(1) Design precautions must be taken to minimize the hazards to the rotorcraft in the event of an engine rotor failure; and

(2) 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 engine rotor structural integrity will not be exceeded in service.

(e) *Restart capability.* (1) A means to restart any engine in flight must be provided.

(2) Except for the in-flight shutdown of all engines, engine restart capability must be demonstrated throughout a flight envelope for the rotorcraft.

(3) Following the in-flight shutdown of all engines, in-flight engine restart capability must be provided.

(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. 5084, 29 FR 16150, Dec. 3, 1964, as amended by Amdt. 29–12, 41 FR 55472, Dec. 20, 1976; Amdt. 29–26, 53 FR 34215, Sept. 2, 1988; Amdt. 29–31, 55 FR 38967, Sept. 21, 1990; 55 FR 41309, Oct. 10, 1990; Amdt. 29–36, 60 FR 55776, Nov. 2, 1995]

§ 29.907 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.

§ 29.908 Cooling fans.

For cooling fans that are a part of a powerplant installation the following apply:

(a) *Category A.* For cooling fans installed in Category A rotorcraft, it must be shown that a fan blade failure will not prevent continued safe flight either because of damage caused by the failed blade or loss of cooling air.

(b) *Category B.* For cooling fans installed in category B rotorcraft, there must be means to protect the rotorcraft and allow a safe landing if a fan blade fails. It must be shown that—

(1) The fan blade would be contained in the case of a failure;

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

(3) Each fan blade can withstand an ultimate load of 1.5 times the centrifugal force expected in service, limited by either—

(i) The highest rotational speeds achievable under uncontrolled conditions; or

(ii) An overspeed limiting device.

(c) *Fatigue evaluation.* Unless a fatigue evaluation under § 29.571 is conducted, it must be shown that cooling fan blades are not operating at resonant conditions within the operating limits of the rotorcraft.

(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))

[Amdt. 29–13, 42 FR 15046, Mar. 17, 1977, as amended by Amdt. 29–26, 53 FR 34215, Sept. 2, 1988]

ROTOR DRIVE SYSTEM

§ 29.917 Design.

(a) *General.* 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.

(b) *Design assessment.* A design assessment must be performed to ensure that the rotor drive system functions safely over the full range of conditions for which certification is sought. The design assessment must include a detailed failure analysis to identify all failures that will prevent continued safe flight or safe landing and must identify the means to minimize the likelihood of their occurrence.

(c) *Arrangement.* Rotor drive systems must be arranged as follows:

(1) Each rotor drive system of multiengine rotorcraft must be arranged so that each rotor necessary for operation and control will continue to be driven by the remaining engines if any engine fails.