§ 23.331 Symmetrical flight conditions.

(a) The appropriate balancing horizontal tail load must be accounted for in a rational or conservative manner when determining the wing loads and linear inertia loads corresponding to any of the symmetrical flight conditions specified in §§ 23.333 through 23.341.

(b) The incremental horizontal tail loads due to maneuvering and gusts must be reacted by the angular inertia of the airplane in a rational or conservative manner.

(c) Mutual influence of the aerodynamic surfaces must be taken into account when determining flight loads.


§ 23.333 Flight envelope.

(a) General. Compliance with the strength requirements of this subpart must be shown at any combination of airspeed and load factor on and within the boundaries of a flight envelope (similar to the one in paragraph (d) of this section) that represents the envelope of the flight loading conditions specified by the maneuvering and gust criteria of paragraphs (b) and (c) of this section respectively.

(b) Maneuvering envelope. Except where limited by maximum (static) lift coefficients, the airplane is assumed to be subjected to symmetrical maneuvers resulting in the following limit load factors:

1. The positive maneuvering load factor specified in § 23.337 at speeds up to \( V_D \);
2. The negative maneuvering load factor specified in § 23.337 at \( V_C \); and
3. Factors varying linearly with speed from the specified value at \( V_C \) to 0.0 at \( V_D \) for the normal and commuter category, and −1.0 at \( V_D \) for the aerobatic and utility categories.

(c) Gust envelope. (1) The airplane is assumed to be subjected to symmetrical vertical gusts in level flight. The resulting limit load factors must correspond to the conditions determined as follows:

1. Positive (up) and negative (down) gusts of 50 f.p.s. at \( V_C \) must be considered at altitudes between sea level and 20,000 feet. The gust velocity may be reduced linearly from 50 f.p.s. at 20,000 feet to 25 f.p.s. at 50,000 feet.
2. Positive and negative gusts of 25 f.p.s. at \( V_D \) must be considered at altitudes between sea level and 20,000 feet. The gust velocity may be reduced linearly from 25 f.p.s. at 20,000 feet to 12.5 f.p.s. at 50,000 feet.
3. Positive and negative rough air gusts of 66 f.p.s. at \( V_B \) must be considered at altitudes between sea level and 20,000 feet. The gust velocity may be reduced linearly from 66 f.p.s. at 20,000 feet to 38 f.p.s. at 50,000 feet.

(ii) Positive and negative gusts of 25 f.p.s. at \( V_D \) must be considered at altitudes between sea level and 20,000 feet. The gust velocity may be reduced linearly from 25 f.p.s. at 20,000 feet to 12.5 f.p.s. at 50,000 feet.

(iii) In addition, for commuter category airplanes, positive (up) and negative (down) rough air gusts of 66 f.p.s. at \( V_B \) must be considered at altitudes between sea level and 20,000 feet. The gust velocity may be reduced linearly from 66 f.p.s. at 20,000 feet to 38 f.p.s. at 50,000 feet.

(2) The following assumptions must be made:

(i) The shape of the gust is—

\[
U = \frac{U_{de}}{2} \left( 1 - \cos \frac{2\pi s}{25C} \right)
\]

Where—

- \( s \) = Distance penetrated into gust (ft.);
- \( C \) = Mean geometric chord of wing (ft.); and