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turn or 30 degrees in the opposite direction in the case of turning flight stalls;

(5) Exceeding a bank angle of 90 degrees in the original direction of the turn or 60 degrees in the opposite direction in the case of accelerated turning stalls; and

(6) Exceeding the maximum permissible speed or allowable limit load factor.

(c) Compliance with the requirements of this section must be shown under the following conditions:

(1) *Wing flaps*: Retracted, fully extended, and each intermediate normal operating position;

(2) *Landing gear*: Retracted and extended;

(3) *Cowl flaps*: Appropriate to configuration;

(4) *Power*:

(i) Power off; and

(ii) 75 percent of maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power results in extreme nose-up attitudes, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of 1.4 V_{SO} , except that the power may not be less than 50 percent of maximum continuous power.

(5) *Trim*: The airplane trimmed at a speed as near 1.5 V_{S1} as practicable.

(6) *Propeller*. Full increase rpm position for the power off condition.

[Amdt. 23-14, 38 FR 31820, Nov. 19, 1973, as amended by Amdt. 23-45, 58 FR 42159, Aug. 6, 1993; Amdt. 23-50, 61 FR 5191, Feb. 9, 1996]

§ 23.207 Stall warning.

(a) There must be a clear and distinctive stall warning, with the flaps and landing gear in any normal position, in straight and turning flight.

(b) The stall warning may 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.

(c) During the stall tests required by § 23.201(b) and § 23.203(a)(1), the stall warning must begin at a speed exceeding the stalling speed by a margin of

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not less than 5 knots and must continue until the stall occurs.

(d) When following procedures furnished in accordance with § 23.1585, the stall warning must not occur during a takeoff with all engines operating, a takeoff continued with one engine inoperative, or during an approach to landing.

(e) During the stall tests required by § 23.203(a)(2), the stall warning must begin sufficiently in advance of the stall for the stall to be averted by pilot action taken after the stall warning first occurs.

(f) For acrobatic category airplanes, an artificial stall warning may be mutable, provided that it is armed automatically during takeoff and rearmed automatically in the approach configuration.

[Amdt. 23-7, 34 FR 13087, Aug. 13, 1969, as amended by Amdt. 23-45, 58 FR 42159, Aug. 6, 1993; Amdt. 23-50, 61 FR 5191, Feb. 9, 1996]

SPINNING

§ 23.221 Spinning.

(a) *Normal category airplanes*. A single-engine, normal category airplane must be able to recover from a one-turn spin or a three-second spin, whichever takes longer, in not more than one additional turn after initiation of the first control action for recovery, or demonstrate compliance with the optional spin resistant requirements of this section.

(1) The following apply to one turn or three second spins:

(i) For both the flaps-retracted and flaps-extended conditions, the applicable airspeed limit and positive limit maneuvering load factor must not be exceeded;

(ii) No control forces or characteristic encountered during the spin or recovery may adversely affect prompt recovery;

(iii) It must be impossible to obtain unrecoverable spins with any use of the flight or engine power controls either at the entry into or during the spin; and

(iv) For the flaps-extended condition, the flaps may be retracted during the recovery but not before rotation has ceased.

(2) At the applicant's option, the airplane may be demonstrated to be spin resistant by the following:

(i) During the stall maneuver contained in §23.201, the pitch control must be pulled back and held against the stop. Then, using ailerons and rudders in the proper direction, it must be possible to maintain wings-level flight within 15 degrees of bank and to roll the airplane from a 30 degree bank in one direction to a 30 degree bank in the other direction;

(ii) Reduce the airplane speed using pitch control at a rate of approximately one knot per second until the pitch control reaches the stop; then, with the pitch control pulled back and held against the stop, apply full rudder control in a manner to promote spin entry for a period of seven seconds or through a 360 degree heading change, whichever occurs first. If the 360 degree heading change is reached first, it must have taken no fewer than four seconds. This maneuver must be performed first with the ailerons in the neutral position, and then with the ailerons deflected opposite the direction of turn in the most adverse manner. Power and airplane configuration must be set in accordance with §23.201(e) without change during the maneuver. At the end of seven seconds or a 360 degree heading change, the airplane must respond immediately and normally to primary flight controls applied to regain coordinated, unstalled flight without reversal of control effect and without exceeding the temporary control forces specified by §23.143(c); and

(iii) Compliance with §§23.201 and 23.203 must be demonstrated with the airplane in uncoordinated flight, corresponding to one ball width displacement on a slip-skid indicator, unless one ball width displacement cannot be obtained with full rudder, in which case the demonstration must be with full rudder applied.

(b) *Utility category airplanes.* A utility category airplane must meet the requirements of paragraph (a) of this section. In addition, the requirements of paragraph (c) of this section and §23.807(b)(7) must be met if approval for spinning is requested.

(c) *Acrobatic category airplanes.* An acrobatic category airplane must meet

the spin requirements of paragraph (a) of this section and §23.807(b)(6). In addition, the following requirements must be met in each configuration for which approval for spinning is requested:

(1) The airplane must recover from any point in a spin up to and including six turns, or any greater number of turns for which certification is requested, in not more than one and one-half additional turns after initiation of the first control action for recovery. However, beyond three turns, the spin may be discontinued if spiral characteristics appear.

(2) The applicable airspeed limits and limit maneuvering load factors must not be exceeded. For flaps-extended configurations for which approval is requested, the flaps must not be retracted during the recovery.

(3) It must be impossible to obtain unrecoverable spins with any use of the flight or engine power controls either at the entry into or during the spin.

(4) There must be no characteristics during the spin (such as excessive rates of rotation or extreme oscillatory motion) that might prevent a successful recovery due to disorientation or incapacitation of the pilot.

[Doc. No. 27807, 61 FR 5191, Feb. 9, 1996]

GROUND AND WATER HANDLING CHARACTERISTICS

§ 23.231 Longitudinal stability and control.

(a) A landplane may have no uncontrollable tendency to nose over in any reasonably expected operating condition, including rebound during landing or takeoff. Wheel brakes must operate smoothly and may not induce any undue tendency to nose over.

(b) A seaplane or amphibian may not have dangerous or uncontrollable porpoising characteristics at any normal operating speed on the water.

§ 23.233 Directional stability and control.

(a) A 90 degree cross-component of wind velocity, demonstrated to be safe for taxiing, takeoff, and landing must be established and must be not less than 0.2 V_{SO} .