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failures will jeopardize the safe operation of the rotorcraft except that the failure of structural elements need not be considered if the probability of any such failure is extremely remote.

(d) Each auxiliary power unit installation must meet the applicable provisions of this subpart.

(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)))

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§ 29.903 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) *Category A; engine isolation.* For each category A rotorcraft, the powerplants must be arranged and isolated from each other to allow operation, in at least one configuration, so that the failure or malfunction of any engine, or the failure of any system that can affect any engine, will not—

(1) Prevent the continued safe operation of the remaining engines; or

(2) Require immediate action, other than normal pilot action with primary flight controls, by any crewmember to maintain safe operation.

(c) *Category A; control of engine rotation.* For each Category A rotorcraft, there must be a means for stopping the rotation of any engine individually in flight, except that, for turbine engine installations, the means for stopping the engine need be provided only where necessary for safety. In addition—

(1) Each component of the engine stopping system that is located on the engine side of the firewall, and that might be exposed to fire, must be at least fire resistant; or

(2) Duplicate means must be available for stopping the engine and the controls must be where all are not likely to be damaged at the same time in case of fire.

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(d) *Turbine engine installation.* For turbine engine installations—

(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))

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§ 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