



Federal Aviation Administration

Memorandum

Date: February 3, 2006

From: Manager, Atlanta ACO, ACE-115A

To: Manager, Small Airplane Directorate, ACE-100

Prepared by: Donald O. Young, Propulsion and Services Branch, ACE-118A

Subject: ACTION: Request for Review and Concurrence with an Equivalent Level of Safety (ELOS) to 14 CFR 23.1061, Liquid Cooling-Installation, for Piper PA-28-161 Cadet, Warrior II and Warrior III airplanes with Thielert Aircraft Engines, GmbH (TAE) Model TAE-125-01 Aircraft Diesel Engine (ADE). ACE-05-22

This memorandum documents concurrence for the subject finding of an ELOS. We request your office to review and concur with the proposed Equivalent Level of Safety (ELOS) finding to 14 CFR § 23.1061, Liquid Cooling-Installation. The proposed ELOS will allow the use of a coolant tank that has a capacity less than that required by § 23.1061(b).

Background: The airplanes that the STC will apply to are the Piper PA-28-161 Cadet, Warrior II, and Warrior III. These are conventional airplanes powered by gasoline engines that are air-cooled. The Thielert Model TAE-125-01 ADE uses a liquid cooling system with a capacity smaller than one gallon, plus 10 percent of cooling system capacity required by 14 CFR § 23.1061(b).

The applicant has requested, by submission of type design data and materials through the Luftfahrt-Bundesamt (LBA) of Germany, an ELOS for the provisions of 14 CFR § 23.1061(b), Liquid Cooling-Installation, at Amendment 51. This request for ELOS finding is the same request and finding applied to Cessna 172K, L, M, N, P, R and S airplanes with the same engine installation.

The FAA notes that the § 23.1061(b) coolant tank capacity requirement has remained unchanged since its adoption in 1945. The FAA also notes that the coolant systems in service at that time were used on lower powered gasoline engines, and believes that the rule did not envision the use of coolant systems on higher powered engines for small airplanes. The FAA also believes that, despite the prescriptive nature of the regulation, a review of the requirement is needed since it is based on sixty-year-old technology.

Applicable Regulations:

The applicable regulation is 14 CFR § 23.1061(b), which states:

Section 23.1061 Installation.

- (b) Coolant tank. The tank capacity must be at least one gallon, plus 10 percent of the cooling system capacity. In addition--*
- (1) Each coolant tank must be able to withstand the vibration, inertia, and fluid loads to which it may be subjected in operation;*
 - (2) Each coolant tank must have an expansion space of at least 10 percent of the total cooling system capacity; and*
 - (3) It must be impossible to fill the expansion space inadvertently with the airplane in the normal ground attitude.*

Compensating Features:

Piper Models PA-28-161 Cadet, Warrior II and Warrior III airplanes with a TAE Model TAE-125-01 ADE use a closed loop liquid cooling system with an expansion tank for engine cooling. In normal operation, the system does not lose cooling fluid, with the expansion tank ensuring a proper fluid level for various temperature and pressure conditions. This type of cooling system is state-of-the-art in the automotive industry and complies with applicable airworthiness requirements, except for coolant tank volume.

To ensure an ELOS to the intent of § 23.1061(b), for a safety margin in case of coolant loss, the following provisions were adopted by the LBA for the TAE ADE/PA-28-161 German STC:

- The expansion tank capacity was shown, by analysis and tests, to be large enough to ensure safe operation of the engine in case of loss of a quantity of coolant that could be expected in service. Minimum and maximum fluid levels were also established.
- It was demonstrated that the reduced thermal buffer capacity of the TAE-125-01 coolant tank did not adversely affect safe operation or emergency capability for either increasing or decreasing temperatures. The cooling capacity of the system was shown to compensate for the reduced thermal buffer capacity.
- The expansion tank, as well as the coolant tank, was required to withstand the vibration, inertia and fluid loads to which it may be subjected in operation, as required by § 23.1063.

These same provisions will constitute the FAA equivalent level of safety.

Recommendation: We concur that the above listed provisions and compensating features for a smaller capacity coolant tank provides an ELOS to the intentions of

§ 23.1061(b) although it does not meet the minimum capacity mandated by § 23.1061(b), and recommend the issuance of this ELOS.

Concurred by:

Melvin D. Taylor
Manager, Atlanta ACO, ACE-115A

2/13/06
Date

John Colomy
Manager, Standards Office, ACE-110

4/25/06
Date

John Colomy
for Manager, Small Airplane Directorate, ACE-100

4/26/06
Date