equal in magnitude and opposite in direction to the rotorcraft inertia load factor at the center of gravity.

(b) Compliance with the flight load requirements of this subpart must be shown—

(1) At each weight from the design minimum weight to the design maximum weight; and

(2) With any practical distribution of disposable load within the operating limitations in the Rotorcraft Flight Manual.


§ 27.337 Limit maneuvering load factor.

The rotorcraft must be designed for—

(a) A limit maneuvering load factor ranging from a positive limit of 3.5 to a negative limit of –1.0; or

(b) Any positive limit maneuvering load factor not less than 2.0 and any negative limit maneuvering load factor of not less than –0.5 for which—

(1) The probability of being exceeded is shown by analysis and flight tests to be extremely remote; and

(2) The selected values are appropriate to each weight condition between the design maximum and design minimum weights.

[Amdt. 27–26, 55 FR 7999, Mar. 6, 1990]

§ 27.339 Resultant limit maneuvering loads.

The loads resulting from the application of limit maneuvering load factors are assumed to act at the center of each rotor hub and at each auxiliary lifting surface, and to act in directions, and with distributions of load among the rotors and auxiliary lifting surfaces, so as to represent each critical maneuvering condition, including power-on and power-off flight with the maximum design rotor tip speed ratio. The rotor tip speed ratio is the ratio of the rotorcraft flight velocity component in the plane of the rotor disc to the rotational tip speed of the rotor blades, and is expressed as follows:

\[ \mu = \frac{V \cos \alpha}{\Omega R} \]

where—

- \( V \) = The airspeed along flight path (f.p.s.);
- \( \alpha \) = The angle between the projection, in the plane of symmetry, of the axis of no feathering and a line perpendicular to the flight path (radians, positive when axis is pointing aft);
- \( \omega \) = The angular velocity of rotor (radians per second); and
- \( R \) = The rotor radius (ft).


§ 27.341 Gust loads.

The rotorcraft must be designed to withstand, at each critical airspeed including hovering, the loads resulting from a vertical gust of 30 feet per second.

§ 27.351 Yawing conditions.

(a) Each rotorcraft must be designed for the loads resulting from the maneuvers specified in paragraphs (b) and (c) of this section with—

(1) Unbalanced aerodynamic moments about the center of gravity which the aircraft reacts to in a rational or conservative manner considering the principal masses furnishing the reacting inertia forces; and

(2) Maximum main rotor speed.

(b) To produce the load required in paragraph (a) of this section, in unaccelerated flight with zero yaw, at forward speeds from zero up to 0.6 \( V_{NE} \)—

(1) Displace the cockpit directional control suddenly to the maximum deflection limited by the control stops or by the maximum pilot force specified in §27.397(a);

(2) Attain a resulting sideslip angle or 90°, whichever is less; and

(3) Return the directional control suddenly to neutral.

(c) To produce the load required in paragraph (a) of this section, in unaccelerated flight with zero yaw, at forward speeds from 0.6 \( V_{NE} \) up to \( V_{NE} \) or \( V_H \), whichever is less—

(1) Displace the cockpit directional control suddenly to the maximum deflection limited by the control stops or by the maximum pilot force specified in §27.397(a);

(2) Attain a resulting sideslip angle or 15°, whichever is less, at the lesser speed of \( V_{NE} \) or \( V_H \).
§ 27.361 Engine torque.

(a) For turbine engines, the limit torque may not be less than the highest of—

(1) The mean torque for maximum continuous power multiplied by 1.25;
(2) The torque required by §27.923;
(3) The torque required by §27.927; or
(4) The torque imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming).

(b) For reciprocating engines, the limit torque may not be less than the mean torque for maximum continuous power multiplied by—

(1) 1.33, for engines with five or more cylinders; and
(2) Two, three, and four, for engines with four, three, and two cylinders, respectively.

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(a) For turbine engines, the limit torque may not be less than the highest of—

(1) The mean torque for maximum continuous power multiplied by 1.25;
(2) The torque required by §27.923;
(3) The torque required by §27.927; or
(4) The torque imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming).

(b) For reciprocating engines, the limit torque may not be less than the mean torque for maximum continuous power multiplied by—

(1) 1.33, for engines with five or more cylinders; and
(2) Two, three, and four, for engines with four, three, and two cylinders, respectively.

§ 27.391 Control system.

The part of each control system from the pilot's controls to the control stops must be designed to withstand pilot forces of not less than—

(1) The forces specified in §27.397; or
(2) If the system prevents the pilot from applying the limit pilot forces to the system, the maximum forces that the system allows the pilot to apply, but not less than 0.60 times the forces specified in §27.397.

§ 27.397 Limit pilot forces and torques.

(a) Except as provided in paragraph (b) of this section, the limit pilot forces are as follows:

(1) For foot controls, 130 pounds.
(2) For stick controls, 100 pounds fore and aft, and 67 pounds laterally.

(b) For flap, tab, stabilizer, rotor brake, and landing gear operating controls, the follows apply (R=radius in inches):

(1) Crank, wheel, and lever controls, \(1+R/3 \times 50\) pounds, but not less than 50 pounds nor more than 100 pounds for hand operated controls or 130 pounds for foot operated controls, applied at any angle within 20 degrees of the plane of motion of the control.