

(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. Except for showing compliance with the stall warning margin prescribed in paragraph (h)(3)(ii) of this section, stall warning for flight in icing conditions must be provided by the same means as stall warning for flight in non-icing conditions.

(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) In icing conditions, the stall warning margin in straight and turning flight must be sufficient to allow the pilot to prevent stalling (as defined in § 25.201(d)) when the pilot starts a recovery maneuver not less than three seconds after the onset of stall warning. When demonstrating compliance with this paragraph, the pilot must perform the recovery maneuver in the same way as for the airplane in non-icing conditions. Compliance with this requirement must be demonstrated in flight with the speed reduced at rates not exceeding one knot per second, with—

(1) The more critical of the takeoff ice and final takeoff ice accretions defined in appendix C for each configuration used in the takeoff phase of flight;

(2) The en route ice accretion defined in appendix C for the en route configuration;

(3) The holding ice accretion defined in appendix C for the holding configuration(s);

(4) The approach ice accretion defined in appendix C for the approach configuration(s); and

(5) The landing ice accretion defined in appendix C for the landing and go-around configuration(s).

(f) The stall warning margin must be sufficient in both non-icing and icing conditions to allow the pilot to prevent stalling when the pilot starts a recovery maneuver not less than one second after the onset of stall warning in slow-down turns with at least 1.5 g load factor normal to the flight path and air-speed deceleration rates of at least 2 knots per second. When demonstrating

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compliance with this paragraph for icing conditions, the pilot must perform the recovery maneuver in the same way as for the airplane in non-icing conditions. Compliance with this requirement must be demonstrated in flight with—

(1) The flaps and landing gear in any normal position;

(2) The airplane trimmed for straight flight at a speed of $1.3 V_{SR}$; and

(3) The power or thrust necessary to maintain level flight at $1.3 V_{SR}$.

(g) Stall warning must also be provided in each abnormal configuration of the high lift devices that is likely to be used in flight following system failures (including all configurations covered by Airplane Flight Manual procedures).

(h) For flight in icing conditions before the ice protection system has been activated and is performing its intended function, with the ice accretion defined in appendix C, part II(e) of this part, the stall warning margin in straight and turning flight must be sufficient to allow the pilot to prevent stalling without encountering any adverse flight characteristics when:

(1) The speed is reduced at rates not exceeding one knot per second;

(2) The pilot performs the recovery maneuver in the same way as for flight in non-icing conditions; and

(3) The recovery maneuver is started no earlier than:

(i) One second after the onset of stall warning if stall warning is provided by the same means as for flight in non-icing conditions; or

(ii) Three seconds after the onset of stall warning if stall warning is provided by a different means than for flight in non-icing conditions.

(i) In showing compliance with paragraph (h) of this section, if stall warning is provided by a different means in icing conditions than for non-icing conditions, compliance with § 25.203 must be shown using the accretion defined in appendix C, part II(e) of this part. Compliance with this requirement must be shown using the demonstration prescribed by § 25.201, except that the de-

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celeration rates of § 25.201(c)(2) need not be demonstrated.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25–7, 30 FR 13118, Oct. 15, 1965; Amdt. 25–42, 43 FR 2322, Jan. 16, 1978; Amdt. 25–108, 67 FR 70827, Nov. 26, 2002; Amdt. 25–121, 72 FR 44668, Aug. 8, 2007; Amdt. 25–129, 74 FR 38339, Aug. 3, 2009]

GROUND AND WATER HANDLING CHARACTERISTICS

§ 25.231 Longitudinal stability and control.

(a) Landplanes may have no uncontrollable tendency to nose over in any reasonably expected operating condition or when rebound occurs during landing or takeoff. In addition—

(1) Wheel brakes must operate smoothly and may not cause any undue tendency to nose over; and

(2) If a tail-wheel landing gear is used, it must be possible, during the takeoff ground run on concrete, to maintain any attitude up to thrust line level, at 75 percent of V_{SR1} .

(b) For seaplanes and amphibians, the most adverse water conditions safe for takeoff, taxiing, and landing, must be established.

[Docket No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25–108, 67 FR 70828, Nov. 26, 2002]

§ 25.233 Directional stability and control.

(a) There may be no uncontrollable ground-looping tendency in 90° cross winds, up to a wind velocity of 20 knots or $0.2 V_{SRO}$, whichever is greater, except that the wind velocity need not exceed 25 knots at any speed at which the airplane may be expected to be operated on the ground. This may be shown while establishing the 90° cross component of wind velocity required by § 25.237.

(b) Landplanes must be satisfactorily controllable, without exceptional piloting skill or alertness, in power-off landings at normal landing speed, without using brakes or engine power to maintain a straight path. This may be shown during power-off landings made in conjunction with other tests.

(c) The airplane must have adequate directional control during taxiing. This may be shown during taxiing prior to