Federal Aviation Administration

Memorandum

Date: December 16, 2015

To: Manager, Regulations and Policy, ACE-111

From: Manager, Small Airplane Directorate, ACE-100

Prepared by: Jeff Pretz, Regulations and Policy Branch, ACE-111

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Diamond Aircraft Industries, DA42, DA42NG, DA42M-NG, and DA62 Airplanes; Liquid Cooling—Installation, FAA Project Numbers CE1704SN,TD0326CE-A, and AT0755CE-A.

ELOS Memo#: ACE-05-07

Regulatory Ref: 14 CFR 23.1061, amendment 23-43

Revision Description: The FAA revises ELOS Memo# ACE-05-07 to add the Diamond Aircraft Industries (DAI) model DA62, project # AT0755CE-A.

This memorandum informs the certificate management aircraft certification office of an evaluation made by the Accountable Directorate on the establishment of an equivalent level of safety finding for the DAI models DA42, project # CE1704CE-A; DA42NG, project # TD0326CE-A; DA42M-NG, project # TD0326CE-A; and DA62.

Background:

The DA62 is a derivative of the DA42 airplane to be included on type certificate A57CE, along with prior certificated models DA42, DA42NG, and DA42M-NG. ELOS ACE-05-07 was originally extended from the model DA42 to the models DA42NG (ACE-05-07A), and then to the DA42M-NG (ACE-05-07B). This is a further extension of this ELOS to the model DA62.

The model DA62 utilizes two Austro AE300 (model E4) engines, which each incorporate the use of a closed-loop liquid cooling system with an expansion tank. The major change with respect to this amended type design, the DA62, is the addition of a larger cabin to accommodate up to seven seats. The coolant system is unchanged from the previous Austro AE300 engine installation and is fundamentally identical for the requested ELOS extension to that of the

original ELOS granted to the DA42 and those previously issued ELOS extensions granted to the DA42NG and DA42M-NG.

The remainder of this ELOS memorandum provides the background information and justification for the original approval of ELOS ACE-05-07 to the model DA42, extended to the DA42NG, DA42M-NG and requested for the DA62.

> "The Diamond Aircraft Industries (DAI) DA42 aircraft is a new fully composite, four-place, twin-engine airplane with retractable gear, cantilever low wing, and T-tail. The airplane was certified by the European Aviation Safety Agency (EASA) on type certificate (TC) number A005, dated May 13, 2004. The airplane is powered by two Thielert Aircraft Engines GmbH (Thielert) TAE 125-01 aircraft diesel engines (ADE), type certificated in the United States (U.S.), type certificate number E00069EN. The Thielert engine requires a liquid cooling system be installed; however, the system does not have the capacity mandated by § 23.1061(b). Under the Bilateral Airworthiness Agreement (BAA) between the U.S. and the Austrian Exporting Civil Aviation Authority (ECAA), the Austro Control GmbH (ACG), an application for U.S. Type Certification of Diamond Aircraft Industries (DAI) model DA42 was made on August 2, 2004, by the DAI through the EASA.
>
> The Federal Aviation Administration has researched the origins of § 23.1061(b) concerning the coolant tank volume requirements. The coolant tank volume requirements date from at least 1945 and have been unchanged since then. The types of liquid coolant systems in service at that time were systems used on lower-powered gasoline engines, neither the type of engines nor the type of system that the requirement was applicable to were envisioned when the requirement originated.
>
> Because of this, we believe that, despite the prescriptive nature of this regulation, its basis in five-decade-old technology compels the FAA to review the need for the requirement. In reviewing the Thielert coolant system, we determined that the relevant goal is maintaining the operability of the engine. While not complying with the prescriptive requirements of § 23.1061(b), the Thielert cooling system demonstrated appropriate engine cooling capability, including expected cases of coolant loss."

Applicable Regulation:

14 CFR 23.1061(b)

Regulations Requiring an ELOS Finding:

The applicable section of 14 CFR 23.1061, Installation, paragraph (b) requires the following:

"§ 23.1061(b)

(b) Coolant tank. The tank capacity must be at least one gallon, plus 10 percent of the cooling system capacity."

Description of compensating design features or alternative Methods of Complaince (MoC) which allow the granting of the ELOS (including changes, limitations, or equipment needed for equivalency)

The below description of compensating design features is from for the original approval of ELOS ACE-05-07 to the DA42, extended to the DA42NG, DA42M-NG and requested for the DA62.

"The Austro model AE300 diesel engine is very similar to the Thielert TAE-125 ADE, in that it uses a closed-loop liquid cooling system with an expansion tank for engine cooling. In normal operation, such a system does not have a loss of cooling fluid, with the expansion tank ensuring a proper fluid level with various temperature and pressure situations. This type of cooling system is state-of-the-art in automobile liquid cooling systems and has been tested for functionality. Otherwise, it complies with all provisions of the applicable airworthiness standards; and the only deviation from the regulations is the volume of the tank.

To ensure an ELOS to the general intent of § 23.1061(b) for a safety margin in case of coolant fluid loss, the following is required by Austro Control GmbH (ACG) on the original DA42 Thielert installation:

- The expansion tank capacity was shown to be large enough to ensure safe operation of the cooling system in case of cooling fluid loss that could be expected in service. This was demonstrated by analysis and tests. The minimum and maximum fluid levels were established.

- It was demonstrated that the reduced thermal buffer capacity of the TAE 125 cooling tank does not affect the safe operation and the emergency capability adversely. This was shown for both heating up and cooling down. The cooling capacity of the system was shown to be able to compensate for the reduced thermal buffer capacity.

- The expansion tank must be able to withstand the vibration, inertia and fluid loads to which it may be subjected in operation, as required in § 23.1063."

These provisions constituted the FAA ELOS finding for the DA42 with the Thielert TAE-125 ADE engine, and the DA42NG, DA42M-NG with the Austro AE300 engine, and applies to the DA62 with the Austro AE300.

Explanation of how design features or alternative Method of Compliance (MoC) provide an equivalent level of safety intended by the regulation:

Based on the functional identicality of the respective design, we concur with the requested extension of this ELOS for the Austro AE300 installations use of a coolant tank that has a capacity less than that required by § 23.1061(b) Liquid Coolant - Installation.

FAA approval and documentation of the ELOS finding:

The FAA previously approved the aforementioned ELOS finding during initial certification of the DA42, and as documented in this memorandum, grants an extension to the existing revision of ELOS ACE-05-07 to the DA62.

This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Accountable Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number must be listed in the Type Certificate Data Sheet under the Type Certificate (TC) and Amended Type Certificate (ATC) or in the Limitations and Conditions section of the Supplemental Type Certificate (STC). An example of an appropriate statement is provided below.

Equivalent Level of Safety Finding has been made for the following regulation:

14 CFR 23.1061, amendment 23-43, Liquid Coolant - Installation
(documented in ELOS Memo ACE-05-07)

//SIGNED// December 16, 2015

Mel Johnson, Acting Manager, Small Airplane Directorate, Aircraft Certification Service — Date

ELOS Originated by: Regulations and Policy Branch	Manager, Regulations and Policy Branch: William Schinstock	Symbol: ACE-111