

§ 23.337

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(ii) Mach 0.05 for normal, utility, and acrobatic category airplanes (at altitudes where  $M_D$  is established); or

(iii) Mach 0.07 for commuter category airplanes (at altitudes where  $M_D$  is established) unless a rational analysis, including the effects of automatic systems, is used to determine a lower margin. If a rational analysis is used, the minimum speed margin must be enough to provide for atmospheric variations (such as horizontal gusts), and the penetration of jet streams or cold fronts), instrument errors, airframe production variations, and must not be less than Mach 0.05.

(c) *Design maneuvering speed*  $V_A$ . For  $V_A$ , the following applies:

(1)  $V_A$  may not be less than  $V_S \sqrt{n}$  where—

(i)  $V_S$  is a computed stalling speed with flaps retracted at the design weight, normally based on the maximum airplane normal force coefficients,  $C_{NA}$ ; and

(ii)  $n$  is the limit maneuvering load factor used in design

(2) The value of  $V_A$  need not exceed the value of  $V_C$  used in design.

(d) *Design speed for maximum gust intensity*,  $V_B$ . For  $V_B$ , the following apply:

(1)  $V_B$  may not be less than the speed determined by the intersection of the line representing the maximum positive lift,  $C_{NMAX}$ , and the line representing the rough air gust velocity on the gust  $V$ - $n$  diagram, or  $V_{S1} \sqrt{n_g}$ , whichever is less, where:

(i)  $n_g$  the positive airplane gust load factor due to gust, at speed  $V_C$  (in accordance with § 23.341), and at the particular weight under consideration; and

(ii)  $V_{S1}$  is the stalling speed with the flaps retracted at the particular weight under consideration.

(2)  $V_B$  need not be greater than  $V_C$ .

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-7, 34 FR 13088, Aug. 13, 1969; Amdt. 23-16, 40 FR 2577, Jan. 14, 1975; Amdt. 23-34, 52 FR 1829, Jan. 15, 1987; Amdt. 23-24, 52 FR 34745, Sept. 14, 1987; Amdt. 23-48, 61 FR 5143, Feb. 9, 1996]

§ 23.337 **Limit maneuvering load factors.**

(a) The positive limit maneuvering load factor  $n$  may not be less than—

(1)  $2.1 + (24,000 + (W + 10,000))$  for normal and commuter category airplanes,

where  $W$ =design maximum takeoff weight, except that  $n$  need not be more than 3.8;

(2) 4.4 for utility category airplanes; or

(3) 6.0 for acrobatic category airplanes.

(b) The negative limit maneuvering load factor may not be less than—

(1) 0.4 times the positive load factor for the normal utility and commuter categories; or

(2) 0.5 times the positive load factor for the acrobatic category.

(c) Maneuvering load factors lower than those specified in this section may be used if the airplane has design features that make it impossible to exceed these values in flight.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-7, 34 FR 13088, Aug. 13, 1969; Amdt. 23-34, 52 FR 1829, Jan. 15, 1987; Amdt. 23-48, 61 FR 5144, Feb. 9, 1996]

§ 23.341 **Gust loads factors.**

(a) Each airplane must be designed to withstand loads on each lifting surface resulting from gusts specified in § 23.333(c).

(b) The gust load for a canard or tandem wing configuration must be computed using a rational analysis, or may be computed in accordance with paragraph (c) of this section, provided that the resulting net loads are shown to be conservative with respect to the gust criteria of § 23.333(c).

(c) In the absence of a more rational analysis, the gust load factors must be computed as follows—

$$n = 1 + \frac{K_g U_{de} V_a}{498 (W/S)}$$

Where—

$K_g$ = $0.88\mu_g/5.3 + \mu_g$ =gust alleviation factor;

$\mu_g$ = $2(W/S)/\rho$   $C_{ag}$ =airplane mass ratio;

$U_{de}$ =Derived gust velocities referred to in § 23.333(c) (f.p.s.);

$\rho$ =Density of air (slugs/cu.ft.);

$W/S$ =Wing loading (p.s.f.) due to the applicable weight of the airplane in the particular load case.

$W/S$ =Wing loading (p.s.f.);

$C$ =Mean geometric chord (ft.);

$g$ =Acceleration due to gravity (ft./sec.<sup>2</sup>)

$V$ =Airplane equivalent speed (knots); and

$\alpha$ =Slope of the airplane normal force coefficient curve  $C_{NA}$  per radian if the gust loads are applied to the wings and horizontal tail