

V_{so} =seaplane stalling speed (knots) with landing flaps extended in the appropriate position and with no slipstream effect; and β =angle of dead rise at appropriate station.

(2) The unsymmetrical pressure distribution consists of the pressures prescribed in paragraph (c)(1) of this section on one side of the hull or main float centerline and one-half of that pressure on the other side of the hull or main float centerline, in accordance with figure 3 of appendix I of this part.

(3) These pressures are uniform and must be applied simultaneously over the entire hull or main float bottom. The loads obtained must be carried into the sidewall structure of the hull proper, but need not be transmitted in a fore and aft direction as shear and bending loads.

[Doc. No. 26269, 58 FR 42161, Aug. 6, 1993; 58 FR 51970, Oct. 5, 1993]

§ 23.535 Auxiliary float loads.

(a) *General.* Auxiliary floats and their attachments and supporting structures must be designed for the conditions prescribed in this section. In the cases specified in paragraphs (b) through (e) of this section, the prescribed water loads may be distributed over the float bottom to avoid excessive local loads, using bottom pressures not less than those prescribed in paragraph (g) of this section.

(b) *Step loading.* The resultant water load must be applied in the plane of symmetry of the float at a point three-fourths of the distance from the bow to the step and must be perpendicular to the keel. The resultant limit load is computed as follows, except that the value of L need not exceed three times the weight of the displaced water when the float is completely submerged:

$$L = \frac{C_5 V_{so}^2 W^{\frac{2}{3}}}{\tan^{\frac{2}{3}} \beta_s (1 + r_y)^{\frac{2}{3}}}$$

where—

L=limit load (lbs.);

C_5 =0.0053;

V_{so} =seaplane stalling speed (knots) with landing flaps extended in the appropriate position and with no slipstream effect;

W=seaplane design landing weight in pounds;

β_s =angle of dead rise at a station $\frac{3}{4}$ of the distance from the bow to the step, but need not be less than 15 degrees; and

r_y =ratio of the lateral distance between the center of gravity and the plane of symmetry of the float to the radius of gyration in roll.

(c) *Bow loading.* The resultant limit load must be applied in the plane of symmetry of the float at a point one-fourth of the distance from the bow to the step and must be perpendicular to the tangent to the keel line at that point. The magnitude of the resultant load is that specified in paragraph (b) of this section.

(d) *Unsymmetrical step loading.* The resultant water load consists of a component equal to 0.75 times the load specified in paragraph (a) of this section and a side component equal to $0.025 \tan \beta$ times the load specified in paragraph (b) of this section. The side load must be applied perpendicularly to the plane of symmetry of the float at a point midway between the keel and the chine.

(e) *Unsymmetrical bow loading.* The resultant water load consists of a component equal to 0.75 times the load specified in paragraph (b) of this section and a side component equal to $0.25 \tan \beta$ times the load specified in paragraph (c) of this section. The side load must be applied perpendicularly to the plane of symmetry at a point midway between the keel and the chine.

(f) *Immersed float condition.* The resultant load must be applied at the centroid of the cross section of the float at a point one-third of the distance from the bow to the step. The limit load components are as follows:

$$\text{vertical} = PgV$$

$$\text{aft} = \frac{C_X PV^{\frac{2}{3}} (KV_{so})^2}{2}$$

$$\text{side} = \frac{C_Y PV^{\frac{2}{3}} (KV_{so})^2}{2}$$

where—

P=mass density of water (slugs/ft.³)

V=volume of float (ft.³);

C_X =coefficient of drag force, equal to 0.133;

C_Y =coefficient of side force, equal to 0.106;

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K=0.8, except that lower values may be used if it is shown that the floats are incapable of submerging at a speed of 0.8 V_{so} in normal operations;

V_{so}=seaplane stalling speed (knots) with landing flaps extended in the appropriate position and with no slipstream effect; and g=acceleration due to gravity (ft/sec²).

(g) *Float bottom pressures.* The float bottom pressures must be established under § 23.533, except that the value of K₂ in the formulae may be taken as 1.0. The angle of dead rise to be used in determining the float bottom pressures is set forth in paragraph (b) of this section.

[Doc. No. 26269, 58 FR 42162, Aug. 6, 1993; 58 FR 51970, Oct. 5, 1993]

§ 23.537 Seawing loads.

Seawing design loads must be based on applicable test data.

[Doc. No. 26269, 58 FR 42163, Aug. 6, 1993]

EMERGENCY LANDING CONDITIONS

§ 23.561 General.

(a) The airplane, although it may be damaged in emergency landing conditions, must be designed as prescribed in this section to protect each occupant under those conditions.

(b) The structure must be designed to give each occupant every reasonable chance of escaping serious injury when—

(1) Proper use is made of the seats, safety belts, and shoulder harnesses provided for in the design;

(2) The occupant experiences the static inertia loads corresponding to the following ultimate load factors—

(i) Upward, 3.0g for normal, utility, and commuter category airplanes, or 4.5g for acrobatic category airplanes;

(ii) Forward, 9.0g;

(iii) Sideward, 1.5g; and

(iv) Downward, 6.0g when certification to the emergency exit provisions of § 23.807(d)(4) is requested; and

(3) The items of mass within the cabin, that could injure an occupant, experience the static inertia loads corresponding to the following ultimate load factors—

(i) Upward, 3.0g;

(ii) Forward, 18.0g; and

(iii) Sideward, 4.5g.

(c) Each airplane with retractable landing gear must be designed to protect each occupant in a landing—

(1) With the wheels retracted;

(2) With moderate descent velocity; and

(3) Assuming, in the absence of a more rational analysis—

(i) A downward ultimate inertia force of 3 g; and

(ii) A coefficient of friction of 0.5 at the ground.

(d) If it is not established that a turnover is unlikely during an emergency landing, the structure must be designed to protect the occupants in a complete turnover as follows:

(1) The likelihood of a turnover may be shown by an analysis assuming the following conditions—

(i) The most adverse combination of weight and center of gravity position;

(ii) Longitudinal load factor of 9.0g;

(iii) Vertical load factor of 1.0g; and

(iv) For airplanes with tricycle landing gear, the nose wheel strut failed with the nose contacting the ground.

(2) For determining the loads to be applied to the inverted airplane after a turnover, an upward ultimate inertia load factor of 3.0g and a coefficient of friction with the ground of 0.5 must be used.

(e) Except as provided in § 23.787(c), the supporting structure must be designed to restrain, under loads up to those specified in paragraph (b)(3) of this section, each item of mass that could injure an occupant if it came loose in a minor crash landing.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-7, 34 FR 13090, Aug. 13, 1969; Amdt. 23-24, 52 FR 34745, Sept. 14, 1987; Amdt. 23-36, 53 FR 30812, Aug. 15, 1988; Amdt. 23-46, 59 FR 25772, May 17, 1994; Amdt. 23-48, 61 FR 5147, Feb. 9, 1996]

EFFECTIVE DATE NOTE: By Amdt. 23-62, 76 FR 75756, Dec. 2, 2011, § 23.561 was amended by adding new paragraph (e)(1), and adding and reserving paragraph (e)(2), effective Jan. 31, 2012. For the convenience of the user, the added text is set forth as follows:

§ 23.561 General.

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(e) * * *

(1) For engines mounted inside the fuselage, aft of the cabin, it must be shown by test or analysis that the engine and attached