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Sec. 25.933

Part 25 AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES	
Subpart E--Powerplant	General

Sec. 25.933

Reversing systems.

(a) Reversing systems intended for ground operation only must be designed so that no single failure or malfunction of the system will result in unwanted reverse thrust under any expected operating condition. Failure of structural elements need not be considered if the probability of this kind of failure is extremely remote.
(b) Turbojet reversing systems intended for inflight use must be designed so that no unsafe condition will result during normal operation of the system, or from any failure (or reasonably likely combination of failures) of the reversing system, under any anticipated condition of operation of the airplane. Failure of structural elements need not be considered if the probability of this kind of failure is extremely remote.
(c) Compliance with this section may be shown by failure analysis, testing, or both, for propeller systems that allow propeller blades to move from the flight low-pitch position to a position that is substantially less than that at the normal flight low-pitch stop position. The analysis may include or be supported by the analysis made to show compliance with the requirements of Sec. 35.21 for the propeller and associated installation components.

Comments

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(c) Compliance with this section may be shown by failure analysis, testing, or both, for propeller systems that allow propeller blades to move from the flight low-pitch position to a position that is substantially less than that at the normal flight low-pitch stop position. The analysis may include or be supported by the analysis made to show compliance with the requirements of Sec. 35.21 for the propeller and associated installation components.
[(d) Each turbojet reversing system must have means to prevent the engine from producing more than idle forward thrust when the reversing system malfunctions, except that it may produce any greater forward thrust that is shown to allow directional control to be maintained, with aerodynamic means alone, under the most critical reversing condition expected in operation.]

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Sec. 25.934

Part 25 AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES	
Subpart E--Powerplant	General

Sec. 25.934

[Turbojet engine thrust reverser system tests.]

[Thrust reversers installed on turbojet engines must meet the requirements of Sec. 33.97 of this chapter.]

Amdt. 25-23, Eff. 5/8/70

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Sec. 33.97

Part 33 AIRWORTHINESS STANDARDS: AIRCRAFT ENGINES	
Subpart F--Block Tests; Turbine Aircraft Engines	

Sec. 33.97

Thrust reversers.

(a) If the engine incorporates a reverser, the endurance, calibration, operation, and vibration tests prescribed in this subpart must be run with the reverser installed. In complying with this section, the power control lever must be moved from one extreme position to the other in not more than one second except, if regimes of control operations are incorporated necessitating scheduling of the power-control lever motion in going from one extreme position to the other, a longer period of time is acceptable but not more than three seconds. In addition, the test prescribed in paragraph (b) must be made. This test may be scheduled as part of the endurance run.
(b) 175 reversals must be made from flight-idle forward thrust to maximum reverse thrust and 25 reversals must be made from [rated takeoff thrust] to maximum reverse thrust. After each reversal, the reverser must be operated at full reverse thrust for a period of one minute, except that, in the case of a reverser intended for use only as a braking means on the ground, the reverser need only be operated at full reverse thrust for 30 seconds.

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Sec. 25.1309

Part 25 AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES	
Subpart F--Equipment	General

Sec. 25.1309

Equipment systems and installations.

(a) The equipment, systems, and installations whose functioning is required by this subchapter, must be designed and installed to ensure that they perform their intended functions under any foreseeable operating condition.
(b) The equipment, systems, and installations must be designed to prevent hazards to the airplane if they malfunction or fail.
(c) Each installation whose functioning is required by this subchapter, and that requires a power supply, is an "essential load" on the power supply. The power sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:
(1) Loads connected to the system with the system functioning normally; and
(2) Essential loads, after failure of any one primer mover, power converter, or energy storage device.
(3) Essential loads after failure of--
(i) Any one engine, on two- or three-engine airplanes.
(ii) Any two engines on four-or-more-engine airplanes.
(d) In determining compliance with paragraph (c)(2) and (3) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operation authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with four or more engines.
(e) In showing compliance with paragraphs (a) and (b) of this section with regard to the electrical system and equipment design and installation, critical environmental conditions must be considered. For electrical generation, distribution, and utilization equipment required by or used in complying with this chapter, except equipment covered by Technical Standard Orders containing environmental test procedures, the ability to provide continuous, safe service

under foreseeable environmental conditions may be shown by environmental tests, design analysis, or reference to previous comparable service experience on other aircraft.

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Sec. 25.1309

Part 25 AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES	
Subpart F--Equipment	General

Sec. 25.1309

Equipment systems and installations.

[The equipment, systems, and installations whose functioning is required by this subchapter, must be designed to ensure that they perform their intended functions under any foreseeable operating condition.
(b) The airplane systems and associated components, considered separately and in relation to other systems, must be designed so that--
(1) The occurrence of any failure condition which would prevent the continued safe flight and landing of the airplane is extremely improbable, and
(2) The occurrence of any other failure conditions which would result in injury to the occupants, or reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions is improbable.
(c) Warning information must be provided to alert the crew to unsafe system operating conditions, and to enable them to take appropriate corrective action. Systems, controls, and associated monitoring and warning means must be designed so that crew errors that would create additional hazards are improbable.
(d) Compliance with the requirements of paragraphs (b) and (c) of this section must be shown by analysis, and where necessary, by appropriate ground, flight, or flight simulator tests. The analysis must consider--
(1) Possible modes of failure, including malfunctions and damage from external sources.
(2) The probability of multiple failures and undetected failures.
(3) The resulting effects on the airplane and occupants, considering the stage of flight and operating conditions, and
(4) The crew warning cues, corrective action required, and the capability of detecting faults.
(e) Each installation whose functioning is required by this subchapter, and that requires a power supply, is an "essential load" on the power supply. The power

sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:
(1) Loads connected to the system with the system functioning normally.
(2) Essential loads, after failure of any one prime mover, power converter, or energy storage device.
(3) Essential loads after failure of--
(i) Any one engine on two- or three-engine airplanes; and
(ii) Any two engines on four-or-more-engine airplanes.
(4) Essential loads for which an alternate source of power is required by this chapter, after any failure or malfunction in any one power supply system, distribution system, or other utilization system.
(f) In determining compliance with paragraph (e)(2) and (3) of this section, the powerloads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operation authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with four or more engines.
(g) In showing compliance with paragraphs (a) and (b) of this section with regard to the electrical system and equipment design and installation, critical environmental conditions must be considered. For electrical generation, distribution, and utilization equipment required by or used in complying with this chapter, except equipment covered by Technical Standard Orders containing environmental test procedures, the ability to provide continuous, safe service under foreseeable environmental conditions may be shown by environmental tests, design analysis, or reference to previous comparable service experience on other aircraft.]

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