§ 25.343  Design fuel and oil loads.

(a) The disposable load combinations must include each fuel and oil load in the range from zero fuel and oil to the selected maximum fuel and oil load. A structural reserve fuel condition, not exceeding 45 minutes of fuel under the operating conditions in § 25.1001(e) and (f), as applicable, may be selected.

(b) If a structural reserve fuel condition is selected, it must be used as the minimum fuel weight condition for showing compliance with the flight load requirements as prescribed in this subpart. In addition—

1. The structure must be designed for a condition of zero fuel and oil in the wing at limit loads corresponding to—

   (i) A maneuvering load factor of +2.25; and

   (ii) The gust conditions of § 25.341(a) but assuming 85% of the design velocities prescribed in § 25.341(a)(4).

2. Fatigue evaluation of the structure must account for any increase in operating stresses resulting from the design condition of paragraph (b)(1) of this section; and

3. The flutter, deformation, and vibration requirements must also be met with zero fuel.

§ 25.345  High lift devices.

(a) If wing flaps are to be used during takeoff, approach, or landing, at the design flap speeds established for these stages of flight under § 25.335(e) and with the wing flaps in the corresponding positions, the airplane is assumed to be subjected to symmetrical maneuvers and gusts. The resulting limit loads must correspond to the conditions determined as follows:

   (1) Maneuvering to a positive limit load factor of 2.0; and

   (2) Positive and negative gusts of 25 ft/sec EAS acting normal to the flight path in level flight. Gust loads resulting on each part of the structure must be determined by rational analysis. The analysis must take into account the unsteady aerodynamic characteristics and rigid body motions of the aircraft. The shape of the gust must be as described in § 25.341(a)(2) except that—

   \( U_{d}=25 \) ft/sec EAS;

   \( H=12.5 \) c; and

   c=mean geometric chord of the wing (feet).

   (b) The airplane must be designed for the conditions prescribed in paragraph (a) of this section, except that the airplane load factor need not exceed 1.0, taking into account, as separate conditions, the effects of—

   (1) Propeller slipstream corresponding to maximum continuous power at the design flap speeds \( V_f \) and with takeoff power at not less than 1.4 times the stalling speed for the particular flap position and associated maximum weight; and

   (2) A head-on gust of 25 feet per second velocity (EAS).

   (c) If flaps or other high lift devices are to be used in en route conditions, and with flaps in the appropriate position at speeds up to the flap design speed chosen for these conditions, the airplane is assumed to be subjected to symmetrical maneuvers and gusts within the range determined by—

   (1) Maneuvering to a positive limit load factor as prescribed in § 25.337(b); and

   (2) The discrete vertical gust criteria in § 25.341(a).

   (d) The airplane must be designed for a maneuvering load factor of 1.5 g at the maximum take-off weight with the wing-flaps and similar high lift devices in the landing configurations.
§ 25.361 Engine torque.

(a) Each engine mount and its supporting structure must be designed for the effects of—

(1) A limit engine torque corresponding to takeoff power and propeller speed acting simultaneously with 75 percent of the limit loads from flight condition A of §25.333(b);

(2) A limit torque corresponding to the maximum continuous power and propeller speed, acting simultaneously with the limit loads from flight condition A of §25.333(b); and

(3) For turbopropeller installations, in addition to the conditions specified gravity must be reacted in a rational or conservative manner considering the airplane inertia forces. In computing the tail loads the yawing velocity may be assumed to be zero.

(a) With the airplane in unaccelerated flight at zero yaw, it is assumed that the cockpit rudder control is suddenly displaced to achieve the resulting rudder deflection, as limited by:

(1) The control system on control surface stops; or

(2) A limit pilot force of 300 pounds from $V_{MC}$ to $V_A$ and 200 pounds from $V_C/M_C$ to $V_D/M_D$, with a linear variation between $V_A$ and $V_C/M_C$.

(b) With the cockpit rudder control deflected so as always to maintain the maximum rudder deflection available within the limitations specified in paragraph (a) of this section, it is assumed that the airplane yaws to the overwing sideslip angle.

(c) With the airplane yawed to the static equilibrium sideslip angle, it is assumed that the cockpit rudder control is suddenly returned to neutral.


SUPPLEMENTARY CONDITIONS

§ 25.361 Engine torque.

(a) Each engine mount and its supporting structure must be designed for the effects of—

(1) A limit engine torque corresponding to takeoff power and propeller speed acting simultaneously with 75 percent of the limit loads from flight condition A of §25.333(b);

(2) A limit torque corresponding to the maximum continuous power and propeller speed, acting simultaneously with the limit loads from flight condition A of §25.333(b); and

(3) For turbopropeller installations, in addition to the conditions specified gravity must be reacted in a rational or conservative manner considering the airplane inertia forces. In computing the tail loads the yawing velocity may be assumed to be zero.

(a) With the airplane in unaccelerated flight at zero yaw, it is assumed that the cockpit rudder control is suddenly displaced to achieve the resulting rudder deflection, as limited by:

(1) The control system on control surface stops; or

(2) A limit pilot force of 300 pounds from $V_{MC}$ to $V_A$ and 200 pounds from $V_C/M_C$ to $V_D/M_D$, with a linear variation between $V_A$ and $V_C/M_C$.

(b) With the cockpit rudder control deflected so as always to maintain the maximum rudder deflection available within the limitations specified in paragraph (a) of this section, it is assumed that the airplane yaws to the overwing sideslip angle.

(c) With the airplane yawed to the static equilibrium sideslip angle, it is assumed that the cockpit rudder control is suddenly returned to neutral.


SUPPLEMENTARY CONDITIONS

§ 25.361 Engine torque.

(a) Each engine mount and its supporting structure must be designed for the effects of—

(1) A limit engine torque corresponding to takeoff power and propeller speed acting simultaneously with 75 percent of the limit loads from flight condition A of §25.333(b);

(2) A limit torque corresponding to the maximum continuous power and propeller speed, acting simultaneously with the limit loads from flight condition A of §25.333(b); and

(3) For turbopropeller installations, in addition to the conditions specified gravity must be reacted in a rational or conservative manner considering the airplane inertia forces. In computing the tail loads the yawing velocity may be assumed to be zero.

(a) With the airplane in unaccelerated flight at zero yaw, it is assumed that the cockpit rudder control is suddenly displaced to achieve the resulting rudder deflection, as limited by:

(1) The control system on control surface stops; or

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(b) With the cockpit rudder control deflected so as always to maintain the maximum rudder deflection available within the limitations specified in paragraph (a) of this section, it is assumed that the airplane yaws to the overwing sideslip angle.

(c) With the airplane yawed to the static equilibrium sideslip angle, it is assumed that the cockpit rudder control is suddenly returned to neutral.