

(2) Flight dry air tests of the ice protection system as a whole, or its individual components.

(3) Flight test of the airplane or its components in measured simulated icing conditions.

(c) If certification with ice protection has been accomplished on prior type certificated airplanes whose designs include components that are thermodynamically and aerodynamically equivalent to those used on a new airplane design, certification of these equivalent components may be accomplished by reference to previously accomplished tests, required in § 23.1419 (a) and (b), provided that the applicant accounts for any differences in installation of these components.

(d) A means must be identified or provided for determining the formation of ice on the critical parts of the airplane. Adequate lighting must be provided for the use of this means during night operation. Also, when monitoring of the external surfaces of the airplane by the flight crew is required for operation of the ice protection equipment, external lighting must be provided that is adequate to enable the monitoring to be done at night. Any illumination that is used must be of a type that will not cause glare or reflection that would handicap crewmembers in the performance of their duties. The Airplane Flight Manual or other approved manual material must describe the means of determining ice formation and must contain information for the safe operation of the airplane in icing conditions.

[Doc. No. 26344, 58 FR 18977, Apr. 9, 1993]

MISCELLANEOUS EQUIPMENT

§ 23.1431 Electronic equipment.

(a) In showing compliance with § 23.1309(b)(1) and (2) with respect to radio and electronic equipment and their installations, critical environmental conditions must be considered.

(b) Radio and electronic equipment, controls, and wiring must be installed so that operation of any unit or system of units will not adversely affect the simultaneous operation of any other radio or electronic unit, or system of units, required by this chapter.

(c) For those airplanes required to have more than one flightcrew member, or whose operation will require more than one flightcrew member, the cockpit must be evaluated to determine if the flightcrew members, when seated at their duty station, can converse without difficulty under the actual cockpit noise conditions when the airplane is being operated. If the airplane design includes provision for the use of communication headsets, the evaluation must also consider conditions where headsets are being used. If the evaluation shows conditions under which it will be difficult to converse, an intercommunication system must be provided.

(d) If installed communication equipment includes transmitter “off-on” switching, that switching means must be designed to return from the “transmit” to the “off” position when it is released and ensure that the transmitter will return to the off (non transmitting) state.

(e) If provisions for the use of communication headsets are provided, it must be demonstrated that the flightcrew members will receive all aural warnings under the actual cockpit noise conditions when the airplane is being operated when any headset is being used.

[Doc. No. 26344, 58 FR 18977, Apr. 9, 1993, as amended by Amdt. 23-49, 61 FR 5169, Feb. 9, 1996]

§ 23.1435 Hydraulic systems.

(a) *Design.* Each hydraulic system must be designed as follows:

(1) Each hydraulic system and its elements must withstand, without yielding, the structural loads expected in addition to hydraulic loads.

(2) A means to indicate the pressure in each hydraulic system which supplies two or more primary functions must be provided to the flight crew.

(3) There must be means to ensure that the pressure, including transient (surge) pressure, in any part of the system will not exceed the safe limit above design operating pressure and to prevent excessive pressure resulting from fluid volumetric changes in all lines which are likely to remain closed long enough for such changes to occur.

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(4) The minimum design burst pressure must be 2.5 times the operating pressure.

(b) *Tests.* Each system must be substantiated by proof pressure tests. When proof tested, no part of any system may fail, malfunction, or experience a permanent set. The proof load of each system must be at least 1.5 times the maximum operating pressure of that system.

(c) *Accumulators.* A hydraulic accumulator or reservoir may be installed on the engine side of any firewall if—

(1) It is an integral part of an engine or propeller system, or

(2) The reservoir is nonpressurized and the total capacity of all such nonpressurized reservoirs is one quart or less.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-7, 34 FR 13096, Aug. 13, 1969; Amdt. 23-14, 38 FR 31824, Nov. 19, 1973; Amdt. 23-43, 58 FR 18977, Apr. 9, 1993; Amdt. 23-49, 61 FR 5170, Feb. 9, 1996]

§ 23.1437 Accessories for multiengine airplanes.

For multiengine airplanes, engine-driven accessories essential to safe operation must be distributed among two or more engines so that the failure of any one engine will not impair safe operation through the malfunctioning of these accessories.

§ 23.1438 Pressurization and pneumatic systems.

(a) Pressurization system elements must be burst pressure tested to 2.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(b) Pneumatic system elements must be burst pressure tested to 3.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(c) An analysis, or a combination of analysis and test, may be substituted for any test required by paragraph (a) or (b) of this section if the Administrator finds it equivalent to the required test.

[Amdt. 23-20, 42 FR 36969, July 18, 1977]

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§ 23.1441 Oxygen equipment and supply.

(a) If certification with supplemental oxygen equipment is requested, or the airplane is approved for operations at or above altitudes where oxygen is required to be used by the operating rules, oxygen equipment must be provided that meets the requirements of this section and §§ 23.1443 through 23.1449. Portable oxygen equipment may be used to meet the requirements of this part if the portable equipment is shown to comply with the applicable requirements, is identified in the airplane type design, and its stowage provisions are found to be in compliance with the requirements of § 23.561.

(b) The oxygen system must be free from hazards in itself, in its method of operation, and its effect upon other components.

(c) There must be a means to allow the crew to readily determine, during the flight, the quantity of oxygen available in each source of supply.

(d) Each required flight crewmember must be provided with—

(1) Demand oxygen equipment if the airplane is to be certificated for operation above 25,000 feet.

(2) Pressure demand oxygen equipment if the airplane is to be certificated for operation above 40,000 feet.

(e) There must be a means, readily available to the crew in flight, to turn on and to shut off the oxygen supply at the high pressure source. This shutoff requirement does not apply to chemical oxygen generators.

[Amdt. 23-9, 35 FR 6386, Apr. 21, 1970, as amended by Amdt. 23-43, 58 FR 18978, Apr. 9, 1993]

§ 23.1443 Minimum mass flow of supplemental oxygen.

(a) If continuous flow oxygen equipment is installed, an applicant must show compliance with the requirements of either paragraphs (a)(1) and (a)(2) or paragraph (a)(3) of this section:

(1) For each passenger, the minimum mass flow of supplemental oxygen required at various cabin pressure altitudes may not be less than the flow required to maintain, during inspiration and while using the oxygen equipment