

**§ 25.175 Demonstration of static longitudinal stability.**

Static longitudinal stability must be shown as follows:

(a) *Climb.* The stick force curve must have a stable slope at speeds between 85 and 115 percent of the speed at which the airplane—

- (1) Is trimmed, with—
  - (i) Wing flaps retracted;
  - (ii) Landing gear retracted;
  - (iii) Maximum takeoff weight; and
  - (iv) 75 percent of maximum continuous power for reciprocating engines or the maximum power or thrust selected by the applicant as an operating limitation for use during climb for turbine engines; and

(2) Is trimmed at the speed for best rate-of-climb except that the speed need not be less than  $1.3 V_{SR1}$ .

(b) *Cruise.* Static longitudinal stability must be shown in the cruise condition as follows:

(1) With the landing gear retracted at high speed, the stick force curve must have a stable slope at all speeds within a range which is the greater of 15 percent of the trim speed plus the resulting free return speed range, or 50 knots plus the resulting free return speed range, above and below the trim speed (except that the speed range need not include speeds less than  $1.3 V_{SR1}$ , nor speeds greater than  $V_{FC}/M_{FC}$ , nor speeds that require a stick force of more than 50 pounds), with—

- (i) The wing flaps retracted;
- (ii) The center of gravity in the most adverse position (see § 25.27);
- (iii) The most critical weight between the maximum takeoff and maximum landing weights;
- (iv) 75 percent of maximum continuous power for reciprocating engines or for turbine engines, the maximum cruising power selected by the applicant as an operating limitation (see § 25.1521), except that the power need not exceed that required at  $V_{MO}/M_{MO}$ ; and

(v) The airplane trimmed for level flight with the power required in paragraph (b)(1)(iv) of this section.

(2) With the landing gear retracted at low speed, the stick force curve must have a stable slope at all speeds within a range which is the greater of 15 percent of the trim speed plus the result-

ing free return speed range, or 50 knots plus the resulting free return speed range, above and below the trim speed (except that the speed range need not include speeds less than  $1.3 V_{SR1}$ , nor speeds greater than the minimum speed of the applicable speed range prescribed in paragraph (b)(1), nor speeds that require a stick force of more than 50 pounds), with—

- (i) Wing flaps, center of gravity position, and weight as specified in paragraph (b)(1) of this section;
- (ii) Power required for level flight at a speed equal to  $(V_{MO} + 1.3 V_{SR1})/2$ ; and
- (iii) The airplane trimmed for level flight with the power required in paragraph (b)(2)(i) of this section.

(3) With the landing gear extended, the stick force curve must have a stable slope at all speeds within a range which is the greater of 15 percent of the trim speed plus the resulting free return speed range, or 50 knots plus the resulting free return speed range, above and below the trim speed (except that the speed range need not include speeds less than  $1.3 V_{SR1}$ , nor speeds greater than  $V_{LE}$ , nor speeds that require a stick force of more than 50 pounds), with—

- (i) Wing flap, center of gravity position, and weight as specified in paragraph (b)(1) of this section;
- (ii) 75 percent of maximum continuous power for reciprocating engines or, for turbine engines, the maximum cruising power selected by the applicant as an operating limitation, except that the power need not exceed that required for level flight at  $V_{LE}$ ; and
- (iii) The aircraft trimmed for level flight with the power required in paragraph (b)(3)(i) of this section.

(c) *Approach.* The stick force curve must have a stable slope at speeds between  $V_{SW}$  and  $1.7 V_{SR1}$ , with—

- (1) Wing flaps in the approach position;
- (2) Landing gear retracted;
- (3) Maximum landing weight; and
- (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;

## § 25.177

- (2) Landing gear extended;
- (3) Maximum landing weight;
- (4) Power or thrust off on the engines; and
- (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]

### § 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]

### § 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

## 14 CFR Ch. I (1-1-04 Edition)

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