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Advisory Circular

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ADVISORY CIRCULAR

AC No: 61-67B

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Initiated by: AFS-840

Change:

Subject: STALL AND SPIN AWARENESS TRAINING

1. PURPOSE. This advisory circular (AC) explains the stall and spin awareness training required under Part 61 of the Federal Aviation Regulations (FAR) and offers guidance to flight instructors who provide that training. In addition, this AC informs pilots of the airworthiness standards for the type certification of small airplanes prescribed in FAR Section 23.221 concerning spin maneuvers and it emphasizes the importance of observing restrictions that prohibit the intentional spinning of certain airplanes.

2. CANCELLATION. AC 61-67A, dated October 8, 1982, and AC 61-92 dated January 25, 1980, are canceled.

3. RELATED READING MATERIAL.

a. Report No. FAA-RD-77-26, General Aviation Pilot Stall Awareness Training Study. This document may be purchased from the National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. Telephone orders: (703) 487-4650. NTIS identification number ADA041310.

b. The following documents may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402:

(1) AC 61-21, Flight Training Handbook, current edition.

(2) AC 91-23, Pilot's Weight and Balance Handbook, current edition.

(3) FAA-S-8081-1, Private Pilot - Practical Test Standards, current edition.

(4) FAA-S-8081-2, Commercial Pilot - Practical Test Standards, current edition.

(5) FAA-S-8081-6, Flight Instructor - Airplane Practical Test Standards, current edition.

4. BACKGROUND. In January 1980, the Federal Aviation Administration (FAA) issued AC 61-92, "Use of Distractions During Pilot Certification Flight Tests," announcing its policy of incorporating the use of certain distractions during the performance of flight test maneuvers.

This policy came about as a result of Report No. FAA-RD-77-26 which revealed that stall/spin related accidents accounted for approximately one-quarter of all fatal general aviation accidents. National Transportation Safety Board statistics indicate that most stall/spin accidents result when a pilot is distracted momentarily from the primary task of flying the aircraft.

5. CHANGES. Changes to FAR Part 61, completed in 1991, included increased stall and spin awareness training for applicants for recreational, private, and commercial pilot certificates. The training is intended to emphasize recognition of situations that could lead to an inadvertent stall and/or spin by using realistic distractions such as those suggested in Report No. FAA-RD-77-26 and incorporated into the performance of flight test maneuvers. Although the training is intended to emphasize stall spin awareness and recovery techniques for all pilots, only flight instructor-airplane and flight instructor-glider candidates are required to demonstrate instructional proficiency in spin entry, spins, and spin recovery techniques as a requirement for certification. Where applicable, AC 61-67B supersedes AC 61-21A.

6. COMMENTS INVITED. Comments regarding this publication should be directed to:

Federal Aviation Administration
Field Programs Division, AFS-500
Advisory Circular Staff
P.O. Box 20034, Gateway Building
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Washington, DC 20041-2034

Every comment will not necessarily generate a direct acknowledgement to the commenter. Comments received will be considered in the development of upcoming revisions to AC's or other related technical material.

/s/ William C. Withycombe

Acting Director, Flight Standards Service

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CHAPTER 1. GROUND TRAINING - STALL AND SPIN AWARENESS

1. DEFINITIONS. A stall is a loss of lift and increase in drag that occurs when an aircraft is flown at an angle of attack greater than the angle for maximum lift. If recovery from a stall is not effected in a timely and appropriate manner by reducing the angle of attack, a secondary stall and/or spin may result. All spins are preceded by a stall on at least part of the wing. The angle of the relative wind is determined primarily by the aircraft's airspeed. Other factors are considered, such as aircraft weight, center of gravity, configuration, and the amount of acceleration used in a turn. The speed at which the critical angle of the relative wind is exceeded is the stall speed. Stall speeds are listed in the Airplane Flight Manual (AFM) or the Pilot Operating handbook (POH) and pertain to certain conditions or aircraft configurations, e.g., landing configuration. Other specific operational speeds are calculated based upon the aircraft's stall speed in the landing configuration. Airspeed values specified in the AFM or POH may vary under different circumstances. Factors such as weight, center of gravity, altitude, temperature, turbulence, and the

presence of snow, ice, or frost on the wings will affect an aircraft's stall speed. To thoroughly understand the stall/spin phenomenon, some basic factors affecting aircraft aerodynamics and flight should be reviewed with particular emphasis on their relation to stall speeds. (This advisory circular is principally concerned with and discusses airplanes. However, much of the information also is applicable to gliders.) The following terms are defined as they relate to stalls/spins.

a. Angle of Attack. Angle of attack is the angle at which the wing meets the relative wind. The angle of attack must be small enough to allow attached airflow over and under the airfoil to produce lift. A change in angle of attack will affect the amount of lift that is produced. An excessive angle of attack will eventually disrupt the flow of air over the airfoil. If the angle of attack is not reduced, a section of the airfoil will reach its critical angle of attack, lose lift, and stall. Exceeding the critical angle of attack for a particular airfoil section will always result in a stall.

b. Airspeed. Airspeed is controlled primarily by the elevator or longitudinal control position for a given configuration and power. If an airplane's speed is too slow, the angle of attack required for level flight will be so large that the air can no longer follow the upper curvature of the wing. The result is a separation of airflow from the wing, loss of lift, a large increase in drag, and eventually a stall if the angle of attack is not reduced. The stall is the result of excessive angle of attack - not airspeed. A stall can occur at any airspeed, in any attitude, and at any power setting.

c. Configuration. Flaps, landing gear, and other configuring devices can affect an airplane's stall speed. Extension of flaps and/or landing gear in flight will usually increase drag. Flap extension will generally increase the lifting ability of the wings, thus reducing the airplane's stall speed. The effect of flaps on an airplane's stall speed can be seen by markings on the airplane's airspeed indicator, where the lower airspeed limit of the white arc (power-off stall speed with gear and flaps in the landing configuration) is less than the lower airspeed limit of the green arc (power-off stall speed in the clean configuration).

d. V sub so. V sub so means the stall speed or the minimum steady flight speed in the landing configuration.

e. V sub s1. V sub s1 means the stall speed or the minimum steady flight speed obtained in a specific configuration.

f. V sub A. V sub A is the design maneuvering speed which is the speed at which an airplane can be stalled without exceeding its structural limits.

g. Load Factor. Load factor is the ratio of the lifting force produced by the wings to the actual weight of the airplane and its contents. Load factors are usually expressed in terms of "G." The aircraft's stall speed increases in proportion to the square root of the load factor. For example, an airplane that has a normal unaccelerated stall speed of 45 knots can be stalled at 90 knots when subjected to a load factor of 4 G's. The possibility of inadvertently stalling the airplane by increasing the load factor (by putting the airplane in a steep turn or spiral, for example) is therefore much greater than in normal cruise flight. A stall entered from straight and level flight or from an unaccelerated straight climb will not produce additional load factors. In a constant rate turn, increased load factors will cause an airplane's stall speed to increase as the angle of bank increases. Excessively steep banks should be avoided because the airplane will stall at a much higher speed or, if the aircraft exceeds maneuvering speed, structural damage to the aircraft may result before it stalls. If the nose falls during a steep turn, the pilot might attempt to raise it to the level flight attitude without shallowing the bank. This situation tightens the turn and can lead to a diving spiral. A feeling of weightlessness will result if a stall recovery is performed by abruptly pushing the elevator control forward, which will reduce the up load on the wings. Recoveries from stalls and spins involve a tradeoff between loss of altitude (and an increase in airspeed) and an increase in load factor in the pullup. However, recovery from the dive following spin recovery generally causes higher airspeeds and consequently higher load factors than stall recoveries due to the much lower position of the nose. Significant load factor increases are sometimes induced during pullup after recovery from a stall or spin. It should be noted that structural damage can result from the high load factors imposed by intentional stalls practiced above the airplane's design maneuvering speed.

h. Center of Gravity (CG). The CG location has an indirect effect on the effective lift and angle of attack of the wing, the amount and direction of force on the tail, and the degree of stabilizer deflection needed to supply the proper tail force for equilibrium. The CG position, therefore, has a significant effect on stability and stall/spin recovery. As the CG is moved aft, the amount of elevator deflection will be reduced. An increased angle of attack will be achieved with less elevator control force. This could make the entry into inadvertent stalls easier, and during the subsequent recovery, it would be easier to generate higher load factors, due to the reduced forces. In an airplane with an extremely aft CG, very light back elevator control forces may lead to inadvertent stall entries and if a spin is entered, the balance of forces on the airplane may result in a flat spin. Recovery from a flat spin is often impossible. A forward CG location will often cause the stalling angle of attack to be reached at a higher airspeed. Increased back elevator control force is generally required with a forward CG location.

i. Weight. Although the distribution of weight has the most direct effect on stability, increased gross weight can also have an effect on an aircraft's flight characteristics, regardless of the CG position. As the weight of the airplane is increased, the stall speed increases. The increased weight requires a higher angle of attack to produce additional lift to support the weight.

j. Altitude and Temperature. Altitude has little or no effect on an airplane's indicated stall speed. Thinner air at higher altitudes will result in decreased aircraft performance and a higher true airspeed for a given indicated airspeed. Higher than standard temperatures will also contribute to increased true airspeed. However, the higher true airspeed has no effect on indicated approach or stall speeds. The manufacturer's recommended indicated airspeeds should therefore be maintained during the landing approach, regardless of the elevation or the density at the airport of landing.

k. Snow, Ice or Frost on the Wings. Even a small accumulation of snow, ice or frost on an aircraft's surface can cause an increase in that aircraft's stall speed. Such accumulation changes the shape of the wing, disrupting the smooth flow of air over the surface and, consequently, increasing drag and decreasing lift. Flight should not be attempted when snow, ice, or frost has accumulated on the aircraft surfaces.

l. Turbulence. Turbulence can cause an aircraft to stall at a significantly higher airspeed than in stable conditions. A vertical gust or windshear can cause a sudden change in the relative wind, and result in an abrupt increase in angle of attack. Although a gust may not be maintained long enough for a stall to develop, the aircraft may stall while the pilot is attempting to control the flightpath, particularly during an approach in gusty conditions. When flying in moderate to severe turbulence or strong crosswinds, a higher than normal approach speed should be maintained. In cruise flight in moderate or severe turbulence, an airspeed well above the indicated stall speed and below maneuvering speed should be used.

2. DISTRACTIONS. Improper airspeed management resulting in stalls are most likely to occur when the pilot is distracted by one or more other tasks, such as locating a checklist or attempting a restart after an engine failure; flying a traffic pattern on a windy day; reading a chart or making fuel and/or distance calculations; or attempting to retrieve items from the floor, back seat, or glove compartment. Pilots at all skill levels should be aware of the increased risk of entering into an inadvertent stall or spin while performing tasks that are secondary to controlling the aircraft.

3. STALL RECOGNITION. There are several ways to recognize that a stall is impending before it actually occurs. When one or more of these indicators is noted, initiation of a recovery should be instinctive (unless a full stall is being practiced intentionally from an altitude that allows recovery above 1,500 feet above ground level (AGL) for single-engine airplanes and 3,000 feet AGL for multiengine airplanes). One indication of a stall is a mushy feeling in the controls and less control effect as the aircraft's speed is reduced. This reduction in control effectiveness is attributed in part to reduced airflow over the flight control surfaces. In fixed-pitch propeller airplanes, a loss of revolutions per minute (RPM) may be evident when approaching a stall in power-on conditions. For both airplanes and gliders, a

reduction in the sound of air flowing along the fuselage is usually evident. Just before the stall occurs, buffeting, uncontrollable pitching, or vibrations may begin. Many aircraft are equipped with stall warning devices that will alert the pilot when the airflow over the wing(s) approaches a point that will not allow lift to be sustained. Finally, kinesthesia (the sensing of changes in direction or speed of motion), when properly learned and developed, will warn the pilot of a decrease in speed or the beginning of a "mushing" of the aircraft. These preliminary indications serve as a warning to the pilot to increase airspeed by adding power, and/or lowering the nose, and/or decreasing the angle of bank.

4. TYPES OF STALLS. Stalls can be practiced both with and without power. Stalls should be practiced to familiarize the student with the aircraft's particular stall characteristics without putting the aircraft into a potentially dangerous condition. In multiengine airplanes, single-engine stalls must be avoided. A description of some different types of stalls follows:

a. Power-off stalls (also known as approach-to-landing stalls) are practiced to simulate normal approach-to-landing conditions and configuration. Many stall/spin accidents have occurred in these power-off situations, such as crossed control turns from base leg to final approach (resulting in a skidding or slipping turn); attempting to recover from a high sink rate on final approach by using only an increased pitch attitude; and improper airspeed control on final approach or in other segments of the traffic pattern.

b. Power-on stalls (also known as departure stalls) are practiced to simulate takeoff and climb-out conditions and configuration. Many stall/spin accidents have occurred during these phases of flight, particularly during go-arounds. A causal factor in such accidents has been the pilot's failure to maintain positive control due to a nose-high trim setting or premature flap retraction. Failure to maintain positive control during short field takeoffs has also been an accident causal factor.

c. Accelerated stalls can occur at higher-than-normal airspeeds due to abrupt and/or excessive control applications. These stalls may occur in steep turns, pullups, or other abrupt changes in flightpath. Accelerated stalls usually are more severe than unaccelerated stalls and are often expected because they occur at higher-than-normal airspeeds.

5. STALL RECOVERY. The key factor in recovery from a stall is regaining positive control of the aircraft by reducing the angle of attack. At the first indication of a stall, the aircraft angle of attack must be decreased to allow the wings to regain lift. Every aircraft in upright flight may require a different amount of forward pressure to regain lift. It should be noted that too much forward pressure can hinder recovery by imposing a negative load on the wing. The next step in recovering from a stall is to smoothly apply maximum allowable power (if applicable) to increase the airspeed and to minimize the loss of

altitude. Certain high performance airplanes may require only an increase in thrust and relaxation of the back pressure on the yoke to effect recovery. As airspeed increases and the recovery is completed, power should be adjusted to return the airplane to the desired flight condition. Straight and level flight should be established with full coordinated use of the controls. The airspeed indicator or tachometer, if installed, should never be allowed to reach their high-speed red lines at anytime during a practice stall.

6. SECONDARY STALLS. If recovery from a stall is not made properly, a secondary stall or a spin may result. A secondary stall is caused by attempting to hasten the completion of a stall recovery before the aircraft has regained sufficient flying speed. When this stall occurs, the back elevator pressure should again be released just as in a normal stall recovery. When sufficient airspeed has been regained, the aircraft can then be returned to straight-and-level flight.

7. SPINS. A spin in a small airplane or glider is a controlled or uncontrolled maneuver in which the glider or airplane descends in a helical path while flying at an angle of attack greater than the angle of maximum lift. Spins result from aggravated stalls in either a slip or a skid. If a stall does not occur, a spin cannot occur. In a stall, one wing will often drop before the other and the nose will yaw in the direction of the low wing.

8. WEIGHT AND BALANCE. Minor weight or balance changes can affect an aircraft's spin characteristics. For example, the addition of a suitcase in the aft baggage compartment will affect the weight and balance of the aircraft. An aircraft that may be difficult to spin intentionally in the utility category (restricted aft CG and reduced weight) could have less resistance to spin entry in the normal category (less restricted aft CG and increased weight) due to its ability to generate a higher angle of attack and increased load factor. Furthermore, an aircraft that is approved for spins in the utility category, but loaded in the normal category, may not recover from a spin that is allowed to progress beyond one turn.

9. PRIMARY CAUSE. The primary cause of an inadvertent spin is exceeding the critical angle of attack for a given stall speed while executing a turn with excessive or insufficient rudder, and, to a lesser extent, aileron. In an uncoordinated maneuver, the pitot/static instruments, especially the altimeter and airspeed indicator, are unreliable due to the uneven distribution of air pressure over the fuselage. The pilot may not be aware that a critical angle of attack has been exceeded until the stall warning device activates. If a stall recovery is not promptly initiated, the airplane is more likely to enter an inadvertent spin. The spin that occurs from cross controlling an aircraft usually results in rotation in the direction of the rudder being applied, regardless of which wing tip is raised. In a skidding turn, where both aileron and rudder are applied in the same direction, rotation will be in the direction the controls are applied. However, in a slipping turn, where opposite aileron is held against the rudder, the resultant spin will usually occur in

the direction opposite the aileron that is being applied.

10. TYPES OF SPINS.

a. An incipient spin is that portion of a spin from the time the airplane stalls and rotation starts, until the spin becomes fully developed. Incipient spins that are not allowed to develop into a steady spin are commonly used as an introduction to spin training and recovery techniques.

b. A fully developed spin occurs when the aircraft angular rotation rates, airspeed, and vertical speed are stabilized from turn-to-turn in a flightpath that is close to vertical.

c. A flat spin is characterized by a near level pitch and roll attitude with the spin axis near the CG of the airplane. Recovery from a flat spin may be extremely difficult and, in some cases, impossible.

11. SPIN RECOVERY. Before flying any aircraft, in which spins are to be conducted, the pilot should be familiar with the operating characteristics and standard operating procedures, including spin recovery techniques, specified in the approved AFM or POH. The first step in recovering from an upright spin is to close the throttle completely to eliminate power and minimize the loss of altitude. If the particular aircraft spin recovery techniques are not known, the next step is to neutralize the ailerons, determine the direction of the turn, and supply full opposite rudder. When the rotation slows, briskly move the elevator control forward to approximately the neutral position. Some aircraft require merely a relaxation of back pressure; others require full forward elevator control pressure. Forward movement of the elevator control will decrease the angle of attack. Once the stall is broken, the spinning will stop. Neutralize the rudder when the spinning stops to avoid entering a spin in the opposite direction. When the rudder is neutralized, gradually apply enough aft elevator pressure to return to level flight. Too much or abrupt aft elevator pressure and/or application of rudder and ailerons during the recovery can result in a secondary stall and possibly another spin. If the spin is being performed in an airplane, the engine will sometimes stop developing power due to centrifugal force acting on the fuel in the airplane's tanks causing fuel interruption. It is, therefore, recommended to assume that power is not available when practicing spin recovery. As a rough estimate, an altitude loss of approximately 500 feet per each 3-second turn can be expected in most small aircraft in which spins are authorized. Greater losses can be expected at higher density altitudes.

CHAPTER 2. FLIGHT TRAINING - STALLS

12. STALL TRAINING. Flight instructor-airplane and flight instructor-glider applicants must be able to give stall training. The flight instructor should emphasize that techniques and procedures for each aircraft may differ and that pilots should be aware of the flight characteristics of each aircraft flown.

Single-engine stalls should not be demonstrated or practiced in multiengine airplanes. Engine-out minimum control speed demonstrations in multiengine airplanes should not be attempted when the density altitude and temperature are such that the engine-out minimum control speed is close to the stall speed, since loss of directional or lateral control could result. The flight training required by FAR Part 61 does not entail the actual practicing of spins for other than flight instructor-airplane and flight instructor-glider applicants, but emphasizes stall and spin avoidance. The most effective training method contained in Report No. FAA-RD-77-26 is the simulation of scenarios that can lead to inadvertent stalls by creating distractions while the student is practicing certain maneuvers. Stall demonstrations and practice, including maneuvering during slow flight and other maneuvers with distractions that can lead to inadvertent stalls, should be conducted at a sufficient altitude to enable recovery above 1,500 feet AGL in single-engine airplanes and 3,000 feet AGL in multiengine airplanes. The following training elements are based on Report No. FAA-RD-77-26:

a. Stall Avoidance Practice at Slow Airspeeds.

(1) Assign a heading and an altitude. Have the student reduce power and slow to an airspeed just above the stall speed, using trim as necessary.

(2) Have the student maintain heading and altitude with the stall warning device activated.

(3) Demonstrate the effect of elevator trim (use neutral and full nose-up settings) and rudder trim, if available.

(4) Note the left turning tendency and rudder effectiveness for lateral/directional control.

(5) Emphasize how right rudder pressure is necessary to center the ball indicator and maintain heading.

(6) Release the rudder and advise the student to observe to the left yaw.

(7) Adverse yaw demonstration. While at a low airspeed, have the student enter left and right turns without using rudder pedals.

(8) Have the student practice turns, climbs, and descents at low airspeeds.

(9) Demonstrate the proper flap extension and retraction procedures while in level flight to avoid a stall at low airspeeds. Note the change in stall speeds with flaps extended and retracted.

(10) Realistic distractions at low airspeeds. Give the student a task to perform while flying at a low airspeed. Instruct the student to divide his/her attention between the task

and flying the aircraft to maintain control and avoid a stall. The following distractions can be used:

(i) Drop a pencil. Ask the student to pick it up. Ask the student to determine a heading to an airport using a chart.

(ii) Ask the student to reset the clock to Universal Coordinated Time.

(iii) Ask the student to get something from the back seat.

(iv) Ask the student to read the outside air temperature.

(v) Ask the student to call the Flight Service Station (FSS) for weather information.

(vi) Ask the student to compute true airspeed with a flight computer.

(vii) Ask the student to identify terrain or objects on the ground.

(viii) Ask the student to identify a field suitable for forced landing.

(ix) Have the student climb 200 feet and maintain altitude, then descend 200 feet and maintain altitude.

(x) Have the student reverse course after a series of S-turns.

(11) Flight at low airspeeds with the airspeed indicator covered. Use various flap settings and distractions.

b. Departure Stall.

(1) At a safe altitude, have the student attempt coordinated power-on (departure) stalls straight ahead and in turns. Emphasize how these stalls could occur during takeoff.

(2) Ask the student to demonstrate a power-on (departure) stall and distract him/her just before the stall occurs. Explain any effects the distraction may have had on the stall or recovery.

c. Engine Failure in a Climb Followed by a 180-Degree Turn. This demonstration will show the student how much altitude the airplane loses following a power failure after takeoff and during a 180-degree turn back to the runway and why returning to the airport after losing an engine is not a recommended procedure. This can be performed using either a medium or steep bank in the 180-degree turn, but emphasis should be given to stall avoidance.

(1) Set up best rate of climb (V sub y).

(2) Reduce power smoothly to idle as the airplane passes through a cardinal altitude.

(3) Lower the nose to maintain the best glide speed and make a 180-degree turn at the best glide speed.

(4) Point out the altitude loss and emphasize how rapidly airspeed decreases following a power failure in a climb attitude.

d. Cross Controlled Stalls in Gliding Turns. Perform stalls in gliding turns to simulate turns from base to final. Perform the stalls from a properly coordinated turn, a slipping turn, and a skidding turn. Explain the difference between slipping and skidding turns. Explain the ball indicator position in each turn and the aircraft behavior in each of the stalls.

e. Power off (Approach-To-Landing) Stalls.

(1) Have the student perform a full-flap, gear extended, power-off stall with the correct recovery and cleanup procedures. Note the loss of altitude.

(2) Have the student repeat this procedure and distract the student during the stall and recovery and note the effect of the distraction. Show how errors in flap retraction procedure can cause a secondary stall.

f. Stalls During Go-Arounds.

(1) Have the student perform a full-flap, gear extended, power-off stall, then recover and attempt to climb with flaps extended. If a higher than normal climb pitch attitude is held, a secondary stall will occur. (In some airplanes, a stall will occur if a normal climb pitch attitude is held.)

(2) Have the student perform a full-flap, gear extended, power-off stall, then recover and retract the flaps rapidly as a higher than normal climb pitch attitude is held. A secondary stall or settling with a loss of altitude may result.

g. Elevator Trim Stall.

(1) Have the student place the airplane in a landing approach configuration, in a trimmed descent.

(2) After the descent is established, initiate a go-around by adding full power, holding only light elevator and right rudder pressure.

(3) Allow the nose to pitch up and torque to swerve the airplane left. At the first indication of a stall, recover to a normal climbing pitch attitude.

(4) Emphasize the importance of correct attitude control, application of control pressures, and proper trim during go-arounds.

CHAPTER 3. FLIGHT TRAINING - SPINS

13. SPIN TRAINING. Spin training is required for flight instructor-airplane and flight instructor-glider applicants only. Upon completion of the training, the applicant's logbook or training record should be endorsed by the flight instructor who provided the training. A sample endorsement of spin training for flight instructor applicants is available in AC 61-65, Certification: Pilots and Flight Instructors, current edition.

a. Spin training must be accomplished in an aircraft that is approved for spins. Before practicing intentional spins, the AFM or POH should be consulted for the proper entry and recovery techniques.

b. The training should begin by practicing both power-on and power-off stalls to familiarize the applicant with the aircraft's stall characteristics. Spin avoidance, incipient spins, and actual spin entry, spin, and spin recovery techniques should be practiced from an altitude above 3,500 feet AGL.

c. Spin avoidance training should consist of stalls and maneuvering during slow flight using realistic distractions such as those listed in Chapter 2. Performance is considered unsatisfactory if it becomes necessary for the instructor to take control of the aircraft to avoid a fully developed spin.

d. Incipient spins should be practiced to train the instructor applicant to recover from a student's poorly performed stall or unusual attitude that could lead to a spin.

(1) Configure the aircraft for a power-on or power-off stall, and continue to apply back elevator pressure. As the stall occurs, apply right or left rudder and allow the nose to yaw toward the stalled wing. Release the spin inducing controls and recover as the spin begins by applying opposite rudder and forward elevator pressure. The instructor should discuss control application in the recovery.

e. Spin entry, spin, and spin recovery should be demonstrated by the instructor and repeated, in both directions, by the applicant.

(1) Apply the entry procedure for a power-off stall. As the airplane approaches a stall, smoothly apply full rudder in the direction of desired spin rotation and continue to apply back elevator to the limit of travel. The ailerons should be neutral.

(2) Allow the spin to develop, and be fully recovered no later than one full turn. Observe the airspeed indicator during the spin and subsequent recovery to ensure that it does not reach the red line (V sub NE).

(3) Follow the recovery procedures recommended by the manufacturer in the AFM or POH. In most aircraft, spin recovery techniques consist of retarding power (if in a powered aircraft),

applying opposite rudder to slow the rotation, neutralizing the ailerons, applying positive forward-elevator movement to break the stall, neutralizing the rudder as the spinning stops, and returning to level flight.

CHAPTER 4. AIRWORTHINESS STANDARDS

14. OPERATING LIMITATIONS. Operating limitations are imposed for the safety of pilots and their passengers. Operations contrary to these restrictions are a serious compromise of safety. It is, therefore, most important that all pilots, flight and ground instructors, and pilot examiners apply the following information on spinning to pilot training and flight operations.

a. Normal Category. Single-engine normal category airplanes are placarded against intentional spins. However, to provide a margin of safety when recovery from a stall is delayed, these airplanes are tested during certification and must be able to recover from a one-turn spin or a 3-second spin, whichever takes longer, in not more than one additional turn with the controls used in the manner normally used for recovery. In addition:

(1) For both the flaps-retracted and flaps-extended conditions, the applicable airspeed limit and positive limit maneuvering load factor may not be exceeded. For the flaps-extended condition, the flaps may be retracted during recovery;

(2) There may be no excessive back pressure during the spin recovery; and

(3) It must be impossible to obtain uncontrollable spins with any use of the controls.

Note: Since airplanes certificated in the normal category have not been tested for more than a one-turn or 3-second spin, their performance characteristics beyond these limits are unknown. This is the reason they are placarded against intentional spins.

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b. Acrobatic Category. An acrobatic category airplane must meet the following requirements.

(1) The airplane must recover from any point in a spin, in not more than one and one-half additional turns after normal recovery application of the controls. Prior to normal recovery application of the controls, the spin test must proceed for six turns or 3 seconds, whichever takes longer, with flaps retracted, and one turn or 3 seconds, whichever takes longer, with flaps extended. However, beyond 3 seconds, the spin may be discontinued when spiral characteristics appear with flaps retracted.

(2) For both the flaps-retracted and flaps-extended conditions, the applicable airspeed limit and the positive limit

maneuvering load factor may not be exceeded. For the flaps-extended condition, the flaps may be retracted during recovery, if a placard is installed prohibiting intentional spins with flaps extended.

(3) It must be impossible to obtain uncontrollable spins with any use of the controls.

Note: Since airplanes certificated in the acrobatic category have not been tested for more than six turns or 3 seconds, their performance characteristics beyond these limits are unknown.

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c. Utility Category. A utility category airplane must meet the requirements for either the normal or acrobatic category.

15. PLACARDS. Under FAR Section 23.1567, all airplanes type certificated under FAR Part 23 must have a flight maneuver placard containing the following information:

a. For normal category airplanes, there must be a placard in front of and in clear view of the pilot stating: "No acrobatic maneuvers, including spins, approved."

b. Additionally, for those utility category airplanes, with a certification basis after March 1978 and that do not meet the spin requirements for acrobatic category airplanes, there must be an additional placard in clear view of the pilot stating: "Spins Prohibited."

c. For acrobatic category airplanes, there must be a placard in clear view of the pilot listing the approved acrobatic maneuvers and the recommended entry airspeed for each. If inverted flight maneuvers are not approved, the placard must include a notation to this effect.

16. PILOT AWARENESS. The pilot of an airplane placarded against intentional spins should assume that the airplane may become uncontrollable in a spin. In addition, stall warning devices should not be deactivated for pilot certification flight tests in airplanes for which they are required equipment.