§ 23.574 Metallic damage tolerance and fatigue evaluation of commuter category airplanes.

For commuter category airplanes—

(2) The growth rate or no-growth of damage that may occur from fatigue, corrosion, manufacturing flaws or impact damage, under repeated loads expected in service, must be established by tests or analyses supported by tests.

(3) The structure must be shown by residual strength tests, or analysis supported by residual strength tests, to be able to withstand critical limit flight loads, considered as ultimate loads, with the extent of detectable damage consistent with the results of the damage tolerance evaluations. For pressurized cabins, the following loads must be withstood:

(i) Critical limit flight loads with the combined effects of normal operating pressure and expected external aerodynamic pressures.

(ii) The expected external aerodynamic pressures in 1g flight combined with a cabin differential pressure equal to 1.1 times the normal operating differential pressure without any other load.

(4) The damage growth, between initial detectability and the value selected for residual strength demonstrations, factored to obtain inspection intervals, must allow development of an inspection program suitable for application by operation and maintenance personnel.

(5) For any bonded joint, the failure of which would result in catastrophic loss of the airplane, the limit load capacity must be substantiated by one of the following methods—

(i) The maximum disbonds of each bonded joint consistent with the capability to withstand the loads in paragraph (a)(3) of this section must be determined by analysis, tests, or both. Disbonds of each bonded joint greater than this must be prevented by design features; or

(ii) Proof testing must be conducted on each production article that will apply the critical limit design load to each critical bonded joint; or

(iii) Repeatable and reliable non-destructive inspection techniques must be established that ensure the strength of each joint.

(6) Structural components for which the damage tolerance method is shown to be impractical must be shown by component fatigue tests, or analysis supported by tests, to be able to withstand the repeated loads of variable magnitude expected in service. Sufficient component, subcomponent, element, or coupon tests must be done to establish the fatigue scatter factor and the environmental effects. Damage up to the threshold of detectability and ultimate load residual strength capability must be considered in the demonstration.

(b) Metallic airframe structure. If the applicant elects to use §23.571(c) or §23.572(a)(3), then the damage tolerance evaluation must include a determination of the probable locations and modes of damage due to fatigue, corrosion, or accidental damage. Damage at multiple sites due to fatigue must be included where the design is such that this type of damage can be expected to occur. The evaluation must incorporate repeated load and static analyses supported by test evidence. The extent of damage for residual strength evaluation at any time within the operational life of the airplane must be consistent with the initial detectability and subsequent growth under repeated loads. The residual strength evaluation must show that the remaining structure is able to withstand critical limit flight loads, considered as ultimate, with the extent of detectable damage consistent with the results of the damage tolerance evaluations. For pressurized cabins, the following load must be withstood:

(1) The normal operating differential pressure combined with the expected external aerodynamic pressures applied simultaneously with the flight loading conditions specified in this part, and

(2) The expected external aerodynamic pressures in 1g flight combined with a cabin differential pressure equal to 1.1 times the normal operating differential pressure without any other load.

§ 23.575 Metallic damage tolerance.

(a) Metallic damage tolerance. An evaluation of the strength, detail design, and fabrication must show that catastrophic failure due to fatigue, corrosion, defects, or damage will be avoided throughout the operational life of the airplane. This evaluation must be conducted in accordance with the provisions of §23.573, except as specified in paragraph (b) of this section, for each part of the structure that could contribute to a catastrophic failure.

(b) Fatigue (safe-life) evaluation. Compliance with the damage tolerance requirements of paragraph (a) of this section is not required if the applicant establishes that the application of those requirements is impractical for a particular structure. This structure must be shown, by analysis supported by test evidence, to be able to withstand the repeated loads of variable magnitude expected during its service life without detectable cracks. Appropriate safe-life scatter factors must be applied.

[Doc. No. 27805, 61 FR 5148, Feb. 9, 1996]

§ 23.575 Inspections and other procedures.

Each inspection or other procedure, based on an evaluation required by §§23.571, 23.572, 23.573 or 23.574, must be established to prevent catastrophic failure and must be included in the Limitations Section of the Instructions for Continued Airworthiness required by §23.1529.

[Doc. No. 27805, 61 FR 5148, Feb. 9, 1996]

Subpart D—Design and Construction

§ 23.601 General.

The suitability of each questionable design detail and part having an important bearing on safety in operations, must be established by tests.

§ 23.603 Materials and workmanship.

(a) The suitability and durability of materials used for parts, the failure of which could adversely affect safety, must—

(1) Be established by experience or tests;

(2) Meet approved specifications that ensure their having the strength and other properties assumed in the design data; and

(3) Take into account the effects of environmental conditions, such as temperature and humidity, expected in service.

(b) Workmanship must be of a high standard.


§ 23.605 Fabrication methods.

(a) The methods of fabrication used must produce consistently sound structures. If a fabrication process (such as gluing, spot welding, or heat-treating) requires close control to reach this objective, the process must be performed under an approved process specification.

(b) Each new aircraft fabrication method must be substantiated by a test program.


§ 23.607 Fasteners.

(a) Each removable fastener must incorporate two retaining devices if the loss of such fastener would preclude continued safe flight and landing.

(b) Fasteners and their locking devices must not be adversely affected by the environmental conditions associated with the particular installation.

(c) No self-locking nut may be used on any bolt subject to rotation in operation unless a non-friction locking device is used in addition to the self-locking device.

[Doc. No. 27805, 61 FR 5148, Feb. 9, 1996]

§ 23.609 Protection of structure.

Each part of the structure must—

(a) Be suitably protected against deterioration or loss of strength in service due to any cause, including—

(1) Weathering;

(2) Corrosion; and

(3) Abrasion; and

(b) Have adequate provisions for ventilation and drainage.

§ 23.611 Accessibility provisions.

For each part that requires maintenance, inspection, or other servicing,