

equal to the takeoff distance. If the takeoff distance includes a clearway—

(1) The takeoff run on a dry runway is the greater of—

(i) The horizontal distance along the takeoff path from the start of the takeoff to a point equidistant between the point at which  $V_{LOF}$  is reached and the point at which the airplane is 35 feet above the takeoff surface, as determined under §25.111 for a dry runway; or

(ii) 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to a point equidistant between the point at which  $V_{LOF}$  is reached and the point at which the airplane is 35 feet above the takeoff surface, determined by a procedure consistent with §25.111.

(2) The takeoff run on a wet runway is the greater of—

(i) The horizontal distance along the takeoff path from the start of the takeoff to the point at which the airplane is 15 feet above the takeoff surface, achieved in a manner consistent with the achievement of  $V_2$  before reaching 35 feet above the takeoff surface, as determined under §25.111 for a wet runway; or

(ii) 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to a point equidistant between the point at which  $V_{LOF}$  is reached and the point at which the airplane is 35 feet above the takeoff surface, determined by a procedure consistent with §25.111.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-23, 35 FR 5671, Apr. 8, 1970; Amdt. 25-92, 63 FR 8320, Feb. 18, 1998]

#### § 25.115 Takeoff flight path.

(a) The takeoff flight path shall be considered to begin 35 feet above the takeoff surface at the end of the takeoff distance determined in accordance with §25.113(a) or (b), as appropriate for the runway surface condition.

(b) The net takeoff flight path data must be determined so that they represent the actual takeoff flight paths (determined in accordance with §25.111 and with paragraph (a) of this section) reduced at each point by a gradient of climb equal to—

(1) 0.8 percent for two-engine airplanes;

(2) 0.9 percent for three-engine airplanes; and

(3) 1.0 percent for four-engine airplanes.

(c) The prescribed reduction in climb gradient may be applied as an equivalent reduction in acceleration along that part of the takeoff flight path at which the airplane is accelerated in level flight.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-92, 63 FR 8320, Feb. 18, 1998]

#### § 25.117 Climb: general.

Compliance with the requirements of §§25.119 and 25.121 must be shown at each weight, altitude, and ambient temperature within the operational limits established for the airplane and with the most unfavorable center of gravity for each configuration.

#### § 25.119 Landing climb: All-engines-operating.

In the landing configuration, the steady gradient of climb may not be less than 3.2 percent, with—

(a) The engines at the power or thrust that is available eight seconds after initiation of movement of the power or thrust controls from the minimum flight idle to the go-around power or thrust setting; and

(b) A climb speed of not more than  $V_{REF}$ .

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-84, 60 FR 30749, June 9, 1995; Amdt. 25-108, 67 FR 70826, Nov. 26, 2002]

#### § 25.121 Climb: One-engine-inoperative.

(a) *Takeoff; landing gear extended.* In the critical takeoff configuration existing along the flight path (between the points at which the airplane reaches  $V_{LOF}$  and at which the landing gear is fully retracted) and in the configuration used in §25.111 but without ground effect, the steady gradient of climb must be positive for two-engine airplanes, and not less than 0.3 percent for three-engine airplanes or 0.5 percent for four-engine airplanes, at  $V_{LOF}$  and with—

(1) The critical engine inoperative and the remaining engines at the power

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or thrust available when retraction of the landing gear is begun in accordance with § 25.111 unless there is a more critical power operating condition existing later along the flight path but before the point at which the landing gear is fully retracted; and

(2) The weight equal to the weight existing when retraction of the landing gear is begun, determined under § 25.111.

(b) *Takeoff; landing gear retracted.* In the takeoff configuration existing at the point of the flight path at which the landing gear is fully retracted, and in the configuration used in § 25.111 but without ground effect, the steady gradient of climb may not be less than 2.4 percent for two-engine airplanes, 2.7 percent for three-engine airplanes, and 3.0 percent for four-engine airplanes, at  $V_2$  and with—

(1) The critical engine inoperative, the remaining engines at the takeoff power or thrust available at the time the landing gear is fully retracted, determined under § 25.111, unless there is a more critical power operating condition existing later along the flight path but before the point where the airplane reaches a height of 400 feet above the takeoff surface; and

(2) The weight equal to the weight existing when the airplane's landing gear is fully retracted, determined under § 25.111.

(c) *Final takeoff.* In the en route configuration at the end of the takeoff path determined in accordance with § 25.111, the steady gradient of climb may not be less than 1.2 percent for two-engine airplanes, 1.5 percent for three-engine airplanes and 1.7 percent for four-engine airplanes, at  $V_{FTO}$  and with

(1) The critical engine inoperative and the remaining engines at the available maximum continuous power or thrust; and

(2) The weight equal to the weight existing at the end of the takeoff path, determined under § 25.111.

(d) *Approach.* In a configuration corresponding to the normal all-engines-operating procedure in which  $V_{SR}$  for this configuration does not exceed 110 percent of the  $V_{SR}$  for the related all-engines-operating landing configuration, the steady gradient of climb may

not be less than 2.1 percent for two-engine airplanes, 2.4 percent for three-engine airplanes, and 2.7 percent for four engine airplanes, with

(1) The critical engine inoperative, the remaining engines at the go-around power or thrust setting;

(2) The maximum landing weight;

(3) A climb speed established in connection with normal landing procedures, but not more than  $1.4 V_{SR}$ ; and

(4) Landing gear retracted.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25–84, 60 FR 30749, June 9, 1995; Amdt. 25–108, 67 FR 70826, Nov. 26, 2002]

### § 25.123 En route flight paths.

(a) For the en route configuration, the flight paths prescribed in paragraphs (b) and (c) of this section must be determined at each weight, altitude, and ambient temperature, within the operating limits established for the airplane. The variation of weight along the flight path, accounting for the progressive consumption of fuel and oil by the operating engines, may be included in the computation. The flight paths must be determined at any selected speed, with—

(1) The most unfavorable center of gravity;

(2) The critical engines inoperative;

(3) The remaining engines at the available maximum continuous power or thrust; and

(4) The means for controlling the engine-cooling air supply in the position that provides adequate cooling in the hot-day condition.

(b) The one-engine-inoperative net flight path data must represent the actual climb performance diminished by a gradient of climb of 1.1 percent for two-engine airplanes, 1.4 percent for three-engine airplanes, and 1.6 percent for four-engine airplanes.

(c) For three- or four-engine airplanes, the two-engine-inoperative net flight path data must represent the actual climb performance diminished by a gradient of climb of 0.3 percent for three-engine airplanes and 0.5 percent for four-engine airplanes.

### § 25.125 Landing.

(a) The horizontal distance necessary to land and to come to a complete stop (or to a speed of approximately 3 knots