voltage (typically 2.4 volts) can cause corrosion of the electrodes of the cell, resulting in loss of battery capacity that cannot be reversed by recharging. This loss of capacity may not be detected by the simple voltage measurements commonly available to flight crews as a means of checking battery status – a problem shared with nickel-cadmium batteries.

3. Flammability of Cell Components

Unlike nickel-cadmium and lead-acid batteries, some types of lithium batteries use liquid electrolytes that are flammable. The electrolyte can serve as a source of fuel for an external fire if there is a breach of the battery container.

These problems experienced by users of lithium batteries raise concern about the use of these batteries in commercial aviation. The intent of these special condition is to establish appropriate airworthiness standards for rechargeable lithium battery installations in the Embraer Model EMB-550, and to ensure, as required by §§ 25.1309 and 25.601, that these battery installations are not hazardous or unreliable.

Applicability

As discussed above, these special conditions are applicable to the Embraer S.A. Model EMB-550 airplane. Should Embraer S.A. apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on one airplane model. It is not a rule of general applicability.

The substance of these special conditions has been subjected to the notice and comment period in several prior instances and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, because a delay would significantly affect the certification of the airplane, which is imminent, the FAA has determined that prior public notice and comment are unnecessary and impracticable, and good cause exists for adopting these special conditions upon publication in the *Federal Register*. The FAA is requesting comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for the Embraer S.A. Model EMB-550 airplane.

Installation of Rechargeable Lithium Batteries

In lieu of the requirements of § 25.1353(b)(1) through (b)(4) at Amendment 25-123, all rechargeable lithium batteries and battery system installations on the Model EMB-550 must be designed and installed as follows:

(1) Safe cell temperatures and pressures must be maintained during any 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 preclude explosion in the event of those failures.

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

(3) No explosive or toxic gases emitted by any rechargeable lithium battery in normal operation, or as the result of any failure of the battery charging system, monitoring system, or battery installation that is not shown to be extremely remote, may accumulate in hazardous quantities within the airplane.

(4) Installations of rechargeable lithium batteries must meet the requirements of 14 CFR 25.863(a) through (d).

(5) 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, in accordance with § 25.1309(b) and applicable regulatory guidance.

(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.

(7) Rechargeable lithium battery installations must have a system to control the charging rate of the battery automatically, so as to prevent battery overheating or overcharging, and,

(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.

(8) Any rechargeable lithium battery installation, the function of which is required for safe operation of the airplane, 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 airplane.

(9) The Instructions for Continued Airworthiness required by § 25.1529 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 Instructions for Continued Airworthiness 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 Instructions for Continued Airworthiness maintenance instructions to prevent mishandling of the rechargeable

lithium battery and rechargeable lithium battery systems that 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.

Note 1: The electrical wiring interconnection systems (EWIS) maintenance and inspection tasks required by § 25.1729 must ensure that EWIS components associated with the batteries and battery systems are sufficient to detect degradation of any EWIS component that is designed and installed to support compliance with special conditions 1 through 8.

Note 2: The term “sufficiently charged” means that the battery will retain enough of a charge, expressed in ampere-hours, to ensure that the battery cells will not be damaged. A battery cell may be damaged by lowering the charge below a point where there is a reduction in the ability to charge and retain a full charge. This reduction would be greater than the reduction that may result from normal operational degradation.

Note 3: These special conditions are not intended to replace § 25.1353(b) at Amendment 25-123 in the certification basis of the Embraer Model EMB-550. These special conditions apply only to rechargeable lithium batteries and rechargeable lithium battery systems and their installations. The requirements of § 25.1353(b) at Amendment 25-123 remain in effect for batteries and battery installations on the Embraer Model EMB-550 that do not use rechargeable lithium batteries.

Issued in Renton, Washington, on June 2, 2014.

Michael Kaszycki,
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Aircraft Certification Service.

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