

§ 27.871

and flight tests to be both transportable and releasable throughout the approved operational envelope without hazard to the rotorcraft during normal flight conditions. In addition, these external loads must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions.

(e) A placard or marking must be installed next to the external-load attaching means clearly stating any operational limitations and the maximum authorized external load as demonstrated under § 27.25 and this section.

(f) The fatigue evaluation of § 27.571 of this part does not apply to rotorcraft-load combinations to be used for nonhuman external cargo except for the failure of critical structural elements that would result in a hazard to the rotorcraft. For rotorcraft-load combinations to be used for human external cargo, the fatigue evaluation of § 27.571 of this part applies to the entire quick release and personnel carrying device structural systems and their attachments.

[Amdt. 27-11, 41 FR 55469, Dec. 20, 1976; as amended by Amdt. 27-26, 55 FR 8001, Mar. 6, 1990; Amdt. 27-36, 64 FR 43019, Aug. 6, 1999]

MISCELLANEOUS

§ 27.871 Leveling marks.

There must be reference marks for leveling the rotorcraft on the ground.

§ 27.873 Ballast provisions.

Ballast provisions must be designed and constructed to prevent inadvertent shifting of ballast in flight.

Subpart E—Powerplant

GENERAL

§ 27.901 Installation.

(a) For the purpose of this part, the powerplant installation includes each part of the rotorcraft (other than the main and auxiliary rotor structures) that—

- (1) Is necessary for propulsion;
- (2) Affects the control of the major propulsive units; or
- (3) Affects the safety of the major propulsive units between normal inspections or overhauls.

14 CFR Ch. I (1-1-06 Edition)

(b) For each powerplant installation—

(1) Each component of the installation must be constructed, arranged, and installed to ensure its continued safe operation between normal inspections or overhauls for the range of temperature and altitude for which approval is requested;

(2) Accessibility must be provided to allow any inspection and maintenance necessary for continued airworthiness;

(3) Electrical interconnections must be provided to prevent differences of potential between major components of the installation and the rest of the rotorcraft;

(4) Axial and radial expansion of turbine engines may not affect the safety of the installation; and

(5) Design precautions must be taken to minimize the possibility of incorrect assembly of components and equipment essential to safe operation of the rotorcraft, except where operation with the incorrect assembly can be shown to be extremely improbable.

(c) The installation must comply with—

(1) The installation instructions provided under § 33.5 of this chapter; and

(2) The applicable provisions of this subpart.

(Secs. 313(a), 601, and 603, 72 Stat. 752, 775, 49 U.S.C. 1354(a), 1421, and 1423; sec. 6(c), 49 U.S.C. 1655(c))

[Doc. No. 5074, 29 FR 15695, Nov. 24, 1964, as amended by Amdt. 27-2, 33 FR 963, Jan. 26, 1968; Amdt. 27-12, 42 FR 15044, Mar. 17, 1977; Amdt. 27-23, 53 FR 34211, Sept. 2, 1988]

§ 27.903 Engines.

(a) *Engine type certification.* Each engine must have an approved type certificate. Reciprocating engines for use in helicopters must be qualified in accordance with § 33.49(d) of this chapter or be otherwise approved for the intended usage.

(b) *Engine or drive system cooling fan blade protection.* (1) If an engine or rotor drive system cooling fan is installed, there must be a means to protect the rotorcraft and allow a safe landing if a fan blade fails. This must be shown by showing that—

- (i) The fan blades are contained in case of failure;

(ii) Each fan is located so that a failure will not jeopardize safety; or

(iii) Each fan blade can withstand an ultimate load of 1.5 times the centrifugal force resulting from operation limited by the following:

(A) For fans driven directly by the engine—

(1) The terminal engine r.p.m. under uncontrolled conditions; or

(2) An overspeed limiting device.

(B) For fans driven by the rotor drive system, the maximum rotor drive system rotational speed to be expected in service, including transients.

(2) Unless a fatigue evaluation under § 27.571 is conducted, it must be shown that cooling fan blades are not operating at resonant conditions within the operating limits of the rotorcraft.

(c) *Turbine engine installation.* For turbine engine installations, the powerplant systems associated with engine control devices, systems, and instrumentation must be designed to give reasonable assurance that those engine operating limitations that adversely affect turbine rotor structural integrity will not be exceeded in service.

[Doc. No. 5074, 29 FR 15695, Nov. 24, 1964, as amended by Amdt. 27-11, 41 FR 55469, Dec. 20, 1976; Amdt. 27-23, 53 FR 34211, Sept. 2, 1988]

§ 27.907 Engine vibration.

(a) Each engine must be installed to prevent the harmful vibration of any part of the engine or rotorcraft.

(b) The addition of the rotor and the rotor drive system to the engine may not subject the principal rotating parts of the engine to excessive vibration stresses. This must be shown by a vibration investigation.

(c) No part of the rotor drive system may be subjected to excessive vibration stresses.

ROTOR DRIVE SYSTEM

§ 27.917 Design.

(a) Each rotor drive system must incorporate a unit for each engine to automatically disengage that engine from the main and auxiliary rotors if that engine fails.

(b) Each rotor drive system must be arranged so that each rotor necessary for control in autorotation will continue to be driven by the main rotors

after disengagement of the engine from the main and auxiliary rotors.

(c) If a torque limiting device is used in the rotor drive system, it must be located so as to allow continued control of the rotorcraft when the device is operating.

(d) The rotor drive system includes any part necessary to transmit power from the engines to the rotor hubs. This includes gear boxes, shafting, universal joints, couplings, rotor brake assemblies, clutches, supporting bearings for shafting, any attendant accessory pads or drives, and any cooling fans that are a part of, attached to, or mounted on the rotor drive system.

[Doc. No. 5074, 29 FR 15695, Nov. 24, 1964, as amended by Amdt. 27-11, 41 FR 55469, Dec. 20, 1976]

§ 27.921 Rotor brake.

If there is a means to control the rotation of the rotor drive system independently of the engine, any limitations on the use of that means must be specified, and the control for that means must be guarded to prevent inadvertent operation.

§ 27.923 Rotor drive system and control mechanism tests.

(a) Each part tested as prescribed in this section must be in a serviceable condition at the end of the tests. No intervening disassembly which might affect test results may be conducted.

(b) Each rotor drive system and control mechanism must be tested for not less than 100 hours. The test must be conducted on the rotorcraft, and the torque must be absorbed by the rotors to be installed, except that other ground or flight test facilities with other appropriate methods of torque absorption may be used if the conditions of support and vibration closely simulate the conditions that would exist during a test on the rotorcraft.

(c) A 60-hour part of the test prescribed in paragraph (b) of this section must be run at not less than maximum continuous torque and the maximum speed for use with maximum continuous torque. In this test, the main rotor controls must be set in the position that will give maximum longitudinal cyclic pitch change to simulate