

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.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-17, 41 FR 55464, Dec. 20, 1976; Amdt. 23-23, 43 FR 50592, Oct. 10, 1978]

§ 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.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964; 30 FR 258, Jan. 9, 1965, as amended by Amdt. 23-23, 43 FR 50592, Oct. 10, 1978]

§ 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 de-

vice 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, appropriate means must be incorporated into the aircraft design to allow such servicing to be accomplished.

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

§ 23.613 Material strength properties and design values.

(a) Material strength properties must be based on enough tests of material meeting specifications to establish design values on a statistical basis.

(b) Design values must be chosen to minimize the probability of structural failure due to material variability. Except as provided in paragraph (e) of this section, compliance with this paragraph must be shown by selecting design values that ensure material strength with the following probability:

(1) Where applied loads are eventually distributed through a single member within an assembly, the failure of which would result in loss of structural integrity of the component; 99 percent probability with 95 percent confidence.

(2) For redundant structure, in which the failure of individual elements would result in applied loads being safely distributed to other load carrying members; 90 percent probability with 95 percent confidence.

(c) The effects of temperature on allowable stresses used for design in an essential component or structure must be considered where thermal effects are significant under normal operating conditions.

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(d) The design of the structure must minimize the probability of catastrophic fatigue failure, particularly at points of stress concentration.

(e) Design values greater than the guaranteed minimums required by this section may be used where only guaranteed minimum values are normally allowed if a "premium selection" of the material is made in which a specimen of each individual item is tested before use to determine that the actual strength properties of that particular item will equal or exceed those used in design.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964; 30 FR 258, Jan. 9, 1965, as amended by Amdt. 23-23, 43 FR 50592, Oct. 30, 1978; Amdt. 23-45, 58 FR 42163, Aug. 6, 1993]

§ 23.619 Special factors.

The factor of safety prescribed in § 23.303 must be multiplied by the highest pertinent special factors of safety prescribed in §§ 23.621 through 23.625 for each part of the structure whose strength is—

- (a) Uncertain;
- (b) Likely to deteriorate in service before normal replacement; or
- (c) Subject to appreciable variability because of uncertainties in manufacturing processes or inspection methods.

[Amdt. 23-7, 34 FR 13091, Aug. 13, 1969]

§ 23.621 Casting factors.

(a) *General.* The factors, tests, and inspections specified in paragraphs (b) through (d) of this section must be applied in addition to those necessary to establish foundry quality control. The inspections must meet approved specifications. Paragraphs (c) and (d) of this section apply to any structural castings except castings that are pressure tested as parts of hydraulic or other fluid systems and do not support structural loads.

(b) *Bearing stresses and surfaces.* The casting factors specified in paragraphs (c) and (d) of this section—

(1) Need not exceed 1.25 with respect to bearing stresses regardless of the method of inspection used; and

(2) Need not be used with respect to the bearing surfaces of a part whose bearing factor is larger than the applicable casting factor.

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(c) *Critical castings.* For each casting whose failure would preclude continued safe flight and landing of the airplane or result in serious injury to occupants, the following apply:

(1) Each critical casting must either—

(i) Have a casting factor of not less than 1.25 and receive 100 percent inspection by visual, radiographic, and either magnetic particle, penetrant or other approved equivalent non-destructive inspection method; or

(ii) Have a casting factor of not less than 2.0 and receive 100 percent visual inspection and 100 percent approved non-destructive inspection. When an approved quality control procedure is established and an acceptable statistical analysis supports reduction, non-destructive inspection may be reduced from 100 percent, and applied on a sampling basis.

(2) For each critical casting with a casting factor less than 1.50, three sample castings must be static tested and shown to meet—

(i) The strength requirements of § 23.305 at an ultimate load corresponding to a casting factor of 1.25; and

(ii) The deformation requirements of § 23.305 at a load of 1.15 times the limit load.

(3) Examples of these castings are structural attachment fittings, parts of flight control systems, control surface hinges and balance weight attachments, seat, berth, safety belt, and fuel and oil tank supports and attachments, and cabin pressure valves.

(d) *Non-critical castings.* For each casting other than those specified in paragraph (c) or (e) of this section, the following apply:

(1) Except as provided in paragraphs (d)(2) and (3) of this section, the casting factors and corresponding inspections must meet the following table:

Casting factor	Inspection
2.0 or more	100 percent visual.
Less than 2.0 but more than 1.5	100 percent visual, and magnetic particle or penetrant or equivalent nondestructive inspection methods.
1.25 through 1.50	100 percent visual, magnetic particle or penetrant, and radiographic, or approved equivalent nondestructive inspection methods.