Flightlab Ground School
13. A Selective Summary of Certification Requirements
FAR Parts 23 & 25

The Federal Aviation Regulation Part 23 Airworthiness Standards covers normal, utility, aerobatic, and computer category airplanes. According to section 23.3:

"(a) The normal category is limited to airplanes that have a seating configuration, excluding pilot seats, of nine or less, a maximum certificated takeoff weight of 12,500 pounds or less, and intended for nonacrobatic operation. Nonacrobatic operation includes:

(1) Any maneuver incident to normal flying;

(2) Stalls (except whip stalls); and

(3) Lazy eights, chandelles, and steep turns, in which the angle of bank is not more than 60 degrees.

(b) The utility category is limited to airplanes that have a seating configuration, excluding pilot seats, of nine or less, a maximum certificated takeoff weight of 12,500 pounds or less, and intended for limited acrobatic operation. Airplanes certificated in the utility category may be used in any of the operations covered under paragraph (a) of this section and in limited acrobatic operations. Limited acrobatic operation includes:

(1) Spins (if approved for the particular type of airplane); and

(2) Lazy eights, chandelles, and steep turns, or similar maneuvers, in which the angle of bank is more than 60 degrees but not more than 90 degrees.

(c) The acrobatic category is limited to airplanes that have a seating configuration, excluding pilot seats, of nine or less, a maximum certificated takeoff weight of 12,500 pounds or less, and intended for use without restrictions, other than those shown to be necessary as a result of required flight tests.

(d) The commuter category is limited to propeller-driven, multiengine airplanes that have a seating configuration, excluding pilot seats, of 19 or less, and a maximum certificated takeoff weight of 19,000 pounds or less. The commuter category operation is limited to any maneuver incident to normal flying, stalls (except whip stalls), and steep turns, in which the angle of bank is not more than 60 degrees.

(e) Except for commuter category, airplanes may be type certificated in more than one category if the requirements of each requested category are met."

FAR Part 25 contains the airworthiness standards for transport category airplanes.

We've reproduced some of the regulations that pertain to maneuvers we fly in the course, and that set the baseline for aircraft behavior. You'll see that the standards are not always the same in both parts. If you really want to enter the belly of the beast, Parts 23 and 25 are available online.

Far 23	FAR 25
Controllability and Maneuverability	**Controllability and Maneuverability**
§23.147 Directional and lateral control.	**§25.147 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 --	(a) *Directional control; general.* It must be possible, with the wings level, to yaw into the operative engine and to safely make a reasonably sudden change in heading of up to 15 degrees in the direction of the critical inoperative engine. This must be shown at 1.4Vs1 for heading changes up to 15 degrees (except that the heading change at which the rudder pedal force is 150 pounds need not be exceeded), and with --
(1) Critical engine inoperative and its propeller in the minimum drag position;	(1) The critical engine inoperative and its propeller in the minimum drag position;
(2) Remaining engines at maximum continuous power;	(2) The power required for level flight at 1.4 *V*S1, but not more than maximum continuous power;
(3) Landing gear --	(3) The most unfavorable center of gravity;
(i) Retracted; and	(4) Landing gear retracted;
(ii) Extended; and	(5) Flaps in the approach position; and
(4) Flaps retracted.	(6) Maximum landing weight.
(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 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:	(b) *Directional control; airplanes with four or more engines.* Airplanes with four or more engines must meet the requirements of paragraph (a) of this section except that --
(1) Maximum continuous power on each engine;	(1) The two critical engines must be inoperative with their propellers (if applicable) in the minimum drag position;
(2) The wing flaps retracted;	(2) [Reserved]
(3) The landing gear retracted;	(3) The flaps must be in the most favorable climb position.
(4) A speed equal to that at which compliance with §23.69(a) has been shown; and	(c) *Lateral control; general.* It must be possible to make 20° banked turns, with and against the inoperative engine, from steady flight at a speed equal to 1.4 *V*S1, with --
(5) All propeller controls in the position at which compliance with §23.69(a) has been shown.	(1) The critical engine inoperative and its propeller (if applicable) in the minimum drag position;
(c) For all airplanes, it must be shown that the airplane	(2) The remaining engines at maximum continuous power;
	(3) The most unfavorable center of gravity;

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]

§23.155 Elevator control force in maneuvers.

(a) The elevator control force needed to achieve the positive limit maneuvering load factor may not be less than:

(1) For wheel controls, W/100 (where W is the maximum weight) or 20 pounds, whichever is greater, except that it need not be greater than 50 pounds; or

(2) For stick controls, W/140 (where W is the maximum weight) or 15 pounds, whichever is greater, except that it need not be greater than 35 pounds.

(b) The requirement of paragraph (a) of this section must be met at 75 percent of maximum continuous power for reciprocating engines, or the maximum continuous power for turbine engines, and with the wing flaps and landing gear retracted --

(1) In a turn, with the trim setting used for wings level

(4) Landing gear (i) retracted and (ii) extended;

(5) Flaps in the most favorable climb position; and

(6) Maximum takeoff weight.

(d) *Lateral control; airplanes with four or more engines.* Airplanes with four or more engines must be able to make 20° banked turns, with and against the inoperative engines, from steady flight at a speed equal to 1.4 V_{S1}, with maximum continuous power, and with the airplane in the configuration prescribed by paragraph (b) of this section.

(e) *Lateral control; all engines operating.* With the engines operating, roll response must allow normal maneuvers (such as recovery from upsets produced by gusts and the initiation of evasive maneuvers). There must be enough excess lateral control in sideslips (up to sideslip angles that might be required in normal operation), to allow a limited amount of maneuvering and to correct for gusts. Lateral control must be enough at any speed up to V_{FC}/M_{FC} to provide a peak roll rate necessary for safety, without excessive control forces or travel.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-42, 43 FR 2321, Jan. 16, 1978; Amdt. 25-72, 55 FR 29774, July 20, 1990]

flight at V_O; and

(2) In a turn with the trim setting used for the maximum wings level flight speed, except that the speed may not exceed V_{NE} or V_{MO}/M_{MO}, whichever is appropriate.

(c) There must be no excessive decrease in the gradient of the curve of stick force versus maneuvering load factor with increasing load factor.

[Amdt. 23-14, 38 FR 31819, Nov. 19, 1973; 38 FR 32784, Nov. 28, 1973, as amended by Amdt. 23-45, 58 FR 42158, Aug. 6, 1993; Amdt. 23-50, 61 FR 5189 Feb. 9, 1996]

[TOP]

§23.157 Rate of roll.

(a) *Takeoff.* It must be possible, using a favorable combination of controls, to roll the airplane from a steady 30-degree banked turn through an angle of 60 degrees, so as to reverse the direction of the turn within:

(1) For an airplane of 6,000 pounds or less maximum weight, 5 seconds from initiation of roll; and

(2) For an airplane of over 6,000 pounds maximum weight,

(W+500)/1,300

seconds, but not more than 10 seconds, where W is the weight in pounds.

(b) The requirement of paragraph (a) of this section must be met when rolling the airplane in each direction with --

(1) Flaps in the takeoff position;

(2) Landing gear retracted;

(3) For a single-engine airplane, at maximum takeoff power; and for a multiengine airplane with the critical engine inoperative and the propeller in the minimum drag position, and the other engines at maximum takeoff power; and

(4) The airplane trimmed at a speed equal to the greater of 1.2 V_{S1} or 1.1 V_{MC}, or as nearly as possible in trim for

straight flight. (c) *Approach.* It must be possible, using a favorable combination of controls, to roll the airplane from a steady 30-degree banked turn through an angle of 60 degrees, so as to reverse the direction of the turn within: (1) For an airplane of 6,000 pounds or less maximum weight, 4 seconds from initiation of roll; and (2) For an airplane of over 6,000 pounds maximum weight, (W+2,800)/2,200 seconds, but not more than 7 seconds, where W is the weight in pounds. (d) The requirement of paragraph (c) of this section must be met when rolling the airplane in each direction in the following conditions -- (1) Flaps in the landing position(s); (2) Landing gear extended; (3) All engines operating at the power for a 3 degree approach; and (4) The airplane trimmed at V_{REF}. [Amdt. 23-14, 38 FR 31819, Nov. 19, 1973, as amended by Amdt. 23-45, 58 FR 42158, Aug. 6, 1993; Amdt. 23-50, 61 FR 5189, Feb. 9, 1996]	
Stability	**Stability**
§23.171 General. The airplane must be longitudinally, directionally, and laterally stable under §§23.173 through 23.181. In addition, the airplane must show suitable stability and control "feel" (static stability) in any condition normally encountered in service, if flight tests show it is necessary for safe operation.	**§25.171 General.** The airplane must be longitudinally, directionally, and laterally stable in accordance with the provisions of §§25.173 through 25.177. In addition, suitable stability and control feel (static stability) is required in any condition normally encountered in service, if flight tests show it is necessary for safe operation. [Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-7, 30 FR 13117, Oct. 15, 1965]
§23.173 Static longitudinal stability.	

§23.173 Static longitudinal stability.	§25.173 Static longitudinal stability.
Under the conditions specified in §23.175 and with the airplane trimmed as indicated, the characteristics of the elevator control forces and the friction within the control system must be as follows: (a) A pull must be required to obtain and maintain speeds below the specified trim speed and a push required to obtain and maintain speeds above the specified trim speed. This must be shown at any speed that can be obtained, except that speeds requiring a control force in excess of 40 pounds or speeds above the maximum allowable speed or below the minimum speed for steady unstalled flight, need not be considered. (b) The airspeed must return to within the tolerances specified for applicable categories of airplanes when the control force is slowly released at any speed within the speed range specified in paragraph (a) of this section. The applicable tolerances are -- (1) The airspeed must return to within plus or minus 10 percent of the original trim airspeed; and (2) For commuter category airplanes, the airspeed must return to within plus or minus 7.5 percent of the original trim airspeed for the cruising condition specified in §23.175(b). (c) The stick force must vary with speed so that any substantial speed change results in a stick force clearly perceptible to the pilot. [Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-14, 38 FR 31820 Nov. 19, 1973; Amdt. 23-34, 52 FR 1828, Jan. 15, 1987]	Under the conditions specified in §25.175, the characteristics of the elevator control forces (including friction) must be as follows: (a) A pull must be required to obtain and maintain speeds below the specified trim speed, and a push must be required to obtain and maintain speeds above the specified trim speed. This must be shown at any speed that can be obtained except speeds higher than the landing gear or wing flap operating limit speeds or *V*FC/*M*FC, whichever is appropriate, or lower than the minimum speed for steady unstalled flight. (b) The airspeed must return to within 10 percent of the original trim speed for the climb, approach, and landing conditions specified in §25.175 (a), (c), and (d), and must return to within 7.5 percent of the original trim speed for the cruising condition specified in §25.175(b), when the control force is slowly released from any speed within the range specified in paragraph (a) of this section. (c) The average gradient of the stable slope of the stick force versus speed curve may not be less than 1 pound for each 6 knots. (d) Within the free return speed range specified in paragraph (b) of this section, it is permissible for the airplane, without control forces, to stabilize on speeds above or below the desired trim speeds if exceptional attention on the part of the pilot is not required to return to and maintain the desired trim speed and altitude. [Amdt. 25-7, 30 FR 13117, Oct. 15, 1965]
§23.177 Static directional and lateral stability. (a) The static directional stability, as shown by the tendency to recover from a wings level sideslip with the rudder free, must be positive for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach, and landing configurations. This must be shown with symmetrical power up to maximum continuous power, and at speeds from 1.2 V_{S1} up to the maximum allowable speed for the condition being investigated. The angel of sideslip for these tests must be appropriate to the type of airplane. At larger angles of sideslip, up to that at which full rudder is used or a control force limit in §23.143 is reached, whichever occurs first, and at speeds from 1.2 V_{S1} to V_O, the rudder	**§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 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 1.2 VS1 to

pedal force must not reverse. (b) The static lateral stability, as shown by the tendency to raise the low wing in a sideslip, must be positive for all landing gear and flap positions. This must be shown with symmetrical power up to 75 percent of maximum continuous power at speeds above 1.2 V_{S1} in the take off configuration(s) and at speeds above 1.3 V_{S1} in other configurations, up to the maximum allowable speed for the configuration being investigated, in the takeoff, climb, cruise, and approach configurations. For the landing configuration, the power must be that necessary to maintain a 3 degree angle of descent in coordinated flight. The static lateral stability must not be negative at 1.2 V_{S1} in the takeoff configuration, or at 1.3 V_{S1} in other configurations. The angle of sideslip for these tests must be appropriate to the type of airplane, but in no case may the constant heading sideslip angle be less than that obtainable with a 10 degree bank, or if less, the maximum bank angle obtainable with full rudder deflection or 150 pound rudder force. (c) Paragraph (b) of this section does not apply to acrobatic category airplanes certificated for inverted flight. (d) In straight, steady slips at 1.2 V_{S1} for any landing gear and flap positions, and for any symmetrical power conditions up to 50 percent of maximum continuous power, the aileron and rudder control movements and forces must increase steadily, but not necessarily in constant proportion, as the angle of sideslip is increased up to the maximum appropriate to the type of airplane. At larger slip angles, up to the angle at which full rudder or aileron control is used or a control force limit contained in §23.143 is reached, the aileron and rudder control movements and forces must not reverse as the angle of sideslip is increased. Rapid entry into, and recovery from, a maximum sideslip considered appropriate for the airplane must not result in uncontrollable flight characteristics. [Doc. No. 27807, 61 FR 5190, Feb. 9, 1996] **§23.181 Dynamic stability.** (a) Any short period oscillation not including combined lateral-directional oscillations occurring between the stalling speed and the maximum allowable speed appropriate to the configuration of the airplane must be heavily damped with the primary controls --	VFE, VLE, or VFC/MFC, 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] **§25.181 Dynamic stability.** (a) Any short period oscillation, not including combined lateral-directional oscillations, occurring between 1.2 V_S 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 between the stalling speed and the maximum allowable speed appropriate to the configuration of the airplane must be damped to 1/10 amplitude in 7 cycles with the primary controls -- (1) Free; and (2) In a fixed position. (c) If it is determined that the function of a stability augmentation system, reference §23.672, is needed to meet the flight characteristic requirements of this part, the primary control requirements of paragraphs (a)(2) and (b)(2) of this section are not applicable to the tests needed to verify the acceptability of that system. (d) During the conditions as specified in §23.175, when the longitudinal control force required to maintain speeds differing from the trim speed by at least plus and minus 15 percent is suddenly released, the response of the airplane must not exhibit any dangerous characteristics nor be excessive in relation to the magnitude of the control force released. Any long-period oscillation of flight path, phugoid oscillation, that results must not be so unstable as to increase the pilot's workload or otherwise endanger the airplane. [Amdt. 23-21, 43 FR 2318, Jan. 16, 1978, as amended by Amdt. 23-45, 58 FR 42158, Aug. 6, 1993]	(1) Free; and (2) In a fixed position. (b) Any combined lateral-directional oscillations ("Dutch roll") occurring between 1.2 V_S 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]
Stalls	**Stalls**
§23.201 Wings level stall. (a) It must be possible to produce and to correct roll by unreversed use of the rolling control and to produce and to correct yaw by unreversed use of the directional control, up to the time the airplane stalls. (b) The wings level stall characteristics must be demonstrated in flight as follows. Starting from a speed at least 10 knots above the stall speed, the elevator control must be pulled back so that the rate of speed reduction will not exceed one knot per second until a	**§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 1.6 *V*S1 (where *V*S1 corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight).

stall is produced, as shown by either:

(1) An uncontrollable downward pitching motion of the airplane;

(2) A downward pitching motion of the airplane that results from the activation of a stall avoidance device (for example, stick pusher); or

(3) The control reaching the stop.

(c) Normal use of elevator control for recovery is allowed after the downward pitching motion of paragraphs (b)(1) or (b)(2) of this section has unmistakably been produced, or after the control has been held against the stop for not less than the longer of two seconds or the time employed in the minimum steady slight speed determination of §23.49.

(d) During the entry into and the recovery from the maneuver, it must be possible to prevent more than 15 degrees of roll or yaw by the normal use of controls.

(e) 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 result 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 r.p.m. position for the power off condition.

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

landing weight).

(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)(1).

(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 airplane is stalled. Acceptable indications of a stall, occurring either individually or in combination, are --

(1) A nose-down pitch that cannot be readily arrested;

(2) Buffeting, of a magnitude and severity that is a strong and effective deterrent to further speed reduction; or

(3) The pitch control reaches the aft stop and no further increase in pitch attitude occurs when the control is held full aft for a short time before recovery is initiated. [Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-84, 60 FR 30750, June 9, 1995]

§23.203 Turning flight and accelerated turning stalls.

Turning flight and accelerated turning stalls must be demonstrated in tests as follows:

(a) Establish and maintain a coordinated turn in a 30 degree bank. Reduce speed by steadily and progressively tightening the turn with the elevator until the airplane is stalled, as defined in §23.201(b). The rate of speed reduction must be constant, and --

(1) For a turning flight stall, may not exceed one knot per second; and

(2) For an accelerated turning stall, be 3 to 5 knots per second with steadily increasing normal acceleration.

(b) After the airplane has stalled, as defined in §23.201(b), it must be possible to regain wings level flight by normal use of the flight controls, but without increasing power and without --

(1) Excessive loss of altitude;

(2) Undue pitchup;

(3) Uncontrollable tendency to spin;

(4) Exceeding a bank angle of 60 degrees in the original direction of the 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;

§25.203 Stall characteristics.

(a) It must be possible to produce and to correct roll and yaw by unreversed use of the aileron and rudder controls, up to the time the airplane is stalled. No abnormal nose-up pitching may occur. The longitudinal control force must be positive up to and throughout the stall. In addition, it must be possible to promptly prevent stalling and to recover from a stall by normal use of the controls.

(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]

(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 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	**§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 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. 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 paragraph (c) of this section. (c) The stall warning must begin at a speed exceeding the stalling speed (i.e., the speed at which the airplane stalls or the minimum speed demonstrated, whichever is applicable under the provisions of §25.201(d)) by seven percent or at any lesser margin if the stall warning has enough clarity, duration, distinctiveness, or similar properties. [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]

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

§25.351 Yaw maneuver conditions.

The airplane must be designed for loads resulting from the yaw maneuver conditions specified in paragraphs (a) through (d) of this section at speeds from V_{MC} to V_D. Unbalanced aerodynamic moments about the center of gravity must be reacted in a rational or conservative manner considering the airplane inertia forces. In computing the tail loads the yawing velocity may be assumed to be zero.

(a) With the airplane in unaccelerated flight at zero yaw, it is assumed that the cockpit rudder control is suddenly displaced to achieve the resulting rudder deflection, as limited by:

(1) The control system on control surface stops; or

(2) A limit pilot force of 300 pounds from V_{MC} to V_A and 200 pounds from V_C/M_C to V_D/M_D, with a linear variation between V_A and V_C/M_C.

(b) With the cockpit rudder control deflected so as always to maintain the maximum rudder deflection available within the limitations specified in paragraph (a) of this section, it is assumed that the airplane yaws to the overswing sideslip angle.

(c) With the airplane yawed to the static equilibrium sideslip angle, it is assumed that the cockpit rudder control is held so as to achieve the maximum rudder deflection available within the limitations specified in paragraph (a) of this section.

(d) With the airplane yawed to the static equilibrium sideslip angle of paragraph (c) of this section, it is assumed that the cockpit rudder control is suddenly returned to neutral.

[Amdt. 25-91, 62 FR 40704, July 29, 1997]

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]	