U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: **ACTION**: Cessna Model 182S Equivalent Level of Safety; Engine Induction Icing; Engine Control and Engine Mixture Control; ACE-96-4

Date: November 17, 1997

From: Carlos Blacklock, Program Manager, ACE-117W, Wichita Aircraft Certification Office

Reply to Attn. of:

To: Manager, Project Support Section, ACE-112, Small Airplane Directorate

BACKGROUND

The FAA determined for the Model 182S that compliance with certain later amendments was appropriate. These were considered in order to maintain the same level of operational safety on the redesigned engine system of the Model 182S as compared to the earlier Model 182 series airplanes. Cessna indicated by correspondence of their agreement to voluntarily comply with the later Part 23 amendments as follows:

(1) Engine induction icing protection, § 23.1093(a)(5), as amended by Amendment 23-43, and;
(2) Engine controls, § 23.1143(g), as amended by Amendment 23-43, and;
(3) Engine mixture controls, § 23.1147(b), as amended by Amendment 23-43.

DISCUSSION OF APPLICABLE REGULATIONS

(1) Compliance with § 23.1093. § 23.1093(a) allows the option to show "by other means" that the induction system will prevent or eliminate icing. Cessna has chosen a type of fuel injection system that has shown adverse service experience on other airplane installations. Cessna agreed to voluntarily comply with all of the requirements of § 23.1093, as amended by Amendment 23-43. Analysis alone, was not deemed sufficient to document compliance. As such, Cessna agreed to show by tests, both on the ground and in flight, that the induction system will continue to allow operation of the engine when exposed to icing conditions.

(2) and (3) These requirements specify that the throttle and mixture attachments must be designed so that if the control(s) separate at the engine, the airplane is capable of continued safe flight and landing. Literal compliance with these requirements would normally involve the addition of spring devices on the engine.

CESSNA POSITION

(1) Refer to Cessna letter L417-02-96-82, dated September 25, 1996. Cessna requested FAA concurrence to the closing of the FAA Specific Finding item related to evaluation of engine induction system icing protection for the Model 182S. An equivalent level of safety finding was requested because the induction system does not literally comply with FAR § 23.1093, as amended by Amendment 23-43. Cessna proposed to conduct flight test demonstrations to show that the engine will continue to function with ice blocking the induction system.

(2) & (3) Refer to Cessna letter L417-02-96-55, dated August 14, 1996. This letter provided information about the design of the throttle and mixture control attachments, and requested that equivalent levels of safety be granted for the Cessna Model 182S with regard to the above referenced regulations. Cessna proposed a design with a higher level of reliability, and proposes to establish mandatory inspection intervals, inspection procedures and replacement criteria for the attachments. This design criteria is the same as used for the Model 172R.

FAA's concurrence and/or input is requested.

FAA POSITION

(1) Regarding compliance with FAR § 23.1093, as amended by Amendment 23-43. Cessna requested FAA concurrence to the closing of the FAA Specific Finding item related to evaluation of engine induction system icing protection for the Model 182S. An equivalent level of safety finding was requested because the induction system does not literally comply with FAR § 23.1093, as amended by Amendment 23-43.

FAA letter dated October 3, 1996, provided concurrence to Cessna's proposed means of compliance subject to satisfactory flight test demonstration.

On September 25, 1996, a representative from the FAA Wichita Aircraft Certification Office Flight Test Branch participated in flight tests of a Model 182S. Compliance was demonstrated in a manner similar to that demonstrated for the Model 172R, and involved the following test conditions:

a. The test article was conformed.
b. All impact tubes and static reference to port were blocked, pressure side injector chamber was referenced to cockpit with cockpit shutoff available, and inlet filter was taped over 50% of area to simulate icing conditions.
c. The engine was operated on the ground with injector components blocked.
d. At 4,000 feet in cruise flight, the injector components were blocked and the condition was maintained for 30 minutes.
e. A climb from 4,000 feet to 10,000 feet was performed with injector components continuing to be blocked.

FAA POSITION, CONTINUED

f. A descent from 10,000 feet to 2,500 feet was performed with injector components continuing to be blocked.
g. A landing was demonstrated with injector components continuing to be blocked.

Results showed that the engine could continue to function under various flight conditions without benefit of heat, as required by the referenced regulation. Engine operations under these conditions required no special pilot procedures or techniques and, therefore, the FAA Approved Airplane Flight Manual procedures were not affected by these conditions.

The above elements have been found to provide a level of safety equivalent to that envisioned by the referenced regulation. Therefore, Cessna is eligible for an equivalent level of safety with regard to § 23.1093, as amended by Amendment 23-43.

(2) & (3) Regarding compliance with §§ 23.1143(g) and 23.1147(b), as amended by Amendment 23-43. The FAA has reviewed the Cessna Model 182S design and compared it to the Model 172R which was previously granted an equivalent level of safety without the addition of springs. Cessna is eligible to be granted an equivalent level of safety finding, in lieu of literal compliance to §§ 23.1143(g) and 23.1147(b), as amended by Amendment 23-43. Compensating elements for consideration remain the same as for the Model 172R and must include: engine control attachment design features which are not likely to separate in flight; establishment of mandatory inspection intervals; inspection procedures; and replacement criteria.

RECOMMENDATION

(1) Induction Icing. Cessna was found to provide a level of safety equivalent to that envisioned by the referenced regulation. Therefore, Cessna has met the conditions for the grant of an equivalent level of safety with regard to § 23.1093, as amended by Amendment 23-43.

(2) & (3) Engine and Mixture Controls. The Cessna design was found to include all the conditional FAA elements. Therefore, Cessna has met the conditions for the grant of an equivalent level of safety with regard to §§ 23.1143(g) and 23.1147(b), as amended by Amendment 23-43.

CONCURRENCE

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