



# Federal Aviation Administration

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## Memorandum

Date: April 25, 2016

To: Manager, Atlanta ACO, ACE-115A

From: Manager, Small Airplane Directorate, ACE-100

Prepared by: G. Keith Noles, ACE-117A

Subject: INFORMATION: Equivalent Level of Safety (ELOS)  
Finding for Piper Aircraft Inc., PA-46-600TP, Material  
Design Values, FAA Project No. AT13893AT-A

ELOS Memo #: AT13893AT-A-A-1

Regulatory Ref: 14 CFR 23.613

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This memorandum informs the certificate management aircraft certification office of an evaluation made by the Small Airplane Directorate on the establishment of an equivalent level of safety finding for the PA-46-600TP airplane.

### **Background:**

Section 23.613, amendment 23-62, requires that material strength properties be based on a sufficient number of tests to establish a statistical basis for the design values. For single load path structure, § 23.613(b)(1) further requires the design values be established with a 99% probability and 95% confidence ("A" basis) value. For multiple load path structure, § 23.613(b)(2) requires the design values be established with a 90% probability and a 95% confidence ("B" basis) value. Currently, other than a premium selection of material for parts per § 23.613(e), there is no alternate structure material for use other than "A" or "B" basis statistically determined minimum design values. Also, there is no option to utilize a procurement specification value as a design value coupled with verified receiving inspection test sampling processes.

Piper Aircraft Inc. (Piper) has historically used some materials for various components that do not have design values based on sufficient testing to establish the values with the required probability and confidence. The use of these materials in legacy designs had been justified by coupling Military Handbook 5 (MIL-HDBK-5), Metallic Materials and Elements for Aerospace Vehicle Structures or DOT/FAA/AR-MMPDS-01, Metallic Materials Properties Development and Standardization (MMPDS) Handbook. The MMPDS Handbook published "S" design values with Piper procurement specifications as

“minimums” and restricted the application to structure that was neither fatigue critical nor a principal structural element. Historically, many of these materials have been tested on a per lot basis, but § 23.613(b) acceptable statistically based design values have not been established because the data was not accumulated and retained. In previous similar designs such as engine mounts, control systems structure, and seat base structure, the materials have been in service for many years with no adverse service history based on certification testing.

**Applicable regulation(s)**

14 CFR 23.613

**Regulation(s) requiring an ELOS finding**

14 CFR 23.613, Amendment 23-62

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

Piper must—

- Procure the material from suppliers, which can meet the applicable material specification requirements;
- Have a system in place to confirm that incoming material is received from these acceptable suppliers; and
- Routinely test the incoming material to verify the design values.

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

Piper has agreed to comply with § 23.613, amendment 23-62, based on alternate methods described herein. Compliance to § 23.613 will be shown—

- In the submittal of a typical sample Piper Material Specification (PMS) procurement document(s);
- In individual test reports to be accumulated during material procurement for other than “A” or “B” basis material; and
- In a substantiation document, VB-2535, which ties the design values used to the test values witnessed for the procured material lot.

The VB-2535 document will provide substantiation for other than “A” or “B” basis materials used in new parts for the PA-46-600TP airplane. The VB-2535 document will provide evidence of material control connected to design minimums, while retaining test data for future determination of § 23.613 type minimums.

Piper concludes that the “S” allowable materials that will be used in the design of the PA-46-600TP airplane meet the latest 14 CFR requirements, given the above-described witnessed testing and substantiation document. The majority of materials on the PA-46-600TP airplane are identical in usage and application to that of previously certified materials on existing Piper airplanes. Piper requests an equivalent level of safety finding by specifying other than “A” or “B” design values and how this alternate means of compliance meets the intent of the current rule.

Piper will substantiate in document VB-2535 the static design allowable values for new structural materials and existing structural materials in new applications on the PA-46-600TP. A description of each material’s typical usage, “minimum” design value, and material specification references for that value will be included in this document. Additionally, Piper will include data from Organizational Designation Authorization (ODA) approved testing per the applicable PMS:

- PMS-M2101 Steel Alloy-4130 Sheet and Plate
- PMS-M2301 Steel Alloy-4130 Bar and Rod
- PMS-M2501 Steel Alloy 4130 Seamless Tubing

Piper will also include the following in document VB-2535:

- A general description of non “A” or “B” type materials used previously in the Piper fleet, but specifically in new applications on the PA-46-600TP airplane.
- Substantiation of design values used versus witnessed test results on a material procurement basis.
- The applicable procurement specifications references.

This document will contain data to demonstrate that materials used on the PA-46-600TP airplane comply with § 23.613 and allow for an equivalent level of safety finding. The rationale for an equivalent level of safety finding for use of non-“A” or “B” design values is as follows:

1. The design values used are equal to or less than the “S” basis values (or specification values).
2. Materials and applications listed in VB-2535 will be limited to previous structural applications on Piper airplanes. When alternate applications are proposed, the document provides further details such as additional testing requirements, analysis based safety margins, etc.
3. ODA witnessed testing and / or ODA approved test data results is required to be accumulated in this report to support the material specification used (PMS, SAE Aerospace Material Specification (AMS), MIL (Military Handbook) & QQ-A (federal specifications) and future § 23.613 type design allowable values determination.

4. Piper will procure materials to a specification, i.e., PMS, Industry standards (SAE AMS), or Government standards/specifications (MIL & QQ-A), which define the minimum properties and identify the testing needed to ensure these properties.

5. Piper will procure materials from Piper-approved suppliers, which have demonstrated the ability to produce the material by meeting all of the specification requirements of that particular material.

6. The type design specifications mandate that supplier quality system is required to ensure statistical process control and specification conformance, including meeting the design strength and other properties defined in the specification. Tensile properties will be verified by test. All other mechanical properties will be inherited from S-basis values based on successful tensile test.

Supplier procurement per applicable PMS material specifications require that all incoming materials be inspected to ensure both statistical control and conformance with specifications. Such inspections include visual, dimensional, and functional inspection as well as hardness, magnetic particle, penetrant, or other tests necessary to affirm required material composition and quality. Suppliers are required to test samples of the material before shipping and to provide statements certifying that all material meets specification requirements before shipping.

7. All material suppliers test reports must be verified against the original purchase order requirements. In addition, Piper specific in-house tensile testing is required on material samples to validate design values against supplier material certifications or test reports in accordance with SAE AMS2370. Piper approves acceptance sampling plans used in acceptance of materials and/or processes by the supplier, as outlined in section 3.4 of this specification.

### **FAA approval and documentation of the ELOS finding**

The FAA has approved the aforementioned equivalent level of safety finding in project issue paper A-1. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Small Airplane Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should be listed in the Type Certificate Data Sheet under the Certification Basis section. An example of an appropriate statement is provided on the next page.

Equivalent Level of Safety Findings have been made for the following regulations:

14 CFR 23.613

(documented in ELOS Memo AT13893AT-A-A-1)

//SIGNED//

April 26, 2014

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

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Date

ELOS Originated by: Atlanta ACO	ACO Manager: Christina Underwood	Routing Symbol: ACE-115A
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