

***These AC sections are additions and replacements to the existing AC sections, to be published in the next change or revision AC 27-1.***

**Performance and Handling Qualities - Part 27, AC Material**

Amend AC 27.25 by the addition of:

AC 27.25A. § 27.25 (Amendment 27-44) WEIGHT LIMITS.

a. Explanation. Amendment 27-44 adds a requirement to create weight, altitude, and temperature limitations for those rotorcraft that are not able to meet the basic requirements of §§ 27.79 or 27.143(c). The § 27.79 height-velocity diagram must be demonstrated at maximum weight or at the highest weight allowing out-of-ground-effect (OGE) hover at a density altitude of 7,000 feet. The § 27.143(c) controllability must be demonstrated at critical weight at 7,000 feet density altitude. If either or both of these requirements cannot be met, the applicant must have in place the appropriate limitations to assure that take-offs and landings are limited to those weights, altitudes, and temperatures, plus any associated wind constraints, for which satisfactory demonstration has been made. In no case should those limits be established at an altitude that is not operationally suitable. In the past, the minimum operationally suitable altitude for takeoff and landing has been established as 3,000 feet density altitude.

b. Procedures. The policy material pertaining to the procedures outlined in this section remain in effect.

Amend AC 27.73 to new AC 27.49:

AC 27.49. § 27.49 (Former § 27.73) (Amendment 27-44) PERFORMANCE AT MINIMUM OPERATING SPEED.

(For § 27.73 prior to Amendment 27-44, see AC 27.73)

a. Explanation. Amendment 27-44 adds a requirement to determine out-of-ground-effect (OGE) hover performance. Once reserved for special missions, OGE operations are now a common practice.

(1) The word "hover" applies to a helicopter that is airborne at a given altitude over a fixed geographical point regardless of wind. Pure hover is accomplished only in still air. For the purpose of this manual, the word "hover" will mean pure hover.

(2) The regulatory requirement for hover performance, § 27.49, refers to hover in-ground-effect (IGE) and OGE. Hover OGE is the absence of measurable ground

effect. Hover OGE is established when the power required to hover is the same at different heights above the ground.

(3) The objective of hover performance tests is to determine the power required to hover at different gross weights, ambient temperatures, and pressure altitudes. Using non-dimensional power coefficients ( $C_p$ ) and thrust coefficients ( $C_t$ ) for normalizing and presenting test results minimizes the amount of data required to cover the helicopter's operating envelope.

(4) Hover performance tests must be conducted over a sufficient range of pressure altitudes and weights to cover the approved ranges of those variables for takeoff and landing. Additional data should be acquired during cold ambient temperatures, especially at high altitudes, to account for possible Mach effects.

(5) The IGE hover ceiling for which data should be obtained and subsequently presented in the flight manual should be the same height consistent with the minimum hover height demonstrated during the takeoff tests. Refer to AC 27.51 for the procedure to determine this hover height.

b. Procedures.

(1) Two methods of acquiring hover performance data are the tethered and the free flight techniques. The tethered technique is accomplished by tethering the rotorcraft to the ground using a cable and load cell. The load cell and cable are attached to the ground tie-down and to the rotorcraft cargo hook. The load cell is used to measure the rotorcraft's pull on the cable. Hover heights are based on skid or wheel height above the ground. During tethered hover tests, the rotorcraft should be at light gross weight. The rotorcraft will be stabilized at a fixed power setting and rotor speed at the appropriate skid or wheel height. Once the required data are obtained, power should be varied from the minimum to the maximum allowed at various rotor RPM. This technique will produce a large  $C_t/C_p$  spread. The load cell reading is recorded for each stabilized point. The total thrust the rotor produces is equal to the rotorcraft's gross weight plus the weight of the cables and load cell plus cable tension. Care must be taken that the cable tension does not exceed the cargo hook limit or load capacity of the tie-down. For some rotorcraft, it may be necessary to ballast the rotorcraft to a heavy weight in order to record high power hover data. IGE hover performance may be affected by the composition and slope of the surface beneath the rotorcraft. Therefore, the tests should be conducted over a smooth, level, hard surface.

(2) The pilot maintains the rotorcraft in position so that the cables and load cell are perpendicular to the ground. To ensure the cable is vertical, two outside observers, one forward of the rotorcraft and one to one side, can be used. Either hand signals or radio can be used to direct the pilot. The observers should be provided with protective equipment. Positioning can also be accomplished by attaching two accelerometers to the load cell, which sense angle or movement along the longitudinal and lateral axes. Any displacement of the load cell will be reflected on instrumentation in the cockpit, and

by reference to this instrumentation, the rotorcraft can be maintained in the correct position. Increased caution should be utilized as tethered hover heights are decreased because the rotorcraft may become more difficult to control precisely. The tethered hover technique is especially useful for OGE hover performance data because the rotorcraft's internal weight is low and the cable and load cell can be jettisoned in the event of an engine failure or other emergency.

(3) To obtain consistent data, the wind velocity should be less than 3 knots as there are no accurate methods of correcting hover data for wind effects. To minimize inaccuracies due to hysteresis, collective movement should be made in only one direction. Rotorcraft with high downwash velocities may tolerate higher wind velocities. The parameters usually recorded at each stabilized condition are:

- (i) Engine and transmission torque.
- (ii) Rotor speed.
- (iii) Ambient and engine temperatures, such as Measured Gas Temperature (MGT).
- (iv) Pressure altitude.
- (v) Fuel used (or remaining).
- (vi) Load cell reading.
- (vii) Generator(s) load.
- (viii) Wind speed and direction.
- (ix) Hover height.

As a technique, it is recommended the rotorcraft be loaded to a center of gravity (CG) near the hook to minimize fuselage angle changes with varying powers. All tethered hover data should be verified by a limited spot-check using the free flight technique. The free flight technique in AC 27.49.b.(4) will determine if any problems, such as load cell malfunctions, have occurred. The free flight hover data must fall within the allowable scatter of the tethered data.

(4) If there are no provisions or equipment to conduct tethered hover tests, the free flight technique is also a valid method. The disadvantage of this technique, as the primary source of data acquisition, is that it is very time consuming. In addition, a certain element of safety is lost OGE in the event of an emergency. The rotorcraft must be re-ballasted to different weights to allow the maximum  $C_t/C_p$  spread. When using the free flight technique, either as a primary data source or to substantiate the tethered technique, the same considerations for wind, recorded parameters, etc., as used in the

tethered technique, apply. Free flight hover tests should be conducted at CG extremes to verify any CG effects. Applicants must account for any rotorcraft stability augmentation system that may influence hover performance.

(5) Comprehensive hover performance tests are typically conducted at low, intermediate (~7000 feet Hd), and high altitude test sites, with prepared landing surfaces, in conjunction with takeoff, landing, controllability, and maneuverability testing. Alternatively, a predicted hover performance model developed for high altitude may be used if verified by limited flight-testing. The extrapolation guidelines in AC 27.45.b.(2) are still applicable. These higher altitude hover tests could typically be conducted in conjunction with the limited controllability tests. If the applicant is able to demonstrate to the FAA/AUTHORITY a method to provide a reliable hover reference, it is acceptable to conduct OGE tests without ground reference. Hover performance can usually be extrapolated up to a maximum of 4,000 feet above the highest test site altitude.

Amend AC 27.51 by the addition of:

AC 27.51A. § 27.51 (Amendment 27-44) TAKEOFF.

a. Explanation. Amendment 27-44 revised the requirement to perform the test at the most critical center-of-gravity (CG) location as opposed to the most forward CG. While it is not always the case, the forward CG is particularly critical for most rotorcraft. Additionally, the change clarifies that the test must be performed at the maximum weight requested for takeoff for altitudes above sea level. The previous requirement stated that the test be performed at a weight selected by the applicant for altitudes above sea level. That weight was traditionally interpreted to mean the maximum requested takeoff weight for that altitude and it is now stated that way in the rule.

b. Procedures. The policy material pertaining to the procedures outlined in this section remain in effect.

Amend AC 27.71 title to:

AC 27.71. § 27.71 (Amendment 27-44) Autorotation Performance.

All of the policy material pertaining to this section remains in effect.

Amend AC 27.73 to reflect the new AC 27.49:

All of the policy material pertaining to AC 27.73 remains in effect through Amendment 27-43. See § 27.49 and AC 27.49 effective with Amendment 27-44.

Amend AC 27.75 by the addition of:

AC 27.75A. § 27.75 (Amendment 27-44) Landing.

a. Explanation. Amendment 27-44 rewords § 27.75(a) by replacing the word “glide” with “autorotation” and further clarifies that the one-engine-inoperative (OEI) approach is to be performed from an established OEI approach. The OEI approach should be made utilizing a normal helicopter approach angle of approximately 6° or some other angle determined to be acceptable to the FAA/AUTHORITY and properly referenced in the Rotorcraft Flight Manual (RFM).

b. Procedures. The policy material pertaining to this section remains in effect with the following changes and additions:

(1) Instrumentation/Equipment. Aircraft instrumentation may include engine and flight parameters, control positions, power lever position, and landing gear loads. A record of rotor RPM at touchdown is necessary to assure it does not exceed transient limits. Rotor RPM at touchdown may be lower than the minimum transient limit for flight, provided stress limits are not exceeded. A crash recovery team with the support of a fire engine is highly desirable.

(2) The OEI landing is similar in many respects to the Height-Velocity (HV) tests described in AC 27.79 of this advisory circular. Most of the comments, cautions, and techniques for HV also apply here, even though the typical flight conditions are less critical than limiting HV points due to a lower power level and an established rate of descent. The approach is made at a predetermined speed with OEI. The speed is reduced and the rotorcraft is flared to a conventional OEI landing. To show compliance, full OEI landing should be demonstrated from sea level to the maximum altitude capability of the rotorcraft or 7,000 feet, whichever is less, at the maximum landing weight, without damage. For altitudes above 7,000 feet to the maximum takeoff and landing altitude, compliance with this requirement is shown by demonstrating that the OEI descent rate and forward speed can be reasonably controlled.

(3) Power. Power should be limited to minimum specification values on the operating engine(s). This may be accomplished by adjustment of engine topping to minimum specification values for the range of the atmospheric variables to be approved. This is frequently done by installing an adjustable device in the throttle linkage with a control in the cockpit so that engine topping can be accurately adjusted for varying ambient conditions. With such a device in the control system, it becomes vitally important to check topping power prior to each test sequence.

(4) Aircraft Loading. Aft CG is usually the most critical because visibility constraints limit the degree to which the pilot can see the landing surface during the flare. If a weight effect is shown, a minimum of two weights should be flown at each test

altitude. One weight should be the maximum weight for prevailing conditions, and the other should provide a sufficient spread to validate weight accountability.

(5) All-engine-out landing.

(i) Several procedures can be utilized to demonstrate compliance with the all-engine-out landing requirement of § 27.75(a)(1) and § 27.75(b). These paragraphs contain two separate requirements. One is the ability to transition safely into autorotation after failure of the last operative engine. The second aspect of this rule requires that a landing from autorotation be possible. The second requirement is discussed below. The maneuver is entered by smoothly reducing power at an optimum autorotation airspeed at a safe height above the landing surface. Typically a full autorotation landing to touchdown is demonstrated at sea level standard day for the maximum landing gross weight for that altitude. For altitudes above standard sea level, a demonstration of flare effectiveness with power recovery at the maximum landing gross weight corresponding to the altitude satisfies the requirement for touchdown. The flare must reduce the autorotative descent rate and forward speed to a reasonable value (i.e., autorotative descent rate and forward speed consistent with that demonstrated at sea level). If a complete company test program has documented the all-engine-out landing capability, verification tests may be initiated at those limiting weight conditions. If not, buildup testing should be initiated at light weight.

(ii) Demonstrated compliance with this requirement is intended to show that the autorotative descent rate and forward speed at touchdown (less than 40 knots true airspeed (KTAS) is recommended) can be controlled to a reasonable value to ensure a reasonable chance of survivability for the all engine failure condition. On multiengine rotorcraft, rotor inertia is typically lower than for single-engine rotorcraft. RPM decays rapidly when the last engine is made inoperative. Due to this relatively low inertia level, considerable application of collective pitch may be needed to prevent rotor overspeed conditions when the rotorcraft is flared for landing. Also, when testing the final maximum weight points, the pilot should anticipate a need for considerable application of collective pitch to control rotor overspeed during autorotative descent, particularly at high altitude. Some designs incorporate features that may lead to rotorcraft damage in testing this requirement (e.g., droop stop breakage or loss of directional control with skids) if landings are conducted to a full stop with the engines off.

(iii) The intent of this rule is to demonstrate controlled touchdown conditions and freedom from loss of control or apparent hazard to occupants when landing with all engines failed. In these cases, compliance can be demonstrated by leaving throttles in the idle position and ensuring no power is delivered to the drive train. Also, computer analysis may be used in conjunction with simulated in-flight checks to give reasonable assurance that an actual safe touchdown can be accomplished. Another method may be to make a power recovery after flare effectiveness of the rotorcraft has been determined, showing that the rate of descent and forward speed can be controlled to allow for safe landing. Other methods may be considered if they lead to reasonable assurance that rate of descent and forward speed can be controlled to allow safe

landing with no injury to occupants when landing on a prepared surface with all engines failed. Regardless of the method(s) used to comply with this requirement, careful planning and analyses are very important due to the potentially hazardous aspects of power off simulation and landing of a multiengine rotorcraft totally without power. The OEI landing test is ordinarily done in conjunction with height velocity tests because ground and onboard instrumentation requirements are the same for both tests.

(6) Prior to conducting these tests, the crew should be familiar with the engine inoperative landing characteristics of the rotorcraft. The flight profile may be entered in the same manner as a straight-in practice autorotation. It is recommended that for safety reasons, idle power be used if a "needle split" (no engine power to the rotor) can be achieved. In some cases, a low engine idle adjustment has been set to assure needle split is attained. In other cases, a temporary detent between idle and cutoff was used on the throttle. In a third case, the engine was actually shut down on sample runs to verify that the engine power being delivered was not materially influencing landing capability or landing distances. The flare is maintained as long as it is reasonable to dissipate speed and build RPM. Rotor RPM must stay within allowable limits. Aft CG is ordinarily critical due to visibility and pitch attitude effectiveness in a flare. Following the flare, the rotorcraft is allowed to touch down in a landing attitude. Rotor RPM at touchdown should be recorded, and it must be within allowable structural limits.

Amend AC 27.79 to reflect new AC 27.87 with revised title:

All of the policy material pertaining to AC 27.79 remains in effect through Amendment 27-43. See § 27.87 and AC 27.87 effective with Amendment 27-44.

Amend AC 27.79 to new AC 27.87 with revised title:

AC 27.87. § 27.87 (Former § 27.79) (Amendment 27-44) Height-Speed Envelope.

(For § 27.79 prior to Amendment 27-44, see AC 27.79)

AC 27.87. § 27.87 (Amendment 27-44) HEIGHT-SPEED ENVELOPE.

a. Explanation. Amendment 27-44, in addition to some minor text changes, clarifies the one-engine-inoperative (OEI) engine power to be used (for multi-engine rotorcraft) when demonstrating the requirement. The engine power of the remaining engine is the minimum uninstalled specification power after it is corrected for installation losses. The methods of determining this power are established in the general performance paragraph of this AC.

b. Procedures. The policy material pertaining to the procedures outlined in this section remain in effect.

Amend AC 27.143 by the addition of:

AC 27.143A. § 27.143 (Amendment 27-44) CONTROLLABILITY AND MANEUVERABILITY.

a. Explanation. Amendment 27-44 made a minor clarification to assure that in-ground-effect (IGE) controllability is demonstrated at all speeds up to 17 knots. In many rotorcraft, the entry into the regime of translational lift requires the most power, thus potentially causing control difficulties, and frequently occurs at speeds less than 17 knots. The amendment also requires that, above 7,000 feet density altitude in which takeoff and landing performance is scheduled, the controllability of the rotorcraft be determined. The amendment also requires that out-of-ground-effect (OGE) controllability be determined up to a speed of at least 17 knots at a weight selected by the applicant up to the maximum takeoff and landing altitude of the rotorcraft.

All the policy material pertaining to this section remains in effect with the following changes:

(1) This regulation contains the basic controllability requirements for normal category rotorcraft. It also specifies a minimum maneuvering capability for required conditions of flight. The general requirements for controllability and for maneuverability are summarized in § 27.143(a), which is self-explanatory. The hover condition is not specifically addressed in § 27.143(a)(2) so that the general requirement may remain applicable to all rotorcraft types, including those without hover capability. For rotorcraft, the hover condition clearly applies under "any maneuver appropriate to the type."

(2) Paragraphs (b) through (e) in § 27.143 include more specific flight conditions and highlight the typical areas of concern during a flight test program.

(i) § 27.143(b) specifies flight at  $V_{NE}$  with critical weight, center of gravity (CG), rotor RPM, and power. Adequate cyclic authority must remain at  $V_{NE}$  for nose down pitching of the rotorcraft and for adequate roll control. Nose down pitching capability is needed for control of gust response and to allow necessary flight path changes in a nose down direction. Roll control is needed for gust response and for normal maneuvering of the aircraft. In the past, 10 percent control travel margin has been applied as an appropriate minimum control standard. The required amount of control power, however, has very little to do with any fixed percentage of remaining control travel. There are foreseeable designs for which 5 percent remaining is adequate and others for which 20 percent may not be enough. The key is, can the remaining longitudinal control travel at  $V_{NE}$  generate a clearly positive nose down pitching moment, and will the remaining lateral travel allow at least 30° banked turns at reasonable roll rates? Moderate lateral control reversals should be included in this evaluation and since available roll control can diminish with sideslip, reasonable out of trim conditions

(directionally) should be investigated. This "control remaining" philosophy must also be applied for other flight conditions specified in this section.

(ii) § 27.143(c) requires a minimum control capability for hover and takeoff in winds from zero to at least 17 knots from any azimuth. Control capability in wind from zero to at least 17 knots must also be shown for any other appropriate maneuver near the ground such as rolling takeoffs for wheeled rotorcraft. On helicopters incorporating a tail rotor, efficiency of the tail rotor decreases with altitude so that a given sideward flight condition requires more pedal deflection, a higher tail rotor blade angle, and more horsepower. Hence, directional capability in sideward flight (or at critical wind azimuth) is most critical during testing at a high altitude site.

(iii) § 27.143(e) requires adequate controllability when an engine fails. This requirement specifies conditions under which engine failure testing must be conducted and includes minimum required delay times.

(A) For rotorcraft that meet the engine isolation requirements of transport Category A, demonstration of sudden complete single-engine failure is required at critical conditions throughout the flight envelope including hover, takeoff, climb at  $V_Y$ , and high speed flight up to  $V_{NE}$ . Entry conditions for the first engine failure are engine or transmission limiting maximum continuous power (MCP) (or takeoff power where appropriate) including reasonable engine torque splits. For multiengine Category A installations with three or more engines, the subsequent engine failures should be conducted utilizing the same criteria as that used for first-engine failure. The applicant may limit his flight envelope for subsequent failures. Initial or sequential engine failure tests are ordinarily much less severe than the "last" engine failure test required by § 27.75(b). The conditions for last-engine failure are MCP or 30-minute power if that rating is approved, level flight, and sudden engine failure with the same pilot delay of 1-second or normal pilot reaction time, whichever is greater.

(B) For rotorcraft without transport Category A engine isolation, demonstration of sudden complete power failure is required at critical conditions throughout the flight envelope. This includes speeds from zero to  $V_{NE}$  (power-on) and conditions of hover, takeoff, and climb at  $V_Y$ . MCP is specified prior to the failure for the cruise condition. Power levels appropriate to the maneuver should be used for other conditions. The corrective action time delay for the cruise failure should be 1-second or normal pilot reaction time (whichever is greater). Cyclic and directional control motions are normally not subject to the 1-second restriction; however, the delay is always applied to the collective control for the cruise failure. If the aircraft flying qualities and cyclic trim configuration encourage routine release of the cyclic control to complete other cockpit tasks during cruise flight, consideration should be given to also holding cyclic fixed for the 1-second delay. Although the same philosophy could be extended to the directional controls, the likelihood of the pilot having his feet away from the pedals is much lower, unless the aircraft has a heading hold feature. Rotor speed at execution of the cruise condition power failure should be the minimum power-on value. The term "cruise" also includes cruise climb and cruise descent conditions. Normal pilot reaction

times are used elsewhere. Although this requirement specifies MCP, it does not limit engine failure testing to MCP. If a takeoff power rating is authorized for hover or takeoff, engine failure testing must also be accomplished for those conditions. Following power failure, the rotor speed, flapping, and aircraft dynamic characteristics must stay within structurally approved limits.

(iv) § 27.143(f) addresses the special case in which a  $V_{NE}$  (power-off) is established at an airspeed value less than  $V_{NE}$  (power-on). For this case, engine failure tests are still required at speeds up to and including  $V_{NE}$  (power-on), and the rotorcraft must be capable of being slowed to  $V_{NE}$  (power-off) in a controlled manner with normal pilot reactions and skill. There is, however, no controllability requirement for stabilized power-off flight at speeds above  $1.1 V_{NE}$  (power-off) when  $V_{NE}$  (power-off) is established per § 27.1505(c).

(v) Application of the controllability requirement for pitch, roll, and yaw at speeds of  $1.1 V_{NE}$  (power-off) and below is similar to that described above for power-on testing at  $V_{NE}$ . Sufficient directional control must exist to allow straight flight in autorotation during all approved maneuvers including  $30^\circ$  banked turns up to  $V_{NE}$  (power-off) with some small additional allowance for gust control. Adequate controllability margins must exist in all axes throughout the approved autorotative flight envelope. Testing to  $V_{NE}$  at MC power per § 27.143(b) and § 27.175(c), and to  $1.1 V_{NE}$  (power-off) in autorotation per § 27.143(f) should be sufficient to assure adequate control margin during a descent condition at high speed and low power. The high speed, power-on descent condition should be checked for adequate control margin as a "maneuver appropriate to the type." There has been one instance where insufficient directional pedal was available to maintain a reasonable trimmed sideslip angle with low power at very high speeds, and a case where there was insufficient forward and lateral cyclic available to reach the power on  $V_{NE}$ . The insufficient directional pedal margin was due to the offset vertical stabilizers. The lack of cyclic stick margin was because the cyclic stick migrated to the right as power was reduced, and the control limits were circular. This provided less total available forward cyclic stick travel when the cyclic was moved right and forward about  $45^\circ$  from the center position. Each of the above rotorcraft was certificated with a rate of descent limitation to preclude operation in the control-limited area.

(vi) An evaluation of the emergency descent capability of the rotorcraft should be made, either analytically or through flight test. Areas of consideration are the rate of descent available, the maximum approved altitude, and the time before a catastrophic failure following the loss of transmission oil pressure or other similar failure. Each rotorcraft should have the capability to descend to sea level and land from the maximum certificated altitude within the time period established as safe following a critical failure. If the time period does not permit a sea level landing, the maximum height above the terrain must be specified in the limitation section of the Rotorcraft Flight Manual (RFM).

(3) The required controllability and maneuvering capabilities must also be considered following the failure of automatic equipment used in the control system (§ 27.672). Examples include stability augmentation systems (SAS), stability and control augmentation systems (SCAS), automatic flight control systems (AFCS), devices to provide or improve longitudinal static stability such as a pitch bias actuator (PBA), yaw dampers, and fly-by-wire elevator or stabilator surfaces. These systems all use actuators of some type, and are subject to actuator softover and hardover malfunctions. The flight control system should be evaluated to determine whether an actuator jammed in an extreme position would result in reduced control margins. Generally, if the flight control system stops are between the actuator and the cockpit control, the control margin will be affected. If the control stops are between the actuator and the rotor head, the control margins may not be affected, but the location of the cockpit control may be shifted. This could produce interference with other items in the cockpit. An example of this would be a lateral actuator jammed hardover causing a leftward shift in the cyclic stick position. Interference between the cyclic stick, the pilot's leg, and the collective pitch control could reduce the left lateral control available and reduce left sideward flight capability. In the case of fly-by-wire surfaces, both the high-speed forward flight controllability and the rearward flight capabilities could be affected. Flight control systems that incorporate automatic devices should be thoroughly evaluated for critical areas. Every failure condition that is questionable should be flight tested with the appropriate actuator fixed in the critical failure position. These failures may require limitations of the flight envelope. Any procedure or limitation that must be observed to compensate for an actuator hardover or softover malfunction should be included in the RFM.

b. Procedures. The policy material pertaining to this section remains in effect with the following changes and additions:

(1) Flight test instrumentation should include ambient parameters, all flight control positions, rotor RPM, main and tail rotor flapping (if appropriate), engine power instruments, and throttle position. Flight controls that are projected to be near their limits of authority should be rigged to the most adverse production tolerance. A very accurate weight and balance computation is needed along with a precise knowledge of the aircraft's weight/CG variation as fuel is burned.

(2) The critical condition for  $V_{NE}$  controllability testing is ordinarily aft CG, MC power, and minimum power-on rotor RPM, although power and RPM variations should be specifically evaluated to verify their effects. The turbine engine is sensitive to ambient temperatures, which affect the engine's ability to produce rated maximum continuous torque. Flight tests conducted at ambient temperatures that cause the turbine temperature to limit MCP would not produce the same results obtained at the same density altitude at colder ambient temperatures where maximum continuous torque would be limiting. Forward CG should be spot checked for any "tuck under" tendency at high speed. The  $V_{NE}$  controllability test is normally accomplished shortly after the  $1.1 V_{NE}$  (or  $1.1V_H$ ) point obtained during stability tests required by § 27.175(b). Controllability must be satisfactory for both conditions. If  $V_{NE}$  varies with altitude or

temperature,  $V_{NE}$  for existing ambient conditions is utilized for the test. Extremes of the altitude/temperature envelope should be analyzed and investigated by flight test.

### (3) Controllability

(i) The critical condition for controllability testing in a hover is ordinarily forward CG at maximum weight with minimum power-on rotor RPM. For rearward flight testing of configurations where the forward CG limit varies with weight, low or high gross weight may be critical. Lateral CG limits should also be investigated. A calibrated pace vehicle is needed to assure stabilized flight conditions. Surface winds should be less than 3 knots throughout the test sequence. Testing can be done in higher stabilized wind conditions (gusting less than 3 knots); however, these conditions are very difficult to find and the method is very time consuming due to the necessity of waiting for stabilized winds. Testing in calm winds is preferred. IGE hover controllability testing should be accomplished with the lowest portion of the helicopter at the published hover height above ground level; however, the test altitude above the ground may be increased to provide reasonable ground clearance. OGE testing should be done with the rotor at a predetermined height above the ground at which it has been determined that there is no ground effect. Although the necessary yaw response will vary somewhat from model to model, sufficient control power should be available to permit a clearly recognizable yaw response after full directional control displacement when the helicopter is held in the most critical position relative to wind.

(A) Testing will normally be carried out at the power required to achieve stabilized flight conditions. However, it is also important to show that yaw control remains adequate to allow normal power changes that might be required in normal operational maneuvers typical for the type and use of the rotorcraft. With rotorcraft that are operating in conditions in which the gross weight is limited by the power available, there should always be adequate tail rotor pedal control available to maintain yaw control when using up to take-off power. However, this will not be the case if the rotorcraft weight in the low speed flight envelope is limited by yaw control system capability.

(B) To cover the case where excess power is available, it is appropriate to examine the rotorcraft characteristics with some small amounts of additional power applied above the trim power required to hover to allow for typical power variations that will be experienced during normal use of the rotorcraft. For example, maneuvering or turbulence will cause the pilot to use some of the excess power available. The rotorcraft should be flown, both IGE and OGE, with the most adverse wind speed and direction for directional control within the flight envelope proposed. Use power variations above trim that might be expected during normal use of the rotorcraft giving consideration to the amount of excess power available, the ease with which power can be controlled by collective, and the characteristics of the rotorcraft if the limits of directional control are approached. There should be no tendency to deviate rapidly or suddenly in yaw. This assessment is normally conducted in conjunction with the critical azimuth testing.

(C) It may be appropriate to provide flight manual information on the directional control characteristics, including any relevant maximum power above which it could be expected that directional control might not be maintained.

(ii) Comprehensive controllability tests are typically conducted at low, intermediate (~7000 feet Hd) and high tests sites, with prepared landing surfaces, in conjunction with takeoff, landing, and performance testing.

(iii) Alternatively, a predicted controllability model developed for high altitude may be used if verified by limited flight-testing with steady ambient winds. The extrapolation guidelines in AC 27.45 b (2) are still applicable. These high altitude controllability tests could typically be conducted in conjunction with takeoff, landing, and performance tests.

(iv) Controllability can usually be extrapolated up to a maximum of 2,000 feet above the highest test site altitude.

**NOTE:** Engine operating characteristics must be considered during the limited high altitude tests.

(4) Prior to engine failure testing, the pilot should be fully aware of his engine, drive system, and rotor limits. These limits were established during previous ground and flight tests and should be specified in the type inspection authorization (TIA). Particular attention should be given to minimum stabilized and minimum transient rotor RPM limits. These values should be included in the TIA and should be approached gradually with a build-up in time delay unless the company testing has completely validated all pertinent aspects of engine failure testing. On Category A installations, the maximum power output of each engine should be limited so that when an engine fails and the remaining engine(s) assume the additional load, the remaining engine(s) are not damaged by excessive power extraction and exceeding a temperature limitation. This is needed for compliance with § 29.903(b). The propulsion engineer should have assured that this feature was properly addressed in the engine and drive system substantiation; however, it must be assumed that for some period of time the pilot may extract maximum available power from the remaining engine(s) when an engine fails during critical flight maneuvers. Substantiation of this feature should be accomplished primarily by engine and drive system ground tests.

(5) Longitudinal cyclic authority at  $V_{NE}$  with any power setting must permit suitable nose down pitching of the rotorcraft. If the remaining control travel is considered marginal, tests should include applications up to full control deflection to assess the remaining authority. Some knowledge of the aircraft's response to turbulence is useful in assessing the remaining margin. As a minimum, the rotorcraft must have adequate margin available to overcome a moderate turbulent gust and must not have any divergent characteristic that requires full deflection of the primary recovery control to arrest aircraft motion. If other controls must be utilized to overcome adverse aircraft

motion, the results are unacceptable; e.g., if a pitch up tendency resulting from an actual or simulated moderate turbulent gust cannot be satisfactorily overcome by remaining forward cyclic, the use of throttle or collective controls to assist the recovery is not an acceptable procedure; however, the use of lateral cyclic to correct roll in conjunction with forward cyclic to correct pitch-up is satisfactory. Obviously during the conduct of these tests, all available techniques should be utilized when the pilot finds himself "out of control." However, compliance with this section requires that recovery must be shown by use of only the primary control for each axis of aircraft motion.

(6) Cyclic control authority in autorotation must be sufficient to allow adequate flare capability and landing under the all-engine-inoperative requirements of § 27.75.

Amend AC 27.173 by the addition of:

AC 27.173A. § 27.173 (Amendment 27-44) STATIC LONGITUDINAL STABILITY.

a. Explanation.

(1) Amendment 27-44 makes a major change to the requirement by allowing for neutral or negative static longitudinal stability in limited flight domains. Additionally the requirement for the hover demonstration found in § 27.173(c) has been deleted as this requirement is adequately covered by the controllability requirements. The basic tenants of the rule are unchanged in that the rule contains control system design requirements for both stability and control. Paragraph (a) contains the basic control philosophy necessary for all civil aircraft. Forward motion of the cyclic control must produce increasing speeds and aft motion must result in decreasing speeds. For rotorcraft, this is accomplished with throttle and collective held constant. This requirement in no way assures aircraft stability. It is simply a control requirement that speaks to direction of control motion. Rotorcraft with either highly stable or highly unstable static longitudinal stability characteristics can typically comply with the basic requirement for control sense of motion.

All the policy material pertaining to this section remains in effect with the following changes and additions:

(2) §§ 27.173 through 27.175 contain the basic control position requirements necessary to establish a minimum level of static longitudinal stability. Positive stability is found for conditions of climb, cruise,  $V_{NE}$ , and autorotation in § 27.175 by demonstrating a stable stick position gradient through a specified speed range. This is the primary method of demonstrating compliance with the longitudinal static stability requirements.

(3) For aircraft that do not possess positive control position stability for some limited flight conditions or modes of operation, an equivalent level of safety was previously provided which requires a qualitative evaluation of the pilot's ability to

maintain a given airspeed, within 5 knots of the desired speed, without exceptional piloting skill or alertness. These flight conditions and modes of operation could include various combinations of gross weight, CG, flight regime (climb, cruise, descent), ambient conditions (altitude/temperature) as well as possible variations in the stability augmentation configuration. In the past, the FAA/AUTHORITIES have certified numerous rotorcraft, under equivalent level of safety findings, which have neutral or negative static longitudinal stick position stability in some flight domains. This amendment to § 27.173 is intended to allow for this case without having to resort to an equivalent safety finding. For these previous equivalent safety findings, acceptable qualitative flight characteristics were found on aircraft, which possessed negative longitudinal stick position gradients of up to 2-3% of total control travel in certain flight regimes; however, this value is not intended to be a limit. When this means of compliance is elected by the applicant, in addition to the qualitative pilot evaluation, it is still necessary to collect the data associated with the classical static longitudinal stability testing as defined in § 27.175.

b. Procedures.

All the policy material pertaining to this section remains in effect with the following changes and additions:

(1) The control requirement of paragraph (a) of this section is so essential to basic flight mechanics that compliance may be found during conventional flight-testing for compliance with other portions of the regulations. No special or designated testing should be required.

(2) The procedures necessary to assure compliance with the primary stability requirements of this section are contained under § 27.175, Demonstration of Static Longitudinal Stability. Refer to AC 27.175 of this advisory circular for an explanation of detailed flight test procedures.

(3) The procedures necessary to assure compliance with the alternative (i.e., pilot evaluation) method of compliance are provided below.

(i) For those limited conditions where compliance with the basic control position requirements cannot be shown, the evaluation must focus on the ability of the pilot to maintain airspeed in the flight regime without exceptional piloting skill or alertness under typical flight conditions. "Limited flight conditions" infers that the aircraft should be in reasonable compliance with the stick position stability requirements of § 27.173(b) for most of the flight conditions and configurations tested. Extraordinary means of complying with § 27.173(b) should not be forced on the aircraft design if the airspeed retention task meets the pilot skill and alertness guidelines. The demonstration flight regimes are defined in § 27.175(a) through (d). For those flight regimes, conditions and configurations where compliance with stick position requirements of § 27.173(b) cannot be shown, the evaluation pilot should assess the ease of maintaining airspeed within the specified +/- 5 knots.

(ii) When assessing the ease of maintaining airspeed the total workload must be considered. Secondary tasks pertinent to the minimum flight crew in each flight regime should be conducted. This may include visual navigation and communication in cruise, traffic avoidance in climb, and landing site selection in autorotation.

(iii) The cues that the aircraft provides are an important contributor to the evaluation, and the nature of these cues should be noted in the compliance report where this alternate qualitative evaluation determines that the aircraft has satisfactory airspeed stability characteristics. The cues that supplant the control position cues may be found to be sufficient if these cues are natural to the speed maintenance task, and provide adequate guidance to the pilot during the task. One important cue might be the pitch attitude gradient with speed, where a perceptible change in trimmed pitch attitude is required for a perceptible airspeed change. Where pitch attitude is the predominant cue the relationship should be positive (nose down with airspeed increase) and perceptible without exceptional alertness. With this relationship, the evaluation pilot may find that the natural pitch control tasks associated with attitude control result in adequate airspeed retention, and the aircraft would be found to be in compliance. It may be that the power/airspeed relationship of the aircraft can create adequate cues, where a significant rate of descent is created by a nose down pitch attitude change and a subsequent airspeed increase. In this case, the normal cues associated with altitude retention during fixed power cruise flight may prove to be acceptable for airspeed retention if the evaluation pilot finds that, within the context of the overall flight task, airspeed retention is sufficiently accurate. These altitude change cues may not be usable in autorotation or climb, but may be sufficient in cruise or  $V_{NE}$  tasks.

(iv) Other cues may be found for a specific aircraft, such as small but perceptible changes in noise or vibration. It is not intended that the evaluation pilot search for these cues in order to learn how to maintain airspeed in the aircraft under evaluation. These cues should be perceptible to the typical pilot and sufficient to reinforce the airspeed maintenance task.

Amend AC 27.175 by the addition of:

AC 27.175A. § 27.175 (Amendment 27-44) DEMONSTRATION OF STATIC LONGITUDINAL STABILITY.

a. Explanation. Amendment 27-44 reduces the speed range for the climb and cruise demonstration points of §§ 27.175(a) and 27.175(b), respectively. A new paragraph (c) was added to require an additional cruise demonstration point in order to compensate for the change in reduced speed range in paragraph (b). Additionally, for autorotation, two typically used trim points are required in place of the current requirement. The requirement for the hover demonstration was eliminated for the reasons given in AC 27.173 (Amendment 27-44).

All the policy material pertaining to this section remains in effect with the following changes:

(1) This rule incorporates the specific flight requirements for demonstration of static longitudinal stability. Specific loadings, configurations, power levels, and speed ranges are stated for conditions of climb, cruise,  $V_{NE}$ , and autorotation.

(2) Some rotorcraft in forward flight experience significant changes in engine power with changes in airspeed even though collective and throttle controls are held fixed and altitude remains relatively constant. For these cases, the guidance in § 27.173, which states that throttle and collective pitch must be held constant, is appropriate for administration of this rule, and the specified powers in § 27.175 should be considered as power established at initial trim conditions. This will result in slightly higher or lower power readings at “off trim” conditions. Collective and throttle controls are held constant when obtaining test data.

(3) The effects of rotor RPM on autorotative static stability should be determined and positive stability demonstrated for the most critical RPM. For Category A rotorcraft this requirement may be satisfied at a nominal RPM value. RPM values can be expected to change as airspeed is varied from the “trimmed” condition. The manufacturer’s recommended autorotation airspeed is ordinarily used for trim.

b. Procedures.

All the policy material pertaining to this section remains in effect with the following changes:

(1) Instrumentation.

(i) Sensitive control position instrumentation is mandatory. Engine power parameters should be recorded at trim. For testing of minor modifications or when using a “before and after” method, a tape measure or a stick plotting board may be utilized. A stick plotting board consists of a level surface with a clean sheet of paper on it and attached to the cockpit or seat structure. The installation must not interfere when the flight controls are fully displaced. A recording pencil is attached to the cyclic control by an offsetting arm in such a manner that it can be pushed down on the board to record relative cyclic position at key times during test maneuvers. The Figure AC 27.175A-1 plot is a typical presentation of longitudinal static stability.

(ii) Other necessary parameters include pitch attitude, pressure altitude, ambient temperature, and indicated airspeed.

(2) Ambient Conditions. Smooth air is necessary for stability testing.

(3) Loading. Aft center of gravity (CG) is ordinarily critical for longitudinal stability testing, although high-speed flight should be checked at full forward CG and maximum weight. At aft CG, light or heavy weight conditions can be critical. The manufacturer's flight data should be reviewed to determine critical loading conditions.

(4) Conducting The Test.

(i) The rotorcraft should be established in the desired configuration and flight condition (climb, cruise,  $V_{NE}$ , autorotation) with the required power and rotor speed at the trim airspeed. The collective stick should be fixed in that position: usually by applying sufficient friction to ensure that it is not inadvertently moved. For autorotative tests, a rotor speed should be selected so that the variations in rotor speed as airspeed and altitude change do not exceed the allowable limits. This point is recorded as the trim point. Airspeed is then increased or decreased in about 5-knot increments, stabilizing on each speed and recording the data. At least two points on each side of the trim speed should be taken.

(ii) The cruise test should be conducted by varying airspeed around the desired altitude with throttle and collective fixed. This should be accomplished by first determining  $V_H$  (level flight speed at maximum continuous power) at the test altitude. Then adjust power to establish a level trimmed condition at  $V_H$  (or  $0.8 V_{NE}$  if lower). This point is then recorded as the trim point.

(iii) For climb and autorotation tests, conduct fixed collective tests through an altitude band (usually  $\pm 2,000$  feet). It will probably not be possible to obtain the required data on one pass through the altitude band. If repeated passes are required, a trim point should be taken at the beginning of each pass unless very sensitive collective pitch position information is available in the cockpit.

(iv) If extremely precise results are required, an alternate method of testing can be used to acquire the data at a constant altitude. For cruise and  $V_{NE}$ , data can be obtained by alternating airspeeds above and below the trim speed to arrive in the vicinity of the test altitude as the point is recorded. This method results in very precise data because collective and throttle are not moved as airspeed is changed at a constant altitude. A typical sequence of speeds that could produce these results would be:  $140 (0.8 V_{NE})$  trim speed, 135, 145, 130, and 150.

(v) For rotorcraft with high rates of climb, a series of climbs, each at a different speed, may be required through a given altitude, utilizing sensitive instrumentation to assure collective position is the same for each data point. In autorotation, a similar case arises and a series of descents, each at a different speed, may be required through a given altitude band, using sensitive instrumentation to assure a repeatable collective position.

(vi) Normally tests should be conducted at low, medium, and high altitudes. See AC 27.45 for guidance on interpolation and extrapolation. High-speed stability has

been critical during cold weather testing. Cold weather testing should be accomplished or a conservative approach for advancing blade tip Mach number should be used to limit cold weather  $V_{NE}$  to tip Mach number values demonstrated.

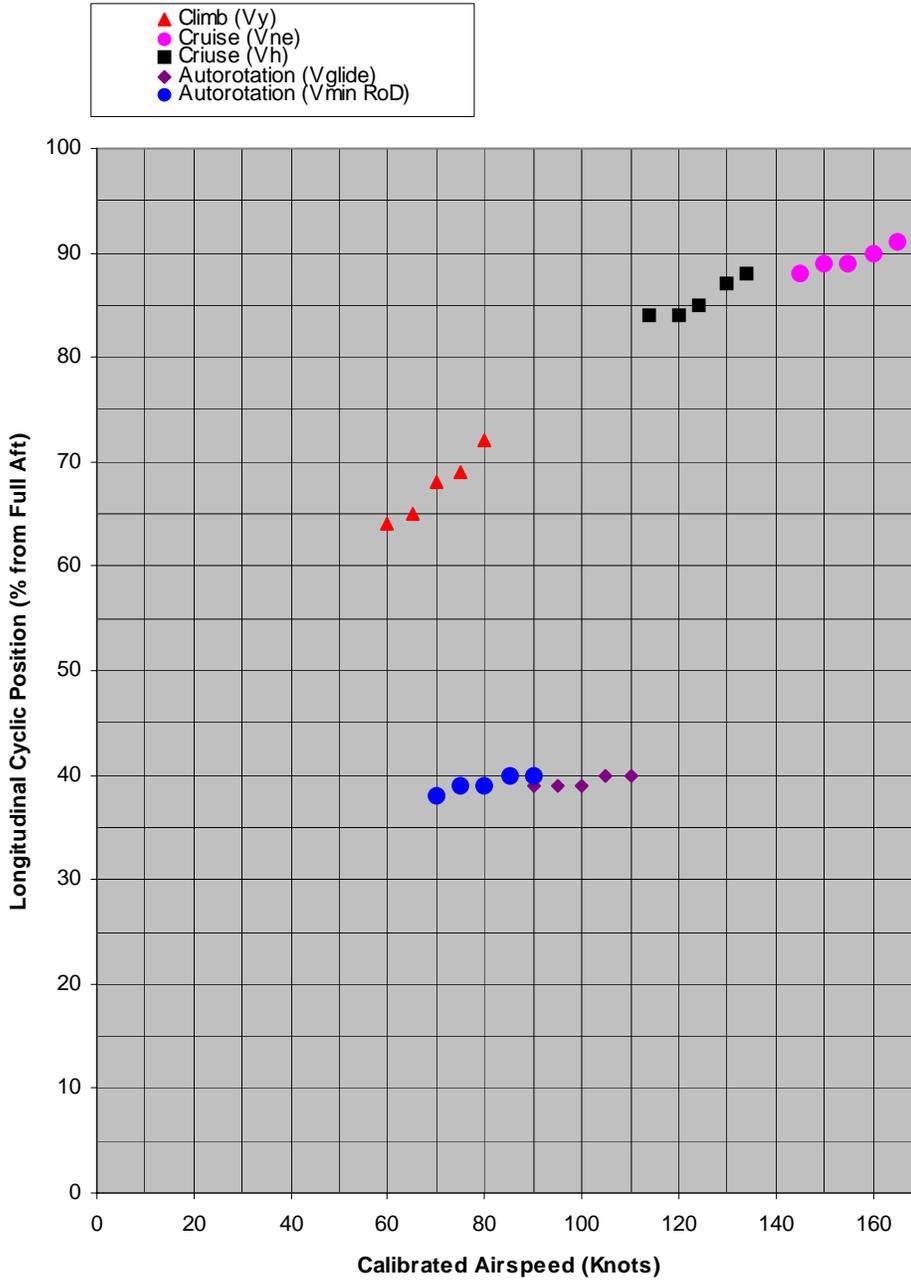


FIGURE AC 27.175A-1  
 STATIC LONGITUDINAL STABILITY

Amend AC 27.177 by the addition of:

AC 27.177A. § 27.177 (Amendment 27-44) STATIC DIRECTIONAL STABILITY.

a. Explanation. Amendment 27-44 makes an extensive change to the current requirement and provides for a clear definition of the sideslip envelope to be evaluated. Most rotorcraft exhibit satisfactory quantitative and qualitative directional characteristics except for the first 2-3 degrees either side of trim due to inherent airflow blockage of the vertical fin or tail rotor. This amendment takes this blockage into account while requiring that positive directional stability is maintained at larger sideslip angles. The actual demonstration has been increased from a maximum range of  $\pm 10^\circ$  at all speeds, as the previous amendment requires, to  $\pm 25^\circ$  at slow speeds and linearly decreasing to  $\pm 10^\circ$  at  $V_{NE}$ . Alternatively to the previous range specified, the requirement limits the maximum sideslip to be demonstrated to at least 0.1g of sideforce or the maximum sideslip attained when full directional control is applied. As in the previous amendment, sufficient cues should alert the pilot when approaching sideslip limits.

b. Procedures. The policy material pertaining to the procedures outlined in this section remain in effect.

Amend AC 27.903 by the addition of:

AC 27.903B. §27.903 (Amendment 27-44) ENGINES.

a. Explanation. Amendment 27-44, § 27.903(d) requires that any engine must have a restart capability that has been demonstrated throughout a flight envelope to be certificated for the rotorcraft.

b. Procedures.

(1) The minimum envelope for the restart capability should be equal to or better than the rotorcraft takeoff/landing maximum altitude and temperature limits. Compliance is usually shown by conducting actual in-flight restarts during flight tests and/or other tests in accordance with an approved test plan. Restarts should be conducted at various altitudes, ambient temperatures, and fuel temperatures using the fuel type most critical, unless the applicant can show that this parameter is not pertinent. Other concerns involve the pilot station arrangement for flight controls and engine starting controls. It should be verified that the engine start can be accomplished without jeopardizing continued safe operation of the rotorcraft. Pilot workload for a preexisting one-engine-inoperative (OEI) situation, the location of the restart system controls, and the availability of a second pilot should be considered. The emergency/malfunction instruction sections of the Rotorcraft Flight Manual (RFM) should present a detailed definition of the approved restart envelope and detailed instructions for the restart. Eligible ambient atmospheric conditions, pre-start requirements (to allow for waste fuel drainage), starter duty cycle (if different from the ground start duty cycle), and pre-start

situation analysis should be included. The pre-start situation analysis should consider the following questions:

- Should a restart be attempted in view of the cause for initial shutdown?
- Is inlet system ice ingestion a possibility?
- Is re-ignition of fuel in the engine nacelle a possibility?
- Is sufficient restart time available?
- Is power available?
- Is altitude sufficient to maintain terrain clearance?

The restart capability can consider wind milling of the engine as part of this restart capability; however, most rotorcraft airspeeds and the locations of the engines do not support engine wind milling up to start speeds. Only electrical power requirements were considered for restarting; however, other factors that may affect this capability are permitted to be considered. Engine restart capability following an in-flight shutdown of all engines is the primary requirement, and the means of providing this capability is left to the applicant.

(2) The restart capability should be available without any delay longer than that required to ensure a satisfactory restart, in order to minimize possible height loss following one or more engine failures. The engine certification should be checked to ensure that the flight manual instructions for in-flight restart are consistent with any specific engine restart requirements.

Amend AC 27.1587 by the addition of:

AC 27.1587A. § 27.1587 (Amendment 27-44) PERFORMANCE INFORMATION.

a. Explanation. Amendment 27-44 added the requirement to include in the Rotorcraft Flight Manual (RFM), the weight at the maximum takeoff and landing altitude for which the rotorcraft can safely hover out-of-ground-effect (OGE) in winds of at least 17 knots in all azimuths. This change is in conjunction with the new demonstration requirements of § 27.143(d). Additionally, this change makes clear that the in-ground-effect (IGE) performance with winds of at least 17 knots be included in the RFM.

All the policy material pertaining to this section remains in effect with the following changes:

(1) This section contains the performance information necessary for operation in compliance with applicable performance requirements of part 27 and applicable special conditions together with additional information and data essential for implementing pertinent operational requirements.

(2) Information on limiting height/speed envelope must be given up to at least 7,000 feet as required in § 27.79. Giving information on limiting height/speed envelope

at altitudes over 7,000 feet is desirable but not mandatory. For this information it is permissible to use a different extrapolation method, provided there is technical data to back it up.

(3) Performance information and data may be presented for the range of weight, altitude, temperature, and other operational variables stated as operational performance limitations. It is recommended that substantial performance information and data be presented per the following paragraphs. Where applicable, reference to the appropriate requirement of the certification or operating regulation should be included.

(i) General. Include all descriptive information necessary to identify the configuration and conditions for which the performance data are applicable. Such information may include the complete model designations of rotorcraft and engines, definition of installed rotorcraft features, and equipment that affects performance together with the operative status thereof. This section should also include definitions or terms used in the performance section (i.e., indicated airspeed (IAS), calibrated airspeed (CAS), international standard atmosphere (ISA), configuration, etc.) plus calibration data for airspeed, altimeter, ambient air temperature, and other information of a general nature.

(ii) Performance Procedures. The procedures, techniques, and other conditions associated with obtainment of the flight manual performance should be included. The procedures may be presented as a performance subsection or in connection with a particular performance graph. In the latter case, a comprehensive listing of the conditions associated with the particular performance may serve the objective of "procedures" if sufficiently complete. Performance figures are based on the minimum installed specification engine.

(iii) Wind Accountability. Wind accountability may be utilized for determining takeoff and landing field lengths. This accountability may be up to 100 percent of the minimum wind component along the takeoff or landing path opposite to the direction of takeoff. Wind accountability data presented in the RFM should be labeled "UNFACTORED" (if 100 percent accountability is taken) and should be accompanied by the following note: "Unless otherwise authorized by operating regulations, the pilot is not authorized to credit more than 50 percent of the performance increase resulting from the actual headwind component and must reduce performance by 150 percent of the performance decrement resulting from the actual tail wind component." In some rotorcraft, it may be necessary to discount the beneficial aid to takeoff performance for winds from zero to 10 knots. This should be done if it is evident that the winds from zero to 10 knots have resulted in a significant degradation to the takeoff performance due to flight through the main rotor vortex. Degradation may be determined by ascertaining the power required to fly, by reference to a calibrated pace vehicle, at speeds of 10 knots or less.

(iv) The following list is illustrative of the information that may be provided for a normal category helicopter.

(A) Density altitude chart for converting from pressure to density altitude.

(B) Airspeed calibration (calibrated vs. true indicated airspeed) for level flight.

(C) Hover performance charts both IGE and OGE with instructions for their use.

(D) For turbine-powered helicopters in all categories, a power assurance check chart.

(E) A statement of the maximum crosswind and downwind components that have been demonstrated as safe for operation both IGE and OGE.

(v) Miscellaneous Performance Data. Any performance information or data not covered in AC 27.1587.a.(3)(iv)(A) through (E) above, but considered necessary or desirable to enhance safety or to enable application of the operating regulations, should be included.

(vi) Flightcrew Notes. Recommend that provisions be made in the "unapproved" portion of the RFM for inclusion of information and data of a type that is useful or desirable for operation of the rotorcraft; but is not approved by FAA/AUTHORITY. (Material in this section should be consistent with material in the approved portion of the manual.)

b. Procedures. None

Amend AC 27 Appendix B by the addition of:

AC 27 Appendix B (Amendment 27-44) AIRWORTHINESS GUIDANCE FOR ROTORCRAFT INSTRUMENT FLIGHT.

a. Explanation. Amendment 27-44 made a change to Section V Static Lateral-Directional Stability that is concurrent with the change to § 27.177 to allow for a small range of sideslip angles (2-3 degrees) for which sideslip angles need not increase steadily with control deflection. The previous rule language stating that directional control position must increase in approximate constant proportion with sideslip angle has been replaced. The intent of this change is that an increase in directional control position must produce an increase in sideslip angle linearly. At greater sideslip angles appropriate to the type, increase in directional control position need not produce a linear increase in sideslip angle but should not become neutral or negative. The change in section VII was a rewrite of the current requirement to clearly state the requirements to be evaluated in the failure case.

b. Procedures. The policy material pertaining to the procedures outlined in this section remain in effect.