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conditions in § 23.959, except that full tanks must be used.
(b) If fuel can be pumped from one tank to another in flight, the fuel tank vents and the fuel transfer system must be designed so that no structural damage to any airplane component can occur because of overfilling of any tank.

(Doc. No. 4080, 29 FR 17855, Dec. 18, 1964, as amended by Amdt. 23–43, 58 FR 18972, Apr. 9, 1993)

§ 23.959 Unusable fuel supply.
(a) The unusable fuel supply for each tank must be established as not less than that quantity at which the first evidence of malfunctioning occurs under the most adverse fuel feed condition occurring under each intended operation and flight maneuver involving that tank. Fuel system component failures need not be considered.

(b) The effect on the usable fuel quantity as a result of a failure of any pump shall be determined.


§ 23.961 Fuel system hot weather operation.
Each fuel system must be free from vapor lock when using fuel at its critical temperature, with respect to vapor formation, when operating the airplane in all critical operating and environmental conditions for which approval is requested. For turbine fuel, the initial temperature must be 110 °F, −0°, +5 °F or the maximum outside air temperature for which approval is requested, whichever is more critical.

(Doc. No. 26344, 58 FR 18972, Apr. 9, 1993; 58 FR 27060, May 6, 1993)

§ 23.963 Fuel tanks: General.
(a) Each fuel tank must be able to withstand, without failure, the vibration, inertia, fluid, and structural loads that it may be subjected to in operation.

(b) Each flexible fuel tank liner must be shown to be suitable for the particular application.

(c) Each integral fuel tank must have adequate facilities for interior inspection and repair.

(d) The total usable capacity of the fuel tanks must be enough for at least one-half hour of operation at maximum continuous power.

(e) Each fuel quantity indicator must be adjusted, as specified in § 23.1337(b), to account for the unusable fuel supply determined under § 23.959(a).


§ 23.965 Fuel tank tests.
(a) Each fuel tank must be able to withstand the following pressures without failure or leakage:

(1) For each conventional metal tank and nonmetallic tank with walls not supported by the airplane structure, a pressure of 3.5 p.s.i., or that pressure developed during maximum ultimate acceleration with a full tank, whichever is greater.

(2) For each integral tank, the pressure developed during the maximum limit acceleration of the airplane with a full tank, with simultaneous application of the critical limit structural loads.

(3) For each nonmetallic tank with walls supported by the airplane structure and constructed in an acceptable manner using acceptable basic tank material, and with actual or simulated support conditions, a pressure of 2 p.s.i. for the first tank of a specific design. The supporting structure must be designed for the critical loads occurring in the flight or landing strength conditions combined with the fuel pressure loads resulting from the corresponding accelerations.

(b) Each fuel tank with large, unsupported, or unstiffened flat surfaces, whose failure or deformation could cause fuel leakage, must be able to withstand the following test without leakage, failure, or excessive deformation of the tank walls:

(1) Each complete tank assembly and its support must be vibration tested while mounted to simulate the actual installation.

(2) Except as specified in paragraph (b)(4) of this section, the tank assembly must be vibrated for 25 hours at a total displacement of not less than 1⁄32 of an
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§ 23.967 Fuel tank installation.

(a) Each fuel tank must be supported so that tank loads are not concentrated. In addition—

(1) There must be pads, if necessary, to prevent chafing between each tank and its supports;

(2) Padding must be nonabsorbent or treated to prevent the absorption of fuel;

(3) If a flexible tank liner is used, it must be supported so that it is not required to withstand fluid loads;

(4) Interior surfaces adjacent to the liner must be smooth and free from projections that could cause wear, unless—

(i) Provisions are made for protection of the liner at those points; or

(ii) The construction of the liner itself provides such protection; and

(5) A positive pressure must be maintained within the vapor space of each bladder cell under any condition of operation, except for a particular condition for which it is shown that a zero or negative pressure will not cause the bladder cell to collapse; and

(6) Syphoning of fuel (other than minor spillage) or collapse of bladder fuel cells may not result from improper securing or loss of the fuel filler cap.

(b) Each tank compartment must be ventilated and drained to prevent the accumulation of flammable fluids or vapors. Each compartment adjacent to a tank that is an integral part of the airplane structure must also be ventilated and drained.

(c) No fuel tank may be on the engine side of the firewall. There must be at least one-half inch of clearance between the fuel tank and the firewall. No part of the engine nacelle skin that lies immediately behind a major air opening from the engine compartment may act as the wall of an integral tank.

(d) Each fuel tank must be isolated from personnel compartments by a fume-proof and fuel-proof enclosure.

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