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§ 29.969 Fuel tank expansion space.

Each fuel tank or each group of fuel tanks with interconnected vent systems must have an expansion space of not less than 2 percent of the combined tank capacity. It must be impossible to fill the fuel tank expansion space inadvertently with the rotorcraft in the normal ground attitude.

[Amdt. 29-26, 53 FR 34217, Sept. 2, 1988]

§ 29.971 Fuel tank sump.

(a) Each fuel tank must have a sump with a capacity of not less than the greater of—

- (1) 0.10 per cent of the tank capacity; or
- (2) $\frac{1}{16}$ gallon.

(b) The capacity prescribed in paragraph (a) of this section must be effective with the rotorcraft in any normal attitude, and must be located so that the sump contents cannot escape through the tank outlet opening.

(c) Each fuel tank must allow drainage of hazardous quantities of water from each part of the tank to the sump with the rotorcraft in any ground attitude to be expected in service.

(d) Each fuel tank sump must have a drain that allows complete drainage of the sump on the ground.

[Doc. No. 5084, 29 FR 16150, Dec. 3, 1964, as amended by Amdt. 29-12, 41 FR 55473, Dec. 20, 1976; Amdt. 29-26, 53 FR 34217, Sept. 2, 1988]

§ 29.973 Fuel tank filler connection.

(a) Each fuel tank filler connection must prevent the entrance of fuel into any part of the rotorcraft other than the tank itself during normal operations and must be crash resistant during a survivable impact in accordance with § 29.952(c). In addition—

(1) Each filler must be marked as prescribed in § 29.1557(c)(1);

(2) Each recessed filler connection that can retain any appreciable quantity of fuel must have a drain that discharges clear of the entire rotorcraft; and

(3) Each filler cap must provide a fuel-tight seal under the fluid pressure expected in normal operation and in a survivable impact.

(b) Each filler cap or filler cap cover must warn when the cap is not fully

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locked or seated on the filler connection.

[Doc. No. 26352, 59 FR 50388, Oct. 3, 1994]

§ 29.975 Fuel tank vents and carburetor vapor vents.

(a) *Fuel tank vents.* Each fuel tank must be vented from the top part of the expansion space so that venting is effective under normal flight conditions. In addition—

(1) The vents must be arranged to avoid stoppage by dirt or ice formation;

(2) The vent arrangement must prevent siphoning of fuel during normal operation;

(3) The venting capacity and vent pressure levels must maintain acceptable differences of pressure between the interior and exterior of the tank, during—

- (i) Normal flight operation;
- (ii) Maximum rate of ascent and descent; and
- (iii) Refueling and defueling (where applicable);

(4) Airspaces of tanks with interconnected outlets must be interconnected;

(5) There may be no point in any vent line where moisture can accumulate with the rotorcraft in the ground attitude or the level flight attitude, unless drainage is provided;

(6) No vent or drainage provision may end at any point—

(i) Where the discharge of fuel from the vent outlet would constitute a fire hazard; or

(ii) From which fumes could enter personnel compartments; and

(7) The venting system must be designed to minimize spillage of fuel through the vents to an ignition source in the event of a rollover during landing, ground operations, or a survivable impact.

(b) *Carburetor vapor vents.* Each carburetor with vapor elimination connections must have a vent line to lead vapors back to one of the fuel tanks. In addition—

(1) Each vent system must have means to avoid stoppage by ice; and

(2) If there is more than one fuel tank, and it is necessary to use the tanks in a definite sequence, each vapor vent return line must lead back

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to the fuel tank used for takeoff and landing.

[Doc. No. 5084, 29 FR 16150, Dec. 3, 1964, as amended by Amdt. 29-26, 53 FR 34217, Sept. 2, 1988; Amdt. 29-35, 59 FR 50388, Oct. 3, 1994; Amdt. 29-42, 63 FR 43285, Aug. 12, 1998]

§ 29.977 Fuel tank outlet.

(a) There must be a fuel strainer for the fuel tank outlet or for the booster pump. This strainer must—

(1) For reciprocating engine powered airplanes, have 8 to 16 meshes per inch; and

(2) For turbine engine powered airplanes, prevent the passage of any object that could restrict fuel flow or damage any fuel system component.

(b) The clear area of each fuel tank outlet strainer must be at least five times the area of the outlet line.

(c) The diameter of each strainer must be at least that of the fuel tank outlet.

(d) Each finger strainer must be accessible for inspection and cleaning.

[Amdt. 29-12, 41 FR 55473, Dec. 20, 1976]

§ 29.979 Pressure refueling and fueling provisions below fuel level.

(a) Each fueling connection below the fuel level in each tank must have means to prevent the escape of hazardous quantities of fuel from that tank in case of malfunction of the fuel entry valve.

(b) For systems intended for pressure refueling, a means in addition to the normal means for limiting the tank content must be installed to prevent damage to the tank in case of failure of the normal means.

(c) The rotorcraft pressure fueling system (not fuel tanks and fuel tank vents) must withstand an ultimate load that is 2.0 times the load arising from the maximum pressure, including surge, that is likely to occur during fueling. The maximum surge pressure must be established with any combination of tank valves being either intentionally or inadvertently closed.

(d) The rotorcraft defueling system (not including fuel tanks and fuel tank vents) must withstand an ultimate load that is 2.0 times the load arising from the maximum permissible defueling pressure (positive or nega-

tive) at the rotorcraft fueling connection.

[Doc. No. 5084, 29 FR 16150, Dec. 3, 1964, as amended by Amdt. 29-12, 41 FR 55473, Dec. 20, 1976]

FUEL SYSTEM COMPONENTS

§ 29.991 Fuel pumps.

(a) Compliance with § 29.955 must not be jeopardized by failure of—

(1) Any one pump except pumps that are approved and installed as parts of a type certificated engine; or

(2) Any component required for pump operation except the engine served by that pump.

(b) The following fuel pump installation requirements apply:

(1) When necessary to maintain the proper fuel pressure—

(i) A connection must be provided to transmit the carburetor air intake static pressure to the proper fuel pump relief valve connection; and

(ii) The gauge balance lines must be independently connected to the carburetor inlet pressure to avoid incorrect fuel pressure readings.

(2) The installation of fuel pumps having seals or diaphragms that may leak must have means for draining leaking fuel.

(3) Each drain line must discharge where it will not create a fire hazard.

[Amdt. 29-26, 53 FR 34217, Sept. 2, 1988]

§ 29.993 Fuel system lines and fittings.

(a) Each fuel line must be installed and supported to prevent excessive vibration and to withstand loads due to fuel pressure, valve actuation, and accelerated flight conditions.

(b) Each fuel line connected to components of the rotorcraft between which relative motion could exist must have provisions for flexibility.

(c) Each flexible connection in fuel lines that may be under pressure or subjected to axial loading must use flexible hose assemblies.

(d) Flexible hose must be approved.

(e) No flexible hose that might be adversely affected by high temperatures may be used where excessive temperatures will exist during operation or after engine shutdown.