

for the effects of normal relative motion.

(b) No bearing factor need be used on a part for which any larger special factor is prescribed.

**§ 29.625 Fitting factors.**

For each fitting (part or terminal used to join one structural member to another) the following apply:

(a) For each fitting whose strength is not proven by limit and ultimate load tests in which actual stress conditions are simulated in the fitting and surrounding structures, a fitting factor of at least 1.15 must be applied to each part of—

- (1) The fitting;
- (2) The means of attachment; and
- (3) The bearing on the joined members.

(b) No fitting factor need be used—

(1) For joints made under approved practices and based on comprehensive test data (such as continuous joints in metal plating, welded joints, and scarf joints in wood); and

(2) With respect to any bearing surface for which a larger special factor is used.

(c) For each integral fitting, the part must be treated as a fitting up to the point at which the section properties become typical of the member.

(d) Each seat, berth, litter, safety belt, and harness attachment to the structure must be shown by analysis, tests, or both, to be able to withstand the inertia forces prescribed in § 29.561(b)(3) multiplied by a fitting factor of 1.33.

[Doc. No. 5084, 29 FR 16150, Dec. 3, 1964, as amended by Amdt. 29-42, 63 FR 43285, Aug. 12, 1998]

**§ 29.629 Flutter and divergence.**

Each aerodynamic surface of the rotorcraft must be free from flutter and divergence under each appropriate speed and power condition.

[Doc. No. 28008, 61 FR 21907, May 10, 1996]

**§ 29.631 Bird strike.**

The rotorcraft must be designed to ensure capability of continued safe flight and landing (for Category A) or safe landing (for Category B) after impact with a 2.2-lb (1.0 kg) bird when the

velocity of the rotorcraft (relative to the bird along the flight path of the rotorcraft) is equal to  $V_{NE}$  or  $V_H$  (whichever is the lesser) at altitudes up to 8,000 feet. Compliance must be shown by tests or by analysis based on tests carried out on sufficiently representative structures of similar design.

[Doc. No. 28008, 61 FR 21907, May 10, 1996; 61 FR 33963, July 1, 1996]

ROTORS

**§ 29.653 Pressure venting and drainage of rotor blades.**

(a) For each rotor blade—

(1) There must be means for venting the internal pressure of the blade;

(2) Drainage holes must be provided for the blade; and

(3) The blade must be designed to prevent water from becoming trapped in it.

(b) Paragraphs (a)(1) and (2) of this section does not apply to sealed rotor blades capable of withstanding the maximum pressure differentials expected in service.

[Amdt. 29-3, 33 FR 967, Jan. 26, 1968]

**§ 29.659 Mass balance.**

(a) The rotor and blades must be mass balanced as necessary to—

(1) Prevent excessive vibration; and

(2) Prevent flutter at any speed up to the maximum forward speed.

(b) The structural integrity of the mass balance installation must be substantiated.

[Amdt. 29-3, 33 FR 967, Jan. 26, 1968]

**§ 29.661 Rotor blade clearance.**

There must be enough clearance between the rotor blades and other parts of the structure to prevent the blades from striking any part of the structure during any operating condition.

[Amdt. 29-3, 33 FR 967, Jan. 26, 1968]

**§ 29.663 Ground resonance prevention means.**

(a) The reliability of the means for preventing ground resonance must be shown either by analysis and tests, or

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reliable service experience, or by showing through analysis or tests that malfunction or failure of a single means will not cause ground resonance.

(b) The probable range of variations, during service, of the damping action of the ground resonance prevention means must be established and must be investigated during the test required by § 29.241.

[Amdt. 27-26, 55 FR 8003, Mar. 6, 1990]

### CONTROL SYSTEMS

#### § 29.671 General.

(a) Each control and control system must operate with the ease, smoothness, and positiveness appropriate to its function.

(b) Each element of each flight control system must be designed, or distinctively and permanently marked, to minimize the probability of any incorrect assembly that could result in the malfunction of the system.

(c) A means must be provided to allow full control movement of all primary flight controls prior to flight, or a means must be provided that will allow the pilot to determine that full control authority is available prior to flight.

[Doc. No. 5084, 29 FR 16150, Dec. 3, 1964, as amended by Amdt. 29-24, 49 FR 44437, Nov. 6, 1984]

#### § 29.672 Stability augmentation, automatic, and power-operated systems.

If the functioning of stability augmentation or other automatic or power-operated system is necessary to show compliance with the flight characteristics requirements of this part, the system must comply with § 29.671 of this part and the following:

(a) A warning which is clearly distinguishable to the pilot under expected flight conditions without requiring the pilot's attention must be provided for any failure in the stability augmentation system or in any other automatic or power-operated system which could result in an unsafe condition if the pilot is unaware of the failure. Warning systems must not activate the control systems.

(b) The design of the stability augmentation system or of any other automatic or power-operated system must

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allow initial counteraction of failures without requiring exceptional pilot skill or strength, by overriding the failure by moving the flight controls in the normal sense, and by deactivating the failed system.

(c) It must be shown that after any single failure of the stability augmentation system or any other automatic or power-operated system—

(1) The rotorcraft is safely controllable when the failure or malfunction occurs at any speed or altitude within the approved operating limitations;

(2) The controllability and maneuverability requirements of this part are met within a practical operational flight envelope (for example, speed, altitude, normal acceleration, and rotorcraft configurations) which is described in the Rotorcraft Flight Manual; and

(3) The trim and stability characteristics are not impaired below a level needed to allow continued safe flight and landing.

[Amdt. 29-24, 49 FR 44437, Nov. 6, 1984]

#### § 29.673 Primary flight controls.

Primary flight controls are those used by the pilot for immediate control of pitch, roll, yaw, and vertical motion of the rotorcraft.

[Amdt. 29-24, 49 FR 44437, Nov. 6, 1984]

#### § 29.674 Interconnected controls.

Each primary flight control system must provide for safe flight and landing and operate independently after a malfunction, failure, or jam of any auxiliary interconnected control.

[Amdt. 27-26, 55 FR 8003, Mar. 6, 1990]

#### § 29.675 Stops.

(a) Each control system must have stops that positively limit the range of motion of the pilot's controls.

(b) Each stop must be located in the system so that the range of travel of its control is not appreciably affected by—

- (1) Wear;
- (2) Slackness; or
- (3) Takeup adjustments.

(c) Each stop must be able to withstand the loads corresponding to the design conditions for the system.

- (d) For each main rotor blade—