

(1) At least one inch radial clearance between the blade tips and the airplane structure, plus any additional radial clearance necessary to prevent harmful vibration;

(2) At least one-half inch longitudinal clearance between the propeller blades or cuffs and stationary parts of the airplane; and

(3) Positive clearance between other rotating parts of the propeller or spinner and stationary parts of the airplane.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-43, 58 FR 18971, Apr. 9, 1993; Amdt. 23-51, 61 FR 5136, Feb. 9, 1996; Amdt. 23-48, 61 FR 5148, Feb. 9, 1996]

§ 23.929 Engine installation ice protection.

Propellers (except wooden propellers) and other components of complete engine installations must be protected against the accumulation of ice as necessary to enable satisfactory functioning without appreciable loss of thrust when operated in the icing conditions for which certification is requested.

[Amdt. 23-14, 33 FR 31822, Nov. 19, 1973, as amended by Amdt. 23-51, 61 FR 5136, Feb. 9, 1996]

§ 23.933 Reversing systems.

(a) *For turbojet and turbofan reversing systems.* (1) Each system intended for ground operation only must be designed so that, during any reversal in flight, the engine will produce no more than flight idle thrust. In addition, it must be shown by analysis or test, or both, that—

(i) Each operable reverser can be restored to the forward thrust position; or

(ii) The airplane is capable of continued safe flight and landing under any possible position of the thrust reverser.

(2) Each system intended for in-flight use must be designed so that no unsafe condition will result during normal operation of the system, or from any failure, or likely combination of failures, of the reversing system under any operating condition including ground operation. Failure of structural elements need not be considered if the probability of this type of failure is extremely remote.

(3) Each system must have a means to prevent the engine from producing more than idle thrust when the reversing system malfunctions; except that it may produce any greater thrust that is shown to allow directional control to be maintained, with aerodynamic means alone, under the most critical reversing condition expected in operation.

(b) *For propeller reversing systems.* (1) Each system must be designed so that no single failure, likely combination of failures or malfunction of the system will result in unwanted reverse thrust under any operating condition. Failure of structural elements need not be considered if the probability of this type of failure is extremely remote.

(2) Compliance with paragraph (b)(1) of this section must be shown by failure analysis, or testing, or both, for propeller systems that allow the propeller blades to move from the flight low-pitch position to a position that is substantially less than the normal flight, low-pitch position. The analysis may include or be supported by the analysis made to show compliance with § 35.21 for the type certification of the propeller and associated installation components. Credit will be given for pertinent analysis and testing completed by the engine and propeller manufacturers.

[Doc. No. 26344, 58 FR 18971, Apr. 9, 1993, as amended by Amdt. 23-51, 61 FR 5136, Feb. 9, 1996]

§ 23.934 Turbojet and turbofan engine thrust reverser systems tests.

Thrust reverser systems of turbojet or turbofan engines must meet the requirements of § 33.97 of this chapter or it must be demonstrated by tests that engine operation and vibratory levels are not affected.

[Doc. No. 26344, 58 FR 18971, Apr. 9, 1993]

§ 23.937 Turbopropeller-drag limiting systems.

(a) Turbopropeller-powered airplane propeller-drag limiting systems must be designed so that no single failure or malfunction of any of the systems during normal or emergency operation results in propeller drag in excess of that for which the airplane was designed under the structural requirements of

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this part. Failure of structural elements of the drag limiting systems need not be considered if the probability of this kind of failure is extremely remote.

(b) As used in this section, drag limiting systems include manual or automatic devices that, when actuated after engine power loss, can move the propeller blades toward the feather position to reduce windmilling drag to a safe level.

[Amdt. 23-7, 34 FR 13093, Aug. 13, 1969, as amended by Amdt. 23-43, 58 FR 18971, Apr. 9, 1993]

§ 23.939 Powerplant operating characteristics.

(a) Turbine engine powerplant operating characteristics must be investigated in flight to determine that no adverse characteristics (such as stall, surge, or flameout) are present, to a hazardous degree, during normal and emergency operation within the range of operating limitations of the airplane and of the engine.

(b) Turbocharged reciprocating engine operating characteristics must be investigated in flight to assure that no adverse characteristics, as a result of an inadvertent overboost, surge, flooding, or vapor lock, are present during normal or emergency operation of the engine(s) throughout the range of operating limitations of both airplane and engine.

(c) For turbine engines, the air inlet system must not, as a result of airflow distortion during normal operation, cause vibration harmful to the engine.

[Amdt. 23-7, 34 FR 13093 Aug. 13, 1969, as amended by Amdt. 23-14, 38 FR 31823, Nov. 19, 1973; Amdt. 23-18, 42 FR 15041, Mar. 17, 1977; Amdt. 23-42, 56 FR 354, Jan. 3, 1991]

§ 23.943 Negative acceleration.

No hazardous malfunction of an engine, an auxiliary power unit approved for use in flight, or any component or system associated with the powerplant or auxiliary power unit may occur when the airplane is operated at the negative accelerations within the flight envelopes prescribed in § 23.333. This must be shown for the greatest

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value and duration of the acceleration expected in service.

[Amdt. 23-18, 42 FR 15041, Mar. 17, 1977, as amended by Amdt. 23-43, 58 FR 18971, Apr. 9, 1993]

FUEL SYSTEM

§ 23.951 General.

(a) Each fuel system must be constructed and arranged to ensure fuel flow at a rate and pressure established for proper engine and auxiliary power unit functioning under each likely operating condition, including any maneuver for which certification is requested and during which the engine or auxiliary power unit is permitted to be in operation.

(b) Each fuel system must be arranged so that—

(1) No fuel pump can draw fuel from more than one tank at a time; or

(2) There are means to prevent introducing air into the system.

(c) Each fuel system for a turbine engine must be capable of sustained operation throughout its flow and pressure range with fuel initially saturated with water at 80 °F and having 0.75cc of free water per gallon added and cooled to the most critical condition for icing likely to be encountered in operation.

(d) Each fuel system for a turbine engine powered airplane must meet the applicable fuel venting requirements of part 34 of this chapter.

[Amdt. 23-15, 39 FR 35459, Oct. 1, 1974, as amended by Amdt. 23-40, 55 FR 32861, Aug. 10, 1990; Amdt. 23-43, 58 FR 18971, Apr. 9, 1993]

§ 23.953 Fuel system independence.

(a) Each fuel system for a multiengine airplane must be arranged so that, in at least one system configuration, the failure of any one component (other than a fuel tank) will not result in the loss of power of more than one engine or require immediate action by the pilot to prevent the loss of power of more than one engine.

(b) If a single fuel tank (or series of fuel tanks interconnected to function as a single fuel tank) is used on a multiengine airplane, the following must be provided:

(1) Independent tank outlets for each engine, each incorporating a shut-off valve at the tank. This shutoff valve