

(2) With landing gear and flaps extended, power off, and the airplane as nearly as possible in trim at  $1.3 V_{SO}$ , quickly apply takeoff power and retract the flaps as rapidly as possible to the recommended go around setting and allow the airspeed to transition from  $1.3 V_{SO}$  to  $1.3 V_{S1}$ . Retract the gear when a positive rate of climb is established.

(3) With landing gear and flaps extended, in level flight, power necessary to attain level flight at  $1.1 V_{SO}$ , and the airplane as nearly as possible in trim, it must be possible to maintain approximately level flight while retracting the flaps as rapidly as possible with simultaneous application of not more than maximum continuous power. If gated flat positions are provided, the flap retraction may be demonstrated in stages with power and trim reset for level flight at  $1.1 V_{S1}$ , in the initial configuration for each stage—

(i) From the fully extended position to the most extended gated position;

(ii) Between intermediate gated positions, if applicable; and

(iii) From the least extended gated position to the fully retracted position.

(4) With power off, flaps and landing gear retracted and the airplane as nearly as possible in trim at  $1.4 V_{S1}$ , apply takeoff power rapidly while maintaining the same airspeed.

(5) With power off, landing gear and flaps extended, and the airplane as nearly as possible in trim at  $V_{REF}$ , obtain and maintain airspeeds between  $1.1 V_{SO}$ , and either  $1.7 V_{SO}$  or  $V_{FE}$ , whichever is lower without requiring the application of two-handed control forces exceeding those specified in § 23.143(c).

(6) With maximum takeoff power, landing gear retracted, flaps in the takeoff position, and the airplane as nearly as possible in trim at  $V_{FE}$  appropriate to the takeoff flap position, retract the flaps as rapidly as possible while maintaining constant speed.

(c) At speeds above  $V_{MO}/M_{MO}$ , and up to the maximum speed shown under § 23.251, a maneuvering capability of 1.5 g must be demonstrated to provide a margin to recover from upset or inadvertent speed increase.

(d) It must be possible, with a pilot control force of not more than 10

pounds, to maintain a speed of not more than  $V_{REF}$  during a power-off glide with landing gear and wing flaps extended, for any weight of the airplane, up to and including the maximum weight.

(e) By using normal flight and power controls, except as otherwise noted in paragraphs (e)(1) and (e)(2) of this section, it must be possible to establish a zero rate of descent at an attitude suitable for a controlled landing without exceeding the operational and structural limitations of the airplane, as follows:

(1) For single-engine and multiengine airplanes, without the use of the primary longitudinal control system.

(2) For multiengine airplanes—

(i) Without the use of the primary directional control; and

(ii) If a single failure of any one connecting or transmitting link would affect both the longitudinal and directional primary control system, without the primary longitudinal and directional control system.

[Doc. No. 26269, 58 FR 42157, Aug. 6, 1993; Amdt. 23-45, 58 FR 51970, Oct. 5, 1993, as amended by Amdt. 23-50, 61 FR 5188, Feb. 9, 1996]

#### § 23.147 Directional and lateral control.

(a) For each multiengine airplane, it must be possible, while holding the wings level within five degrees, to make sudden changes in heading safely in both directions. This ability must be shown at  $1.4 V_{S1}$  with heading changes up to 15 degrees, except that the heading change at which the rudder force corresponds to the limits specified in § 23.143 need not be exceeded, with the—

(1) Critical engine inoperative and its propeller in the minimum drag position;

(2) Remaining engines at maximum continuous power;

(3) Landing gear—

(i) Retracted; and

(ii) Extended; and

(4) Flaps retracted.

(b) For each multiengine airplane, it must be possible to regain full control of the airplane without exceeding a bank angle of 45 degrees, reaching a dangerous attitude or encountering dangerous characteristics, in the event

## § 23.149

of a sudden and complete failure of the critical engine, making allowance for a delay of two seconds in the initiation of recovery action appropriate to the situation, with the airplane initially in trim, in the following condition:

- (1) Maximum continuous power on each engine;
- (2) The wing flaps retracted;
- (3) The landing gear retracted;
- (4) A speed equal to that at which compliance with § 23.69(a) has been shown; and
- (5) All propeller controls in the position at which compliance with § 23.69(a) has been shown.

(c) For all airplanes, it must be shown that the airplane is safely controllable without the use of the primary lateral control system in any all-engine configuration(s) and at any speed or altitude within the approved operating envelope. It must also be shown that the airplane's flight characteristics are not impaired below a level needed to permit continued safe flight and the ability to maintain attitudes suitable for a controlled landing without exceeding the operational and structural limitations of the airplane. If a single failure of any one connecting or transmitting link in the lateral control system would also cause the loss of additional control system(s), compliance with the above requirement must be shown with those additional systems also assumed to be inoperative.

[Doc. No. 27807, 61 FR 5188, Feb. 9, 1996]

### § 23.149 Minimum control speed.

(a)  $V_{MC}$  is the calibrated airspeed at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with that engine still inoperative, and thereafter maintain straight flight at the same speed with an angle of bank of not more than 5 degrees. The method used to simulate critical engine failure must represent the most critical mode of powerplant failure expected in service with respect to controllability.

(b)  $V_{MC}$  for takeoff must not exceed  $1.2 V_{S1}$ , where  $V_{S1}$  is determined at the maximum takeoff weight.  $V_{MC}$  must be determined with the most unfavorable weight and center of gravity position and with the airplane airborne and the

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

ground effect negligible, for the takeoff configuration(s) with—

- (1) Maximum available takeoff power initially on each engine;
- (2) The airplane trimmed for takeoff;
- (3) Flaps in the takeoff position(s);
- (4) Landing gear retracted; and
- (5) All propeller controls in the recommended takeoff position throughout.

(c) For all airplanes except reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, the conditions of paragraph (a) of this section must also be met for the landing configuration with—

- (1) Maximum available takeoff power initially on each engine;
- (2) The airplane trimmed for an approach, with all engines operating, at  $V_{REF}$ , at an approach gradient equal to the steepest used in the landing distance demonstration of § 23.75;
- (3) Flaps in the landing position;
- (4) Landing gear extended; and
- (5) All propeller controls in the position recommended for approach with all engines operating.

(d) A minimum speed to intentionally render the critical engine inoperative must be established and designated as the safe, intentional, one-engine-inoperative speed,  $V_{SSE}$ .

(e) At  $V_{MC}$ , the rudder pedal force required to maintain control must not exceed 150 pounds and it must not be necessary to reduce power of the operative engine(s). During the maneuver, the airplane must not assume any dangerous attitude and it must be possible to prevent a heading change of more than 20 degrees.

(f) At the option of the applicant, to comply with the requirements of § 23.51(c)(1),  $V_{MCG}$  may be determined.  $V_{MCG}$  is the minimum control speed on the ground, and is the calibrated airspeed during the takeoff run at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane using the rudder control alone (without the use of nosewheel steering), as limited by 150 pounds of force, and using the lateral control to the extent of keeping the wings level to enable the takeoff to be safely continued. In the determination of  $V_{MCG}$ , assuming that the path of