yaw must be mild and readily controllable, using normal piloting techniques. When the airplane is trimmed at V_{MO}/M_{MO}, the slope of the elevator control force versus speed curve need not be stable at speeds greater than V_{FC}/M_{FC}, but there must be a push force at all speeds up to V_{DF}/M_{DF} and there must be no sudden or excessive reduction of elevator control force as V_{DF}/M_{DF} is reached.

(4) Adequate roll capability to assure a prompt recovery from a lateral upset condition must be available at any speed up to V_{DF}/M_{DF}.

(5) With the airplane trimmed at V_{MO}/M_{MO}, extension of the speedbrakes over the available range of movements of the pilot's control, at all speeds above V_{MO}/M_{MO}, but not so high that V_{DF}/M_{DF} would be exceeded during the maneuver, must not result in:

(i) An excessive positive load factor when the pilot does not take action to counteract the effects of extension;

(ii) Buffeting that would impair the pilot's ability to read the instruments or control the airplane for recovery; or

(iii) A nose down pitching moment, unless it is small.

(b) *Maximum speed for stability characteristics, V_{FC}/M_{FC}.* V_{FC}/M_{FC} is the maximum speed at which the requirements of §§25.143(g), 25.147(f), 25.175(b)(1), 25.177(a) through (c), and 25.181 must be met with flaps and landing gear retracted. Except as noted in §25.253(c), V_{FC}/M_{FC} may not be less than a speed midway between V_{MO}/M_{MO} and V_{DF}/M_{DF}, except that, for altitudes where Mach number is the limiting factor, M_{FC} need not exceed the Mach number at which effective speed warning occurs.

(c) *Maximum speed for stability characteristics in icing conditions.* The maximum speed for stability characteristics with the most critical of the ice accretions defined in Appendices C and O of this part, as applicable, in accordance with §25.21(g), at which the requirements of §§25.143(g), 25.147(f), 25.175(b)(1), 25.177(a) through (c), and 25.181 must be met, is the lower of:

(1) 300 knots CAS;

(2) V_{FC}; or

(3) A speed at which it is demonstrated that the airframe will be free of ice accretion due to the effects of increased dynamic pressure.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25–23, 35 FR 5671, Apr. 8, 1970; Amdt. 25–54, 45 FR 60172, Sept. 11, 1980; Amdt. 25–72, 55 FR 29775, July 20, 1990; Amdt. 25–84, 60 FR 30750, June 9, 1995; Amdt. 25–121, 72 FR 44668, Aug. 8, 2007; Amdt. 25–135, 76 FR 74654, Dec. 1, 2011; Amdt. 25–140,79 FR 65525, Nov. 4, 2014]

§25.255 Out-of-trim characteristics.

(a) From an initial condition with the airplane trimmed at cruise speeds up to V_{MO}/M_{MO}, the airplane must have satisfactory maneuvering stability and controllability with the degree of out-of-trim in both the airplane nose-up and nose-down directions, which results from the greater of—

(1) A three-second movement of the longitudinal trim system at its normal rate for the particular flight condition with no aerodynamic load (or an equivalent degree of trim for airplanes that do not have a power-operated trim system), except as limited by stops in the trim system, including those required by §25.655(b) for adjustable stabilizers; or

(2) The maximum mistrim that can be sustained by the autopilot while maintaining level flight in the high speed cruising condition.

(b) In the out-of-trim condition specified in paragraph (a) of this section, when the normal acceleration is varied from + 1 g to the positive and negative values specified in paragraph (c) of this section—

(1) The stick force vs. g curve must have a positive slope at any speed up to and including V_{FC}/M_{FC}; and

(2) At speeds between V_{FC}/M_{FC} and V_{DF}/M_{DF} the direction of the primary longitudinal control force may not reverse.

(c) Except as provided in paragraphs (d) and (e) of this section, compliance with the provisions of paragraph (a) of this section must be demonstrated in flight over the acceleration range—

(1) −1 g to + 2.5 g; or

(2) 0 g to 2.0 g, and extrapolating by an acceptable method to −1 g and + 2.5 g.

(d) If the procedure set forth in paragraph (c)(2) of this section is used to demonstrate compliance and marginal conditions exist during flight test with regard to reversal of primary longitudinal control force, flight tests must be accomplished from the normal acceleration at which a marginal condition is found to exist to the applicable limit specified in paragraph (b)(1) of this section.

(e) During flight tests required by paragraph (a) of this section, the limit maneuvering load factors prescribed in §§ 25.333(b) and 25.337, and the maneuvering load factors associated with probable inadvertent excursions beyond the boundaries of the buffet onset envelopes determined under § 25.251(e), need not be exceeded. In addition, the entry speeds for flight test demonstrations at normal acceleration values less than 1 g must be limited to the extent necessary to accomplish a recovery without exceeding V_{DF}/M_{DF}.

(f) In the out-of-trim condition specified in paragraph (a) of this section, it must be possible from an overspeed condition at V_{DF}/M_{DF} to produce at least 1.5 g for recovery by applying not more than 125 pounds of longitudinal control force using either the primary longitudinal control alone or the primary longitudinal control and the longitudinal trim system. If the longitudinal trim is used to assist in producing the required load factor, it must be shown at V_{DF}/M_{DF} that the longitudinal trim can be actuated in the airplane nose-up direction with the primary surface loaded to correspond to the least of the following airplane nose-up control forces:

(1) The maximum control forces expected in service as specified in §§ 25.301 and 25.397.

(2) The control force required to produce 1.5 g.

(3) The control force corresponding to buffeting or other phenomena of such intensity that it is a strong deterrent to further application of primary longitudinal control force.

[Amdt. 25–42, 43 FR 2322, Jan. 16, 1978]

Subpart C—Structure

GENERAL

§ 25.301 Loads.

(a) Strength requirements are specified in terms of limit loads (the maximum loads to be expected in service) and ultimate loads (limit loads multiplied by prescribed factors of safety). Unless otherwise provided, prescribed loads are limit loads.

(b) Unless otherwise provided, the specified air, ground, and water loads must be placed in equilibrium with inertia forces, considering each item of mass in the airplane. These loads must be distributed to conservatively approximate or closely represent actual conditions. Methods used to determine load intensities and distribution must be validated by flight load measurement unless the methods used for determining those loading conditions are shown to be reliable.

(c) If deflections under load would significantly change the distribution of external or internal loads, this redistribution must be taken into account.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25–23, 35 FR 5672, Apr. 8, 1970]

§ 25.303 Factor of safety.

Unless otherwise specified, a factor of safety of 1.5 must be applied to the prescribed limit load which are considered external loads on the structure. When a loading condition is prescribed in terms of ultimate loads, a factor of safety need not be applied unless otherwise specified.

[Amdt. 25–23, 35 FR 5672, Apr. 8, 1970]

§ 25.305 Strength and deformation.

(a) The structure must be able to support limit loads without detrimental permanent deformation. At any load up to limit loads, the deformation may not interfere with safe operation.

(b) The structure must be able to support ultimate loads without failure for at least 3 seconds. However, when proof of strength is shown by dynamic tests simulating actual load conditions, the 3-second limit does not apply. Static tests conducted to ultimate load must include the ultimate deflections and ultimate deformation induced by the loading. When analytical methods are used to show compliance with the ultimate load strength requirements, it must be shown that—

(1) The effects of deformation are not significant;