

## § 25.177

(4) The airplane trimmed at  $1.3 V_{SR1}$  with enough power to maintain level flight at this speed.

(d) *Landing*. The stick force curve must have a stable slope, and the stick force may not exceed 80 pounds, at speeds between  $V_{SW}$  and  $1.7 V_{SR0}$  with—

- (1) Wing flaps in the landing position;
- (2) Landing gear extended;
- (3) Maximum landing weight;
- (4) The airplane trimmed at  $1.3 V_{SR0}$  with—
  - (i) Power or thrust off, and
  - (ii) Power or thrust for level flight.
- (5) The airplane trimmed at  $1.3 V_{SR0}$  with power or thrust off.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-7, 30 FR 13117, Oct. 15, 1965; Amdt. 25-108, 67 FR 70827, Nov. 26, 2002; Amdt. 25-115, 69 FR 40527, July 2, 2004]

## § 25.177 Static lateral-directional stability.

(a)–(b) [Reserved]

(c) In straight, steady sideslips, the aileron and rudder control movements and forces must be substantially proportional to the angle of sideslip in a stable sense; and the factor of proportionality must lie between limits found necessary for safe operation throughout the range of sideslip angles appropriate to the operation of the airplane. At greater angles, up to the angle at which full rudder is used or a rudder force of 180 pounds is obtained, the rudder pedal forces may not reverse; and increased rudder deflection must be needed for increased angles of sideslip. Compliance with this paragraph must be demonstrated for all landing gear and flap positions and symmetrical power conditions at speeds from  $1.13 V_{SR1}$  to  $V_{FE}$ ,  $V_{LE}$ , or  $V_{FC}/M_{FC}$ , as appropriate.

(d) The rudder gradients must meet the requirements of paragraph (c) at speeds between  $V_{MO}/M_{MO}$  and  $V_{FC}/M_{FC}$  except that the dihedral effect (aileron deflection opposite the corresponding rudder input) may be negative provided the divergence is gradual, easily recognized, and easily controlled by the pilot.

[Amdt. 25-72, 55 FR 29774, July 20, 1990; 55 FR 37607, Sept. 12, 1990; Amdt. 25-108, 67 FR 70827, Nov. 26, 2002]

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### § 25.181 Dynamic stability.

(a) Any short period oscillation, not including combined lateral-directional oscillations, occurring between  $1.13 V_{SR}$  and maximum allowable speed appropriate to the configuration of the airplane must be heavily damped with the primary controls—

- (1) Free; and
- (2) In a fixed position.

(b) Any combined lateral-directional oscillations (“Dutch roll”) occurring between  $1.13 V_{SR}$  and maximum allowable speed appropriate to the configuration of the airplane must be positively damped with controls free, and must be controllable with normal use of the primary controls without requiring exceptional pilot skill.

[Amdt. 25-42, 43 FR 2322, Jan. 16, 1978, as amended by Amdt. 25-72, 55 FR 29775, July 20, 1990; 55 FR 37607, Sept. 12, 1990; Amdt. 25-108, 67 FR 70827, Nov. 26, 2002]

### STALLS

#### § 25.201 Stall demonstration.

(a) Stalls must be shown in straight flight and in 30 degree banked turns with—

- (1) Power off; and
- (2) The power necessary to maintain level flight at  $1.5 V_{SR1}$  (where  $V_{SR1}$  corresponds to the reference stall speed at maximum landing weight with flaps in the approach position and the landing gear retracted).

(b) In each condition required by paragraph (a) of this section, it must be possible to meet the applicable requirements of § 25.203 with—

- (1) Flaps, landing gear, and deceleration devices in any likely combination of positions approved for operation;
- (2) Representative weights within the range for which certification is requested;
- (3) The most adverse center of gravity for recovery; and
- (4) The airplane trimmed for straight flight at the speed prescribed in § 25.103(b)(6).

(c) The following procedures must be used to show compliance with § 25.203:

- (1) Starting at a speed sufficiently above the stalling speed to ensure that a steady rate of speed reduction can be established, apply the longitudinal control so that the speed reduction

does not exceed one knot per second until the airplane is stalled.

(2) In addition, for turning flight stalls, apply the longitudinal control to achieve airspeed deceleration rates up to 3 knots per second.

(3) As soon as the airplane is stalled, recover by normal recovery techniques.

(d) The airplane is considered stalled when the behavior of the airplane gives the pilot a clear and distinctive indication of an acceptable nature that the airplane is stalled. Acceptable indications of a stall, occurring either individually or in combination, are—

(1) A nose-down pitch that cannot be readily arrested;

(2) Buffeting, of a magnitude and severity that is a strong and effective deterrent to further speed reduction; or

(3) The pitch control reaches the aft stop and no further increase in pitch attitude occurs when the control is held full aft for a short time before recovery is initiated.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-84, 60 FR 30750, June 9, 1995; Amdt. 25-108, 67 FR 70827, Nov. 26, 2002]

#### § 25.203 Stall characteristics.

(a) It must be possible to produce and to correct roll and yaw by unreversed use of the aileron and rudder controls, up to the time the airplane is stalled. No abnormal nose-up pitching may occur. The longitudinal control force must be positive up to and throughout the stall. In addition, it must be possible to promptly prevent stalling and to recover from a stall by normal use of the controls.

(b) For level wing stalls, the roll occurring between the stall and the completion of the recovery may not exceed approximately 20 degrees.

(c) For turning flight stalls, the action of the airplane after the stall may not be so violent or extreme as to make it difficult, with normal piloting skill, to effect a prompt recovery and to regain control of the airplane. The maximum bank angle that occurs during the recovery may not exceed—

(1) Approximately 60 degrees in the original direction of the turn, or 30 degrees in the opposite direction, for deceleration rates up to 1 knot per second; and

(2) Approximately 90 degrees in the original direction of the turn, or 60 degrees in the opposite direction, for deceleration rates in excess of 1 knot per second.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-84, 60 FR 30750, June 9, 1995]

#### § 25.207 Stall warning.

(a) Stall warning with sufficient margin to prevent inadvertent stalling with the flaps and landing gear in any normal position must be clear and distinctive to the pilot in straight and turning flight.

(b) The warning must be furnished either through the inherent aerodynamic qualities of the airplane or by a device that will give clearly distinguishable indications under expected conditions of flight. However, a visual stall warning device that requires the attention of the crew within the cockpit is not acceptable by itself. If a warning device is used, it must provide a warning in each of the airplane configurations prescribed in paragraph (a) of this section at the speed prescribed in paragraphs (c) and (d) of this section.

(c) When the speed is reduced at rates not exceeding one knot per second, stall warning must begin, in each normal configuration, at a speed,  $V_{SW}$ , exceeding the speed at which the stall is identified in accordance with § 25.201(d) by not less than five knots or five percent CAS, whichever is greater. Once initiated, stall warning must continue until the angle of attack is reduced to approximately that at which stall warning began.

(d) In addition to the requirement of paragraph (c) of this section, when the speed is reduced at rates not exceeding one knot per second, in straight flight with engines idling and at the center-of-gravity position specified in § 25.103(b)(5),  $V_{SW}$ , in each normal configuration, must exceed  $V_{SR}$  by not less than three knots or three percent CAS, whichever is greater.

(e) The stall warning margin must be sufficient to allow the pilot to prevent stalling (as defined in § 25.201(d)) when recovery is initiated not less than one second after the onset of stall warning in slow-down turns with at least 1.5g load factor normal to the flight path