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(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. 27-2, 33 FR 963, Jan. 26, 1968]

§ 27.659 Mass balance.

(a) The rotors 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. 27-2, 33 FR 963, Jan. 26, 1968]

§ 27.661 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. 27-2, 33 FR 963, Jan. 26, 1968]

§ 27.663 Ground resonance prevention means.

(a) The reliability of the means for preventing ground resonance must be shown either by analysis and tests, or 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 § 27.241.

[Amdt. 27-2, 33 FR 963, Jan. 26, 1968, as amended by Amdt. 27-26, 55 FR 8000, Mar. 6, 1990]

CONTROL SYSTEMS

§ 27.671 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

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minimize the probability of any incorrect assembly that could result in the malfunction of the system.

§ 27.672 Stability augmentation, automatic, and power-operated systems.

If the functioning of stability augmentation or other automatic or power-operated systems is necessary to show compliance with the flight characteristics requirements of this part, such systems must comply with § 27.671 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 allow initial counteraction of failures without requiring exceptional pilot skill or strength by overriding the failure by movement of the flight controls in the normal sense and 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 permit continued safe flight and landing.

[Amdt. 27-21, 49 FR 44433, Nov. 6, 1984; 49 FR 47594, Dec. 6, 1984]

§ 27.673 Primary flight control.

Primary flight controls are those used by the pilot for immediate control

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of pitch, roll, yaw, and vertical motion of the rotorcraft.

[Amdt. 27-21, 49 FR 44434, Nov. 6, 1984]

§ 27.674 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 8001, Mar. 6, 1990]

§ 27.675 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—

(1) Stops that are appropriate to the blade design must be provided to limit travel of the blade about its hinge points; and

(2) There must be means to keep the blade from hitting the droop stops during any operation other than starting and stopping the rotor.

(Secs. 313(a), 601, 603, 604, Federal Aviation Act of 1958 (49 U.S.C. 1354(a), 1421, 1423, 1424), sec. 6(c), Dept. of Transportation Act (49 U.S.C. 1655(c)))

[Doc. No. 5074, 29 FR 15695, Nov. 24, 1964, as amended by Amdt. 27-16, 43 FR 50599, Oct. 30, 1978]

§ 27.679 Control system locks.

If there is a device to lock the control system with the rotorcraft on the ground or water, there must be means to—

- (a) Give unmistakable warning to the pilot when the lock is engaged; and
- (b) Prevent the lock from engaging in flight.

§ 27.681 Limit load static tests.

(a) Compliance with the limit load requirements of this part must be shown by tests in which—

(1) The direction of the test loads produces the most severe loading in the control system; and

(2) Each fitting, pulley, and bracket used in attaching the system to the main structure is included.

(b) Compliance must be shown (by analyses or individual load tests) with the special factor requirements for control system joints subject to angular motion.

§ 27.683 Operation tests.

It must be shown by operation tests that, when the controls are operated from the pilot compartment with the control system loaded to correspond with loads specified for the system, the system is free from—

- (a) Jamming;
- (b) Excessive friction; and
- (c) Excessive deflection.

§ 27.685 Control system details.

(a) Each detail of each control system must be designed to prevent jamming, chafing, and interference from cargo, passengers, loose objects or the freezing of moisture.

(b) There must be means in the cockpit to prevent the entry of foreign objects into places where they would jam the system.

(c) There must be means to prevent the slapping of cables or tubes against other parts.

(d) Cable systems must be designed as follows:

(1) Cables, cable fittings, turn-buckles, splices, and pulleys must be of an acceptable kind.

(2) The design of the cable systems must prevent any hazardous change in cable tension throughout the range of travel under any operating conditions and temperature variations.

(3) No cable smaller than three thirty-seconds of an inch diameter may be used in any primary control system.

(4) Pulley kinds and sizes must correspond to the cables with which they are used. The pulley cable combinations and strength values which must be used are specified in Military Handbook MIL-HDBK-5C, Vol. 1 & Vol. 2, Metallic Materials and Elements for Flight Vehicle Structures, (Sept. 15, 1976, as amended through December 15, 1978). This incorporation by reference