



U.S. Department
of Transportation

**Federal Aviation
Administration**

Advisory Circular

Subject: SMALL AIRPLANE CERTIFICATION
COMPLIANCE PROGRAM

Date:
Initiated by: ACE-100

AC No: 23-15A
Change: 1

1. PURPOSE. This change revises existing material in two sentences. The change number and the date of the changed material are shown at the top of each changed page. Vertical bars in the margin indicate the changed material. Pages having no changes retain the same heading information.

2. PRINCIPAL CHANGES.

Paragraph 5n(2)(e) is revised.

PAGE CONTROL CHART

Remove Pages	Dated	Insert Pages	Dated
27-28	12/30/03	27-28	3/15/05

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5.2 Gases.

5.3 Storage of rods and electrodes.

(f) 6.0 TECHNICAL

6.1 Inspection and manufacturing requirements.

6.2 Pre-heat and post-heat requirements if needed.

6.3 Heat treatment. This paragraph should cover any heat treatment required to restore all material in a weldment to a certain temper or tensile strength.

6.4 Detail gap - joint design information.

6.5 Describe weld repairs if applicable.

6.6 Cleaning, pre- and post-welding.

(g) 7.0 MANUFACTURING AND QUALITY CONTROL

7.1 Manufacturing requirements.

7.2 Quality control requirements.

m. Flutter.

(1) Regulation Reference. Section 23.629.

(2) Discussion. For general guidance on this section see AC 23.629-1A.

(3) Regulation Reference. Section 23.629 (b).

(4) Discussion. All airplanes certified to Title 14 CFR part 23, in any category, must perform flight flutter test(s) to show compliance in addition to any analytical methods.

(5) Regulation Reference. Section 23.629(d).

(6) Discussion. Airplanes that are the subject of this AC would typically meet the requirements of § 23.629(d)(1) through (d)(3). However, the applicant should review the criteria to ensure applicability. Based on the review of criteria, Engineering Report No. 45 (Simplified Flutter Prevention Criteria) could then be used to substantiate this portion of the regulations.

(7) Regulation Reference. Section 23.629(f)(2).

- (8) Discussion. For small low performance airplanes, designing the actuating structures to a factor of safety equaling four and providing redundant fastener safety as a means to minimize loss of single fastener joint integrity would be an acceptable method of showing compliance with this request.

n. Proof of Strength (Wings).

- (1) Regulation Reference. Section 23.641.

(2) Discussion. Section 23.641 requires proof of strength of a stressed skin wing through tests or by combined structural analysis and load tests.

(a) Proof of strength of conventional aluminum or wood stressed skin wing structures primarily by analysis to limit and test to ultimate loads for the most critical bending and torsional wing load conditions is acceptable.

(b) In order to determine the most critical bending and torsional wing loads, one must complete a loads survey of the structure to determine which load case(s) produce the lowest safety margin against catastrophic failure of the wing. The actual mechanics of how to determine those specific load conditions requires qualified and experienced engineering personnel. The critical load conditions must be determined for the specific structural and airplane configuration, by detailed load and stress analysis. A specific explanation of this procedure that would be applicable for every airplane design doesn't exist.

(c) For conventional aluminum materials, the ultimate strength is typically less than one and a half times the yield strength. This means that as long as the article doesn't fail at the ultimate load, it will not yield at limit load. This rationale is for the worst-case scenario where the part fails in tension. For most structures however, failures occur due to instability first. The allowable ultimate load capability of a member in compression is lower than the tension capability. This further reduces the difference between the ultimate and yield strength. Structural analysis should still be used to demonstrate that the yield strength is not exceeded at limit loads. If non-conventional aluminum is used, where this yield-to-ultimate strength relationship doesn't exist, then testing to ensure no yielding occurs at limit loads may be in order, at the ACO's discretion.

(d) In any event, part 23.307 is still applicable. Section 23.307 states in part that "Structural analysis may be used only if the structure conforms to those for which experience has shown this method to be reliable." If in the ACO's judgment, the structure or analysis techniques used by the applicant, will not produce reliable analytical data, then testing may be in order.

(e) For wooden structures, there are no well-defined (published) yield strength values. When you observe the stress-strain curves for wood, it is evident that the relationship is not linear up to failure. The mechanism, that appears as yielding on the stress-strain curve, is actually micro cracks that develop within the matrix (lignin) between the fibers (cellulose). [3/15/05] These micro cracks have a negligible effect on the final ultimate strength [or—3/15/05] stiffness, of the material. Experience has shown that the ultimate strength test along with analysis is adequate to show compliance.