Title 14—AERONAUTICS AND SPACE

Chapter I—Federal Aviation Administration, Department of Transportation

[Docket No. 7087; Amdts. 1-15, 27-2, 29-3]

SUBCHAPTER A—DEFINITIONS

PART 1—DEFINITIONS AND ABBREVIATIONS

SUBCHAPTER C—AIRCRAFT

PART 27—AIRWORTHINESS STANDARDS: NORMAL CATEGORY ROTORCRAFT

PART 29—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT

Rotorcraft Type Certification Requirements

The purpose of these amendments is to improve the airworthiness requirements applicable to the type certification of rotorcraft.

These amendments are based on, and reflect comments from interested persons concerning, the notice of proposed rule making published in the FEDERAL REGISTER (30 F.R. 16129) on December 28, 1965, and circulated as Notice 65-42.

Numerous comments were received in response to Notice 65-42. Based upon these comments and upon review within the FAA, a number of changes have been made to the proposed rules. These changes to the proposals and the FAA's disposition of public comments are set forth hereinafter. Interested persons have been afforded an opportunity to participate in the making of this amendment, and due consideration has been given to all matter presented.

Flight. The notice proposed to add a new speed symbol "V_{FF}" (maximum speed for freedom from rotor flutter and vibration) to Part 1, and amend Parts 27 and 29 to accomodate the new speed V_{FF}. Analysis of comments indicates that incorporation of the new speed V_{FF} in Parts 27 and 29 requires further study. The proposals concerning speed V_{FF} are therefore withdrawn. The notice also proposed to amend the definition of V_H. One comment stated that the proposed definition should be changed by deleting the reference to engine speed since it is not essential in addition to the term "maximum continuous power." The FAA agrees. This amendment is therefore drafted as proposed with the exception of the reference to engine speed.

The notice proposed to broaden the center of gravity limits prescribed in §§ 27.27 and 29.27 to cover the entire envelope of lateral as well as longitudinal limits. One comment stated that determination of lateral center of gravity limits should be required only if laterally displaced external stores could result in extreme lateral loadings. The FAA agrees that an entire envelope of lateral and longitudinal limits need not be established in every case and that lateral limits should be established only if critical. However, if critical, it is not relevant whether those limits involve external or internal loading conditions. Amended §§ 27.27 and 29.27 therefore prescribe extreme lateral centers of gravity "where critical."

The notice proposed detailed amendments to the main rotor speed and pitch limit provisions of §§ 27.33 and 29.33. No adverse comments having been received, these amendments are drafted as proposed.

The notice proposed to amend § 29.67 (a) (2) to require that the currently prescribed rate of climb of 150 feet per minute for Category A rotorcraft be available, 1,000 feet above the takeoff surface, for each weight and temperature for which takeoff data are to be scheduled. One comment objected for several reasons: The commentator stated that the 1,000-foot figure is arbitrary and is not consistent with helicopter operations. The FAA disagrees. The purpose of the 1,000-foot requirement is to provide a margin of climb performance at all altitudes outside of ground effect, not only at the 1,000-foot altitude itself. This minimum margin is not arbitrarily determined since experience has shown that lesser margins can result in hazardously low rates of climb under conditions deviating from ideal conditions. Considered as increasing the margin of climb performance for all operations, the 1,000-foot requirement is in no way inconsistent with normal helicopter operations. The commentator stated that more climb performance to compensate for turbulence should not be necessary since the present 150-foot-per-minute climb rate was originally established for this purpose. The FAA disagrees. The climb performance margin created by the 150-foot-per-minute requirement has been shown to be insufficient to ensure adequate performance under expected conditions of turbulence. The commentator states that the 1,000-foot altitude requirement should be an operations requirement rather than a type certification requirement since circling altitude requirements are the concern of FAA operations inspectors rather than FAA type certification personnel. The FAA disagrees. The 1,000-foot altitude requirement is not intended to substantiate the rotorcraft for a particular altitude or to prescribe an operating altitude of any sort, but is rather intended to increase the climb performance margin of the rotorcraft, under less than ideal conditions, during operations at all altitudes. This is properly a type certification function. This amendment is therefore drafted as proposed, with one exception: The notice proposed to require that the climb performance be shown for each "weight and temperature" for which takeoff data are to be scheduled. The present rule requires that this be shown for each "weight, altitude, and temperature". It was not intended that the conditions of substantiation be changed from the former rule with respect to altitude as an aspect of takeoff data scheduling by the applicant. Section 29.51(a) requires that the takeoff data required by § 29.67(a) (2) must be determined at each "weight, altitude, and temperature" selected by the applicant. The applicant must thus in any case include his choice of altitude in his selection of conditions under which takeoff data are "to be scheduled" under § 29.67(a)(2). This being the case, no substantive change would result from including "altitude" in § 29.67(a)(2). This is therefore done to avoid an inference of intent to change the present rule with respect to altitude as a test condition that the applicant schedules as part of the established takeoff data.

The notice proposed to amend § 29.73 (b)(2) to require single engine turbine engine powered Category B helicopters to have a hovering ceiling of at least 2,500 feet, in standard atmosphere plus 40° F., at maximum weight. Standards for multiengine, turbine engine powered Category B helicopters were also proposed. One comment objected, stating that hovering performance should not be a criterion for helicopters, and stating that the proposed requirement for single engine turbine engine powered helicopters is more restrictive than the present 4,000-foot density altitude requirement at temperatures above 30° C. at sea level and certain lower temperatures at altitude. The FAA agrees that the value of hovering performance as a criterion should be reevaluated for helicopters generally throughout the regulations. However, until this is done, the hovering performance for turbine engine powered helicopters at high operating temperatures should be no less than that of reciprocating engine powered helicopters. This amendment accomplishes this result. It is recognized that, for turbine engine powered helicopters, compliance with the amendment may result in a hovering performance higher than that of piston engine powered helicopters at standard temperatures. The FAA believes, however, that increased hovering performance of turbine engine powered helicopters must be accepted at normal temperatures in order to ensure that, at high temperatures, such performance will not be less than that of a piston engine powered helicopter as a result of meeting the present 4,000-foot standard temperature requirement. This amendment is drafted as proposed.

The notice proposed to amend § 29.75 (b)(4) to specifically permit approach and landing paths to enter critical areas of the limiting height-speed envelope established under § 29.79. Where such an envelope is specifically limited to operations other than approach and landing, this proposal is not necessary. Where such an envelope is not so limited, further study is necessary to redefine the operating limitations to be derived from the envelope, under approach and landing conditions, under § 91.31(b)(9). This proposal is therefore withheld pending such study.

The notice proposed to delete § 29.75 (b)(6). No adverse comments having been received, this amendment is adopted as proposed. Consistent with this change, § 29.75(c)(2)(ii) is amended by deleting the cross reference to (b)(6).

(As published in the Federal Register /33 F.R. 956/ on January 26, 1968)

The notice proposed to add a new section prescribing water landing capability for rotorcraft for which approval for overwater operation is requested. In the light of comments received, this proposal is withdrawn pending further study of the airworthiness and operations aspects of overwater operation.

The notice proposed to amend § 27.79 to require that no point on the low speed side of the limiting height-speed envelope may exceed V_Y. In the light of comments received, it is felt that the proposal could in some cases lead to unconservative envelopes being established, which may more than offset the advantages to be obtained by the proposal. Where the envelope has a satisfactory corridor, it is not clear that pilot tendency to climb within the critical area of the envelope must be assumed to exist merely because V_Y is within that area. The pilot has knowledge of the envelope as performance information. This proposal is therefore withdrawn pending further study of the operational consequences of the location of V_Y within the envelope.

The notice proposed to amend §§ 27.141 and 29.141 with respect to the provision that sudden powerplant failure must be assumed. This amendment, as explained in the notice, is based on the assumption that sudden, complete power failure is a probable operating condition for rotorcraft that do not meet Transport Category A engine isolation requirements and that sudden failure of one engine is a probable operating condition for rotorcraft that do meet those requirements. One comment objected, stating that turbine engines are less prone to sudden failure than are reciprocating engines and should therefore not be assumed to fail suddenly. The FAA disagrees with the commentator's conclusion. Sudden failure is a necessary assumption since such failure is possible and can lead to adverse flight or control characteristics regardless of the kind of engine. These amendments are drafted as proposed.

The notice proposed, in part, to replace a requirement for a demonstration of control at "maximum weight" in §§ 27.143 and 29.143 with a requirement for a demonstration at "critical weight." No adverse comments having been received, this proposal is drafted as proposed (§§ 27.143(b)(1) and 29.143(b)(1)). The notice also proposed to amend those sections to require a controllability demonstration in uncoordinated flight. This proposal is withdrawn in the light of comments received.

The notice proposed to amend §§ 27.143 and 29.143 with respect to controllability after power failure. No adverse comments having been received, these amendments are drafted as proposed.

The notice proposed to amend §§ 27.173 (b) and 29.173(b) to prohibit a negative stick position versus speed slope except for hovering and to restrict the negative stick travel in the hovering condition to not more than 1 inch measured at the top of the pilot's normal hand position. One comment objected for several reasons. The commentator stated that the hazards of negative stick stability should be determined on a case-by-case basis. The FAA disagrees. Except for the hovering condition, a negative stick slope is known to be undesirable regardless of the severity of the slope. This is particularly true with respect to the trend of current rotocraft to operate at higher speeds and under instrument flight conditions. This is also true with respect to pilot fatigue. Flight safety may be directly affected by negative static longitudinal stability in any rotorcraft in climb, cruise, and autorotation. It would therefore be inappropriate to require a detailed investigation of the results of such instability on each type design. This comment cannot, therefore, be accepted. The commentator stated that the permitted negative stick travel in the hovering condition should be 10 percent of total stick travel rather than 1 inch for all type designs. The FAA disagrees. Helicopters may vary widely in total stick travel. The amount of negative stick travel being a percentage, would thus also vary widely from helicopter to helicopter. This may adversely affect the piloting responses of a pilot who operates more than one type of rotorcraft. A fixed percentage may also result in large absolute values of negative stick travel that are potentially unsafe in the hovering condition. This comment cannot be accepted. The commentator stated that elimination of negative stick travel in climb and cruise may result in more aft longitudinal control at V_{NE}, which could permit the pilot to pull higher load factors and greater nose-up attitudes than would be possible at present. While possibly correct, this comment is not accepted since piloting response can safely deal with high speeds in a helicopter that has positive static longitudinal stability whereas the effects of permitting negative stability may be undesirable through a wide speed range. This amendment is drafted as proposed.

The notice proposed to amend §§ 27.175 and 29.175 to require that the static longitudinal stability of multiengine rotorcraft be shown with a rate of descent of 1,000 feet per minute rather than in autorotation as currently required. This proposal was in response to the fact that a 1,000 feet per minute rate of descent is a representative flight condition for multiengine rotorcraft whereas autorotation is not. This is correct. However, other regulations, such as § 29.75(b)(5) and (c)(1)(ii) require that complete power failure be accounted for in the case of multiengine rotorcraft in Category A and Category B. These regulations are based on the assumption that total power failure, while rare, must be regarded as a real possibility to be taken into account from a performance point of view. It would be inconsistent to require the substantiation of the performance of multiengine rotorcraft in autorotation because of the possibility of total power failure and at the same time dispense with substantiation of safe static longitudinal stability under the same conditions. This proposal is withdrawn pending further study of operating assumptions underlying the autorotation requirements for multiengine rotorcraft.

The notice proposed to amend the power requirement for demonstrating static longitudinal stability in the hovering condition under §§ 27.175 and 29.175. No adverse comments having been received, these amendments are drafted as proposed.

The notice proposed to amend the pilot compartment view requirement of § 29.773 with respect to the first pilot's position. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to add new §§ 27.1322 and 29.1322 covering warning, caution and advisory lights. No adverse comments having been received, these amendments are drafted as proposed.

The notice proposed, in part, to delete the requirement in § 29.1323(b)(2) that the airspeed indicating system must be calibrated "in ground effect, during the accelerated takeoff run," and replace it with a requirement that the system be calibrated, "during takeoff," so as to provide indications that can ensure consistent realization of specified field lengths and ensure avoidance of the critical areas of the limiting height-speed envelope. One comment objected to this part of the proposal for the following reasons: The commentator states that system calibration should not be required "during takeoff" since this involves calibration in a flight realm that the explanation in the Notice states is difficult. The FAA disagrees. While it is true that this amendment involves calibration in flight, it was calibration in ground effect, not in all flight conditions, that was stated to be difficult. The commentator states that the calibration requirement should be discontinued and that only field length and height-speed safety should be considered during takeoff demonstrations conducted under § 29.51. The FAA disagrees. Calibration of the airspeed indicating system is the only means of ensuring repeatability of airspeed indications so as to obtain consistent realization of specified field lengths and avoidance of critical height-speed combinations. This part of the proposal is therefore drafted as proposed. The Notice proposed, in part, to change several speed references from miles per hour to knots. One comment stated that references to "five m.p.h." should be changed to an even "five knots" to avoid a fractional knot requirement, which would assume unrealistic airspeed indicating accuracy. This comment is accepted. Except for this change from the notice, this part of the proposal is drafted as proposed. The notice proposed, in part, to delete the words "including the airspeed indicator instrument calibration error" from the airspeed error provisions of § 29.1323 (c) and (d). One comment objected, stating that, unless the accuracy of the system includes indicator calibration error, it would not be possible to know the total error in the system. The FAA disagrees. Total error can be obtained by separately determining system error and indicator error. Further, this method of determining total error, by separately identifying the system and indicator errors, more adequately permits future determinations of total error when the

original indicator is replaced with another having a different instrument error. This part of the proposal is drafted as proposed. The notice also proposed to raise the low speed calibration speed in § 29.1323(c)(1) from 10 m.p.h. to 30 knots and that in § 29.1323(d) from 10 m.p.h. to 20 knots (including the change from miles per hour to knots) in order to ease the difficulty of low speed calibration while still obtaining a calibration speed allowing consistent avoidance of hazardous height-speed combinations during takeoff. One comment stated that raising the minimum calibration speeds would not assure avoidance of hazardous height-speed combinations during takeoff. This comment is not accepted. For takeoff, avoidance of the critical areas of the limiting height-speed envelope would be ensured under amended § 29.1323(b)(2), which requires that the airspeed indications for this flight condition be repeatable and readable. Experience in the type certification of multiengine transport category rotorcraft indicates that compliance with the airspeed accuracy requirements below 30 knots is not feasible. Further, for the forward flight conditions of § 29.1323(c)(1) and (d), calibration down to 30 knots and 20 knots, for multiengine and single engine rotorcraft, respectively, is sufficient to avoid hazardous height-speed combinations and will avoid unnecessarily difficult airspeed calibration down to 10 m.p.h. This part of the proposal is drafted as proposed. Several suggestions for further amendment of the airspeed calibration requirements were received. These suggestions are appreciated. However, they go beyond the scope of the notice and will be reserved for future consideration.

The notice proposed to amend § 29.1329(d) to allow autopilot malfunctions to create speeds up to 1.05 V_{NE} if the stability curve is positive to 1.1. V_{NE}. One comment requested that 1.1 V_{NE} be permitted. The speed V_{NE} is chosen to ensure a margin of safety between it and the highest speed shown to be safe. It is thus essential that the conditions under which V_{NE} may be exceeded be precisely described in the rules if such an allowance is to be given. The only controlling condition in § 29.1329(d) is that corrective action is assumed to begin within a "reasonable period of time." It is clear that the safety of any speed permitted above V_{NE} depends entirely upon the conservatism of the time administered under the language "reasonable period of time." This is true regardless of whether 1.05 V_{NE} or 1.1 V_{NE} is permitted. The time for pilot response may be particularly critical in the high altitude, low V_{NE} condition. This proposal is therefore withdrawn pending further study of the time delay aspects of automatic pilot system failures at high speeds.

The notice proposed to amend §§ 27.1505 and 29.1505 to provide for variations in V_{NE} with respect to altitude, r.p.m., temperature, and weight. No adverse comments having been received, these amendments are drafted as proposed.

The notice proposed to amend § 27.1519 to require that either (1) the limiting height-speed envelope be shown to be satisfactory, at each altitude, at the highest weight allowing hovering in ground effect at that altitude, or (2) if lesser weights are demonstrated for any altitudes, these lesser weights be established as operating weight limitations for those altitudes. One comment stated that since the envelope derived under Part 27 is performance information and is not an operating limitation, no information derived from the envelope should be an operating limitation. The FAA disagrees. The value of the envelope as performance information depends entirely upon whether the envelope information provides a basis for the pilot to adequately determine the limits of safe operation. For any given altitude, the envelope provides no firm basis for pilot decision making at weights above those at which the envelope is developed for that altitude. Section 27.79(a)(2) permits the applicant to select any weight for each altitude. This amendment does not alter this flexibility with respect to weight to be demonstrated. This should be left to the applicant. But the ability of a helicopter to operate at weights above the selected weight must be considered since there may be a significant incentive to operate a rotorcraft at the limits of its takeoff capability. This amendment is drafted as proposed except that cross-references to §§ 27.73 and 27.79 are added for clarity.

The notice proposed to delete empty weight items from the Rotorcraft Flight Manual provisions of §§ 27.1583(c) and 29.1583(c). No adverse comments having been received, these amendments are adopted as proposed.

Airframe. The notice proposed to include "design maximum altitude" as a "design limitation." One comment stated that altitude should not be treated as a "design limitation." The FAA agrees that the intent of the proposal (which is to ensure that the effect of altitude on rotorcraft fatigue strength will be accounted for) can be achieved by requiring that altitude effects be accounted for without designating a "design maximum altitude." This proposal is therefore withdrawn. The requirement to account for altitude effects has been reproposed, together with amendments proposed under airframe proposal 8 of Notice 65–42, in a separate notice of proposed rule making (Notice 67–44, published in the FEDERAL REGISTER (32 F.R. 14106)) on October 11, 1967.

The notice proposed to add a new § 29.473(c) concerning triggering of actuating devices for supplementary landing load absorption. No adverse comments having been received, this amendment is drafted as proposed. One comment requested that this amendment be considered for Part 27. This comment is accepted. An identical proposal for public comment will be considered for amendment of Part 27.

The notice proposed to amend § 27.473(a)(1) to allow a rotor lift of two-thirds of the design maximum weight in establishing limit ground loads. No adverse comments having been received, this amendment to § 27.473(a)(1) is drafted as proposed. The notice further proposed to limit the rotor lift to two-thirds of the design maximum weight under Parts 27 and 29 by eliminating the reference to "any greater lift proven to be appropriate" in §§ 27.473(a)(2) and 29.473(a)(2). One comment objected, stating that this change would inhibit certain benefits of advancing rotor technology. This is not the case. Section 21.21(b)(1) provides that any provision not complied with may be compensated by factors that provide an "equivalent level of safety." For rotorcraft for which such "equivalent level of safety" is shown for the specific technological advances mentioned by the commentator, this amendment causes no substantive change and (a)(2) is surplus. For rotorcraft for which such showings cannot be made, present (a)(2) is misleading, since it assumes that a greater fractional rotor lift may be "appropriate" even though an "equivalent level of safety" cannot be shown therefor. More than a decade of type certification programs conducted under the current rules indicates that two-thirds of design maximum weight is the highest rotor lift acceptable, as a general rule, for establishing limit ground loads. This amendment is therefore drafted as proposed. Editorially, these amendments result in the elimination of subparagraphs under paragraph (a) of §§ 27.473 and 29.473.

The notice proposed to delete the cross references to §§ 27.727 and 29.727 from §§ 27.473(b) and 29.473(b), respectively, since limit inertia load factors are not substantiated under those sections. No adverse comments having been received, this change is made as proposed.

The notice proposed to add a new § 29.501 providing standards for skid landing gear. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to delete § 27.501(c)(2)(ii) which required that ground loads must pass through the center of gravity. No adverse comments having been received, this amendment is adopted as proposed.

The notice proposed to add a new § 29.511 covering unsymmetrical loads on multiple-wheel landing gear units. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to add new §§ 29.519 and 29.757, and amend §§ 29.521, 29.755, and 29.803, all concerning substantiation of amphibian and limited amphibian rotorcraft. Comments objected to the inclusion of a flotation time requirement in § 29.755(b), stating that flotation time is entirely an operational problem. The FAA agrees that flotation time is an important operational consideration and must be responsive to different operating conditions. However, it is also clear that some minimum flotation time must be prescribed for all operations since a form of amphibian approval is involved. One half hour is believed to be a reasonable time, and should present no difficulty for any hull that meets the structural requirements in these amendments. Section 29.755(b)

therefore requires that the rotorcraft be able to remain afloat for one half hour.

The notice proposed to amend the fatigue evaluation provisions of Part 29 to permit manufacturers to adopt failsafe design practices on certain conditions. The proposal has been amplified and reproposed, together with appropriate operating rule changes, in Notice 67-44, published in the FEDERAL REGISTER (32 F.R. 14106) on October 11, 1967, for the reasons contained therein.

The notice proposed to require that each engine mount and adjacent structure to be designed to withstand the loads resulting from a limit torque equal to 1.25 times the mean torque for 2½-minute power combined with 1g. flight loads. One comment stated that a certain higher flight loading should be required. The FAA disagrees, since the 2½-minute rating is intended to take care of the relatively infrequent case of engine failure during takeoff and approach to landing. For this contingency, the proposed flight loading is adequate. This amendment is drafted as proposed.

The notice proposed to require dual locking devices on all fasteners whose function is necessary for safety. In response to comments received, this proposal is withdrawn. The material in this item has been reproposed in Notice 67-49, published (32 F.R. 15676) on November 14, 1967.

The notice proposed to amend §§ 27.653 and 29.653 to except certain sealed rotor blades. No adverse comments having been received, these amendments are drafted as proposed.

The notice proposed to amend §§ 27.653 through 27.661, and §§ 29.653 through 29.661 to cover all rotors, not just main rotors. No adverse comments having been received, these amendments are drafted as proposed.

The notice proposed to amend §§ 27.659 and 29.659 to require substantiation of the mass balance installation. No adverse comments having been received, these amendments are drafted as proposed.

The notice proposed to add new §§ 27.663 and 29.663 containing reliability and damping action investigation requirements for ground resonance prevention means and to require that specific maintenance standards for this means must be approved under §§ 27.1529 and 29.1529. One comment requested that the requirement in proposed paragraph (b) to consider the "probable" range of service variations should be changed to refer to the "allowable" range. This comment is not accepted since the objective is to establish the variations expected in service. The commentator also stated that the requirement in proposed paragraph (b) to investigate the range of probable variations "in flight" should be broadened to allow other testing. The FAA agrees. The words "in flight" are therefore omitted from §§ 27.663(b) and 29.663(b). One comment objected to the proposal to require approval of specific maintenance practices. The FAA agrees that the current requirement to place recommended maintenance procedures in the Maintenance Manual under §§ 27.1519 and 29.1519 is sufficient. Separate approval of those practices is not necessary for ground resonance prevention means.

The notice proposed to amend § 29.725 (a) to require only an 8-inch drop height with no contact velocity prescribed. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to amend §§ 27.751 (b) and 29.751(b) to provide capsize protection for main floats. No adverse comments having been received, these amendments are drafted as proposed.

The notice proposed to amend the pilot compartment requirements of § 29.771 by deleting the requirement for a passageway between the pilot compartment and the passenger compartment (paragraph (e)) and the requirement for a means to prevent passengers from entering the pilot compartment without permission (paragraph (f)). No adverse comments having been received, these amendments are adopted as proposed.

The notice proposed to amend § 29.805 to require that the flight crew emergency exit rapid evacuation capability must be shown by test. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to amend §§ 29.807 through 29.813 to update the emergency exit requirements. In response to one comment, the amended table in § 29.807 (b) contains the same headings as the current table. There was no intent to change the headings of the table, although no headings were included in the table in the notice. One comment objected to the allowance, in the table of one Type IV exit per side for passenger seating capacities of 1 through 10, stating that no exit should be smaller than a Type III exit. The FAA disagrees. Experience with airplanes has demonstrated that one Type IV exit per side is adequate for the prescribed seating capacity. The notice proposed to amend § 29.807 to allow the substitution of one Type I or Type II exit in the floor ramp of rear ramp rotorcraft, instead of in the sides of the fuselage, if the aft exit meets § 29.813. One comment stated that the rule should make it clear that only one exit may be substituted, even though that exit may be a Type I or Type II exit. This is in accord with the intent of the proposal. Amended § 29.807(d) is therefore limited to "one Type I exit only, or one Type II exit only". The notice proposed to add a new § 29.809(f)(1) requiring that evacuation ropes must have a specified diameter. It is now felt that the static load and attachment requirements also proposed for evacuation ropes (proposed (f) (2) and (3)) make any specified diameter unnecessary. Proposed (f) (1) is therefore withdrawn and the remaining subparagraphs are renumbered accordingly. Further, the FAA has determined that the prescribed evacuation assist means are not necessary for overwing exists since the wing (including stub wings to be expected on compound helicopter) itself provides a passageway to the ground. Section 29.809(f) is therefore changed from the notice to specifically except such exits.

Proposed § 29.811(h) referred to each exit "that is required to be openable from the outside." Since § 29.809(b) requires each emergency exit to have this characteristic, the quoted language is surplus and is deleted from amended § 29.811(h).

Proposed § 29.811(h)(1) specified that each exit must be outlined with 2-inch colored band. One comment suggested that this provision also include a requirement for a crash locator light visible outside of the window. This comment goes beyond the scope of the notice and therefore cannot be accepted. However, the proposal is changed in this amendment to cover only passenger emergency exits. It was not intended to require the 2-inch band marking for crew exits.

Proposed § 29.811(h)(2) provided that outside markings be such that the reflectance of the lighter color must exceed that of the darker color by a factor of at least three. Where the reflectance of the darker color exceeds 15 percent, the proposal is unduly severe. This amendment therefore permits a reflectance differential of 30 percent in such cases. On the other hand, study since the notice indicates that the factor of 3 to 1 is not sufficient to ensure safe visibility where the reflectance of the darker color is 15 percent or less. For these low reflectance values, safety requires that the reflectance of the lighter color must be no less than 45 percent. This change from the notice is necessary to achieve minimum acceptable conspicuity under emergency evacuation conditions.

One comment suggested amending § 29.813, to make it clear that the requirement for "unobstructed" passageways between passenger compartments and "unobstructed" passageways leading to Type I and Type II emergency exits means "unobstructed" by maximum seat positions either reclined or broken over. No difficulty in administering the current "unobstructed" provision has been experienced in this regard. This comment is not accepted.

The notice proposed to amend § 29.813(b) to include the assumption that all passengers are ambulatory. Since that paragraph is only concerned with the amount of space required for a crewmember to assist in evacuation "without reducing the unobstructed width of the passageway" it is evident that the space requirements of crewmembers, not the condition of passengers, is the only regulatory concern of § 29.813(b). This proposal is therefore withdrawn.

The notice proposed to amend § 27.807(a) to delete the reference to seating capacity. No adverse comments having been received, this amendment is adopted as proposed.

The notice proposed to amend § 29.853(f) to prescribe at least three hand fire extinguishers for rotorcraft with passenger seating capacities greater than 60. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to require that doors and windows of cargo and baggage

compartments must be lined with fire resistant materials in addition to the current requirement in § 29.855(a) that those compartments themselves be so lined. This proposal is withdrawn in agreement with comments received. No further detailed lining requirement is necessary since the doors and windows are part of the compartment and, as such, are adequately covered by current § 29.855(a). The notice also proposed to amend § 29.855(d) to make that paragraph specifically applicable only to compartments that are not sealed against fire and to compartments intended for cargo only. One comment stated that the requirement to prevent the "entry" of noxious gases into crew and passenger compartments should be amended to make it clear that compliance may be shown by devices that prevent retention of gases that have entered. The FAA agrees. The purpose of this portion of the rule is to ensure that harmful quantities of noxious gases do not accumulate in crew or passenger compartments. This amendment therefore uses the word "accumulation" in place of the word "entry." The notice finally proposed a new § 29.855(e) containing additional requirements for cargo-only rotorcraft. This amendment is drafted substantively as proposed.

The notice proposed to specifically express the intent of §§ 27.1565 and 29.1565 to provide conspicuity under daylight conditions only. One comment requested that night conspicuity also be required. This comment goes beyond the scope of the notice but will be considered for future rule making. No other adverse comments having been received, §§ 27.1565 and 29.1565 are amended as proposed.

Powerplant. The notice proposed to amend §§ 27.901 and 29.901 to require that "axial and lateral expansion of turbine engines may not affect the safety of the installation." No comments objecting to the intent of this proposal having been received, new §§ 27.901(b)(4) and 29.901(b)(5) are drafted, as proposed, with one minor clarifying change: The word "lateral" is replaced with the word "radial" since the latter word is the more appropriate counterpart of the word "axial." No substantive change results.

The notice proposed to amend the engine stoppage requirement of § 29.903(c) to except turbine engines whose stoppage is not necessary for safety. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to amend §§ 27.923 and 29.923 to require substantiation of accessory drive pads under the rotor drive system and control mechanism tests. Where identical pads are involved, the proposal would have permitted the loading of one pad only. Study indicates that this may not be appropriate in every case, and that adequate standards for the substantiation of drive pads would exceed the scope of the notice. These changes are therefore withdrawn and will be reproposed in greater detail.

The notice proposed to amend § 27.923 to require that the rotor system endurance test include a clutch endurance test in which at least 200 "clutch engagements" are accomplished in a certain manner. One comment suggested that more than 200 engagements should be prescribed. The FAA believes that 200 engagements is sufficient to simulate conditions that would exist in service and to substantiate the clutch mechanism for those conditions. This comment cannot, therefore, be accepted. This amendment is drafted as proposed, with one exception: The proposed words "clutch engagements" are changed to read "start-up clutch engagements". This amendment is intended to cover only the start-up (engine accelerating) clutch, not the overrunning (freewheeling) clutch.

The notice proposed to add new §§ 27.923(j) and 29.923(o) to require that the rotor system endurance test include substantiation of the system for certain overboost conditions. One comment generaly concurred, with the following exceptions: The commentator stated that the proposal would require a low temperature operating facility or else test procedures to allow the proposed torque requirements to be met under the normal range of temperatures. The commentator then suggested language changes under which the engines would not be operated above their approved ratings. Under certain conditions, these suggested lauguage changes might not result in substantiation of the system for torque loads above the approved ratings and might therefore prevent the desired evaluation of overboost conditions. The commentator is correct in stating that either a low temperature facility, or procedures to achieve overboost conditions under normal temperatures, are necessary under the proposal. However, the need to obtain overboost conditions requires that the commentator's suggested language be rejected. The commentator stated that the proposal was wrong in assuming that there is no direct control of engine power output by the pilot, because such control in fact exists. It is recognized that power limits are closely followed and controlled during most operations. However, these amendments are necessary to ensure safe operation in conditions under which the pilots are likely to be distracted by an emergency or are forced to exceed power limitations in order to maintain safe flight. For these conditions, it must be assumed that the transmission may be subjected to torque values exceeding those obtainable within approved engine ratings. For these possible overboost conditions, this comment cannot be accepted. These proposals are drafted as proposed, with one relaxing change: The notice would have added these amendments to §§ 27.923 and 29.923. Under § 29.923(a)(2) this would have required that the overboost test under Part 29 be conducted on the rotorcraft, which might result in damage to the engines. One industry comment correctly objected to this aspect of the proposal. Amending §§ 27.923 and 29.923 would also have required the overboost test to be done as part of the endurance test. Neither of these consequences are necessary to the substantiation of the transmission itself for temporary overboost conditions. This is the sole purpose of these amendments. They are therefore drafted as new §§ 27.927(b) and 29.927(b) rather than as amendments to §§ 27.923 and 29.923. New § 27.927(b)(3) and 29.927(b)(3) specify the conditions under which the test need not be conducted on the rotorcraft. The present language in §§ 27.927 and 29.927 is designated as paragraph (a) without substantive change. These amendments also make it clear that, in determining maximum attainable torque for the purpose of the overboost test, it may be assumed that torque limiting devices, if any, function properly. Finally, the words "torque output of the engines" in the proposal for the all-engines operating case are replaced with the words "torque attainable under probable operating conditons" for consistency with the language describing the engine-inoperative test. No differences between the two test conditions, with respect to the probability of attaining the appropriate test power condition in operation, were intended.

The notice proposed to amend §§ 27.991 and 29.991 to require that each fuel pump must meet the endurance test prescribed in §§ 27.923 and 29.923, or equivalent. The main issue in this proposal concerns the possibility that the cited endurance tests may not be sufficient to fully substantiate fuel pumps. This proposal is therefore withdrawn for further study of the severity of endurance testing appropriate for fuel pumps.

The notice proposed to amend §§ 27.991(b) and 29.991(b) to allow a main fuel pump to be used as an emergency pump, as is allowed under § 25.991(b) for transport category airplanes. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to delete provisions in §§ 27.991 and 29.991 that require the maintenance of safe fuel pressures, since such provisions duplicate fuel flow requirements in §§ 27.951, 27.955, 29.951, and 29.955. No adverse comments were received. With respect to § 29.991, this amendment is drafted as proposed. However, under § 27.991, the fuel pressure requirement is linked directly to the requirement for automatic or continuous operation, which should not be deleted. The proposal is therefore withdrawn with respect to Part 27.

The notice proposed to amend § 27.993 to eliminate the oversize fuel line requirement and corresponding test requirements of paragraphs (d) and (e), and to add requirements like those in § 29.993(c) (that flexible fuel connections subject to pressure or axial loadings must have a flexible hose assembly) and § 29.993(e) (that no flexible line that might be adversely affected by high temperatures may be used where excessive temperatures will exist during operation or after engine shutdown). No adverse comments were received with respect to the objectives of these proposals. However, one comment stated

that no requirement for flexible hose assembly is necessary if the rule states that relative motion must not result in an unsafe condition. The FAA disagrees. The intent of § 29.993(c), and its proposed adoption under Part 27, is not to account for relative motion (which is covered elsewhere in the rule), but rather to alleviate the effects of pressure and axial loadings. These amendments are drafted as proposed.

The notice proposed to amend § 29.1091 (d) to apply to reciprocating engines only. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to amend § 29.997 to add a fuel strainer ice protection requirement similar to those in §§ 25.997 (b) and 27.997(b). One comment suggested that the proposal be clarified to apply only to filter blockage and not to ice crystals downstream of the filter. Experience with §§ 25.997(b) and 27.997 (b) does not indicate any need for such clarification. This amendment is drafted as proposed.

The notice proposed to amend §§ 27.1041 and 29.1041 to require adequate cooling "after engine shutdown" as well as under the conditions now specified in those sections. No adverse comments having been received with respect to the objective of the proposal, these amendments are drafted as proposed, with one minor change: In response to a similar proposal for Part 25 in a separate rule-making action, one comment noted that there may be abnormal engine shutdowns, such as an emergency shutdown from a high power setting, following which temperature limits may be exceeded. The FAA agreed in that case, and therefore narrowed the Part 25 amendment to cover only "normal" engine shutdowns. These amendments are similarly limited for the same reason.

The notice proposed to add, to §§ 27.1091 and 29.1091, turbine engine inlet protection requirements now prescribed for transport category airplanes in § 25.1091(d). One comment suggested limiting the requirement to flammable fluid lines furnished by the airframe manufacturer. The FAA disagrees. Adequate protection of the inlet from hazardous quantities of fuel leakage and from overflow from flammable fluid systems should be provided regardless of the leakage or overflow source within the flammable fluid systems. These amendments are drafted as proposed.

The notice proposed to add to § 29.1093 continuous maximum and intermittent icing condition provisions currently prescribed in § 27.1093. No adverse comments having been received with respect to the objective of the proposal, this amendment is drafted as proposed.

The notice proposed to add a new § 29.1121(h) requiring fuel drains that discharge clear of the rotorcraft if significant fuel traps exist. No adverse comments having been received, this amendment is drafted as proposed.

The notice proposed to amend §§ 27.1163 and 29.1163 to require torque limiting means on certain accessory drives in order to prevent the torque limits established by the manufacturer from being exceeded. One comment suggested language that would cover all "likely" effects of accessory malfunctions. The reason given was the prevention of possible misadministration of the rule as proposed. The exact nature of the misadministration anticipated by the commentator is not clear. However, the language suggested by the commentator would in any case exceed the scope of the notice by covering all possible likely effects of accessory malfunctions, not only the exceeding of torque limits. This amendment is limited to the objective expressed in the notice, which covered only the prevention of unsafe torque loads on accessory drives.

The notice proposed several changes to the designated fire zone provisions of § 29.1181. No adverse comments having been received with respect to the objectives of these proposals, these amendments are drafted substantially as proposed, with one editorial correction: Proposed § 29.1181(a)(8) is drafted as new § 29.1181(a)(7). Further, while the notice, in paragraph (c)(2), proposed that the combined combustor-turbine-tailpipe and compressor-accessory zones would be "a designated fire zone" under certain conditions, this conflicts with the proposal to designate the compressor and accessory sections as a fire zone and the combustor, turbine, and tailpipe sections as another fire zone. This proposed combination of zones is therefore withdrawn. In addition, the designated fire zone comprising the combustor, turbine, and tailpipe sections of turbine engine installations is drafted in a form consistent with the corresponding requirement in Part 25 (§ 25.1181(a)(7)). This limits the designated fire zone prescribed in § 29.1181(a)(7) to regions that contain lines or components carrying flammable fluids or gases. It is therefore unnecessary to refer to the absence of such lines or components in § 29.1181(b) as proposed in the notice. The notice also proposed to except combustor, turbine, and tailpipe sections from the requirement, in § 29.1181(b), to meet §§ 29.1183 through 29.1201 if those sections are isolated from the compressor and accessory sections by a firewall that meets § 29.1191. This proposed exception from §§ 29.1183 through 29.1201 would be too broad since it would except those regions from certain requirements that should apply regardless of whether or not a fire zone is involved, such as certain of the cowling and engine compartment covering requirements of § 29.1193. The proposal is therefore revised as follows: The combustor, turbine, and tailpipe sections designated as fire zones in § 29.1181 (a)(7) are drafted to exclude regions that are isolated from the compressor and accessory sections by a firewall meeting § 29.1191(a); § 29.1191(a) is amended to include the combustor, turbine, and tailpipe sections of turbine engine installations (as proposed in proposal 20 of the notice); finally, § 29.1203 is amended to require a fire detector system for the combustor, turbine, and tailpipe sections (regardless of whether such sections also qualify as designated fire zones). These amendments leave § 29.1181(b) unchanged.

The notice proposed to amend § 27.1185(b) to clearly limit it to reciprocating engines (and therefore remove any question as to whether turbine engines having thrust ratings comparable to reciprocating engines of 900 cubic inches displacement are also included). One comment objected, stating that the present requirements could not in any case be rationally applied to turbine engines by merely equating turbine thrust ratings with the prescribed displacements. The FAA agrees with this statement, but believes that the possibility that such an equation may be attempted is great enough to justify this clarifying amendment. This amendment is drafted as proposed by amending the applicability of paragraphs (a) and (b) to make them mutually exclusive on their face.

The notice proposed to amend §§ 27.1189, 29.1189, 29.1195, and 29.1203 to make it clear that exceptions contained in those sections for engines of certain cubic inch displacements may not be applied by anaogy to turbine engines of roughly comparable thrust ratings. One comment objected, stating that the reasons for the exceptions are also valid for turbine engines of counterpart thrust parameters. The FAA agrees that extension of the exceptions to cover some turbine engines may be possible, after study, and should be proposed in a future notice of proposed rule making. However, until this is done, it is not appropriate to permit extension of the present exceptions, by analogy, to turbine engines. These amendments are drafted as proposed. Section 29.1195(a), second sentence, is also amended to conform more closely to the form of former § 7.484 (a)(3), on which it was based. No substantive change results since none was involved in the recodification. This amendment is therefore adopted without notice.

The notice proposed to amend §§ 27.1191(a) and 29.1191(a) to extend the term "engine," in the case of turbine engine installations, to cover the combustor, turbine, and tailpipe sections of those installations. No adverse comments having been received with respect to the objectives of this proposal, these amendments are drafted as proposed.

The notice proposed to amend § 29.1193(e)(3) by deleting the words "in the engine power or accessory sections" and replacing them with the words "or burns out of any fire zone," in order to prevent turbine engine combustor burn-throughs from causing a fire to burn out of a fire zone. One comment objected, stating that the need for the changes cannot be found in the service experience of turbine engine powered rotorcraft. While specific helicopter experience bears out the commentator's statement, the FAA disagrees with the conclusion that no rule change is necessary. There is an established history of combustor can burn-through on turbine engines like those used in rotorcraft, although this history was obtained on airplanes. The fact that

this history was obtained on airplanes does not lessen its validity, particularly since this history is based on service experience that is much longer than that yet available in the case of most rotorcraft. This amendment is therefore drafted as proposed. The notice also proposed to amend § 29.1193(c) to take account of the tendency of a fire that burns out of one zone to pass into the next zone "downstream." Because of the wide range of speeds available to helicopters, including hovering, the concept of what is "downstream" requires further study. This proposal is therefore withdrawn.

The notice proposed to add new §§ 27.1194 and 29.1194 to require fire protection of surfaces aft of, and adjacent to, engine compartments and designated fire zones. One comment stated that there is no need for proposed paragraph (b) of these sections in addition to the provisions of §§ 27.861 and 29.861. The FAA agrees. These proposed paragraphs are therefore withdrawn. The remainder of the proposal is drafted as proposed with one exception: Since there are no designated fire zones under Part 27, § 27.1194 uses the words "powerplant compartments" where the proposal referred to "engines compartments and designated fire zones." No substantive change results.

The notice proposed several amendments to the powerplant instrument requirements of § 29.1305. Comments objected to a proposed requirement for a fuel flow meter on the basis that the need for such an instrument should be determined in the operating environment rather than during type certification. The FAA agrees. This part of the proposal is therefore withdrawn. Except for this change and paragraphing changes, these amendments are drafted as proposed.

The notice proposed to add new §§ 27.1459 and 29.1459 to provide standards for equipment containing high energy rotors. These amendments have been renumbered as §§ 27.1461 and 29.1461. One comment stated that the proposed specific rules are unnecessary in addition to the general provisions of §§ 27.1309 and 29.1309. The FAA disagrees. Instances of fragmentation of air turbine starter wheels have occurred. These failures have in turn damaged components external to the starter. Reliance upon general rules to prevent recurrences of this kind of failure should not be continued. These amendments are therefore drafted as proposed.

The notice proposed several changes to the powerplant limitation provisions of § 29.1521 to accommodate turbine engines and achieve consistency with similar provisions in Part 25 where necessary for safe takeoff and continuous operation. The changes included a proposal to specify transmission oil temperature as a powerplant limitation. One comment objected, stating that the transmission oil temperature recorded during the endurance testing under § 29.923 should not become a limitation since it merely represents a temperature occurring under the test conditions. To the extent that only a recorded value is involved, the commentator would be correct. However, § 29.1011(e) requires rotor drive system oil cooling provisions to maintain the oil temperature at or below the "maximum established value" under specified conditions. Further § 29.1041(b) requires provisions to maintain the power transmission fluid temperature "within safe values" under specified conditions. Finally, with respect to the power transmission fluid cooling tests conducted under § 29.1043, paragraph (a) of that section requires (1) correction of recorded powerplant temperatures to account for changing test conditions, and (2) assurance that no corrected temperature will exceed "established limits." It is thus clear that, with respect to power transmission fluid temperatures, the establishing of a safe limit rather than the mere recording of values is involved under the present regulations. This comment cannot, therefore, be accepted. These amendments are drafted as proposed.

Nautical measure. The notice proposed to amend Parts 27 and 29 by changing all references to "miles" and "miles per hour" to "nautical miles" and "knots," respectively, wherever the former are used. No adverse comments were received with respect to the objectives of this proposal. These amendments are therefore drafted as proposed, using the following criteria: (1) In response to one comment, conversions from miles per hour to knots are rounded off to whole units to avoid fractions of a knot, since accurate fractional knot measurement is not necessary under the present rules and is not required to be within the capability of required airspeed indicating systems; (2) current requirements specifying extremely low airspeed values, such as 5 or 10 miles per hour, are not changed numerically (such as to 4 or 9 knots, respectively) since the substantive difference in these cases is approximately 1 mile per hour, which is not practically significant. Sections 27.1399 and 29.1399, which require that each riding light required for water operations must show a white light for at least "two miles", have been amended to read "two nautical miles". This change is substantively insignificant within the conditions of visibility under which illumination is measured. No increase in burden results. One comment requested that no change be made with respect to allowing the use of airspeed indicators calibrated to read in terms of miles per hour. This comment is accepted. Nothing contained in these amendments requires the calibration of the airspeed indicator to read in terms of knots. Finally, it should be noted that the change to nautical units in § 29.1323 is combined with substantive changes based on Flight Proposal 19.

In consideration of the foregoing, Parts 1, 27, and 29 of the Federal Aviation Regulations are amended, effective February 25, 1968, as hereinafter set forth.

§ 1.2 [Amended]

a. Part 1 is amended by amending the definition of "V_H" in § 1.2 to read as follows:

V_H means maximum speed in level flight with maximum continuous power.

b. Part 27 is amended as follows:

1. Section 27.27 is amended to read as follows:

§ 27.27 Center of gravity limits.

The extreme forward and aft centers of gravity and, where critical, the extreme lateral centers of gravity must be established for each weight established under § 27.25. Such an extreme may not lie beyond—

(a) The extremes selected by the applicant;

(b) The extremes within which the structure is proven; or

(c) The extremes within which compliance with the applicable flight requirements is shown.

2. Section 27.33(b) and (c) are amended, and a new § 27.33(d) is added, to read as follows:

§ 27.33 Main rotor speed and pitch limits.

* * * * *

(b) *Normal main rotor high pitch limits (power on).* It must be shown, with power on and without exceeding approved engine maximum limitations, that main rotor speeds substantially less than the minimum approved main rotor speed will not occur under any substained flight condition. This must be met by—

(1) Appropriate setting of the main rotor high pitch stop;

(2) Inherent rotorcraft characteristics that make unsafe low main rotor speeds unlikely; or

(3) Adequate means to warn the pilot of unsafe main rotor speeds.

(c) *Normal main rotor low pitch limits (power off).* It must be shown, with power off, that—

(1) The normal main rotor low pitch limit provides sufficient rotor speed, in any autorotative condition, under the most critical combinations of weight and airspeed; and

(2) It is possible to prevent overspeeding of the rotor without exceptional piloting skill.

(d) *Emergency high pitch.* If the main rotor high pitch stop is set to meet paragraph (b)(1) of this section, and if that stop cannot be exceeded inadvertently, additional pitch may be made available for emergency use.

3. Section 27.141(b) is amended to read as follows:

§ 27.141 General.

* * * * *

(b) Be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including—

(1) Sudden failure of one engine, for multiengine rotorcraft meeting Transport Category A engine isolation requirements of Part 29 of this chapter; and

(2) Sudden, complete power failure, for other rotorcraft; and

* * * * *

4. Section 27.143 (b)(1), (c), and (d) are amended to read as follows:

§ 27.143 Controllability and maneuverability.

* * * * *

(b) * * *

(1) Critical weight.

* * * * *

(c) A wind velocity of not less than 17 knots must be established in which the rotorcraft can be operated without loss of control on or near the ground in any maneuver appropriate to the type (such as crosswind takeoffs, sideward flight, and rearward flight), with—

(1) Critical weight;

(2) Critical center of gravity; and

(3) Critical rotor r.p.m.

(d) The rotorcraft, after (1) failure of one engine in the case of multiengine rotorcraft that meet Transport Category A engine isolation requirements, or (2) complete engine failure in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failure occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than—

(i) For the cruise condition, one second, or normal pilot reaction time (whichever is greater); and

(ii) For any other condition, normal pilot reaction time.

5. Section 27.173(b) is amended to read as follows:

§ 27.173 Static longitudinal stability.

* * * * *

(b) The stick position versus speed curve may have a negative slope within the speed range specified for the maneuver in § 27.175(d) if the necessary negative stick travel does not exceed 1 inch measured at the top of the pilot's normal hand position.

6. Section 27.175(d)(2) is amended to read as follows:

§ 27.175 Demonstration of static longitudinal stability.

* * * * *

(d) * * *

(2) The stick position curve must have a stable slope, between the maximum approved rearward speed and a forward speed of 17 knots with—

(i) Critical weight;

(ii) Critical center of gravity;

(iii) Power required to maintain an approximately constant height in ground effect;

(iv) The landing gear retracted; and

(v) The helicopter trimmed for hovering.

7. Section 27.473 is amended to read as follows:

§ 27.473 Ground loading conditions and assumptions.

(a) For specified landing conditions, a design maximum weight must be used that is not less than the maximum weight. A rotor lift may be assumed to act through the center of gravity throughout the landing impact. This lift may not exceed two-thirds of the design maximum weight.

(b) Unless otherwise prescribed, for each specified landing condition, the rotorcraft must be designed for a limit load factor of not less than the limit inertia load factor substantiated under § 27.725.

8. Section 27.501(c)(2) is amended to read as follows:

§ 27.501 Ground loading conditions: landing gear with skids.

* * * * *

(c) * * *

(2) The resultant ground loads must equal the vertical load specified in paragraph (b) of this section.

* * * * *

9. The center heading "Main Rotor", following § 27.629 is amended to read "Rotors".

10. Section 27.653 is amended to read as follows:

§ 27.653 Pressure venting and drainage of rotor blades.

(a) For each rotor blade—

(1) There must be means for venting the internal pressure of the blade;

(2) Drainage holes must be provided for the blade; and

(3) The blade must be designed to prevent water from becoming trapped in it.

(b) Paragraph (a) (1) and (2) of this section does not apply to sealed rotor blades capable of withstanding the maximum pressure differentials expected in service.

11. Section 27.659 is amended to read as follows:

§ 27.659 Mass balance.

(a) The rotors and blades must be mass balanced as necessary to—

(1) Prevent excessive vibration; and

(2) Prevent flutter at any speed up to the maximum forward speed.

(b) The structural integrity of the mass balance installation must be substantiated.

12. Section 27.661 is amended to read as follows:

§ 27.661 Rotor blade clearance.

There must be enough clearance between the rotor blades and other parts of the structure to prevent the blades from striking any part of the structure during any operating condition.

13. New § 27.663 is added to read as follows:

§ 27.663 Ground resonance prevention means.

(a) The reliability of the means for preventing ground resonance must be shown either by analysis and tests, or reliable service experience, or by showing that malfunction of a single means will not cause ground resonance.

(b) The probable range of variations, during service, of the damping action of the ground resonance prevention means must be established and must be investigated during the test required by § 27.241.

14. Section 27.751(b) is amended to read as follows:

§ 27.751 Main float buoyancy.

* * * * *

(b) Each main float must have enough water-tight compartments so that, with any single main float compartment flooded, the main floats will provide a margin of positive stability great enough to minimize the probability of capsizing.

15. Section 27.807(a) is amended to read as follows:

§ 27.807 Emergency exits.

(a) *Number and location.* Rotorcraft with closed cabins must have at least one emergency exit on the opposite side of the cabin from the main door. Additional exists must be provided where the total seating capacity is more than 15.

* * * * *

16. A new § 27.901(b)(4) is added to read as follows:

§ 27.901 Installation.

* * * * *

(b) * * *

(4) Axial and radial expansion of turbine engines may not affect the safety of the installation.

17. A new § 27.923(i) is added to read as follows:

§ 27.923 Rotor drive system and control mechanism tests.

* * * * *

(i) At least 200 start-up clutch engagements must be accomplished—

(1) So that the shaft on the driven side of the clutch is accelerated; and

(2) Using a speed and method selected by the applicant.

18. Section 27.927 is amended to read as follows:

§ 27.927 Additional tests.

(a) Any additional dynamic, endurance, and operational tests, and vibratory investigations necessary to determine that the rotor drive mechanism is safe, must be performed.

(b) If turbine engine power output to the transmission can exceed the highest engine or transmission power rating, and that output is not directly controlled by the pilot under normal operating conditions (such as where the primary engine power control is accomplished through the flight control), the following test must be made:

(1) Under conditions associated with all engines operating, make 200 applications, for 10 seconds each, of torque that is at least equal to the lesser of—

(i) The maximum torque used in meeting § 27.923 plus 10 percent; or

(ii) The maximum attainable torque output of the engines, assuming that torque limiting devices, if any, function properly.

(2) For multiengine rotorcraft under conditions associated with each engine, in turn, becoming inoperative, apply to the remaining transmission power inputs the maximum torque attainable under probable operating conditions, assuming that torque limiting devices, if any, function properly. Each transmission input must be tested at this maximum torque for at least one hour.

(3) The tests prescribed in this paragraph must be conducted on the rotorcraft and the power must be absorbed by the rotors to be installed, except that other ground or flight test facilities with other appropriate methods of power absorption may be used if the conditions of support and vibration closely simulate the conditions that would exist during a test on the rotorcraft.

19. Section 27.991(b) is amended to read as follows:

§ 27.991 Fuel pumps.

* * * * *

(b) *Emergency pumps.* There must be emergency pumps, or another main pump, to feed the engines immediately after the failure of any main pump (other than fuel injection pump approved as part of the engine). Each pump used for this purpose must be activated automatically or operated continuously so that enough fuel pressure will be maintained to prevent engine stoppage.

20. Section 27.993 (d) and (e) are amended to read as follows:

§ 27.993 Fuel system lines and fittings.

* * * * *

(d) Each flexible connection in fuel lines that may be under pressure or subjected to axial loading must use flexible hose assemblies.

(e) No flexible hose that might be adversely affected by high temperatures may be used where excessive temperatures will exist during operation or after engine shutdown.

21. Section 27.1041(a) is amended to read as follows:

§ 27.1041 General.

(a) Each powerplant cooling system must be able to maintain the temperatures of powerplant components and engine fluids within the limits established for those components and fluids under any critical surface (ground or water) and flight operating conditions, and after normal engine shutdown.

* * * * *

22. A new § 27.1091(e) is added to read as follows:

§ 27.1091 Air induction.

* * * * *

(e) For turbine engine powered rotorcraft—

(1) There must be means to prevent hazardous quantities of fuel leakage or overflow from drains, vents, or other components of flammable fluid systems from entering the engine intake system; and

(2) The air inlet ducts must be located or protected so as to minimize the ingestion of foreign matter during takeoff, landing, and taxiing.

23. Section 27.1163 is amended to read as follows:

§ 27.1163 Powerplant accessories.

(a) Each engine-mounted accessory must—

(1) Be approved for mounting on the engine involved; and

(2) Use the provisions on the engine for mounting.

(b) Torque limiting means must be provided on all accessory drives that are located on the transmission, including drives on gearboxes that are part of the transmission, in order to prevent the torque limits established for those drives from being exceeded.

24. Section 27.1185 (a) and (b) are amended to read as follows:

§ 27.1185 Flammable fluids.

(a) For rotorcraft with turbine engines, or with reciprocating engines of 900 cubic inches displacement or less, each fuel tank must be isolated from the engines by a firewall or shroud.

(b) For rotorcraft with reciprocating engines of more than 900 cubic inches displacement—

(1) Each flammable fluid tank must be isolated under paragraph (a) of this section; or

(2) The fluid in the tank, the design of the system, the materials used in the tank, the shutoff means, and all connections, lines, and controls must provide a degree of safety equal to that resulting from isolation under paragraph (a) of this section.

25. Section 27.1189(a)(2) is amended to read as follows:

§ 27.1189 Shutoff means.

(a) * * *

(2) For reciprocating engine installations only, engine oil system lines in installation using engines of less than 500 cu. in. displacement.

* * * * *

26. Section 27.1191(a) is amended to read as follows:

§ 27.1191 Firewalls.

(a) Each engine, including the combustor, turbine, and tailpipe sections of turbine engines must be isolated by a firewall, shroud, or equivalent means, from personnel compartments, structures, controls, rotor mechanisms, and other parts that are—

(1) Essential to a controlled landing; and

(2) Not protected under § 27.861.

* * * * *

27. A new § 27.1194 is added to read as follows:

§ 27.1194 Other surfaces.

All surfaces aft of, and near, powerplant compartments, other than tail surfaces not subject to heat, flames, or sparks emanating from a powerplant compartment, must be at least fire resistant.

28. A new § 27.1322 is added to read as follows:

§ 27.1322 Warning, caution, and advisory lights.

If warning, caution, or advisory lights are used, they must be—

(a) Red, for warning lights (lights indicating a hazard requiring immediate corrective action);

(b) Amber, for caution lights (lights indicating the possible need for future corrective action); and

(c) Green, for advisory lights (lights used solely for information not indicating the need for corrective action).

29. Section 27.1323 (a) and (b)(2) is amended to read as follows:

§ 27.1323 Airspeed indicating system.

(a) The airspeed indicating system must be calibrated in flight at forward speeds of 10 knots and over.

(b) * * *

(2) Five knots.

30. Section 27.1399(a)(1) is amended to read as follows:

§ 27.1399 Riding light.

(a) * * *

(1) Show a white light for at least two nautical miles at night under clear atmospheric conditions; and

* * * * *

31. A new § 27.1461 is added to read as follows:

§ 27.1461 Equipment containing high energy rotors.

(a) Equipment containing high energy rotors must meet paragraph (b), (c), or (d) of this section.

(b) High energy rotors contained in equipment must be able to withstand damage caused by malfunctions, vibration, abnormal speeds, and abnormal temperatures. In addition—

(1) Auxiliary rotor cases must be able to contain damage caused by the failure of high energy rotor blades; and

(2) Equipment control devices, systems, and instrumentation must reasonably ensure that no operating limitations affecting the integrity of high energy rotors will be exceeded in service.

(c) It must be shown by test that equipment containing high energy rotors can contain any failure of a high energy rotor that occurs at the highest speed obtainable with the normal speed control devices inoperative.

(d) Equipment containing high energy rotors must be located where rotor failure will neither endanger the occupants nor adversely affect continued safe flight.

32. Section 27.1505(b) is amended to read as follows:

§ 27.1505 Never-exceed speed.

* * * * *

(b) V_{NE} may vary with altitude, r.p.m., temperature, and weight, if—

(1) No more than two of these variables (or no more than two instruments integrating more than one of these variables) are used at one time; and

(2) The ranges of these variables (or of the indications on instruments integrating more than one of these variables) are large enough to allow an operationally practical and safe variation of V_{NE}.

33. Section 27.1519 is amended to read as follows:

§ 27.1519 Weight and center of gravity.

(a) The weight and center of gravity limitations determined under §§ 27.25 and 27.27, respectively, must be established as operating limitations.

(b) Each weight that is less than the highest weight allowing hovering in ground effect at any given altitude under § 27.73, and that is used to establish the limiting height-speed envelope under § 27.79, must be established as a weight limitation for operation at that altitude.

34. Section 27.1565 is amended to read as follows:

§ 27.1565 Tail rotor.

Each tail rotor must be marked so that its disc is conspicuous under normal daylight ground conditions.

35. Section 27.1583(c) is amended to read as follows:

§ 27.1583 Operating limitations.

* * * * *

(c) *Weight and loading distribution.* The weight and center of gravity limits required by §§ 27.25 and 27.27, respectively, must be furnished. If the variety of possible loading conditions warrants, instructions must be included to allow ready observance of the limitations.

* * * * *

c. Part 29 is amended as follows:

1. Section 29.27 is amended to read as follows:

§ 29.27 Center of gravity limits.

The extreme forward and aft centers of gravity and, where critical, the extreme lateral centers of gravity must be established for each weight established under § 29.25. Such an extreme may not lie beyond—

(a) The extremes selected by the applicant;

(b) The extremes within which the structure is proven; or

(c) The extremes within which compliance with the applicable flight requirements is shown.

2. Section 29.33 (b) and (c) are amended, and a new § 29.33(d) is added, to read as follows:

§ 29.33 Main rotor speed and pitch limits.

* * * * *

(b) *Normal main rotor high pitch limit (power on).* It must be shown, with power on and without exceeding approved engine maximum limitations, that main rotor speeds substantially less than the minimum approved main rotor speed will not occur under any sustained flight condition. This must be met by—

(1) Appropriate setting of the main rotor high pitch stop;

(2) Inherent rotorcraft characteristics that make unsafe low main rotor speeds unlikely; or

(3) Adequate means to warn the pilot of unsafe main rotor speeds.

(c) *Normal main rotor low pitch limit (power off).* It must be shown, with power off, that—

(1) The normal main rotor low pitch limit provides sufficient rotor speed, in any autorotative condition, under the most critical combinations of weight and airspeed; and

(2) It is possible to prevent overspeeding of the rotor without exceptional piloting skill.

(d) *Emergency high pitch.* If the main rotor high pitch stop is set to meet paragraph (b)(1) of this section, and if that stop cannot be exceeded inadvertently, additional pitch may be made available for emergency use.

3. Section 29.67(a)(2) is amended to read as follows:

§ 29.67 Climb: one engine inoperative.

(a) * * *

(2) The steady rate of climb without ground effect must be at least 150 feet per minute, 1,000 feet above the takeoff surface, for each weight, altitude, and temperature for which takeoff data are to be scheduled, with—

(i) The critical engine inoperative and the remaining engines at maximum continuous power, or (for helicopters for which certification for the use of 30-minute power is requested), at 30-minute power;

(ii) The most unfavorable center of gravity for takeoff;

(iii) The landing gear retracted;

(iv) The speed selected by the applicant; and

(v) Cowl flaps, or other means of controlling the engine-cooling air supply, in the position that provides adequate cooling at the temperatures and altitudes for which certification is requested.

* * * * *

4. Section 29.73(b)(2) is amended to read as follows:

§ 29.73 Performance at minimum operating speed.

* * * * *

(b) * * *

(2) The hovering ceiling determined under subparagraph (1) of this paragraph—

(i) For reciprocating engine powered helicopters, must be at least 4,000 feet in standard atmosphere at maximum weight;

(ii) For single engine, turbine engine powered helicopters, must be at least 2,500 feet, in standard atmosphere plus 40° F., at maximum weight; and

(iii) For multiengine, turbine engine powered helicopters, must be available at each altitude, temperature, and weight for which takeoff data are to be scheduled.

* * * * *

§ 29.75 [Amended]

5. The introductory text of § 29.75(c)(1) is amended to read as follows:

(1) The horizontal distance required to land and come to a complete stop (or to a speed of approximately three knots for water landings), from a point 50 feet above the landing surface, must be determined with—

6. Section 29.75(b)(6) is deleted, and the semicolon and the word "and", following (b)(5), are deleted and a period is inserted in place thereof.

7. Section 29.75(c)(2)(ii) is amended to read as follows:

(ii) Paragraphs (b)(2) through (5) of this section.

8. Section 29.141(b) is amended to read as follows:

§ 29.141 General.

* * * * *

(b) Be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including—

(1) Sudden failure of one engine, for multiengine rotorcraft meeting Transport Category A engine isolation requirements; and

(2) Sudden, complete power failure, for other rotorcraft; and

* * * * *

9. Section 29.143 (b)(1), (c), and (d) are amended to read as follows:

§ 29.143 Controllability and maneuverability.

* * * * *

(b) * * *

(1) Critical weight.

* * * * *

(c) A wind velocity of not less than 17 knots must be established in which the rotorcraft can be operated without loss of control on or near the ground in any maneuver appropriate to the type (such as crosswind takeoffs, sideward flight, and rearward flight), with—

(1) Critical center of gravity; and

(2) Critical rotor r.p.m.

(d) The rotorcraft, after (1) failure of one engine, in the case of multiengine rotorcraft that meet Transport Category A engine isolation requirements, or (2) complete power failure in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failure occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than—

(i) For the cruise condition, one second, or normal pilot reaction time (whichever is greater); and

(ii) For any other condition, normal pilot reaction time.

10. Section 29.173(b) is amended to read as follows:

§ 29.173 Static longitudinal stability.

* * * * *

(b) The stick position versus speed curve may have a negative slope within the speed range specified for the maneuver in § 29.175(d) if the necessary negative stick travel does not exceed 1 inch measured at the top of the pilot's normal hand position.

11. Section 29.175(d)(2) is amended to read as follows:

§ 29.175 Demonstration of static longitudinal stability.

* * * * *

(d) * * *

(2) The stick position curve must have a stable slope, between the maximum approved rearward speed and a forward speed of 17 knots, with—

(i) The determined hovering weight (for Category A helicopters), or critical weight (for other helicopters);

(ii) The critical center of gravity;

(iii) Power required to maintain an approximately constant height in ground effect;

(iv) The landing gear retracted; and

(v) The helicopter trimmed for hovering.

12. Section 29.473 is amended to read as follows:

§ 29.473 Ground loading conditions and assumptions.

(a) For specified landing conditions, a design maximum weight must be used that is not less than the maximum weight. A rotor lift may be assumed to act through the center of gravity throughout the landing impact. This lift may not exceed two-thirds of the design maximum weight.

(b) Unless otherwise prescribed, for each specified landing condition, the rotorcraft must be designed for a limit load factor of not less than the limit inertia load factor substantiated under § 29.725.

(c) Triggering or actuating devices for additional or supplementary energy absorption may not fail under loads established in the tests prescribed in §§ 29.725 and 29.727, but the factor of safety prescribed in § 29.303 need not be used.

13. A new § 29.501 is added to read as follows:

§ 29.501 Ground loading conditions: landing gear with skids.

(a) *General.* Rotorcraft with landing gear with skids must be designed for the loading conditions specified in this section. In showing compliance with this section, the following apply:

(1) The design maximum weight, center of gravity, and load factor must be determined under §§ 29.471 through 29.475.

(2) Structural yielding of elastic spring members under limit loads is acceptable.

(3) Design ultimate loads for elastic spring members need not exceed those obtained in a drop test of the gear with—

(i) A drop height of 1.5 times that specified in § 29.725; and

(ii) An assumed rotor lift of not more than 1.5 times that used in the limit drop tests prescribed in § 29.725.

(4) Compliance with paragraph (b) through (e) of this section must be shown with—

(i) The gear in its most critically deflected position for the landing condition being considered; and

(ii) The ground reactions rationally distributed along the bottom of the skid tube.

(b) *Vertical reactions in the level landing attitude.* In the level attitude, and with the rotorcraft contacting the ground along the bottom of both skids, the vertical reactions must be applied as prescribed in paragraph (a) of this section.

(c) *Drag reactions in the level landing attitude.* In the level attitude, and with the rotorcraft contacting the ground along the bottom of both skids, the following apply:

(1) The vertical reactions must be combined with horizontal drag reactions of 50 percent of the vertical reaction applied at the ground.

(2) The resultant ground loads must equal the vertical load specified in paragraph (b) of this section.

(d) *Sideloads in the level landing attitude.* In the level attitude, and with the rotorcraft contacting the ground along the bottom of both skids, the following apply:

(1) The vertical ground reaction must be—

(i) Equal to the vertical loads obtained in the condition specified in paragraph (b) of this section; and

(ii) Divided equally among the skids.

(2) The vertical ground reactions must be combined with a horizontal sideload of 25 percent of their value.

(3) The total sideload must be applied along the length of one skid only.

(4) The unbalanced moments are assumed to be resisted by angular inertia.

(5) The skid gear must be investigated for—

(i) Inward acting sideloads; and

(ii) Outward acting sideloads.

(e) *One-skid landing loads in the level attitude.* In the level attitude, and with the rotorcraft contacting the ground along the bottom of one skid only, the following apply:

(1) The vertical load on the ground contact side must be the same as that obtained on that side in the condition specified in paragraph (b) of this section.

(2) The unbalanced moments are assumed to be resisted by angular inertia.

(f) *Special conditions.* In addition to the conditions specified in paragraphs (b) and (c) of this section, the rotorcraft must be designed for the following ground reactions:

(1) A ground reaction load acting up and aft at an angle of 45 degrees to the longitudinal axis of the rotorcraft. This load must be—

(i) Equal to 1.33 times the maximum weight;

(ii) Distributed symmetrically among the skids;

(iii) Concentrated at the forward end of the straight part of the skid tube; and

(iv) Applied only to the forward end of the skid tube and its attachment to the rotorcraft.

(2) With the rotorcraft in the level landing attitude, a vertical ground reaction load equal to one-half of the vertical load determined under paragraph (b) of this section. This load must be—

(i) Applied only to the skid tube and its attachment to the rotorcraft; and

(ii) Concentrated at a point midway between the skid tube attachments.

14. A new § 29.511 is added to read as follows:

§ 29.511 Ground load: unsymmetrical loads on multiple-wheel units.

(a) In dual-wheel gear units, 60 percent of the total ground reaction for the gear unit must be applied to one wheel and 40 percent to the other.

(b) To provide for the case of one deflated tire, 60 percent of the specified load for the gear unit must be applied to either wheel except that the vertical ground reaction may not be less than the full static value.

(c) In determining the total load on a gear unit, the transverse shift in the load centroid, due to unsymmetrical load distribution on the wheels, may be neglected.

15. New § 29.519 is added to read as follows:

§ 29.519 Hull type rotorcraft: Water-based, amphibian, and limited amphibian.

(a) *General.* For hull type rotorcraft, the structure must be designed to withstand the water loadings set forth in paragraphs (b), (c), and (d) of this section considering the most severe wave heights for which approval is desired. The loads for the landing conditions of paragraphs (b) and (c) of this section must be developed and distributed along and among the hull and auxiliary floats, if used, in a rational and conservative manner, assuming a rotor lift equal to two-thirds of the rotorcraft weight to act throughout the landing impact. For limited amphibian rotorcraft, a factor of safety of 1.15 may be applied to the loads specified in this section.

(b) *Vertical landing conditions.* The rotorcraft must initially contact the water surface at zero forward speed in likely pitch and roll attitudes which result in critical design loadings. The vertical descent velocity may not be less than 6.5 f.p.s.

(c) *Forward speed landing conditions.* The rotorcraft must contact the water at forward velocities from 0 up to 30 knots in likely pitched, rolled, and yawed attitudes and with a vertical decent velocity of not less than 6.5 f.p.s. A maximum forward velocity of less than 30 knots may be used in design if it can be demonstrated that the forward velocity selected would not be exceeded in a normal one-engine out landing.

(d) *Auxiliary float immersion condition.* In addition to the loads from the landing conditions, the auxiliary float, and its support and attaching structure in the hull, must be designed for the load developed by a fully immersed float

unless it can be shown that full immersion of the float is unlikely, in which case the highest likely float buoyancy load must be applied that considers loading of the float immersed to create restoring moments compensating for upsetting moments caused by side wind, asymmetrical rotorcraft loading, water wave action, and rotorcraft inertia.

16. Section 29.521 is amended to read as follows:

§ 29.521 Float landing conditions.

If certification for float operation (including float amphibian operation) is requested, the rotorcraft, with floats, must be designed to withstand the following loading conditions (where the limit load factor is determined under § 29.473(b) or assumed to be equal to that determined for wheel landing gear):

(a) Up-load conditions in which—

(1) A load is applied so that, with the rotorcraft in the static level attitude, the resultant water reaction passes vertically through the center of gravity; and

(2) The vertical load prescribed in subparagraph (1) of this paragraph is applied simultaneously with an aft component of 0.25 times the vertical component

(b) A side load condition in which—

(1) A vertical load of 0.75 times the total vertical load specified in paragraph (a)(1) of this section is divided equally among the floats; and

(2) For each float, the load share determined under subparagraph (1) of this paragraph, combined with a total side load of 0.25 times the total vertical load specified in subparagraph (1) of this paragraph, is applied to that float only.

17. A new § 29.549(e) is added to read as follows:

§ 29.549 Fuselage and rotor pylon structures.

* * * * *

(e) If approval for the use of a 2½-minute power is requested, each engine mount and adjacent structure must be designed to withstand the loads resulting from a limit torque equal to 1.25 times the mean torque for 2½-minute power combined with 1g. flight loads.

18. The subtopic "Main Rotor" following § 29.629 is changed to read "rotors".

19. Section 29.653 is amended to read as follows:

§ 29.653 Pressure venting and drainage of rotor blades.

(a) For each rotor blade—

(1) There must be means for venting the internal pressure of the blade;

(2) Drainage holes must be provided for the blade; and

(3) The blade must be designed to prevent water from becoming trapped in it.

(b) Paragraph (a) (1) and (2) of this section does not apply to sealed rotor blades capable of withstanding the maximum pressure differentials expected in service.

20. Section 29.659 is amended to read as follows:

§ 29.659 Mass balance.

(a) The rotor and blades must be mass balanced as necessary to—

(1) Prevent excessive vibration; and

(2) Prevent flutter at any speed up to the maximum forward speed.

(b) The structural integrity of the mass balance installation must be substantiated.

21. Section 29.661 is amended to read as follows:

§ 29.661 Rotor blade clearance.

There must be enough clearance between the rotor blades and other parts of the structure to prevent the blades from striking any part of the structure during any operating condition.

22. New § 29.663 is added to read as follows:

§ 29.663 Ground resonance prevention means.

(a) The reliability of the means for preventing ground resonance must be shown either by analysis and tests, or reliable service experience, or by showing that malfunction of a single means will not cause ground resonance.

(b) The probable range of variations, during service, of the damping action of the ground resonance prevention means must be investigated during the test required by § 29.241.

23. Section 29.725(a) is amended to read as follows:

§ 29.725 Limit drop test.

* * * * *

(a) The drop height must be at least 8 inches.

* * * * *

24. Section 29.751(b) is amended to read as follows:

§ 29.751 Main float buoyancy.

* * * * *

(b) Each main float must have enough water-tight compartments so that, with any single main float compartment flooded, the mainfloats will provide a margin of positive stability great enough to minimize the probability of capsizing.

25. Section 29.755 is amended to read as follows:

§ 29.755 Hull buoyancy.

(a) *Water-based and amphibian rotorcraft.* The hull and auxiliary floats, if used, must have enough watertight compartments so that, with any single compartment of the hull or auxiliary floats flooded, the buoyancy of the hull and auxiliary floats, and wheel tires if used, provides a margin of positive water stability great enough to minimize the probability of capsizing the rotorcraft for the worst combination of wave heights and surface winds for which approval is desired.

(b) *Limited amphibian rotorcraft.* For limited amphibian rotorcraft, the following apply:

(1) The hull and auxiliary floats, if used, must be divided into compartments so that, with any single compartment located in the likely area of water impact during landing flooded, the buoyancy of the hull and auxiliary floats, and wheel tires if used, will provide a sufficient margin of positive water stability to minimize the probability of capsizing the rotorcraft.

(2) The rotorcraft must remain afloat, after a landing on water, for at least one-half hour.

(3) The requirements of subparagraphs (1) and (2) of this paragraph apply considering the most severe combination of wave heights and wind conditions for which approval is desired.

26. A new § 29.757 is added to read as follows:

§ 29.757 Hull and auxiliary float strength.

The hull, and auxiliary floats if used, must withstand the water loads prescribed by § 29.519 with a rational and conservative distribution of local and distributed water pressures over the hull and float bottom.

§ 29.771 [Amended]

27. Section 29.771 is amended by deleting paragraphs (e) and (f) thereof.

28. Section 29.773(b)(2) is amended to read as follows:

§ 29.773 Pilot compartment view.

* * * * *

(b) * * *

(2) The first pilot must have a window that—

(i) Is openable under the conditions prescribed in subparagraph (1) of this paragraph; and

(ii) Provides the view prescribed in that subparagraph.

29. Section 29.803 is amended by adding the following new paragraph (c):

§ 29.803 Emergency evacuation.

* * * * *

(c) Limited amphibian rotorcraft must meet paragraphs (a) and (b) of this section. In addition, the following apply:

(1) Each external door, window, and exit must withstand the probable maximum local water pressures, unless it can be shown that its failure will not be hazardous to the passengers and crew or have an adverse effect on the rotorcraft's water stability that would preclude safe evacuation of the occupants.

(2) At least two exits, one per side, meeting the minimum dimensions of the exit specified in § 29.807(a)(4) and located above the water level must be provided for passenger seating capacities up to 39, inclusive. For passenger seating capacities from 40 to 59, inclusive, two exits, one per side, above the water level must be provided meeting the minimum dimensions of the exit specified in § 29.807(a)(3). In all cases, there must be at least one emergency exit located above the water level for each 35 passengers.

30. Section 29.805 is amended to read as follows:

§ 29.805 Flight crew emergency exits.

(a) For rotorcraft with passenger emergency exits that are not convenient to the flight crew, there must be flight crew emergency exits, on both sides of the rotorcraft or as a top hatch, in the flight crew area.

(b) Each flight crew emergency exit must be of sufficient size and must be located so as to allow rapid evacuation of the flight crew. This must be shown by test.

31. Section 29.807 is amended to read as follows:

§ 29.807 Passenger emergency exits.

(a) *Type.* For the purpose of this part, the types of passenger emergency exit are as follows:

(1) *Type I.* This type must have a rectangular opening of not less than 24 inches wide by 48 inches high, with corner radii not greater than one-third the width of the exit, in the passenger area in the side of the fuselage at floor level and as far away as practicable from areas that might become potential fire hazards in a crash.

(2) *Type II.* This type is the same as Type I, except that the opening must be at least 20 inches wide by 44 inches high.

(3) *Type III.* This type is the same as Type I, except that—

(i) The opening must be at least 20 inches wide by 36 inches high; and

(ii) The exits need not be at floor level.

(4) *Type IV.* This type must have a rectangular opening of not less than 19 inches wide by 26 inches high, with corner radii not greater than one-third the width of the exit, in the side of the fuselage with a step-up inside the rotorcraft of not more than 29 inches.

Openings with dimensions larger than those specified in this section may be used, regardless of shape, if the base of the opening has a flat surface of not less than the specified width.

(b) *Passenger emergency exits; side-of-fuselage.* Emergency exits must be accessible to the passengers and, except as provided in paragraph (d) of this section, must be provided in accordance with the following table:

Passenger seating capacity	Emergency exits for each side of the fuselage			
	Type I	Type II	Type III	Type IV
1 through 10	----	----	----	1
11 through 19	----	----	1 or---	2
20 through 39	----	1	----	1
40 through 59	1	----	----	1
60 through 79	1	----	1 or---	2

(c) *Passenger emergency exits; other than side-of-fuselage.* In addition to the requirements of paragraph (b) of this section—

(1) There must be enough openings in the top, bottom, or ends of the fuselage to allow evacuation with the rotorcraft on its side; or

(2) The probability of the rotorcraft coming to rest on its side in a crash landing must be extremely remote.

(d) *Ramp exits.* One Type I exit only, or one Type II exit only, that is required in the side of the fuselage under paragraph (b) of this section, may be installed instead in the ramp of floor ramp rotorcraft if—

(1) Its installation in the side of the fuselage is impractical; and

(2) Its installation in the ramp meets § 29.813.

(e) *Tests.* The proper functioning of each emergency exit must be shown by test.

32. Section 29.809 is amended to read as follows:

§ 29.809 Emergency exit arrangement.

(a) Each emergency exit must consist of a movable door or hatch in the external walls of the fuselage and must provide an unobstructed opening to the outside.

(b) Each emergency exit must be openable from the inside and from the outside.

(c) The means of opening each emergency exit must be simple and obvious and may not require exceptional effort.

(d) There must be means for locking each emergency exit and for preventing opening in flight inadvertently or as a result of mechanical failure.

(e) There must be means to minimize the probability of the jamming of any emergency exit in a minor crash landing as a result of fuselage deformation.

(f) Each land-based rotorcraft emergency exit (other than exits located over the wing) more than 6 feet from the ground with the rotorcraft on the ground and the landing gear extended, must have an approved slide, or its equivalent, for each floor level exit, and an approved rope, or its equivalent, for other exits. If a rope is used, it must be—

(1) Able, with its attachment, to withstand a 400-pound static load; and

(2) Attached to the fuselage structure at or above the top of the emergency exit opening, or (for the pilot's emergency exit window where the stowed rope would reduce the pilot's view in flight), at another approved location.

33. Section 29.811 is amended to read as follows:

§ 29.811 Emergency exit marking.

(a) Each passenger emergency exit, its means of access, and its means of opening must be conspicuously marked.

(b) The identity and location of each passenger emergency exit must be recognizable from a distance equal to the width of the cabin.

(c) The location of each passenger emergency exit must be indicated by a sign visible to occupants approaching along the main passenger aisle. There must be a locating sign—

(1) Next to or above the aisle near each floor emergency exit, except that one sign may serve two exits if both exists can be seen readily from that sign; and

(2) On each bulkhead or divider that prevents fore and aft vision along the passenger cabin, to indicate emergency exits beyond and obscured by it, except that if this is not possible the sign may be placed at another appropriate location.

(d) Each passenger emergency exit marking and each locating sign must have white letters 1 inch high on a red background 2 inches high, be self or electrically illuminated, and have a minimum luminescence (brightness) of at least 160 microlamberts. The colors may be reversed if this will increase the emergency illumination of the passenger compartment.

(e) The location of each passenger emergency exit operating handle and instructions for opening must be shown—

(1) For each emergency exit, by a marking on or near the exit that is readable from a distance of 30 inches; and

(2) For each Type I or Type II emergency exit with a locking mechanism released by rotary motion of the handle, by—

(i) A red arrow, with a shaft at least three-fourths inch wide and a head twice the width of the shaft, extending along at least 70 degrees of arc at a radius approximately equal to three-fourths of the handle length; and

(ii) The word "open" in red letters 1 inch high, placed horizontally near the head of the arrow.

(f) A source of light, independent of the main lighting system, must be installed to—

(1) Illuminate each passenger emergency exit marking and locating sign; and

(2) Provide enough general lighting in the passenger cabin so that the average illumination, when measured at 40-inch intervals at seat armrest height on the center line of the main passenger aisle, is at least 0.05 foot-candles.

(g) Each light required by paragraph (f) of this section must be designed to be operable manually, and to operate automatically when armed (if necessary), from the independent lighting system required by paragraph (f) of this section in a crash landing and whenever the rotorcraft's normal electrical power to the light is interrupted.

(h) Each emergency exit, and its means of opening, must be marked on the outside of the rotorcraft. In addition, the following apply:

(1) There must be a 2-inch colored band outlining each passenger emergency exit.

(2) Each outside marking, including the band, must have color contrast to be readily distinguishable from the surrounding fuselage surface. The contrast must be such that, if the reflectance of the darker color is 15 percent or less, the reflectance of the lighter color must be at least 45 percent. "Reflectance" is the ratio of the luminous flux reflected by a body to the luminous flux it receives. When the reflectance of the darker color is greater than 15 percent, at least a 30 percent difference between its reflectance and the reflectance of the lighter color must be provided.

(l) Exits marked as such, though in excess of the required number of exits, must meet the requirements for emergency exits of the particular type. Emergency exits need only be marked with the word "Exit."

34. Section 29.853(f) is amended to read as follows:

§ 29.853 Compartment interiors.

* * * * *

(f) At least the following number of hand fire extinguishers must be conveniently located in passenger compartments:

Passenger capacity:	*Fire extinguishers*
7 through 30	1
31 through 60	2
61 or more	3

35. Section 29.855(d) is amended, and new § 29.855(e) is added to read as follows:

§ 29.855 Cargo and baggage compartments.

* * * * *

(d) Each cargo and baggage compartment that is not sealed so as to contain cargo compartment fires completely without endangering the safety of a rotorcraft or its occupants must be designed, or must have a device, to ensure detection of fires by a crewmember while at his station and to prevent the accumulation of harmful quantities of smoke, flame, extinguishing agents, and other noxious gases in any crew or passenger compartment. This must be shown in flight.

(e) For rotorcraft used for the carriage of cargo only, the cabin area may be considered a cargo compartment and, in addition to paragraphs (a) through (d) of this section, the following apply:

(1) There must be means to shut off the ventilating airflow to or within the compartment. Controls for this purpose must be accessible to the flight crew in the crew compartment.

(2) Required crew emergency exits must be accessible under all cargo loading conditions.

(3) Sources of heat within each compartment must be shielded and insulated to prevent igniting the cargo.

36. A new § 29.901(b)(5) is added to read as follows:

§ 29.901 Installation.

* * * * *

(b) * * *

(5) Axial and radial expansion of turbine engines may not affect the safety of the installation.

37. Section 29.903(c), introductory paragraph, is amended to read as follows:

§ 29.903 Engines.

* * * * *

(c) *Category A; control of engine rotation.* For each Category A rotorcraft, there must be means for stopping and restarting any engine individually in flight, except that, for turbine engine installations, the means for stopping the engine need be provided only where necessary for safety. In addition—

* * * * *

38. Section 29.927 is amended to read as follows:

§ 29.927 Additional tests.

(a) Any additional dynamic, endurance, and operational tests, and vibratory investigations necessary to determine that the rotor drive mechanism is safe, must be performed.

(b) If turbine engine power output to the transmission can exceed the highest engine or transmission power rating, and that output is not directly controlled by the pilot under normal operating conditions (such as where the primary engine power control is accomplished through the flight control), the following test must be made:

(1) Under conditions associated with all engines operating, make 200 applications, for 10 seconds each, of torque that is at least equal to the lesser of—

(i) The maximum torque used in meeting § 29.923 plus 10 percent; or

(ii) The maximum torque attainable under probable operating conditions, assuming that torque limiting devices, if any, function properly.

(2) For multiengine rotorcraft under conditions associated with each engine, in turn, becoming inoperative, apply to the remaining transmission power inputs the maximum torque attainable under probable operating conditions, assuming that torque limiting devices, if any, function properly. Each transmission input must be tested at this maximum torque for at least one hour.

(3) The tests prescribed in this paragraph must be conducted on the rotorcraft and the power must be absorbed by the rotors to be installed, except that other ground or flight test facilities with other appropriate methods of power absorption may be used if the conditions of support and vibration closely simulate the conditions that would exist during a test on the rotorcraft.

39. Section 29.991 (b) and (c) are amended to read as follows:

§ 29.991 Fuel pumps.

* * * * *

(b) *Emergency pumps.* There must be emergency pumps or another main pump to feed the engines immediately after the failure of any main pump (other than a fuel injection pump approved as part of the engine).

(c) *Installation.* The following fuel pump installation requirements apply:

(1) When necessary for the maintenance of the proper fuel pressure—

(i) A connection must be provided to transmit the carburetor air intake static pressure to the proper fuel pump relief valve connection; and

(ii) The gauge balance lines must be independently connected to the carburetor inlet pressure to avoid incorrect fuel pressure readings;

(2) The installation of fuel pumps having seals or diaphragms that may leak must have means for draining leaking fuel; and

(3) Each drain line must discharge where it will not create a fire hazard.

40. A new § 29.997(e) is added to read as follows:

§ 29.997 Fuel strainer or filter.

* * * * *

(e) Unless there are means in the fuel system to prevent the accumulation of ice of the filter, there must be means to automatically maintain the fuel flow if ice-clogging of the filter occurs.

41. Section 29.1041(a) is amended to read as follows:

§ 29.1041 General.

(a) The powerplant cooling provisions must be able to maintain the temperatures of powerplant components, engine fluids, and the carburetor intake air within safe values under any critical surface (ground or water) and flight operating conditions, and after normal engine shutdown.

* * * * *

42. Section 29.1091(d) is amended and (f) is added to read as follows:

§ 29.1091 Air induction.

* * * * *

(d) Each reciprocating engine must have an alternate air source.

* * * * *

(f) For turbine engine powered rotorcraft—

(1) There must be means to prevent hazardous quantities of fuel leakage or overflow from drains, vents, or other components of flammable fluid systems from entering the engine intake system; and

(2) The air inlet ducts must be located or protected so as to minimize the ingestion of foreign matter during takeoff, landing, and taxiing.

43. Section 29.1093 is amended to read as follows:

§ 29.1093 Induction system icing protection.

(a) *Reciprocating engines.* Each reciprocating engine air induction system must have means to prevent and eliminate icing. Unless this is done by other means, it must be shown that, in air free of visible moisture at a temperature of 30° F., and with the engines at 60 percent of maximum continuous power—

(1) Each rotorcraft with sea level engines using conventional venturi carburetors has a preheater that can provide a heat rise of 90° F.;

(2) Each rotorcraft with sea level engines using carburetors tending to prevent icing has a preheater that can provide a heat rise of 70° F.;

(3) Each rotorcraft with altitude engines using conventional venturi carburetors has a preheater that can provide a heat rise of 120° F.; and

(4) Each rotorcraft with altitude engines using carburetors tending to prevent icing has a preheater that can provide a heat rise of 100° F.

(b) *Turbine engines.* Each turbine engine must be able to operate, throughout

its flight power range, without adverse effect on engine operation or serious loss of power or thrust, under the icing conditions specified in Appendix C of Part 25 of this chapter.

44. A new § 29.1121(h) is added to read as follows:

§ 29.1121 General.

* * * * *

(h) If significant traps exist, each turbine engine exhaust system must have drains discharging clear of the rotorcraft, in any normal ground and flight attitudes, to prevent fuel accumulation after the failure of an attempted engine start.

45. A new § 29.1163(d) is added to read as follows:

§ 29.1163 Powerplant accessories.

* * * * *

(d) Torque limiting means must be provided on all accessory drives that are located on the transmission, including drives on gearboxes that are part of the transmission, in order to prevent the torque limits established for those drives from being exceeded.

46. Section 29.1181 is amended to read as follows:

§ 29.1181 Designated fire zones: regions included.

(a) Designated fire zones are—

(1) The engine power section of reciprocating engines;

(2) The engine accessory section of reciprocating engines;

(3) Any complete powerplant compartment in which there is no isolation between the engine power section and the engine accessory section, for reciprocating engines;

(4) Any auxiliary power unit compartment;

(5) Any fuel-burning heater and other combustion equipment installation described in § 29.859;

(6) The compressor and accessory sections of turbine engines; and

(7) The combustor, turbine, and tailpipe sections of turbine engine installations except sections that do not contain lines and components carrying flammable fluids or gases and are isolated from the designated fire zone prescribed in subparagraph (6) of this paragraph by a firewall that meets § 29.1191.

47. Section 29.1189(a) is amended to read as follows:

§ 29.1189 Shutoff means.

(a) There must be means to shut off or otherwise prevent hazardous quantities of fuel, oil, deicing fluid, and other flammable fluids from flowing into, within, or through any designated fire zone, except that this means need not be provided—

(1) For lines and fittings forming an integral part of an engine; or

(2) In the case of reciprocating engines only, for engine oil systems in Category B rotorcraft using engines of less than 500 cubic inches displacement.

* * * * *

48. Section 29.1191(a) is amended to read as follows:

§ 29.1191 Firewalls.

(a) Each engine, including the combustor, turbine, and tailpipe sections of turbine engine installations, must be isolated by a firewall, shroud, or equivalent means, from personnel compartments, structures, controls, rotor mechanisms, and other parts that are—

(1) Essential to controlled flight and landing; and

(2) Not protected under § 29.861.

* * * * *

49. Section 29.1193(e)(3) is amended to read as follows:

§ 29.1193 Cowling and engine compartment covering.

* * * * *

(e) * * *

(3) Have fireproof skin in areas subject to flame if a fire starts in or burns out of any designated fire zone.

50. A new § 29.1194 is added to read as follows:

§ 29.1194 Other surfaces.

All surfaces aft of, and near, engine compartments and designated fire zones, other than tail surfaces not subject to heat, flames, or sparks emanating from a designated fire zone or engine compartment, must be at least fire resistant.

51. Section 29.1195(a) is amended to read as follows:

§ 29.1195 Fire extinguishing systems.

(a) Each turbine engine powered rotorcraft and Category A reciprocating engine powered rotorcraft, and each Category B reciprocating engine powered rotorcraft with engines of more than 1,500 cubic inches must have a fire extinguishing system for the designated fire zones. The fire extinguishing system for a powerplant must be able to simultaneously protect all zones of the powerplant compartment for which protection is provided.

* * * * *

52. Section 29.1203(a) is amended to read as follows:

§ 29.1203 Fire detector systems.

(a) For each turbine engine powered rotorcraft and Category A reciprocating engine powered rotorcraft, and for each Category B reciprocating engine powered rotorcraft with engines of more than 900 cubic inches displacement, there must be approved, quick-acting fire detectors in designated fire zones and in the combustor, turbine, and tailpipe sections of turbine installations (whether or not such sections are designated fire zones) in numbers and locations ensuring prompt detection of fire in those zones.

* * * * *

53. Section 29.1305(a) is amended to read as follows:

§ 29.1305 Powerplant instruments.

(a) For each rotorcraft—

(1) A carburetor air temperature indicator for each reciprocating engine;

(2) A cylinder head temperature indicator for each air-cooled reciprocating engine, and a coolant temperature indicator for each liquid-cooled reciprocating engine;

(3) A fuel quantity indicator for each fuel tank;

(4) If an engine can be supplied with fuel from more than one tank, a warning device to indicate, for each tank, when a 5-minute usable fuel supply remains when the rotorcraft is in the most adverse fuel feed condition for that tank, regardless of whether that condition can be sustained for the 5 minutes;

(5) A manifold pressure indicator, for each reciprocating engine of the altitude type;

(6) An oil pressure warning device for each pressure-lubricated gearbox to indicate when the oil pressure falls below a safe value;

(7) An oil quantity indicator for each oil tank and each rotor drive gearbox, if lubricant is self-contained;

(8) An oil temperature indicator for each engine;

(9) An oil temperature warning device to indicate unsafe oil temperatures in each main rotor drive gearbox, including gearboxes necessary for rotor phasing;

(10) A gas temperature indicator for each turbine engine;

(11) A gas producer rotor tachometer for each turbine engine;

(12) A tachometer for each engine that, if combined with the applicable instrument required by subparagraph (13) of this paragraph, indicates rotor r.p.m. during autorotation.

(13) At least one tachometer to indicate, as applicable—

(i) The r.p.m. of the single main rotor;

(ii) The common r.p.m. of any main rotors whose speeds cannot vary appreciably with respect to each other; and

(iii) The r.p.m. of each main rotor whose speed can vary appreciably with respect to that of another main rotor;

(14) A free power turbine tachometer for each turbine engine; and

(15) A means, for each turbine engine, to indicate power for that engine.

* * * * *

54. A new § 29.1322 is added to read as follows:

§ 29.1322 Warning, caution, and advisory lights.

If warning, caution, or advisory lights are used, they must be—

(a) Red, for warning lights (lights indicating a hazard requiring immediate corrective action);

(b) Amber, for caution lights (lights indicating the possible need for future corrective action); and

(c) Green, for advisory lights (lights used solely for information not indicating the need for corrective action).

55. Section 29.1323 (b)(2), (c), and (d) are amended to read as follows:

§ 29.1323 Airspeed indicating system.

* * * * *

(b) * * *

(2) During takeoff, with repeatable and readable indications that ensure—

(i) Consistent realization of the field lengths specified in the Rotorcraft Flight Manual; and

(ii) Avoidance of the critical areas of the limiting height-speed envelope established under § 29.79.

* * * * *

(c) For multiengine rotorcraft, the airspeed error of the installation may not exceed 3 percent, or 5 knots, whichever is greater—

(1) Throughout the speed range in level flight at forward speeds of 30 knots or over; and

(2) Throughout the speed range in climb from 10 knots below the takeoff climbout safety speed to 10 knots above the best rate of climb speed.

(d) For single engine rotorcraft, calibration of the airspeed indicator must be made in flight at forward speeds of 20 knots or over. The airspeed error of the installation may not exceed 3 percent, or 5 knots, whichever is greater, at any forward speed above 80 percent of the climbout speed.

* * * * *

56. Secton 29.1325(e) is amended to read as follows:

§ 29.1325 Static air vent and pressure altimeter systems.

* * * * *

(e) Each system must be designed and installed so that the error in indicated pressure altitude at sea level with a standard atmosphere, excluding instrument calibration error, does not result in an error of more than ±30 feet in the level flight speed range from 0 knots to $0.9V_H$.

57. A new § 29.1461 is added to read as follows:

§ 29.1461 Equipment containing high energy rotors.

(a) Equipment containing high energy rotors must meet paragraph (b), (c), or (d) of this section.

(b) High energy rotors contained in equipment must be able to withstand damage caused by malfunctions, vibration, abnormal speeds, and abnormal temperatures. In addition—

(1) Auxiliary rotor cases must be able to contain damage caused by the failure of high energy rotor blades; and

(2) Equipment control devices, systems, and instrumentation must reasonably ensure that no operating limitations affecting the integrity of high energy rotors will be exceeded in service.

(c) It must be shown by test that equipment containing high energy rotors can contain any failure of a high energy rotor that occurs at the highest speed obtainable with the normal speed control devices inoperative.

(d) Equipment containing high energy rotors must be located where rotor failure will neither endanger the occupants nor adversely affect continued safe flight.

58. Section 29.1505(b) is amended to read as follows:

§ 29.1505 Never-exceed speed.

* * * * *

(b) V_{NE} may vary with altitude, r.p.m., temperature, and weight, if—

(1) No more than two of these variables (or no more than two instruments integrating more than one of these variables) are used at one time; and

(2) The ranges of these variables (or of the indications on instruments integrating more than one of these variables) are large enough to allow an operationally practical and safe variation of V_{NE}.

59. Section 29.1521 (b) and (c) are amended to read as follows:

§ 29.1521 Powerplant limitations.

* * * * *

(b) *Takeoff operation.* The powerplant takeoff operation must be limited by—

(1) The maximum rotational speed, which may not be greater than—

(i) The maximum value determined by the rotor design; or

(ii) The maximum value shown during the type tests;

(2) The maximum allowable manifold pressure (for reciprocating engines);

(3) The maximum allowable turbine inlet or turbine outlet gas temperature (for turbine engines);

(4) The maximum allowable power or torque for each engine, considering the power input limitations of the transmission with all engines operating;

(5) The maximum allowable power or torque for each engine considering the power input limitations of the transmission with one engine inoperative;

(6) The time limit for the use of the power corresponding to the limitations established in subparagraphs (1) through (5) of this paragraph; and

(7) If the time limit established in subparagraph (6) of this paragraph exceeds 2 minutes—

(i) The maximum allowable cylinder head or coolant outlet temperature (for reciprocating engines); and

(ii) The maximum allowable engine and transmission oil temperatures.

(c) *Continuous operation.* The continuous operation must be limited by—

(1) The maximum rotational speed, which may not be greater than—

(i) The maximum value determined by the rotor design; or

(ii) The maximum value shown during the type tests;

(2) The minimum rotational speed shown under the rotor speed requirements in § 29.1509(c).

(3) The maximum allowable manifold pressure (for reciprocating engines);

(4) The maximum allowable turbine inlet or turbine outlet gas temperature (for turbine engines);

(5) The maximum allowable power or torque for each engine, considering the power input limitations of the transmission with all engines operating;

(6) The maximum allowable power or torque for each engine, considering the power input limitations of the transmission with one engine inoperative; and

(7) The maximum allowable temperatures for—

(i) The cylinder head or coolant outlet (for reciprocating engines);

(ii) The engine oil; and

(iii) The transmission oil.

* * * * *

60. Section 29.1557(d) is amended to read as follows:

§ 29.1557 Miscellaneous markings and placards.

* * * * *

(d) *Emergency exit placards.* Each placard and operating control for each emergency exit must differ in color from the surrounding fuselage surface as prescribed in § 29.811(h)(2). A placard must be near each emergency exit control and must clearly indicate the location of that exit and its method of operation.

61. Section 29.1565 is amended to read as follows:

§ 29.1565 Tail rotor.

Each tail rotor must be marked so that its disc is conspicuous under normal daylight ground conditions.

62. Section 29.1583(c) is amended to read as follows:

§ 29.1583 Operating limitations.

* * * * *

(c) *Weight and loading distribution.* The weight and center of gravity limits required by §§ 29.25 and 29.27, respectively, must be furnished. If the variety of possible loading conditions warrants, instructions must be included to allow ready observance of the limitations.

* * * * *

(Secs. 313(a), 601, 603 Federal Aviation Act of 1958; 49 U.S.C. 1354(a), 1421, 1423)

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D. D. THOMAS,
Acting Administrator.