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## DEPARTMENT OF TRANSPORTATION

### Federal Aviation Administration

#### 14 CFR Part 25

[Docket No. NM464; Notice No. 25-445-SC]

#### Special Conditions: Boeing Model 737-600, -700, -700C, -800, -900, and -900ER Series Airplanes; Rechargeable Lithium-Ion Battery Installations

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final special conditions; request for comments.

**SUMMARY:** These special conditions are issued for the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes. These airplanes, as modified by Electronic Cable Specialists, Inc., will have a novel or unusual design feature associated with the installation of a dual Class 3 electronic flight bag (EFB) system that contains rechargeable lithium-ion batteries. 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 September 9, 2011. We must receive your comments by October 31, 2011.

**ADDRESSES:** You must mail two copies of your comments to: Federal Aviation Administration, Transport Airplane Directorate, Attn: Rules Docket (ANM-113), Docket No. NM464, 1601 Lind Avenue, SW., Renton, Washington 98057-3356. You may deliver two copies to the Transport Airplane Directorate at the above address. You must mark your comments: Docket No.

NM464. You can inspect comments in the Rules Docket weekdays, except Federal holidays, between 7:30 a.m. and 4 p.m.

**FOR FURTHER INFORMATION CONTACT:** Nazih Khaouly, ANM-111, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue, SW., Renton, Washington 98057-3356; telephone (425) 227-2432; facsimile (425) 227-1232.

**SUPPLEMENTARY INFORMATION:** The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions are 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 issuance.

#### 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 ask that you send us two copies of written comments.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning these special conditions. You can inspect the docket before and after the comment closing date. If you wish to review the docket in person, go to the address in the **ADDRESSES** section of this preamble between 7:30 a.m. and 4 p.m., Monday through Friday, except Federal holidays.

We will consider all comments we receive on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay. We may change these special conditions based on the comments we receive.

If you want us to acknowledge receipt of your comments on this proposal, include with your comments a self-addressed, stamped postcard on which you have written the docket number.

We will stamp the date on the postcard and mail it back to you.

#### Background

On September 30, 2009, Electronic Cable Specialists, Inc., applied for a supplemental type certificate for a dual Class 3 EFB system on the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes. The EFB system will contain lithium batteries in the EFB electronic display unit (EDU).

#### Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) 21.101, Electronic Cable Specialists, Inc., must show that the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes, as changed, continue to meet the applicable provisions of the regulations incorporated by reference in A16WE or the applicable regulations in effect on the date of application for the change.

The regulations incorporated by reference in the type certificate are commonly referred to as the "original type-certification basis." The certification basis for the Boeing Model 737 airplanes affected by this modification is as follows:

For 737-600, -700, and -800 series airplanes: 14 CFR part 25 as amended by Amendments 25-1 through 25-77, with the exemptions and special conditions listed on type certificate A16WE.

For 737-700C and -900 series airplanes: 14 CFR part 25 as amended by Amendments 25-1 through 25-91, with the exemptions and special conditions listed on type certificate A16WE.

For 737-900ER series airplanes: 14 CFR part 25 as amended by Amendments 25-1 through 25-108, with the exemptions and special conditions listed on type certificate A16WE.

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 Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes modified by Electronic Cable Specialists, Inc., because of a novel or unusual design feature, special conditions are prescribed under the provisions of 14 CFR 21.16.

In addition to the applicable airworthiness regulations and special

conditions, the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes 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.

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 14 CFR 21.101.

Special conditions are initially applicable to the model for which they are issued. Should Electronic Cable Specialists, Inc., apply for a supplemental type certificate to modify any other model included on type certificate A16WE to incorporate the same or similar novel or unusual design feature, the special conditions would also apply to the other model under § 21.101.

### Novel or Unusual Design Features

Electronic Cable Specialists, Inc., proposes to use rechargeable lithium-ion batteries in a dual Class 3 EFB system on Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes. This type of battery possesses certain failure and operational characteristics, and maintenance requirements differ significantly from that of the nickel-cadmium (Ni-Cd) and lead-acid rechargeable batteries currently approved for installation in large, transport-category airplanes. Small, low-capacity, rechargeable lithium batteries are a novel or unusual design feature in transport-category airplanes, and current regulations in 14 CFR part 25 do not address installation of rechargeable lithium batteries.

### Discussion

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

Increased use of Ni-Cd batteries in small airplanes resulted in increased frequency of battery fires and failures, which led to additional rulemaking affecting large, transport-category airplanes as well as small airplanes. On September 1, 1977, and March 1, 1978, the FAA issued § 25.1353(c)(5) and (c)(6), respectively, which govern Ni-Cd battery installations on large, transport-category airplanes.

The proposed use of rechargeable lithium batteries for equipment on the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes 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 lithium batteries that could affect the safety and reliability of rechargeable lithium-battery installations on the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes.

The use of lithium rechargeable batteries in applications involving commercial aviation has limited history. However, other users of this technology, ranging from wireless-telephone manufacturers to the electric-vehicle industry, have noted safety problems with lithium batteries. These problems include overcharging, over-discharging, and lithium-battery cell-component flammability.

#### 1. Overcharging

In general, lithium-ion batteries are significantly more susceptible than their Ni-Cd or lead-acid counterparts to internal failures that can result in self-sustaining increases in temperature and pressure (*i.e.*, thermal runaway). This is especially true for overcharging, which causes heating and destabilization of the components of the lithium-battery cell, which can lead to the formation, by plating, of highly unstable metallic lithium. The metallic lithium can ignite, resulting in a self-sustaining fire or explosion. The severity of thermal runaway due to overcharging increases with increased battery capacity due to the higher amount of electrolyte in large batteries.

#### 2. Over-Discharging

Discharge of some versions of the lithium-battery cell, beyond a certain voltage (typically 2.4 volts), can cause corrosion of the electrodes in 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 crewmembers as a means of checking battery status, a problem shared with Ni-Cd batteries.

#### 3. Flammability of Cell Components

Unlike Ni-Cd and lead-acid cells, some types of lithium-battery cells use flammable liquid electrolytes. The electrolyte can serve as a source of fuel for an external fire if the cell container is breached.

The problems that lithium-battery users experience raise concerns about the use of these batteries in commercial aviation. The intent of these special conditions is to establish appropriate airworthiness standards for lithium-battery installations in the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes and to ensure, as required by §§ 25.601 and 25.1309, that these battery installations will not result in an unsafe condition.

To address these concerns, these special conditions adopt the following requirements:

- Those sections of § 25.1353 that are applicable to lithium batteries.
- The flammable-fluid fire-protection requirements of § 25.863. In the past, this rule was not applied to batteries in transport-category airplanes because the electrolytes in lead-acid and Ni-Cd batteries are not considered flammable.
- New requirements to address hazards of overcharging and over-discharging that are unique to rechargeable lithium-ion batteries.
- Section 25.1529, Instructions for Continued Airworthiness, must include maintenance requirements to ensure that batteries used as spares are maintained in an appropriate state of charge, and installed lithium batteries are sufficiently charged at appropriate intervals. These instructions must also describe proper repairs, if allowed, and battery part-number configuration control.

In issuing these special conditions, the FAA requires that:

(1) All characteristics of the lithium batteries and their installation that could affect safe operation of the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes are addressed, and

(2) Appropriate instructions for continued airworthiness, which include maintenance requirements, are established to ensure the availability of electrical power from the batteries when needed.

### Applicability

As discussed above, these special conditions are applicable to the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes. Should Electronic Cable Specialists, Inc., apply at a later date for a supplemental type certificate to modify any other model included on type certificate A16WE to incorporate 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 Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes. It is not a rule of general applicability and it affects only the applicant who applied to the FAA for approval of these features on the airplane.

## 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, the Federal Aviation Administration (FAA) issues the following special conditions as part of the type certification basis for Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes, as modified by Electronic Cable Specialists, Inc., to install an EFB system including rechargeable lithium batteries.

In lieu of the requirements of § 25.1353(c)(1) through (c)(4) at Amendment 25-42, Lithium-ion batteries and battery installations on Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes must be designed and installed as follows:

(1) Safe lithium-ion battery-cell temperatures and pressures must be maintained during any charging or discharging condition, and during any failure of the battery-charging or battery-monitoring system not shown to be extremely remote. The lithium-battery installation must preclude explosion in the event of those failures.

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

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

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

(5) No corrosive fluids or gases that may escape from any 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, as determined in accordance with § 25.1309(b).

(6) Each 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) Lithium-battery installations must have a system to control automatically the charging rate of the battery to prevent battery overheating or overcharging, and

(i) A battery-temperature-sensing and over-temperature-warning system with a means to automatically disconnect 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 to automatically disconnect the battery from its charging source in the event of battery failure.

(8) Any 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 (and 14 CFR 26.11) must contain maintenance steps to assure that the lithium batteries are sufficiently charged at appropriate intervals specified by the battery manufacturer. The instructions for continued airworthiness must also contain procedures to ensure the integrity of lithium batteries in spares storage to prevent the replacement of batteries, the function of which are required for safe operation of the airplane, with batteries that have experienced degraded charge-retention ability or other damage due to prolonged storage at a low state-of-charge. Precautions should be included in the continued-airworthiness maintenance instructions to prevent mishandling of lithium batteries, which could result in a short circuit or other unintentional damage that could result in personal injury or property damage.

**Note 1:** The term "sufficiently charged" means that the battery retains enough of a charge, expressed in ampere-hours, to ensure that the battery cells are not damaged. A battery cell may be damaged by reducing the battery's charge below a point where the battery's ability to charge and retain a full charge is reduced. This reduced charging and charge-retention capability would be greater than the reduction that may result from normal operational degradation.

**Note 2:** These special conditions are not intended to replace § 25.1353(b) at Amendments 25-77 (-600, -700, -800), 25-91 (-700C, -900), and 25-108 (-900ER) in the certification basis of the Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes. These special conditions apply only to rechargeable lithium batteries and their use in the dual Class 3 EFB systems and their installation. The requirements of § 25.1353(b) at Amendment 25-77 (-600, -700, -800), 25-91 (-700C, -900), and 25-108 (-900ER) remain in effect for EFB batteries and battery installations on Boeing Model 737-600, -700, -700C, -800, -900, and -900ER series airplanes that do not use rechargeable lithium-ion batteries.

Issued in Renton, Washington, on September 9, 2011.

**Ali Bahrami,**

*Manager, Transport Airplane Directorate, Aircraft Certification Service.*

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**BILLING CODE 4910-13-P**

## DEPARTMENT OF TRANSPORTATION

### Federal Aviation Administration

#### 14 CFR Part 25

[Docket No. NM462; Special Condition No. 25-444-SC]

#### Special Conditions: Cessna Aircraft Company Model M680 Airplane; Rechargeable Lithium-Ion Battery Installations

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final special conditions.

**SUMMARY:** These special conditions are issued for the Cessna Aircraft Company Model 680 airplane. This airplane will have a novel or unusual design feature associated with lithium-ion batteries. 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:** *Effective Date:* October 17, 2011.

**FOR FURTHER INFORMATION CONTACT:** Nazih Khaouly, FAA, Airplane & Flight Crew Interface Branch, ANM-111, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue, SW., Renton, Washington 98057-3356; telephone (425) 227-2432; facsimile (425) 227-1149.

**SUPPLEMENTARY INFORMATION:**