

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No CE309; Notice No. 23-249-SC]

Special Conditions: Garmin International G1000 and GFC700 System Installation in the Cessna Model 525 Citation Jet; Installation of Mid-Continent MD835 Lithium Ion Battery.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Garmin International, model G1000, Multifunctional Display and GFC700 Automatic Flight Control System installation with a Mid-Continent MD835 Lithium Ion Battery in the Cessna model 525 Citation Jet. This airplane as modified by Garmin International will have a novel or unusual design feature(s) associated with installation of the Mid-Continent Instruments MD835 Lithium Ion (Li-ion) battery. 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 July 14, 2010.

We must receive your comments by **[INSERT DATE 30 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Mail two copies of your comments to: Federal Aviation Administration, Regional Counsel, ACE-7, Attn: Rules Docket No CE309, 901 Locust, Room 506, Kansas City,

Missouri 64106. You may deliver two copies to the Small Airplane Directorate at the above address. Mark your comments: Docket No. CE309. You may inspect comments in the Rules Docket weekdays, except Federal holidays, between 7:30 a.m. and 4:00 p.m.

FOR FURTHER INFORMATION CONTACT: James Brady, Federal Aviation

Administration, Small Airplane Directorate, Aircraft Certification Service, 901 Locust, Kansas City, MO 64106; telephone (816) 329-4132; facsimile (816) 329-4090.

SUPPLEMENTARY INFORMATION:

The FAA has determined that notice and opportunity for prior public comment hereon are impracticable because these procedures would significantly delay issuance of the approval design 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 persons to submit written data, views, or arguments as they desire. 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 may 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 4:00 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 the FAA to acknowledge receipt of your comments on this proposal, send us a pre-addressed, stamped postcard on which the docket number appears. We will stamp the date on the postcard and mail it back to you.

Background

On September 18, 2009, Garmin International applied for a supplemental type certificate for installation of the Mid-Continent Instruments MD835 Lithium Ion battery in the G1000 & GFC700 equipped Cessna model 525 Citation Jet. The model 525 is a two-engine turboprop aircraft certified in the normal category under Title 14, part 23. The aircraft is certified for eight seats including the pilot, a maximum gross weight of 10,700 pounds, and maximum altitude of 41,000 feet mean sea level (MSL).

The current regulatory requirements for part 23 airplanes do not contain adequate requirements for the application of Li-ion batteries in airborne applications. Garmin International proposes to replace an existing BF Goodrich PS-834A lead-acid emergency battery with a Mid-Continent Instruments MD835 Lithium Ion battery on Cessna model 525 Citation Jets. This type of battery possesses certain failure, operational, and maintenance characteristics that differ significantly from the nickel cadmium (Ni-Cd) and lead-acid rechargeable batteries currently approved in other normal, utility, acrobatic, and commuter category airplanes.

Type Certification Basis

Under the provisions of § 21.101, Garmin International must show that the Cessna model 525 Citation Jet, as changed, continues to meet the applicable provisions of the regulations incorporated by reference in the type certificate of the Cessna model 525 Citation Jet 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 regulations incorporated by reference in the Cessna model 525 Citation Jet are as follows:

For serial numbers 525-0001 through 525-0599

Part 23 effective February 1, 1965, as amended by Amendments 23-1 through 23-38, and 23-40;

For serial numbers: 525-0600 and subsequent:

Part 23 effective February 1, 1965, as amended by Amendments 23-1 through 23-38, and 23-40; except the following paragraphs applicable for Engines and Full Authority Digital Engine Controls (FADECs):

Sections 23.611, 23.777, 23.779, 23.781, 23.865, 23.867, 23.901, 23.903, 23.939, 23.943, 23.951, 23.955, 23.961, 23.973, 23.1011, 23.1013, 23.1019, 23.1021, 23.1041, 23.1043, 23.1045, 23.1091, 23.1093, 23.1103, 23.1111, 23.1121, 23.1123, 23.1141, 23.1143, 23.1145, 23.1163, 23.1181, 23.1182, 23.1183, 23.1189, 23.1191, 23.1193, 23.1195, 23.1203, 23.1301, 23.1305, 23.1309, 23.1337, 23.1521, 23.1549, and 23.1583 as amended through Amendment 23-1 through 23-38, and 23-40 through 23-54.

For serial numbers 525-0001 through 525-0599:

14 CFR part 36 effective December 1, 1969, as amended by Amendments 36-1 through 36-18;

For serial numbers 525-0600 and subsequent:

Part 36 December 1, 1969, as amended by Amendments 36-1 through 36-25

For serial numbers 525-0001 through 525-0599:

14 CFR part 34 effective September 10, 1990;

For serial numbers 525-0600 and subsequent:

Part 34 effective September 10, 1990, Fuel Venting and Exhaust Emission Requirements for Turbine Engine Powered Airplanes, as amended by Amendments 34-1 through 34-3.

Compliance with the Noise Control Act of 1972;

Special Conditions as follows:

23-ACE-55, additional requirements for:

Smoke evacuation, protection of electronic systems from lightning and high intensity radiated electromagnetic fields (HIRF), electronic flight instrument displays, thrust attenuating systems (thrust attenuating systems are not applicable for serial numbers 525-0600 and subsequent), engine fire extinguishing system, performance, including takeoff, takeoff speeds, accelerate-stop, takeoff path, takeoff distance and takeoff run, takeoff flight path, climb one engine inoperative, landing, balked landing, climb, minimum control speed, trim, static longitudinal stability, demonstration of static longitudinal stability, static directional and lateral stability, wings level stall, turning flight and accelerated stalls, stall warning, vibration and buffeting, high speed characteristics, airspeed indicating system, static pressure system, maximum operating speed limit, minimum flight crew, operating limitations, operating

procedures, performance information, airspeed indicator, effects of contamination on Natural Laminar Flow airfoils, definitions, and AFM approved information.

Exemption as follows:

Exemption No. 5759 granted to use a relaxed “Dutch Roll” damping criteria above 18,000 feet in lieu of damping criteria of § 23.181(b).

Equivalent level of safety as follows (Applicable to airplanes S/N 525-0360 and On equipped with Collins Proline 21 electronic displays of engine instruments):

- Number ACE-00-01: Sections 23.1305(c)(2), (c)(5), and 23.1549(a) through (d), direct reading, digital only displays for the high-pressure turbine speed (N2), and fuel flow indications.

Compliance with ice protection has been demonstrated in accordance with §§ 23.1416 and 23.1419.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 23) do not contain adequate or appropriate safety standards for the Cessna model 525 Citation Jet because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16. The FAA issues special conditions, as defined in § 11.19, under § 11.38 and they become part of the type certification basis under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the model 525 must comply with the part 23 fuel vent and exhaust emission requirements of part 34 and the part 23 noise certification requirements of part 36.

Special conditions are initially applicable to the model for which they are issued. Should the applicant apply for a supplemental type certificate to modify any other model to incorporate

the same type certificate to incorporate the same novel or unusual design feature, the special conditions would also apply to the other model.

Novel or Unusual Design Features

The Cessna model 525 Citation jet will incorporate the following novel or unusual design features:

Garmin International proposes to replace an existing BF Goodrich PS-834A lead-acid emergency battery with a Mid-Continent Instruments MD835 lithium ion battery on Cessna model 525 Citation Jet. This type of battery possesses certain failure, operational characteristics, and maintenance requirements that differ significantly from the Ni-Cd and lead-acid rechargeable batteries currently approved in other normal, utility, acrobatic, and commuter category airplanes.

Discussion

The applicable part 21 and part 23 airworthiness regulations governing the installation of batteries in general aviation airplanes, including § 23.1353, were derived from Civil Air Regulations (CAR 3) as part of the recodification that established 14 CFR part 23. The battery requirements, which were identified as § 23.1353, were basically a rewording of the CAR requirements and did not add any substantive technical requirements. An increase in incidents involving battery fires and failures that accompanied the increased use of Ni-Cd batteries in airplanes resulted in rulemaking activities on the battery requirements for business jet and commuter category airplanes. These regulations were incorporated into § 23.1353(f) and (g), which apply only to Ni-Cd battery installations.

The proposed use of Li-ion batteries on the Cessna model 525 Citation Jet has prompted the FAA to review the adequacy of the existing battery regulations with respect to that chemistry.

As the result of this review, the FAA determines the existing regulations do not adequately address several failure, operational, and maintenance characteristics of Li-ion batteries that could affect safety of the battery installation and the reliability of the Cessna model 525 Citation Jet electrical power supply.

Li-ion batteries in general are significantly more susceptible to internal failures that can result in self-sustaining increases in temperature and pressure (i.e., thermal runaway) than their Ni-Cd and lead-acid counterparts. This is especially true for overcharging a Li-ion battery, which will likely result in explosion, fire, or both. Certain types of Li-ion batteries pose a potential safety problem because of the instability and flammability of the organic electrolyte employed by the cells of those batteries. The severity of thermal runaway in large batteries increases due to the higher amount of electrolyte.

If the discharge of the cells is below a typical voltage of 3.0 volts on some versions of Li-ion batteries, they will no longer accept a charge. 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 Ni-Cd batteries.

Unlike Ni-Cd and lead-acid cells, some types of Li-ion cells employ electrolytes that are known to be flammable. This material can serve as a source of fuel for an external fire in the event of a cell container breach.

The intent of these special conditions is to establish appropriate airworthiness standards for Li-ion battery installations in the Cessna model 525 Citation Jet. Special conditions also ensure that these battery installations do not possess hazardous or unreliable design characteristics. These special conditions adopt the following requirements as a means of

addressing these concerns:

(1) Inclusion of those sections of § 23.1353 that are applicable to batteries of any type.

(2) Inclusion of the flammable fluid fire protection requirements of § 23.863. In the past, this rule was not applied to the batteries of business jet or commuter category airplanes since the electrolytes utilized in lead-acid and Ni-Cd batteries are not considered to be flammable.

(3) Addition of new requirements to address the potential hazards of overcharging and over discharging that are unique to Li-ion battery designs.

(4) Addition of maintenance requirements to ensure that batteries used as spares are maintained in an appropriate state of charge (SOC).

Applicability

As discussed above, these special conditions are applicable to the Cessna model 525 Citation Jet. Should Garmin International apply at a later date for a supplemental type certificate to modify any other model 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 the Cessna model 525 Citation Jet. 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.

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 issuance. 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 23

Aircraft, Aviation safety, Signs and Symbols

Citation

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, and 44701; 14 CFR 21.16 and 21.101; and 14 CFR 11.38 and 11.19.

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 Cessna model 525 Citation Jet airplanes modified by Garmin International.

1. Cessna Model 525 G1000 and GFC700 Lithium Battery Installation. The Federal Aviation Administration issues the following Special Conditions (SC), which apply to all Cessna model 525 Citation Jets equipped with Mid-Continent-835 Lithium Ion batteries, in lieu of the requirements of § 23.1353 (a)(b)(c)(d)(e), Amendment 23-49.

Lithium-ion batteries and battery installations on Cessna model 525 Citation Jet equipped with existing PS-834A batteries must be designed and installed as follows:

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

(2) Li-ion batteries must be designed to preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.

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

(4) Li-ion batteries that contain flammable fluids must comply with the flammable fluid fire protection requirements of § 23.863(a) through (d).

(5) No corrosive fluids or gases that may escape from any Li-ion battery may damage airplane structure or essential equipment.

(6) Each Li-ion battery installation 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.

(7) Li-ion battery installations must have —

(i) a system to control the charging rate of the battery automatically so as to prevent battery overheating or overcharging, or

(ii) 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

(iii) 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 Li-ion battery installation whose function 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 capacity and state of charge (SOC) of the batteries have fallen below levels considered acceptable for dispatch of the airplane.

(9) The Instructions for Continued Airworthiness (ICA) must contain required manufacturer's maintenance and inspection requirements to ensure batteries, including single cells, meet a safety function level essential to the aircraft's continued airworthiness.

(i) The ICA must contain operating instructions and equipment limitations in an installation maintenance manual.

(ii) The ICA must contain installation procedures and limitations in a maintenance manual sufficient to ensure cells or batteries, when installed according to the installation procedures, still meet safety functional levels essential to the aircraft's continued airworthiness. The limitations must identify any unique aspects of the installation.

(iii) The ICA must contain corrective maintenance procedures to functionally check battery capacity at the manufacturer's required inspection intervals.

(iv) The ICA must contain scheduled servicing information to replace batteries at the manufacturer's required replacement time.

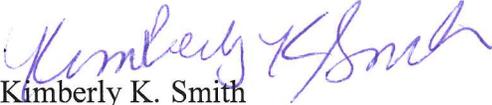
(v) The ICA must contain maintenance and inspection requirements to visually check for a battery and/or charger degradation.

(10) Batteries in a rotating stock (spares) that have experienced degraded charge retention capability or other damage due to prolonged storage must be functionally checked at manufacturers recommended inspection intervals.

(11) If the Lithium Ion battery application contains software and/or complex hardware in accordance with Advisory Circular (AC) 20-115B and AC 20-152, they should be developed to the standards of DO-178B for software and DO-254 for complex hardware.

These special conditions are not intended to replace § 23.1353 in the certification basis of the Cessna model 525 Citation Jet. These special conditions apply only to Li-ion batteries and battery installations. The battery requirements of § 23.1353 remain in effect for batteries and battery installations on Cessna model 525 Citation Jets that do not use Lithium Ion batteries.

Issued in Kansas City, Missouri on July 14, 2010.


Kimberly K. Smith
Manager, Small Airplane Directorate
Aircraft Certification Service