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PART II



Final Order

**DEPARTMENT OF
TRANSPORTATION**

**Federal Aviation
Administration**



**AIRWORTHINESS REVIEW
PROGRAM AMENDMENT
NO. 7**

Airframe Amendments; Final Rule

[4910-13-M]

Title 14—Aeronautics and Space

CHAPTER I—FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

[Docket Nos. 14324, 14606, 14625, 14685, and 14779; Amdt. Nos. 23-23; 25-46; 27-16; 29-17; and 121-149]

AIRWORTHINESS REVIEW PROGRAM
AMENDMENT NO. 7

Airframe Amendments; Final Rule

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: The purpose of these amendments to the Federal Aviation Regulations is to update and improve the airframe and crashworthiness standards applicable to the type certification of aircraft, and to make related changes to the operating rules contained in Part 121. These amendments are part of the Airworthiness Review Program.

EFFECTIVE DATE: December 1, 1978.

FOR FURTHER INFORMATION CONTACT:

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SUPPLEMENTARY INFORMATION: These amendments are the seventh in a series of amendments to be issued as part of the Airworthiness Review Program. The following amendments have previously been issued as part of this Airworthiness Review Program:

Title—FR citation

- Form number and clarifying revisions (40 FR 2576; Jan. 14, 1975).
- Rotorcraft anticollision light standards (41 FR 5290; Feb. 5, 1976).
- Miscellaneous amendments (41 FR 55454; Dec. 20, 1976).
- Powerplant amendments (42 FR 15034; Mar. 17, 1977).
- Equipment and systems amendments (42 FR 36960; July 18, 1977).
- Flight amendments (43 FR 2302; Jan. 16, 1978).

The amendments now being issued are based on five Notices of Proposed Rulemaking—Notice 75-10, published in the FEDERAL REGISTER on March 7, 1975 (40 FR 10802); Notice 75-19 published in the FEDERAL REGISTER on May 19, 1975 (40 FR 21866); Notice 75-23 published in the FEDERAL REGISTER on May 27, 1975 (40 FR 23048); Notice 75-26 published in the FEDERAL REGISTER on June 10, 1975 (40 FR 24802);

and Notice 75-31 published in the FEDERAL REGISTER on July 11, 1975 (40 FR 29410).

The amendments based on Notice 75-10 were deferred in the series of amendments titled "Miscellaneous Amendments" so that they could be considered with the final disposition of certain proposals in Notices 75-23, 75-26, and 75-31. The amendments based on Notice 75-19 were deferred in the series of amendments titled "Powerplant Amendments" so that they could be considered with the final disposition of certain proposals in Notice 75-31. The amendments based on Notice 75-23, including the related amendments based on Notice 75-10, were deferred in the series of amendments titled "Equipment and Systems Amendments" for further consideration and review.

The amendments based on Notice 75-31, and the related amendments based on Notices 75-10, and 75-19, implement the rotorcraft proposals or parallel proposals for the other aircraft airworthiness Parts. These proposals were brought forward for consideration with the final disposition of the proposals in Notice 75-26 in order to dispose of all the outstanding rotorcraft proposals and allow the announcement of a rotorcraft regulatory review. The discussions of the comments received for the deferred proposals from Notice 75-10 are included under the heading of the related proposals from Notices 75-23, 75-26, and 75-31. The discussions of the comments received for the deferred proposals from Notice 75-19 are included under the heading of the related proposals from Notice 75-31.

Interested persons have been afforded an opportunity to participate in the making of these amendments and due consideration has been given to all matter presented. A number of substantive changes and changes of an editorial and clarifying nature have been made to the proposed rules based upon relevant comments received and upon further review within the FAA. Except for minor editorial and clarifying changes and the substantive changes discussed below, these amendments and the reasons for them are the same as those contained in Notices 75-10, 75-19, 75-23, 75-26, and 75-31.

DISCUSSION OF COMMENTS

The following discussion is keyed to like-numbered proposals contained in Notices 75-23, 75-26, and 75-31, and is presented in the same order as the corresponding amendments to be found in the rules portion of this document.

Proposal 7-1. One commentator recommended that the 25 feet per second head-on gust requirement in proposed § 23.345(c) be deleted because there had been no recorded failures of any

flaps or flap structure attributed to head-on gusts and the proposal would increase the power-off flap loads. The FAA believes that a majority of the recorded flap and flap support structural failures resulted from head-on gusts. The amendment to § 23.345(c) is adopted without substantive change.

Based on the comments received and upon further review within the FAA, the proposal for new § 23.345(f) is withdrawn.

Proposal 7-2. One commentator objected to the proposal to amend § 23.561(b)(2) to require a 3.0g rearward ultimate inertial load for seat attachment design. The commentator stated that it is unreasonable to expect rearward inertia forces that are twice the sideward and equal to upward inertia forces. Upon further review, the FAA believes that it does not have enough information at this time to specify the minimum value to be used as a rearward ultimate inertia force. The proposal is withdrawn. However, the proposal to add a new § 23.785(h) concerning seat track retention is adopted. See Proposal 7-11.

Proposal 7-3. Several commentators objected to the proposal to amend § 23.603 and to similar proposals to amend §§ 25.603, 27.603, and 29.603. These proposals would require the applicant to show that the materials used for safety-critical parts will maintain their design properties throughout their service lives, taking into consideration the environmental considerations expected in service. The commentators stated that there is no satisfactory means of showing compliance for many materials. The limiting factors in achieving this objective were stated to be as follows: (1) A complete definition of the operating environment; (2) an understanding of interactive effects; and (3) test methods which correlate with service. After consideration of the comments received, and after further review of the materials used on modern aircraft, the FAA agrees that there may be significant difficulties in developing means to show compliance with the proposed amendments. The FAA believes, however, that the design characteristics of some materials used on aircraft may be affected by environmental conditions and that, where such materials are used in safety-critical parts, the effects of the environment upon them must be considered. The FAA further believes that the term "environmental conditions" should be clarified.

Accordingly, the proposals to add new §§ 23.603(a)(3), 25.603(c), 27.603(c), and 29.603(c) are revised to require only that the suitability and durability of materials used for safety-critical parts must take into account the effects of environmental conditions,

such as temperature and humidity, expected in service.

Two commentators, while agreeing with the proposal for § 25.603, stated that the proposed requirement should apply also to fabrication methods. The FAA does not have any information at this time to indicate that the change recommended by these commentators is necessary, and the commentators did not provide any. These commentators also suggested that the term "design values" be substituted for the proposed term "design properties" to let the designer anticipate deterioration. The FAA believes that the change suggested by these commentators is unnecessary in view of the revision made in the rule as adopted.

Two commentators stated that the proposal for § 27.603(c) is not needed since the proposed requirements appear to be covered in present § 27.609. The FAA does not agree. Section 27.609 requires that each part of the structure must be protected from deterioration or loss of strength in service due to any cause, including weathering, corrosion, and abrasion, and it further requires provisions for ventilation and drainage where necessary for protection. Proposed new § 27.603(c) is concerned with the suitability of materials which may undergo changes in design characteristics, regardless of the degree of protection that is provided them.

One commentator objected to the proposal for § 27.603, stating that the subject material is adequately covered in §§ 27.613 and 27.619. The FAA does not agree. The practical effect of § 27.613 is to require that the effects of temperature on certain allowable stresses be considered where thermal effects are significant under normal operating conditions. Section 27.619 requires that special factors of safety be applied for each part of the structure whose strength is uncertain, likely to deteriorate in service before normal replacement, or subject to appreciable variability because of uncertainties in manufacturing processes or inspection methods. The FAA believes that §§ 27.613 and 27.619 do not specifically provide for the long-term behavior of certain modern construction materials and that the proposals to amend §§ 23.603, 25.603, 27.603, and 29.603 are necessary.

Proposal 7-4. For comments concerning the subject matter of the proposal to amend § 23.605, see Proposal 7-29. The proposal is adopted without substantive change.

Proposal 7-5. No unfavorable comments were received on the proposal to amend § 23.613(c). Accordingly, the proposal is adopted without substantive change.

Proposal 7-6. One commentator objected to the wording of proposed

§ 23.629(a) which states, "It must be shown by any one of the methods specified in paragraphs (b), (c), or (d) of this section that the airplane is free from flutter * * *". The commentator recommended that proposed § 23.629(a) be revised to clarify that combinations of the methods in proposed §§ 23.629 (b), (c), and (d) may be used to show freedom from flutter. The FAA agrees, and the proposal is revised accordingly. The commentator also recommended that proposed § 23.629(a) be revised to clarify that the flutter substantiation requirements of proposed § 23.629 are not applicable to minor structural items such as fairings, lights, and antennas which will not affect safety of flight. The FAA does not agree. The FAA believes that flutter in minor structural items can have an adverse effect upon safety of flight.

One commentator questioned who decides which of the methods specified in paragraphs (b), (c), or (d) are to be applied. The applicant can select any one of the methods specified in paragraphs (b), (c), or (d), or a combination of these methods.

One commentator objected to the requirement in proposed § 23.629(a)(1) that adequate tolerances must be established for quantities which affect flutter, including speed, damping, mass balance, and control system stiffness. The commentator stated that all quantities which affect flutter may not be significant and recommended that proposed § 23.629(a)(1) be reworded to state "those quantities or parameters that would significantly degrade the critical flutter speed are to be considered and pertinent tolerances established where necessary." The FAA believes that all quantities which affect flutter should be considered. However, the use of the word "adequate" indicates that the tolerance to be established will vary, depending on the significance of the quantity considered. Proposed § 23.629(a)(1) is adopted without substantive change.

Two commentators objected to the requirement in proposed § 23.629(a)(2) that natural frequencies of main structural components be determined by vibration tests. It was stated that this proposed change would impose a burden in the case of simple aircraft meeting the requirements of proposed § 23.629(d), and it was recommended that the words "or other approved methods" be reinstated. Upon further review, the FAA believes that the current requirement of "vibration tests or other approved methods" has provided satisfactory results in the past. Proposed § 23.629(a)(2) is revised accordingly.

The FAA believes that the intent of proposed § 23.629(b) may be unclear, since the term "stability" may be ap-

licable either to the structural vibration modes, as intended, or to the airplane itself. The proposal is revised for clarity.

One commentator objected to the wording of proposed § 23.629(c)(1) that "proper and adequate attempts to induce flutter have been made." The commentator stated that this might be interpreted to allow pilot control impulse of the controls and this would not necessarily excite high frequency modes which may exist. The FAA believes that the wording as proposed is adequate. The proposed requirement to develop a vibratory response of the structure during the test will indicate the attempts to induce flutter, and the adequacy of the excitation can be evaluated by reference to the data record. Proposed § 23.629(c) is adopted without substantive change.

One commentator recommended the deletion of proposed § 23.629(d), which allows the use of Airframe and Engineering Report No. 45 in showing the airplane to be free from flutter but submitted no justification for the deletion. Since this report has been used for years with satisfactory results, the FAA believes that this alternative procedure, as revised and set forth in proposed § 23.629(d), should be continued.

One commentator recommended that proposed § 23.629(d)(3)(iii) be revised to state whether a trim-adjustable stabilizer would qualify as a fixed stabilizer. The FAA does not believe that any revision is necessary. The "degree of fixity" governs whether a trim-adjustable stabilizer can be considered a fixed stabilizer in regard to the use of Report No. 45. Some designs may have a high enough "degree of fixity" to allow treatment as fixed stabilizers, while others do not. Accordingly, § 23.629(d)(3)(iii) is adopted without substantive change.

One commentator objected to the proposed § 23.629(f) which would require that the airplane be free from flutter, control reversal, and divergence after the failure of any single element in the primary control system, any tab control system, or any flutter damper. The commentator stated that this requirement would add weight and cost, particularly in light single engine aircraft, since it would require that virtually all primary control systems, tab control systems, and flutter dampers be made fail-safe. The FAA believes this comment has merit, and proposed paragraph (f) is revised to require that airplanes that meet the criteria of paragraphs (d)(1) through (d)(3) of § 23.629 need to be shown to be free from flutter, control reversal, and divergence with a failure of any single element in the tab control system only. The FAA believes that the requirements of Report No. 45 satisfactorily consider

the failure of any single element in the primary flight control system, and flutter dampers are not appropriate for airplanes designed to the requirements of Report No. 45. Further, tab control systems, which have been a significant cause of flutter problems, can be designed to prevent flutter after the failure of any single element by balancing or by structural fail-safe means with a minimum cost and weight increase. The FAA further believes that, for airplanes having a configuration or operating speed that does not meet the criteria of paragraphs (d) (1), (2), and (3), the requirement for considering single element failures should be applied to the primary flight control system, any tab control system, and any flutter damper. The FAA believes that for current complex, high-speed designs, the proposed flutter requirements can be met with minimum cost and effects by use of the current state-of-the-art methods of balancing and structural fail-safe features.

One commentator agreed in principle with the proposal to revise § 23.629, but stated that suitable methods of compliance should be specified. The FAA does not believe the rule needs further change but will consider the issuance of guidance material as to applicable means of compliance.

Proposal 7-7. One commentator objected to the proposed amendment to § 23.677 concerning an aural warning device for certain longitudinal trim systems. The device would provide an aural warning when the horizontal stabilizer trim is in transit due to trim system operation or when the power or thrust controls are advanced to the takeoff position with the stabilizer trim set in a position outside the approved range for takeoff. The commentator stated that the warning would tend to be ignored in a cockpit environment which already contains many aural warnings. The commentator also objected to the cost and complexity that this requirement would add. The FAA agrees, and the proposal to add a new § 23.677(d) is withdrawn.

Proposal 7-8. No unfavorable comments were received on the proposal to amend § 23.701. However, after further review, the FAA believes that the proposed change is not appropriate and is not needed for Part 23 airplanes. The proposal is withdrawn.

Proposal 7-9. No unfavorable comments were received on the proposal to amend § 23.723(a) which would allow the use of analysis to supplement tests to substantiate landing load factors. However, the FAA has revised the proposal based on comments received on Proposal 7-34. See Proposal 7-34.

Proposal 7-10. Two commentators questioned the benefit of the ski shock absorption test in proposed §§ 23.737 and 25.737. The commentators noted that the conditions which may cause ski failure in service do not correspond to the conditions of the proposed shock absorption test. Based upon these comments and upon further review within the FAA, the FAA believes that it does not have enough information at this time to specify requirements for ski shock absorption tests and the proposals are withdrawn.

Proposal 7-11. No unfavorable comments were received on the proposal to add a new § 23.785(h). Accordingly, the proposal is adopted without substantive change. The proposal as adopted is redesignated as § 23.785(l) in view of the adoption of §§ 23.785 (h), (i), (j), and (k) by Amendment 23-19 (42 FR 30601; June 16, 1977).

Proposal 7-12. No unfavorable comments were received on the proposal to add a new § 23.853(e). However, to insure consistent interpretation, the applicable portions of Appendix F to Part 25 are set forth in a new Appendix F to Part 23, and the corresponding reference in the proposal is revised accordingly.

In addition, the FAA believes that the proposed requirement for a vertical self-extinguishing test may be unduly restrictive for electrical wire and cable insulation and for certain small parts. An exception is therefore provided for these items.

Proposal 7-13. One commentator agreed with the intent of the proposal to add a new § 23.863, but stated that without appropriate explanatory material, the proposed rule could be applied in a manner beyond the limits of cost and engineering practicality for many general aviation airplanes. The FAA will consider the issuance of appropriate guidance material. The proposal is adopted without substantive change.

Proposal 7-14. No unfavorable comments were received on the proposal to revise § 23.1307(a). However, a commentator suggested that a provision be added to allow the type design to include a seat or other facility (such as a stretcher) that is intended to be occupied on takeoff, during flight and on landing. The FAA believes that Part 23 airplanes utilized for a special purpose should be allowed to have installed berths, such as those approved under § 23.785, as well as approved seats. Proposed § 23.1307(a) is revised accordingly.

Proposals 5-7, 5-24, 5-41, 5-58, 2-84, 2-129, and 2-184. Proposal 5-7 of Airworthiness Review Notice No. 5 (Notice 75-23), to amend § 23.1329 is similar to proposals to amend §§ 25.1329 and 29.1329 and to the proposal to add a new § 27.1311 (Proposals

5-24, 5-58, and 5-41, respectively). Other related proposals affecting §§ 25.1329, 27.1329, and 29.1329 were included in Airworthiness Review Notice No. 2 (Notice 75-10) as Proposals 2-84, 2-129, and 2-184, respectively, and their disposition was deferred for consideration with Proposals 5-24, 5-41, and 5-58, respectively.

Several commentators objected to the above proposals. After consideration of the comments received, and after further review, the FAA believes that except for proposed §§ 23.1311(h) and 25.1329(h) of Proposals 5-7 and 5-24 respectively, which are discussed below, Proposals 2-84, 2-129, 2-184, 5-41, and 5-58 and the remainder of Proposals 5-7 and 5-24 are premature, and they are withdrawn.

One commentator objected to the language "means independent of the mode selector switch" in proposed § 23.1311(h) on the ground that it would require separation of the mode selector from the mode indicator, constituting an unnecessary and burdensome restriction for single and two-axis automatic pilot systems. The FAA believes, after further consideration, that the need to provide reliable mode selection information to the pilot exists only when the automatic pilot system can be coupled to airborne navigation equipment such as VOR and ILS (localizer and glide slope). Accordingly, the proposal is revised to incorporate that qualification.

Several commentators stated that the proposed requirement attempts to provide design details instead of stating the intent, which tends to retard advances in technology, and that it does not take into account modern panels which incorporate illuminated mode indications that give positive indication of the selected mode but are not "independent" of the mode selector switch. The FAA agrees that the proposed requirement is unnecessarily restrictive, and the proposals are revised to specify that selector switch position is not acceptable as a means of indication instead of requiring the means of indication to be independent of the selector switch.

Commentators objected to the phrase "and the availability status of each alternative system" in proposed §§ 23.1311(h) and 25.1329(h), contending that compliance may not be possible for some systems, and that even when possible, the added complexity would reduce reliability and create confusion in the cockpit. The FAA agrees, and the phrase is deleted.

One commentator suggested that proposed § 23.1311(h) be revised to require that the mode selector indication for the automatic pilot system differ from that for the flight director system. The FAA does not have sufficient information at the present time

to justify imposing such a regulation. This commentator further suggested that when automatic pilot mode selection indication is provided for both pilot and copilot, those indications must agree. This would merely require that both mode selection indications be correct, and the FAA does not believe that the revision suggested by the commentator is necessary.

In view of the withdrawal of the proposals to redesignate § 23.1329 as § 23.1311 and to add a new § 23.1311(g), proposed § 23.1311(h) is redesignated § 23.1329(g) and is adopted with the revisions discussed above. Proposed § 25.1329(h) (Proposal 5-24) is adopted with the revision discussed above for § 23.1311(h).

Proposal 7-15. Several commentators objected to the wording "the highest loads expected in service under any loading condition" in the proposals to revise §§ 23.1413(a), 25.1413(b), 27.1413(a), and 29.1413 which would broaden the rated strength requirements for safety belts and harnesses. The commentators contended that this wording was unreasonable, vague, and would be difficult to administer. The FAA believes that research and development work in the area of full scale dynamic testing of airplanes and mathematical modeling of the man-seat combination is needed to develop a more definitive standard. The proposed revisions of §§ 23.1413(a), 25.1413(b), 27.1413(a), and 29.1413 are withdrawn.

Proposal 7-16. One commentator objected to the proposal to add a new § 23.1416 which would add pneumatic de-icer boot system requirements. The commentator stated that the words "any foreseeable" in paragraph (b) are too broad and suggested that the nominal system operating parameters for each component should be used as a basis for establishing a factor of the nominal as design limit. The FAA disagrees that a factor is appropriate but agrees that the criteria should be revised. Accordingly, the words "any foreseeable" in proposed § 23.1416 are deleted and the words "any normal" are inserted in their place. The same commentator objected to the wording of proposed § 23.1416(c) on the ground that it could be interpreted to mean a pressure gauge would be required in the cockpit. The commentator recommended revising paragraph (c) to require that means be provided to indicate to the flight crew that the pneumatic de-icer boot system is receiving adequate pressure during the inflation cycle. The FAA agrees. This revision would make it clear that the use of pressure switches and indicator lights would be allowed in lieu of a pressure gauge. The proposal is revised accordingly.

Proposal 5-18. One commentator objected to the proposal to amend § 23.1545, contending that it would result in an unwarranted economic burden on aircraft owners. The FAA does not agree. The proposed requirement that the airspeed indicator be marked according to indicated airspeed is necessary to provide a more useful airspeed reference for operation of the airplane. In addition, the FAA does not believe that the proposed requirement would result in an appreciable increase in cost to aircraft owners compared to the current requirements.

Another commentator (who concurred with the proposed revision of § 23.1545) stated that the amount of information required on the airspeed indicator is reaching the point where confusion may be a factor, and that the reference to radials and arcs in § 23.1545 apparently prohibits the use of linear (horizontal or vertical) gauges. The FAA recognizes that indicator markings, if excessive, may cause confusion but believes that the proposed marking requirements are well within safe limits. With respect to linear-scale gauges, it is not the intent of the proposal to prohibit their use. The proposal, as well as present § 23.1545, describes marking for circular airspeed indicators since current airspeed indicators are circular. Analogous markings could be devised for linear-scale instruments and approved under airplane type certification equivalent safety provisions. Accordingly, the proposal to amend § 23.1545 is adopted without substantive change.

Proposal 8-22. For a comment related to proposed § 23.1557(f), see Proposal 8-24. The proposal is revised for the reasons discussed in Proposal 8-24.

Proposal 8-23. No unfavorable comments were received on the proposal to delete § 23.1583(i). Accordingly, the proposal is adopted without substantive change.

Proposal 8-24. Proposed §§ 23.1585(e) and (f), together with Proposal 8-23 for § 23.1583, would transfer information concerning the meaning of the zero fuel indication from the operating limitations section to the operating procedures section of the Airplane Flight Manual. One commentator stated that any reference to "fuel remaining" when the fuel quantity indicator reads "zero" invites pilot error or misinterpretation. The FAA does not agree. The reference to "fuel remaining" appears in the current rule, and the FAA does not have any information at this time to indicate that it has resulted in pilot error or misinterpretation. However, after further review, the FAA believes that the information that is required to be furnished under proposed § 23.1585(e) should be clarified in view of the fuel gauge calibra-

tion requirements set forth in § 23.1337(b)(1).

Accordingly, proposed § 23.1585(e) is revised by adding the language "in level flight" so that the section reads in part " * * * when the fuel quantity indicator reads "zero" in level flight, any fuel remaining in the fuel tank cannot be safely used in flight". Similar revisions are made to proposed §§ 25.1585(d), 27.1585(d), and 29.1585(d). Proposed §§ 23.1585(f), 25.1585(e), 27.1585(e), and 29.1585(e) are adopted without substantive change.

In view of the adoption of new §§ 23.1585(e), 27.1585 (c), and (d), and 29.1585 (c) and (d) in Airworthiness Review Amendment 6 (43 FR 2302; January 16, 1978), proposed §§ 23.1585 (e) and (f), 27.1585 (d) and (e), and 29.1585 (d) and (e) are redesignated and adopted as §§ 23.1585 (f) and (g); 27.1585 (e) and (f), and 29.1585 (e) and (f), respectively.

Proposal 7-17. The proposed amendment to § 25.305(d) and the proposed new Appendix G to Part 25 (Proposal 7-55) are being deferred until final rule making action is taken with respect to Airworthiness Review Notice No. 8 (Notice 75-31; 40 FR 29410; July 11, 1975).

Proposal 7-18. One commentator suggested that proposed § 25.331(a)(4) be revised to allow the trim system to operate at its maximum rate with normal aerodynamic load instead of requiring the flight test trim conditions specified in § 25.255. The FAA believes that there is insufficient data for rulemaking action to make the suggested revision. Another commentator recommended that proposed § 25.331(a)(4) be revised to exclude the effect of out-of-trim conditions as a consideration for the accelerated pitching conditions of proposed § 25.331(c) but retained for the zero pitching acceleration conditions of proposed § 25.331(c). The FAA disagrees. Out-of-trim conditions may exist in zero pitching acceleration maneuvers as well as in accelerated pitching maneuvers and should be considered in both cases. Section 25.331(a)(4) is amended as proposed.

One commentator suggested that proposed § 25.331(c)(1) be revised to clarify the type of pitching parameter to be considered, and to allow for the optional use of transient rigid body response for airplane loads. The FAA agrees. The use of transient rigid body response will yield conservative, but easier-to-calculate loads. The proposal is revised to allow for the use of transient rigid body response and to clarify the type of pitching parameter to be considered.

The same commentator suggested that proposed § 25.331(c) be revised to state that airplane loads which occur

subsequent to the occurrence of maximum positive pitching acceleration need not be considered. The FAA disagrees. The commentator did not submit, and the FAA is not aware of, time-history data that shows that the transient down tail load will always reach its peak value at the same time that the elevator surface reaches its maximum prescribed throw and that the pitching acceleration will also always reach a maximum in the nose-up direction at the same time.

The same commentator further suggested that proposed § 25.331(c)(1) be revised to make the requirements applicable to configurations with conventional trailing-edge elevator controls, and that configurations using an all-movable horizontal stabilizer should be designed to the specified control displacements of current § 23.531(c)(3). The commentator stated that applying the proposed requirements to configurations using an all-movable horizontal stabilizer for primary pitching control results in an entirely different type of loading condition than was originally intended for elevator-controlled airplanes. This results, the commentator stated, from the fact that all-movable stabilizers have much lower rate capabilities than elevators; approximately 6 degrees per second for all-movable stabilizers versus 30 to 40 degrees per second for elevators. The FAA does not have sufficient data to support the distinction suggested by the commentator.

Another commentator objected to combining the requirements for "checked maneuver at speeds between V_A and V_D " and the requirements for "specified control displacement" in proposed § 25.331(c)(2). This commentator stated that he is not aware of any evidence that the present required levels of pitching acceleration have resulted in unsafe designs, and that the design requirement should involve either the use of rational time history analyses or, alternatively, the use of the present acceleration criteria. The proposal to amend § 25.331(c)(2) contains the current requirements except that a rational pitching motion-time profile is required rather than optional. The present acceleration criteria were derived from the behavior of airplanes much older than, and different from, those of current design. The FAA does not have enough information regarding the conservatism these criteria provide for modern designs. However, since the rational time history analysis method does consider the behavior of the modern airplanes, that method is specified.

Two commentators stated that proposed § 25.331(c)(2) is not clear with respect to whether pitching accelerations greater than the values quoted in the formula are to be used for design,

and also stated that it does not define the control movement to be considered nor state whether the limit load factor must be reached. In addition to proposed § 25.331, the strength criteria contained in other sections of the Subpart must be considered in establishing structural design criteria. With respect to control movement and load factor, the FAA does not have any information at this time which would indicate that specific constraints on control movement or load factor are necessary.

The proposal to amend § 25.331 is adopted with the revisions discussed above.

Proposal 7-19. Several commentators, including the initial public proponent, objected to the proposal to add a new § 25.341(d) to require the empennage to be designed for gusts which are not purely vertical or lateral in direction. The commentators referred to existing conservatism in the rules which have resulted in satisfactory service experience to date, and stated the need for further review and evaluation. The FAA, upon further review, believes that there is insufficient data to substantiate the need for the additional requirement at this time. The proposal to add a new § 25.341(d) is withdrawn.

Proposal 7-20. One commentator objected to deletion of the words "as speed brakes" in the proposal to amend § 25.345(c). The commentator stated that the removal of the words "as speed brakes" would increase structural weight, not only in the flaps, but also in the wings and horizontal tail. The FAA agrees that airplane loads, and weight, may increase as a result of this proposed amendment. However, the FAA believes that an airplane should be designed for any condition in which the airplane is normally operated. Airplanes are now commonly flown in en route conditions with flaps deployed for purposes other than as speed brakes, and the airplane structure should be designed for the appropriate loads regardless of the operational reason. Another commentator objected to the deletion of the words "as speed brakes" on the ground that removal would leave unanswered questions on flaps up-down cycling, gust encounters, upsets, and overspeed. The FAA does not have any information at this time which indicates that additional requirements related to these factors are necessary. The amendment to § 25.345(c), is adopted as proposed.

Two commentators suggested rewording the proposed new § 25.345(d) by replacing the word "landing" with the word "maneuvering" to make it clear that the proposed requirement is not intended as an additional landing condition to be

investigated under § 25.473. The FAA believes that the suggested rewording would lead to a possible misunderstanding due to altitude effects which may result in a more severe load being applied to the airplane. The intent of the proposal is to provide an additional landing condition to be investigated, but not under § 25.473, at maximum takeoff weight with a maneuvering load factor of 1.5g and the flaps and similar high lift devices in the landing configuration. Accordingly, the proposed new § 25.345(d) is adopted without substantive change.

Proposal 7-21. Several commentators stated that the proposal for § 25.351(a), which would extend the upper limit of the speed range specified in current § 25.351(a) from V_A to V_D , is unduly severe and recommended that the pilot's maximum rudder pedal force be 300 pounds from V_{MC} to V_A and 200 pounds from V_C/M_C to V_D/M_D with linear variation between V_A and V_C/M_C . In addition, one commentator stated that the proposed extension of the upper limit of the speed range would penalize aircraft utilizing manual control systems. The commentator further stated that reducing rudder control force at the higher speeds would be consistent with probable operational practice. The FAA believes that the capability of current jet transports for high rudder forces throughout the design envelope has resulted in a high degree of structural integrity during recovery maneuvers, and that this capability must be ensured in future designs. The proposal to amend § 25.351(a) is adopted without substantive change.

Proposal 7-22. Two commentators expressed a need for clarification of the terms "sudden engine stoppage" as used in the proposal to amend § 25.361(b) and "torque for maximum continuous take-off power" as used in the proposed lead-in of § 25.361(c). Actually the word "take-off" did not appear in Notice 75-26. However, since both terms occur in the current rule and were used in the same sense in the proposal, the FAA does not believe further clarification is needed. Accordingly, the proposal is adopted without substantive change.

Proposal 7-23. All of the comments received in response to proposed § 25.491 either questioned the definition of the words "roughest runway and taxiway profiles to be expected in normal operations", or questioned the means of showing compliance. Two commentators stated that the costs of conducting dynamic analyses are high and that the proposal would cause an unjustified economic penalty by requiring dynamic analyses whether needed for a particular configuration or not. The FAA agrees that a more

specific proposal is needed. The proposal to revise § 25.491 is withdrawn.

Proposal 7-24. Although no unfavorable comments were received on the proposed new § 25.499(e), two commentators stated that some factor above the nominal values of torque and static reaction is needed to cover possible increases of loads. The FAA does not believe at this time that a factor for nose gear loads due to steering is needed. Accordingly, the proposal is adopted without substantive change.

Proposal 7-25. One commentator objected to the 1.5g rearward ultimate inertia force requirement of the proposed § 25.561(b)(3)(v) because of inadequate substantiation. The commentator stated that the current research on crashworthiness should be completed before the proposal is finalized. After consideration of this comment, and after further review, the FAA agrees that the proposal to add a new § 25.561(b)(3)(v) is premature, and it is withdrawn.

After consideration of the comments received on the proposal to add a new § 25.561(d) concerning structural crashworthiness requirements for certain multi-deck airplanes, and after further review, the FAA believes that it does not have enough information to set forth a rule of general applicability at this time. Accordingly, the proposal to add a new § 25.561(d) is withdrawn.

Proposal 7-26. After consideration of the comments received on the proposal to add a new § 25.563(b), concerning structural ditching requirements for certain multi-deck airplanes, and after further review, the FAA believes that it does not now have enough information to set forth a general standard which would be appropriate for both partial and full multi-deck configurations. The proposal to add a new § 25.563(b) is withdrawn.

Proposal 7-27. The proposal to revise § 25.571(c)(1), concerning fatigue requirements, is withdrawn in view of the separate rulemaking action that has been initiated to consider the fatigue requirements for transport category airplanes (see Notice 77-15; 42 FR 41236; Aug. 15, 1977).

Proposal 7-28. For comments related to the proposal to add a new § 25.603(c), see Proposal 7-3.

Proposal 7-29. One commentator objected to the proposed amendment to § 25.605(b) which would require that new aircraft fabrication methods be substantiated by a test program. The commentator stated that, to meet current § 25.605, manufacturers presently conduct many tests before new fabrication methods are used, especially where the airworthiness of the airplane is involved. The commentator felt that the present regulations are adequate and questioned the need for

a test program requirement since this would require specific FAA approval of the test program. Such approval, the commentator stated, would only increase the expense and require additional time to coordinate. The FAA does not agree that current § 25.605 is adequate. Current § 25.605 requires only that the processes requiring close control to produce a consistently sound structure be performed under an approved process specification. The FAA believes that the proposed rule is necessary to insure that all new aircraft fabrication methods are tested to determine their soundness. In addition, the manufacturers who currently perform an adequate test program should have no difficulty in meeting the proposed requirement. The proposal to amend § 25.605 is adopted without substantive change.

Proposal 7-30. No unfavorable comments were received on the proposal to amend § 25.613(e). Accordingly, the proposal is adopted without substantive change.

Proposal 7-31. One commentator recommended that the proposed amendment to § 25.629(d)(1)(ii) be revised to include the words "affecting divergence or flutter". The FAA does not believe the change is needed since words to this effect are used in the lead-in of present § 25.629(d)(1).

One commentator objected to the requirement in proposed § 25.629(d)(1)(ii) that freedom from flutter or divergence be shown for any combination of failures not shown to be extremely improbable. The commentator stated that the cost would far outweigh any theoretical improvement to safety over what is presently provided. The FAA disagrees. Service experience has shown that combinations of failures can be expected and, therefore, unless combinations of failures are shown to be extremely improbable, they must be considered in design for freedom from flutter and divergence.

One commentator recommended that the proposed § 25.629(d)(4)(vi) requirement for consideration of any single failure in any flutter damper system be revised to exclude active control systems for damping and apply only to flutter dampers connected to a control surface. The FAA disagrees. Failures in all flutter damping systems must be considered if the freedom-from-flutter requirement of § 25.629(d)(1) is to be demonstrated. The proposal is adopted without substantive change.

Proposal 7-32. One commentator on the proposed amendment to § 25.697(b), concerning lift and drag device controls, recommended that the word "inadvertent" in both sentences of the proposal be replaced with the word "unintentional" or "unintended". The FAA does not believe that a

clarification would result from the recommended revision. The proposal is adopted without substantive change.

Proposal 7-33. One commentator objected to proposed § 25.701(a) which would provide for the use of equally reliable means instead of a mechanical interconnection for the synchronization of flaps on opposite sides of an airplane. The commentator questioned what would be as reliable as mechanical interconnection. The FAA believes that there are devices which are available or may become available that are at least as reliable as a mechanical system in this application and would be acceptable alternatives. However, to clarify the intent of the proposed rule, the proposal is revised to read "approved equivalent means" instead of "equally reliable means".

Proposal 7-34. One commentator recommended that proposed § 25.723(a) be revised to state that the analysis which may be used to substantiate landing gear limit load factors for increases in takeoff and landing weights must be based on identical landing gear systems. The commentator expressed the opinion that the use of the word "similar" might cause confusion and allow deviations from the original intent that the analysis must be based on landing gear tests conducted on a landing gear system with identical, not similar, energy absorption characteristics. The FAA agrees, and the proposal is revised accordingly.

Proposal 7-35. For a discussion of the withdrawal of proposed § 25.737, see proposal 7-10.

Proposal 7-36. One commentator opposed the proposal to add a new § 25.773(d) to add markers or other guides to enable pilots to position themselves for optimum outside visibility and instrument scan. The commentator stated that he knew of no airplane that has a position for maximum outside visibility that coincides with optimum eye position for instrument scan. Another commentator concurred with the proposal but recommended that it be revised to clarify that the optimum "combination" of outside visibility and instrument scan is sought. The FAA agrees that what is intended is an optimum combination, and proposed new § 25.773(d) is revised accordingly.

Proposal 7-37. No unfavorable comments were received on the proposal to amend § 25.777. Accordingly, the proposal is adopted without substantive change.

Proposal 7-38. Several commentators objected to the requirements of proposed new § 25.789(b) that would require each major galley component, including serving carts, drawers, and compartments, to have a placard indicating its maximum load. The com-

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mentators stated that drawers and compartments are designed for weights that can reasonably be expected in service. Two commentators stated that placarding galley components would not increase the level of safety for the occupants of the airplane, and would not guarantee adherence to the indicated maximum load during operation. Based on these comments, and upon further review within the FAA, the proposed new § 25.789(b) is withdrawn.

No unfavorable comments were received on proposed new § 25.789(c). Accordingly, the proposal is adopted without substantive change and redesignated as § 25.789(b).

Proposals 7-39 and 7-79. Numerous commentators objected to Proposal 7-39 to add a new § 25.802 to establish standards for evacuation alarm systems, and to Proposal 7-79 to add a new § 121.292 to require that evacuation alarm systems be installed on all passenger-carrying airplanes. After considering the comments received, and after further review, the FAA believes that rulemaking on the subject of evacuation alarm systems in passenger-carrying airplanes is premature. Accordingly, the proposals to add new §§ 25.802 and 121.292 are withdrawn.

Proposal 7-40. Proposed § 25.803(c) would replace the present emergency evacuation demonstration conditions with conditions which satisfy both Part 25 and Part 121, thus providing for one demonstration that serves both airworthiness and operational requirements. One commentator stated that the aircraft manufacturer should not be the sole demonstrator of emergency evacuations and recommended that more than one demonstration be required to rule out a "long shot" success. The commentator did not present any data to show that additional demonstrations by persons other than the manufacturer are needed. The FAA believes that demonstrations made under the prescribed conditions and using the prescribed procedures will yield comparable results, and that the manufacturer is competent to conduct such demonstrations.

Two commentators objected to proposed § 25.803(c)(4) which would require that the airplane's normal electrical power sources be de-energized and stated that the existing wording "using only the emergency lighting system" is preferred. The FAA agrees and § 25.803(c)(4) is revised to state that only the airplane's emergency lighting system may provide illumination, except as noted in paragraph (c)(1).

No unfavorable comments were received on proposal § 25.803(c)(5), to require that all emergency equipment must be installed in accordance with §§ 25.1411 and 25.1415. However the

FAA believes that the proposal may be misconstrued, since certain operating rules of the chapter also state emergency equipment installation requirements. Proposed § 25.803(c)(5) is revised to specify that all emergency equipment that is required for the planned operation of the airplane must be installed.

A statement of required crewmember qualifications was inadvertently omitted from proposal § 25.803(c). Present Part 121 App. D paragraph (a)(12) states a requirement for a regularly scheduled line crew, and present § 25.803(c)(6) states a requirement merely for persons who have knowledge of the exits and emergency equipment. The FAA believes that the training and knowledge levels associated with a regularly scheduled line crew are appropriate for any demonstration that is conducted for the introduction of a type and model of airplane into passenger-carrying operations, whether the demonstration is conducted for compliance with Part 121 alone or for dual compliance with Parts 25 and 121. Accordingly, the crew requirements of present part 121 App. D paragraph (a)(12) are set forth as new § 25.803(c)(7)(i). The crew requirements of present § 25.803(c)(6) have been shown adequate for airplane type certification under Part 25. These requirements are set forth in a new § 25.803(c)(7)(ii) to provide for situations where separate demonstrations of compliance with type certification and operating rules may be necessary or appropriate.

One commentator suggested deletion of the requirements of §§ 25.803(c)(7)(ii) and (c)(7)(iii) requiring at least 5 percent of passengers be over the age of 60 and 5-10 percent be children under the age of 12 years. The FAA believes that age distribution should be considered in the selection of test subjects, and that the proposed requirements are realistic in terms of the age distribution of airline passengers. The proposed §§ 25.803(c)(7)(ii) and (c)(7)(iii) are adopted without substantive change. One commentator requested that, due to laws governing employment and insurance for persons under 18 years of age, § 25.803(c)(7)(iii) be modified to provide an equivalency by adding the words "or at least 5 percent, but not more than 10 percent must be adults between the ages of 50 to 60 years of age." A second commentator suggested essentially the same wording, citing data showing comparable evacuation times for persons under 12 and in the 50 to 59 age group and relating one instance where this equivalency was allowed during evacuation testing. The FAA does not now have enough information on evacuation times for the various age groups to revise the pro-

posal in the manner suggested by these commentators. One commentator recommended that proposed § 25.803(c)(7)(iv) be modified to require the three life-size dolls to have height and weight equivalent to a child. The FAA believes the terms "life-size" and "simulate live infants" adequately express this intent. The proposed § 25.803(c)(7)(iv) is adopted without substantive change.

One commentator stated that reference to the words "crewmembers, mechanics, and training personnel" in § 25.803(c)(7)(v) is only appropriate if tests are being conducted by the operator rather than the manufacturer. The FAA disagrees since such training personnel are also employed by the manufacturer. Accordingly, § 25.803(c)(7)(v) is adopted as proposed.

One commentator suggested that the carry-on baggage, blanket, and pillow requirements of § 25.803(c)(10) be deleted since there would be a reduced risk of injury during the test without significant effect on the results. The FAA does not agree since such items are intended to help simulate actual emergency evacuation conditions and might significantly affect the results of an evacuation test. Proposed § 25.803(c)(10) is adopted without substantive change.

One commentator suggested that § 25.803(c)(12) should state that no "prior" indication may be given of the exits to be used and that the word "advised" is more appropriate in § 25.803(c)(14) than the word "warned". The FAA agrees with both clarifications and the amendments are revised accordingly.

Although no adverse comments were received on the proposed requirements for multi-deck airplanes in § 25.803(c)(16), the FAA believes that it does not now have enough information to establish comprehensive evacuation criteria for multi-deck airplanes and the multi-deck requirements of § 25.803(c)(16) are deleted.

One commentator objected to the requirement in proposed § 25.803(c)(18) that all the emergency equipment that is normally available, including slides, ropes, lights, and megaphones, must be fully utilized during the demonstration. The commentator stated that the utilization of ropes and megaphones places an undue and unrealistic burden on the evacuation demonstration. The commentator believes that the use of ropes at over-wing exits introduces the hazard of tripping and entanglement, and could result in a reduced evacuation flow rate, and that the use of megaphones limits the ability of the flight attendant to effect rapid egress of participants by denying the use of one hand and by restricting the line of vision. The commentator also objected that the use of two or

more megaphones simultaneously during the demonstration could confuse and misdirect evacuees. The FAA recognizes that certain items of emergency equipment are installed for purposes other than evacuating occupants from an airplane after an aborted takeoff and that a need to control the use of communications devices may exist. These factors should be considered in each applicant's approved procedures. Proposed § 25.803(c)(18) is amended to state that the applicant's approved procedures must be fully used during the demonstration.

Several commentators objected to the proposed amendment to § 25.803(d) which would allow analysis in showing that the airplane is capable of being evacuated within 90 seconds. One commentator stated that analysis alone is an incomplete means of showing compliance and should not be allowed. Another commentator stated that extrapolations based on analytical testing have no practical relation to actual conditions which occur in accidents and in evacuation demonstrations. The FAA agrees that the limitations on the use of analytical procedures should be made clear. The requirement that the Administrator find the analysis data acceptable was intended to preclude approvals which might be based on insufficient test data, such as in the case of a completely new airplane model or a model which has major changes or a considerably larger passenger capacity than a previously approved model.

Accordingly, § 25.803(d) is revised to clarify the intent.

No unfavorable comments were received regarding proposed §§ 25.803(c)(1), (c)(2), (c)(3), (c)(6), (c)(7)(i), (c)(8), (c)(9), (c)(11), (c)(13), (c)(15), and (c)(17). Accordingly, these proposals are adopted without substantive change.

It should be noted that the deletion of several proposed paragraphs and the insertion of a new § 25.803(c)(7) has required the redesignation of the adopted paragraphs.

The proposal to revise §§ 25.803(c) and (d) is adopted with the changes discussed above.

Proposal 7-41. One commentator objected to the proposal to revise § 25.807(a)(7)(vi), stating that a flight attendant seat can be so mounted relative to an exit or to other seats that the flight attendant's access to the exit itself is restricted. The commentator recommended that the proposal be revised to specify that forward facing seats be placed aft of the emergency exit, and aft-facing seats be placed forward of the emergency exit, so that no flight attendant is seated with the attendant's back to the exit. The intent of the proposals to revise § 25.807(a)(7)(vi) is to specify that the

seat required by present § 25.807(a)(7)(vi) must be a flight attendant seat which complies with the requirements of §§ 25.785 (h) and (i). The FAA is not aware of any unsatisfactory service history with respect to the orientation of seats provided in accordance with present § 25.807(a)(7)(vi), and the commentator did not provide any information which would indicate that a problem exists. The FAA believes that revising the proposal in the manner suggested by the commentator would unduly restrict design. Accordingly, the proposal is adopted without substantive change.

Proposed § 25.807(c)(7) is based on the existing special conditions developed for the current wide body jet airplanes. Based on the comments received, and upon further review within the FAA, the FAA believes that it does not have enough information to adopt a rule of general applicability to multi-deck airplanes at this time. Proposed § 25.807(c)(7) is withdrawn.

Proposal 7-42. Several commentators objected to proposed new § 25.809(f)(1)(iv) which would require that the emergency exit means to assist the occupants in descending to the ground be usable without outside assistance in 25-knot winds. One commentator stated that the proposed section was not clear with respect to whether deployment into a 25-knot wind was required in addition to operation in 25-knot winds after deployment. Proposed § 25.809(f)(1)(iv) is revised to state the requirement more clearly. Another commentator proposed that the weight of one person on the device be allowed to ground it to make it usable. The FAA agrees that the assistance of one person should be allowed. Proposed § 25.809(f)(1)(iv) is revised accordingly. In response to another comment questioning the state-of-the-art, the FAA believes that the proposed requirement, as revised to allow the assistance of one person after deployment, is within the state-of-the-art.

Another commentator stated that the provision concerning wind force direction in proposed § 25.809(f)(1)(iv) was vague. The FAA disagrees since the critical wind direction may vary for each assisting means and the applicant must demonstrate which direction is most critical.

Several commentators objected to the 98 percent reliability requirement in proposed new § 25.809(f)(1)(v) as being difficult to interpret given a relatively small sample size and indicated that tests conducted on new designs may not adequately represent the reliability level in service. Another commentator stated that the reliability requirements in proposed § 25.809(f)(1)(v) were excessive and un-

warranted. The FAA believes that the evaluation of slide designs during airplane type certification does establish a level of in-service performance if the slides are maintained properly. The FAA agrees, however, that the amount of testing that would be required to obtain data for the proposed determination of 98 percent reliability may be excessive for the systems under consideration. A more direct testing method, requiring fewer tests, has been found to provide an acceptable measure of egress system reliability in recent airplane type certifications. Proposed § 25.809(f)(1)(v) is revised to specify the use that method.

One commentator asked how the inertial forces specified in proposed § 25.809(f)(i)(v) would be applied. In practice, this has been done by applying equivalent static loads. (Clearly, test methods will have to be developed for dynamic testing if future designs indicate a need for it.) This commentator also asked whether the last sentence of proposed § 25.809(f)(i)(v) is necessary. The FAA believes that with the test method specified, the testing series must be restarted following failure to ensure that the reliability assessment is valid. The last sentence of § 25.809(f)(i)(v) has been rewritten to make this clear.

Proposal 7-43. One commentator objected to proposed § 25.811(e), stating that the present operating instructions have historically proven adequate to open doors and that there is no need for the additional requirements. The FAA does not agree and believes that the need for the proposed requirements has been established by recent adverse service experience.

One commentator questioned whether proposed § 25.811(e)(2) is applicable to Type II exits. The FAA is unaware of any need for extending this requirement to Type II exits at this time. Consistent with the proposal, the requirement applies only to Type A and Type I exits.

One commentator recommended that proposed §§ 25.811(e)(2)(i), (e)(2)(ii), and (e)(3) be revised to require that a minimum brightness remain after a substantial amount of weathering in service. The FAA believes that a requirement for a minimum brightness belongs in the operating rules and that it is correctly stated in § 121.310(e)(2) of the Federal Aviation regulations.

Another commentator suggested that the alternative requirements for Type I and Type A passenger exit operating handles set forth in proposed § 25.811(e)(2)(i) and (ii) be made applicable to Type III exit operating handles. The FAA does not agree. The alternative provisions referred to are allowed for Type I and Type A exits be-

cause a specified level of illumination must be provided at these exits. However, since illumination levels are not specified for all Type III exit installations, a self-illuminated operating handle must be provided.

One commentator objected to the proposed ± 0.5 -inch tolerance for the location of the projected point of the arrow for rotary handle markings. The commentator indicated that current door rigging variations cannot always meet the proposed tolerance. The FAA agrees. To allow for rigging variations, proposed $\S 25.811(e)(4)(ii)$ is revised to require that centerline of the exit handle be within ± 1 -inch of the projected point of the arrow when the handle has reached full travel and has released the locking mechanism.

One comment on proposed $\S 25.811(e)(4)(ii)$ suggested that no marking is a substitute for having a door mechanism designed so that it is unmistakable when full travel of the mechanism has been reached. It is not clear what the commentator is recommending. However, the proposal requires marking of the handle position at the full travel limit, after the locking mechanism has been released. Since persons unfamiliar with the mechanism may be required to operate it in an emergency, the marking is needed to insure that they move the handle to full travel against any resistance which may be felt.

Proposed $\S 25.811(e)$ is adopted with the revision discussed above. In addition, several nonsubstantive changes have been made for clarity.

Proposal 7-44. No unfavorable comments were received on the proposal to amend $\S 25.812(e)$. Accordingly, the proposal is adopted without substantive change.

Two commentators questioned proposed $\S\S 25.812(f)$ and (g) to provide emergency lighting coverage with the airplane in abnormal attitudes. One of the commentators contended that present standards have historically provided satisfactory lighting and that a "battery of lights" would be necessary to comply with the proposal. Based on the comments received, and after further review within the FAA, the proposed changes to $\S\S 25.812(f)$ and (g) are withdrawn.

Several commentators objected to the proposal to add a new $\S 25.812(1)$. One commentator stated that the meaning of "high intensity" is subject to broad interpretation and that a flashlight could provide an acceptable level of illumination. Current $\S 121.549(b)$ provides for a readily available flashlight for each crewmember, and the FAA believes that the intent of the proposal can be met by specifying an accessible flashlight storage means. The proposal to add a new $\S 25.812(1)$ is withdrawn and Pro-

posal 7-81 for $\S 121.310(1)$ is revised to require flashlight stowage provisions that are readily accessible from each flight attendant seat and to allow 2 years for compliance.

Proposal 7-45. One commentator objected to the proposal to revise $\S 25.813(c)(1)$ to add a requirement that "there must be no interference in opening the exit." The commentator considered this proposal to be interpretive material better suited for Advisory Circular action and stated it was not clear. The FAA disagrees. Many emergency exits need more clearance than the projected exit opening to prevent interference when opening the exit, and this proposal would make it clear that adequate clearance is required. The commentator suggested adding after the word "protrusions" the words "to prevent exit door ready removal" in $\S 25.813(c)(1)$. The FAA does not believe proposed $\S 25.813(c)(1)$ needs clarification, and the suggested wording could lead to misinterpretations.

Another commentator recommended that the requirement of $\S 25.813(c)(1)$ be applied to airplanes having 9 to 19 passenger seats. The FAA disagrees. Current requirements of $\S 25.813(c)(2)$ consider emergency exit access for airplanes having 19 or less passengers. Service experience has shown no need to change the requirements of $\S 25.813(c)(2)$.

After consideration of the comments received, and after further review, the FAA believes that proposed $\S 25.813(g)$ to establish material and systems requirements and proposed $\S\S 25.813(h)$ and (i) to establish passageway design requirements are premature, and they are withdrawn.

Proposal 7-46. In view of the amendment of $\S 25.831$ by Airworthiness Review Amendment No. 5 (42 FR 36960; July 18, 1977), the FAA believes that proposed $\S 25.831(g)$ is not necessary and it is withdrawn.

Proposal 7-47. No unfavorable comments were received on the proposal to amend $\S 25.863$. One commentator asked for an explanation of the means to show compliance with the proposed requirements of paragraph (d) . The areas where flammable fluids or vapors could escape by the leakage of a fluid system must be identified and defined as part of type design data submitted by the applicant for type certification. The proposal is adopted without substantive change.

Proposal 8-43. One commentator contended that proposed $\S 25.901(d)$ will be difficult to administer because the term "applicable provisions of this subpart" will not be consistently interpreted. The commentator suggested that the applicable provisions be clearly defined. The FAA does not agree with the commentator and believes

the suggested revision is unnecessary. The same wording is used in current $\S 25.901(b)(1)$ with respect to propulsion powerplant installations, and has been administered without difficulty.

One commentator suggested that only those auxiliary power units (APU) that are classed as essential power units need to meet the applicable provisions of the subpart. Several other commentators suggested that the applicable provisions should be clearly defined to differentiate between essential and nonessential APU installations. The FAA does not agree with these comments. The FAA believes that appropriate requirements for safety must be applied to all APU installations. No justification has been shown for the operation of a nonessential or a ground operation only APU at a safety level that is different from that which is required for an essential APU.

The proposal is adopted without substantive change.

Proposal 8-46 and 3-35. Disposition of Proposal 3-35 to amend $\S 25.1103$ (Notice 75-19) was deferred so that it could be considered in connection with Proposal 8-46. One commentator on Proposal 3-35 suggested that the proposed revision to $\S 25.1103(d)$, concerning ducts other than induction system ducts, be placed in a separate section of Part 25. The FAA believes that it is more appropriate to include the requirement in $\S 25.1103$ and to expand the heading of that section to include a reference to air duct systems. Proposal 3-35 is adopted without substantive change. However, $\S 25.1103(d)$ as adopted reflects a change proposed by Proposal 8-46. With respect to Proposal 8-46, one commentator suggested that the phrase "unless it can be shown that a duct failure will not result in an additional fire hazard" be added to proposed $\S 25.1103(b)$. The FAA does not believe that the suggested condition could be met. The ducts under consideration are those which are contained within fire zones, including the auxiliary power unit fire zone. Duct failures in such areas could allow fire to spread, possible outside the fire zone, or could reduce the effectiveness of installed fire-extinguishing systems.

Several commentators suggested that it would be difficult to establish the "sufficient distance upstream of the auxiliary power unit compartment" specified in proposed $\S 25.1103(e)$. The FAA believes that the proposed standard is appropriate. In this instance, a more definitive standard, taking into account all of the factors that might be involved, would tend to restrict design flexibility unnecessarily.

One commentator objected to proposed $\S 25.1103(e)$, contending that its language precluded the use of methi-

ods to prevent hot gas reverse flow, which would provide at least an equivalent level of safety. The FAA knows of no practical method other than fireproofing to prevent hot gas reverse flow in induction system ducts. If such a method were developed, the applicant could apply for its approval under the "equivalent safety" provisions of § 21.21(b)(1). This commentator also contended that if proposed § 25.1103(f) is met, it is unrealistic to consider a fire caused by hot gas reverse flow burning in the air induction system. The commentator suggested, instead, a requirement to determine the maximum intake duct temperature that could occur under hot gas reverse flow conditions and to use a duct material that can resist these temperatures. The commentator apparently misinterpreted the proposal. Proposed § 25.1103(e) requires that certain portions of each auxiliary power unit induction system duct be fireproof, and proposed § 25.1103(f) states heat tolerance requirements for those portions of the induction system other than those which are specifically required to be fireproof. However, the FAA believes the proposed language may be unclear. Therefore, that portion of § 25.1103(f) which states requirements for the heat tolerance of materials be revised to clarify the applicability and is moved to § 25.1103(e).

Two commentators suggested that proposed § 25.1103(f) be revised to allow the use of materials that may absorb or trap non-hazardous quantities of flammable fluids (or flammable fluids that could present a hazard to the aircraft). These commentators contended that proposed § 25.1103(f) would prevent the use of certain sound suppression materials that trap small quantities of fluids. The FAA agrees and § 25.1103(f) is revised accordingly.

One commentator suggested that an acceptable alternative to compliance with proposed § 25.1103(f) would be to show that any fire which may occur is contained within the induction system. The FAA does not believe that it would be possible to contain a fire in the induction system since the induction system is a passage which is open at both ends.

Substantively identical revisions are made to Proposal 8-73 for § 29.1103.

Proposal 8-47. Two commentators on proposed § 25.1142 stated that there was no need for starting control on the flight deck for auxiliary power units (APU) that are operable only on the ground. The FAA believes that any APU installed on the airplane, whether or not intended only for ground use, should be able to be operated by the flight crew since its improper operation or malfunction could affect the safety of the aircraft. The commentators appear to have inter-

preted the proposal to apply to both the APUs which are installed in the airplane and to those stationary, portable, or mobile units which are external to the airplane and are considered to be ground support equipment. The proposal is therefore revised to clarify that it is applicable only to installed APUs.

One commentator stated that APU and engine standards in Part 25 should be separated to insure consistent administration. The FAA does not agree with this commentator, and believes the suggested revision is unnecessary. The APU and engine standards in Part 25 have been administered without difficulty for years.

Another commentator stated that the proposal should be revised to differentiate between essential and non-essential APUs. For a discussion of this comment, see Proposal 8-43.

Proposals 8-49 and 3-41. Disposition of Proposal 3-41 to amend § 25.1195(b) (Notice 75-19) was deferred so that it could be considered in connection with Proposal 8-49. One commentator objected to Proposal 3-41 and suggested that it be revised to read " * * * all extinguishers are not required to cross-feed all engines, but two shots to each engine are required." The proposal deletes the last sentence of present § 25.1195(b) to avoid the possible interpretation that a particular discharge must be directable to every fire zone. Such an arrangement would be acceptable, but individual systems which have a dual discharge capability may be confined to serve a particular fire zone. The proposal is considered equivalent to the wording preferred by this commentator.

Another commentator stated that the proposal does not meet the intent of the explanation unless the last sentence of present § 25.1195(b) is deleted. The proposal includes this deletion. This commentator further stated that the proposed wording contradicts the exemptions allowed by § 25.1195(a). The FAA does not agree. Section 25.1195(b) applies only to non-excepted fire zones. Proposal 3-41 to amend § 25.1195(b) is adopted without substantive change.

One commentator objected to the requirement in Proposal 8-49 for § 25.1195(b) that the test fully simulate actual critical airflow conditions, stating that there should be provisions in the regulations to allow the use of test results and analysis to show compliance. Another commentator objected to the proposal because it does not allow demonstration of compliance by a combination of analysis and analogy with similar engine installations that have been subjected to full scale fire tests. The FAA does not agree with these comments. Distribution of the extinguishing agent within a fire zone

is a controlling factor in extinguishing a fire within that fire zone. No acceptable procedure has been found to demonstrate extinguishing agent concentration by analysis, or by reference to tests or service experience on similar powerplant installations, or by reference to tests conducted under conditions other than those encountered in service. Compliance with proposal § 25.1195(b) must be based on actual or simulated flight tests which fully provide the critical airflow conditions to be encountered in flight.

One commentator objected to the words "under critical airflow conditions," "any fire," and "preventing reignition" as meaningless when engine breakup or cowling damage occurs. A second commentator objected to the proposal because no hole size is specified. However, the proposal is based on the assumption that the fire zones under consideration remain intact, with no engine breakup or cowling damage and with only those holes that are present during normal operation. Therefore, no damage factors are specified.

Several commentators objected to the words "and preventing reignition" for the reason that there is no practical way to determine compliance unless the fire and potential reignition sources are defined. These commentators suggested that this requirement should be changed to "and minimize the probability of reignition." The FAA agrees that the language "and preventing reignition" may imply that extinguishing agent concentration must be maintained indefinitely. The FAA believes that this is beyond the present state-of-the-art, and the proposal is revised in the manner suggested by these commentators. Three of these commentators further objected to the proposed requirement for an extinguishing agent concentration capable of "extinguishing any fire" in a fire zone because there is no practical way to determine compliance unless the fire is defined. The FAA agrees, and the proposal is revised to incorporate the words "extinguishing fires" to be consistent with the provisions of present § 25.1195(b).

One commentator stated that the use of full-scale fire tests, evidence of similar powerplant configurations, and analysis were proposed as part of Airworthiness Review Notice No. 3 (Notice 75-19; 40 FR 21866; May 19, 1975) to show compliance with the requirements of §§ 25.1181 through 25.1203, and that this proposal is in conflict with Notice 75-19. The proposal in Notice 75-19 to which the commentator refers has been adopted as § 25.1207 (Airworthiness Review Amendment No. 4, effective May 2, 1977). Section 25.1207, as adopted, provides for those cases when tests are

specifically required. However, in light of the adoption of proposed § 25.1195(b), the FAA believes that § 25.1207 could be confusing and it is revised for clarity. Additionally, this commentator stated that the method of demonstrating satisfactory fire extinguishing capability should be by agreement between the manufacturer and the certifying authority. The FAA does not agree. Objective rules are needed to ensure that a consistent level of safety is maintained.

One commentator stated that the proposal refers to critical airflow conditions while the explanation refers to flight conditions, which are not necessarily the same thing. The FAA agrees that clarification is necessary. The proposal is revised to specify critical airflow conditions in flight.

Proposal 8-49 to amend § 25.1195(b) is adopted with the revisions discussed above. Similar revisions are also made in connection with Proposal 8-75 for § 29.1195(d).

Proposal 7-48. No unfavorable comments were received on the proposal to amend § 25.1307(a). Accordingly, the proposal is adopted without substantive change.

Proposal 5-24. For comments related to the proposal to revise § 25.1329(b), see Proposal 5-7.

Proposal 7-49. One commentator suggested deletion of the words "Such as automatic life raft releases" from proposed § 25.1411(a)(1) since they imply that the requirement is intended to apply only to equipment for ground emergency use. The FAA agrees. This implication is not intended, and the proposal is revised in the manner suggested by this commentator.

Several commentators objected to proposed § 25.1411(a)(2) and to its companion proposal for § 121.309(a)(2) (Proposal 7-80) regarding accessibility of standard emergency equipment to flight attendants. In light of the comments received, and after further review, the FAA believes that it should not be required that safety equipment such as fire extinguishers, portable oxygen bottles, and first aid kits be positioned adjacent to each flight attendant seat and be readily accessible to the seated flight attendant. From a safety standpoint, it is not essential that this equipment be used from a seated position, and from a practical standpoint it would be difficult to provide for the installation of the equipment in the confined areas proposed. Safety equipment should be installed in accessible areas of the aircraft where it would be available during an emergency. However, the FAA believes that when a public address system is provided in compliance with the operating rules of this chapter, the flight attendant seated in any of the seats lo-

cated adjacent to a floor level exit may be required to use the public address system. Therefore, at least one public address system microphone intended for flight attendant use should be positioned at each floor level exit and be readily accessible to a flight attendant seated in any seat adjacent to the exit. The proposal to amend § 25.1411(a)(2) is revised accordingly. The proposal for § 121.309(a)(2) is revised in a substantively identical manner and is adopted as part of § 121.318(b), which is concerned with public address systems.

One commentator objected to the proposed requirement in § 25.1411(a)(2) that "no equipment may be located as to adversely affect the safety of the flight attendant under any condition," stating that compliance would be clearly impossible to achieve. The FAA agrees that the proposed requirement may be too restrictive and it is deleted.

No unfavorable comments were received on the proposal to add a new § 25.1411(b)(3). The FAA believes that the requirements to identify the contents of storage compartments and containers are adequately covered in § 25.1541(c). The proposal for § 25.1411(b)(3) is withdrawn.

No unfavorable comments were received on the proposal to amend § 25.1411(d) and it is adopted without substantive change.

Two commentators objected to the proposal to add a new § 25.1411(h) which would require that emergency equipment be clearly marked to indicate its method of operation if it is not obvious. The commentator objected to passengers operating emergency equipment without assistance from flight attendants and also pointed out that current § 25.1561 already requires the marking of safety equipment as to its method of operation. After further review, the FAA believes that although crewmembers are not always available, the current marking instructions set forth in § 25.1561 cover passenger use. Proposed new § 25.1411(h) is withdrawn.

Proposal 7-50. The proposal to amend § 25.1413(b) is withdrawn. For comments related to the withdrawal, see Proposal 7-15.

Proposal 7-51. Two commentators objected to the proposal to add a new § 25.1415(b)(4), which would require that one-half of the non-portable rafts be considered unusable for ditching. The commentators stated that the requirement that one-half of the rafts be considered unusable is unrealistic. The FAA does not agree since a non-portable raft, or a raft which by design cannot be used at other than its primary exit, may not be operable if that exit malfunctions or if ditching conditions are such that that exit

cannot be used. However, after consideration of the comments received, and after further review, the FAA believes that it does not have enough information to prescribe a rule of general applicability for the design of ditching provisions which incorporate non-portable rafts. Accordingly, proposed new § 25.1415(b)(4) is withdrawn. The FAA believes that with the withdrawal of proposed § 25.1415(b)(4), the reference to portable rafts that is contained in proposed § 25.1415(b)(3) may be interpreted as allowing the use of non-portable rafts. This effect is not intended, and proposed new § 25.1415(b)(3) is withdrawn.

Several commentators objected to the proposal to add a new § 25.1415(b)(5), which would require that means be provided to assist the airplane's occupants in boarding the rafts from the airplane without entering the water. The commentators contended that for certain sea conditions no means has been demonstrated for boarding rafts from airplanes without the possibility of the occupants entering the water. The FAA agrees and proposed new § 25.1415(b)(5) is withdrawn.

Proposal 7-52. No unfavorable comments were received on the proposal to add a new § 25.1416 which adds pneumatic de-icer systems requirements. However, the FAA has revised the proposal based on the comments received on Proposal 7-16. See Proposal 7-16.

Proposal 7-53. Several commentators recommended revisions to the proposal to add a new § 25.1423 which would establish intercommunication equipment requirements for multideck airplanes. One commentator recommended that the lead-in paragraph be revised to make the requirements applicable to airplanes with adjacent occupiable decks or compartments (excluding lavatories) and that the intercommunication and the two-way alert means be required between each occupiable deck or compartment and the flight deck. The same commentator recommended that the intercommunication system and the two-way alert means be capable of providing crewmembers on all decks or occupiable compartments an immediate indication of an emergency situation on any deck or occupiable compartment (excluding lavatories). In the light of the comments received, and after further review, the FAA believes that it does not now have enough information to specify intercommunication equipment requirements appropriate for all transport category airplanes. The proposal to add a new § 25.1423 is withdrawn.

Proposal 8-57. One commentator suggested that proposed new § 25.1522 be revised so that it would also apply

to auxiliary power units (APU) that do not meet the requirements of TSO-C77 (§ 37.183). The FAA does not agree. The proposal recognizes that operating limitations established under a TSO do not have to be reestablished as a part of airplane type certification. However, an airplane type certificate applicant would have to develop appropriate operating limitations during the airplane type certification for any installed APU not manufactured under the provisions of a TSO. Such APU operating limitations would then become part of the aircraft type design. The proposal has no applicability in the situation discussed by the commentator.

Another commentator, while agreeing with the proposal, suggested that proposed § 25.1522 be revised to require also that each APU meet the requirements of TSO-C77. The FAA does not agree. TSO-C77 is applicable only to gas turbine powered APUs. The suggested revision would require that APUs other than gas turbine units be manufactured to the standards which are appropriate to, and established only for, the manufacture of gas turbine auxiliary power units.

The proposal is adopted without substantive change.

Proposal 7-54. One commentator objected to the proposal to amend § 25.1561(c) which makes clear that the removal of required emergency equipment from the stowage provisions be "easy." The commentator suggested replacement of the word "facilitate" between the words "and" and "removal" with the words "provide easy accessibility and rapid" in § 25.1561(c). The FAA does not believe that the recommended revision is necessary to accomplish the intent of the proposal and the proposal is adopted without substantive change.

Proposal 8-60. No unfavorable comments were received on the proposal to delete § 25.1583(g). Accordingly, the proposal is adopted without substantive change.

Proposal 8-61. For a comment related to the proposal to amend § 25.1585, see Proposal 8-24. Proposed § 25.1585(d) is revised for reasons stated in the discussion of Proposal 8-24. Proposed § 25.1585(e) is adopted without substantive change.

Proposal 7-55. For a discussion of the deferral of the proposal to add a new Appendix G to Part 25, see Proposal 7-17.

Proposal 8-63. No unfavorable comments were received on the proposal to revise § 27.79(b)(2). Accordingly, the proposal is adopted without substantive change.

Proposal 7-56. For comments related to the proposal to add a new § 27.603(c), see Proposal 7-3.

Proposal 7-57. For comments related to the proposal to amend § 27.605, see Proposal 7-29.

Proposal 7-58. One commentator apparently misunderstood the proposed addition to the lead-in of § 27.613(d). The commentator stated that the proposal did not change the current rule. However, the proposal would add the words "or other values approved by the Administrator." to the lead-in. With this change, the Administrator may allow the applicant greater flexibility in the selection of design values. The proposal is adopted without substantive change.

Proposal 7-59. Several commentators objected to the proposed amendments of §§ 27.671 and 29.671 on the ground that they would require extensive redundancy in the mechanical portion of the flight control system and require that the rotorcraft be capable of continued safe flight and landing if all engines fail. The commentators stressed that no current state-of-the-art designs can meet the proposed requirements and that redundancy may cause less reliable structure as a result of extreme complexity. One commentator stated that adequate safety can be achieved by proper design and fatigue testing and analysis. After consideration of the comments received, and after further review, the FAA believes that it does not have enough information at this time to set forth an appropriate general standard for control system performance following failure or malfunction. The proposed changes to §§ 27.671 and 29.671 are withdrawn.

Proposal 7-60. No unfavorable comments were received on the proposal to revise § 27.675(d)(1). Accordingly, the proposal is adopted without substantive change.

Proposal 7-61. The proposed deletions of §§ 27.695 and 29.695 are related to the proposed revisions of §§ 27.671 and 29.671. In consideration of the withdrawal of the proposed revision of §§ 27.671 and 29.671, the proposed deletions of §§ 27.695 and 29.695 are withdrawn. See Proposal 7-59.

Proposal 7-62. Several commentators objected to the requirement in proposed §§ 27.737 and 29.737 that compliance with shock absorption tests must be demonstrated with ski components installed on rotorcraft. The commentators emphasized that the design of helicopter landing gear, such as standard skid designs, is such that ski installations will not generally change energy absorption characteristics. The FAA agrees. The proposals to amend §§ 27.737 and 29.737 are withdrawn.

Proposal 7-63. Several commentators objected to the proposed amendment to § 27.853 which would impose certain of the compartment interior fire protection requirements for transport category airplanes on normal category ro-

torcraft. The commentators stated that these proposed requirements are not reasonable for normal category rotorcraft and are more severe and more restrictive than the current requirements for normal category airplanes. The FAA agrees, and the proposal to amend § 27.853 is withdrawn.

Proposal 7-64. Two commentators objected to the proposal to add a new § 27.863 that would require protection from a flammable fluid or vapor fire outside the engine compartment. The commentators stated that the small, unsophisticated fluid carrying systems in normal category rotorcraft make this an unnecessary and expensive compliance item without increasing safety. The FAA disagrees. The agency believes that the smaller and less complex fluid carrying systems will be able to meet this requirement with correspondingly small and simple means. The proposal is adopted without substantive change. Also see the comments for Proposals 7-47 and 7-75.

Proposal 7-65. The proposal to amend § 27.1413(a) is withdrawn. For comments related to the withdrawal, see Proposal 7-15.

Proposal 7-66. Several commentators objected to the proposals to add new §§ 27.1463 and 29.1463 to require a means to prevent persons from inadvertently contacting the tail rotor of a rotorcraft. The comment was made that the only practical way to prevent a person from contacting a tail rotor is to make it physically impossible for the person to reach the tail rotor. This could be accomplished by raising the tail rotor or by using shrouds and screens. On smaller rotorcraft shrouds and screens would have to be used to prevent tail rotor contact by a person since it would be impossible to raise the tail rotor sufficiently. It was contended that providing a shroud and screen of sufficient strength and rigidity to accomplish its purpose, without itself causing a hazard due to deformations to be expected in service, would add excessive weight in a weight critical area of many rotorcraft designs. The FAA agrees with these comments and after further consideration the proposals to add new §§ 27.1463 and 29.1463 are withdrawn.

Proposals 5-51 and 5-65. Two commentators objected to proposed §§ 27.1545(a) and 29.1545(a) on the ground that these provisions are appropriate only to fixed-wing aircraft. Apparently these commentators construed the reference to paragraph (b) in proposed §§ 27.1545(a) and 29.1545(a) as referring to the markings specified in proposed § 23.1545(b). However, the paragraph (b) that is referred to in proposed § 27.1545(a) is current § 27.1545(b), and the paragraph referred to in proposed § 29.1545(a) is current § 29.1545(b).

Sections 27.1545(b) and 29.1545(b) have not been changed. Accordingly, the proposals to revise §§ 27.1545(a) and 29.1545(a) are adopted without substantive change.

Proposal 8-65. No unfavorable comments were received on the proposal to delete § 27.1583(f). Accordingly, the proposal is adopted without substantive change.

Proposal 8-66. No unfavorable comments were received on the proposal to amend § 27.1585; however, proposed § 27.1585(d) is revised for reasons stated in the discussion of Proposal 8-24. Proposed § 27.1585(e) is adopted without substantive change. In view of the adoption of new §§ 27.1585 (c) and (d) in Airworthiness Review Amendment No. 6 (42 FR 2302; January 16, 1978), proposed §§ 27.1585 (d) and (e) are redesignated and adopted as §§ 27.1585 (e) and (f), respectively.

Proposal 8-68. In the proposed amendment of § 29.75, one commentator objected to the use of the 50-foot height criterion for the determination of Category A landing distance. The commentator suggested a rewording that was identical to the proposal except that the 50-foot height criterion would be replaced by a requirement that the approach flight path cross the edge of the heliport at an altitude of 25 feet or less. According to the commentator, the 50-foot altitude criterion is inconsistent with past practices of some certification programs and there has been no adverse experience with the use of a 25-foot altitude "window." The FAA does not agree with the commentator. The FAA is aware of only one instance in which a 25-foot height criterion was used. In that instance, a 25-foot height was specified for landing operations to be conducted on a 2,300-foot runway. The FAA is not aware of any certification experience involving the use of a range of altitudes over the edge of the heliport (the "altitude window" concept) in the determination of Category A landing distances.

The commentator also suggested that the Category A performance requirements should be edited as a group and put into language which is understandable to people who work with helicopters. However, the commentator did not make any specific recommendations, and the FAA has no information which would indicate that Category A performance requirements are difficult to understand.

The proposal to amend § 29.75 is adopted without substantive change.

Proposal 7-67. For comments related to the proposal to add a new § 29.603(c), see Proposal 7-3. Section 29.603(c), as adopted, differs from the proposal for the reasons discussed in Proposal 7-3.

Proposal 7-68. For comments concerning the subject matter of the proposal to amend § 29.605, see Proposal 7-29. The proposal is adopted without substantive change.

Proposal 7-69. No unfavorable comments were received on the proposal to amend § 29.613(d). Accordingly, the proposal is adopted without substantive change.

Proposal 7-70. The proposal to amend § 29.671 is withdrawn. For a discussion of the withdrawal, see Proposal 7-59.

Proposal 7-71. No unfavorable comments were received on the proposal to amend § 29.675(d)(1). Accordingly, the proposal is adopted without substantive change.

Proposal 7-72. The proposal to delete § 29.695 is withdrawn. For discussion related to the withdrawal, see Proposal 7-61.

Proposal 7-73. The proposal to amend § 29.737 is withdrawn. For discussion related to the withdrawal, see Proposal 7-62.

Proposal 7-74. Several commentators objected to the proposal to amend § 29.853, which would impose certain of the compartment interior fire protection requirements for transport category airplanes on transport category rotorcraft. The commentators cited the favorable service experience to date, the smaller cabins of transport category rotorcraft relative to transport category airplanes, the ability of helicopters to land quickly, and the fact that helicopter cabins are not pressurized, as reasons not to impose transport category airplane requirements on transport category rotorcraft. The FAA disagrees. The service experience cited is based on the relatively small current civil fleet of transport category rotorcraft. However, the current fleet is increasing in size both with respect to the number of rotorcraft and with respect to the size of rotorcraft.

In response to another comment, proposed § 29.853(a) has been further revised to set forth the applicable requirements contained in §§ 25.853 (a) and (b) rather than cross referencing those regulations.

However, the cross-reference to Appendix F of Part 25 for test procedures has been retained. See also the discussion of Proposal 7-12.

Proposal 7-75. Two commentators objected to the proposal to revise § 29.863 on the ground that the present regulations provide an adequate level of safety without adding unnecessary cost to the certification program. The FAA believes that the proposed requirements are necessary to insure protection from a flammable fluid or vapor fire. The proposal is adopted without substantive change.

Also see the discussion of Proposals 7-47 and 7-64.

Proposal 8-69. No unfavorable comments were received on the proposal to amend § 29.901. For comments related to the like proposal to amend § 25.901, see Proposal 8-43. The proposal is adopted without substantive change.

Proposal 8-70. One commentator objected to the requirements in proposed § 29.923(a) that the tests be conducted on the rotorcraft and that the test torque be absorbed by the actual rotors to be installed. This commentator stated that the testing of larger drive systems while installed on the rotorcraft is impractical and, in some cases, unconservative in view of the manner in which the rotorcraft must be attached to the ground to absorb the powers involved. Another commentator also objected to the requirement that the 200-hour test be conducted on the rotorcraft. This commentator stated that for conventional rotorcraft with anti-torque tail rotors, or those with contra-rotating rotors, the test purpose could be fulfilled by conducting the test on a suitable rig, if it can be demonstrated that the distortion and vibration conditions are the same as those met on the rotorcraft. The requirements to which these commentators objected are contained in present § 29.923 and were merely restated for clarity in the proposal. Further, the FAA believes these requirements are necessary to insure the validity of the test results.

One commentator suggested that for clarity § 29.923(a) should read " * * * for at least 200 hours plus any extra time required to meet paragraphs (b)(2) and (k) of this section where more than two engines are fitted in the rotorcraft." The FAA believes that the applicability of §§ 29.923 (b)(2)(ii) and (k)(2) to multi-engine rotorcraft is clearly stated and that the revision suggested by this commentator is unnecessary.

The proposal to amend § 29.923 is adopted without substantive change.

Proposals 8-71 and 2-164. Disposition of Proposal 2-164 to amend § 29.927 (Notice 75-10, 40 FR 10802; March 7, 1975) was deferred so that it could be considered in connection with Proposal 8-71. One commentator on Proposal 2-164 to amend § 29.927(b)(2) questioned whether due consideration had been given to the 30-minute emergency power rating when establishing the 15-minute time requirement for the torque transmission test. The 30-minute rating is substantiated by the endurance testing specified in proposed § 29.923, while the proposed 15-minute time requirement is associated with testing which must be done if turbine engine output can exceed the highest engine or transmission torque

limit and that output is not directly controlled by the pilot under normal operating conditions. The highest engine or transmission torque limit is usually associated with takeoff torque, and the 15-minute test would be done at a torque level substantially higher than that associated with the 30-minute rating. The FAA therefore believes that due consideration has been given to the 30-minute ratings, and Proposal 2-164 is adopted without substantive change.

One commentator on Proposal 8-71 agreed with the concept that the overspeed test should be a "proof" test, but questioned the use of maximum continuous speed as a datum. The commentator stated that the use of 120 percent of maximum continuous speed would be acceptable provided this value is at least equal to 105 percent of rotor never-exceed speed and 115 percent of takeoff speed. Maximum continuous speed is used as a reference speed in other required testing of the rotor drive system, and the FAA believes it is appropriate to retain it for consistency. Further, the FAA does not have any information at the present time to indicate that the additional requirements recommended by the commentator are necessary.

One commentator objected to the provisions "After completion of the 200-hour, tie-down test and without intervening major disassembly" in proposed § 29.927(d). The FAA agrees that this provision is inappropriate. The intent of the proposal was to dissociate the overspeed test from the 200-hour, tie-down test since the tests are unrelated. The proposal is revised by striking the words "After completion of the 200-hour, tie-down test and without intervening major disassembly."

Proposal 8-72. No unfavorable comments were received on the proposal to amend § 29.1091 and it is adopted as proposed.

Proposal 8-73. For comment related to the proposal to revise § 29.1103, see Proposal 8-46. The proposal is revised for the reasons discussed in Proposal 8-46.

Proposal 8-74. One commentator objected to the requirement in proposed § 29.1142 that controllability from the flight deck must be provided for auxiliary power units (APU), contending that nonessential APUs should be excluded from the requirement. The FAA does not agree. The commentator has not presented any reason to justify distinguishing between APUs on the basis of the essential or nonessential nature of the services provided by the APU. The FAA believes the flight crew should be provided a means to control an emergency involving any installed auxiliary power unit.

For reasons that are stated in the discussion of Proposal 8-47, proposed § 29.1142 is revised by inserting the word "installed" between the words "each" and "auxiliary."

Proposal 8-75. For comments related to a proposal similar to the proposal for § 29.1195(d), see Proposal 8-49. Section 29.1195(d), as adopted, differs from the proposal for the reasons discussed in Proposal 8-49.

Proposal 7-76. The proposal to amend § 29.1413 is withdrawn. For a discussion of the withdrawal, see Proposal 7-15.

Proposal 7-77. The proposal to add a new § 29.1463 is withdrawn. For a discussion of the withdrawal, see Proposal 7-66.

Proposal 8-76. No unfavorable comments were received on the proposal to add a new § 29.1522. For comments related to the proposal to add a new like section under Part 25, see Proposal 8-57. The proposal to add new § 29.1522 is adopted without substantive change.

Proposal 5-65. For comments related to the proposal to revise § 29.1545(a), see Proposal 5-51. The proposal is adopted without substantive change.

Proposal 8-78. No unfavorable comments were received on the proposal to delete § 29.1583(g). Accordingly, the proposal is adopted without substantive change.

Proposal 8-79. No unfavorable comments were received on the proposal to amend § 29.1585; however, proposed § 29.1585(d) is revised for reasons stated in the discussion of Proposal 8-24. Proposed § 29.1585(e) is adopted without substantive change. In view of the adoption of new §§ 29.1585 (c) and (d) in Airworthiness Review Amendment No. 6 (43 FR 2302; January 16, 1978), proposed §§ 29.1585 (d) and (e) are redesignated and adopted as §§ 29.1585 (e) and (f), respectively.

Proposal 7-78. One commentator suggested that the proposal to amend § 121.291 be revised to allow an air carrier to utilize the results of an evacuation demonstration conducted by another air carrier to eliminate the need for an additional demonstration. The purpose of the proposed amendment to § 121.291 and the related proposals to revise § 25.803(c) (Proposal 7-40) and to delete paragraph (a) of Appendix D to Part 121 (Proposal 7-84) is to specify conditions for an emergency evacuation demonstration to be conducted during type certification, which meets both airworthiness and operational needs. The FAA does not believe that any further relaxation of the current requirement that a Part 121 operator conduct a demonstration in addition to that conducted during type certification of the airplane, is justified. This commentator also recommended revising the proposal to re-

quire a demonstration upon a major change in cabin interior configuration that significantly affects the emergency evacuation duties of crewmembers. The FAA believes that present § 121.291(a)(2) adequately provides for the situation described by the commentator.

One commentator suggested that paragraph (a) of Appendix D to Part 121 be retained since there are certain differences in wording between that paragraph and § 25.803(c) which would be inappropriate. After consideration of this comment, and upon further review, the FAA agrees that paragraph (a) of Appendix D Part 121 contains certain requirements for emergency equipment installation, for seating density and arrangement, and for crewmember qualifications which are appropriate to an emergency evacuation demonstration conducted by an operator and which should be retained. Proposal 7-84 to delete paragraph (a) of Appendix D is withdrawn, and the reference to that paragraph which appears in present § 121.291(a) is retained.

Proposal 7-79. The proposal to add a new § 121.292 is withdrawn. For a discussion of comments related to the proposal, see Proposal 7-39.

Proposal 7-80. For discussion concerning the revision of the proposal for § 121.309(a)(2), see Proposal 7-49. Since provisions for a public address system and its use are currently provided under § 121.318, the FAA believes that substance of the proposed § 121.309(a)(2), as revised, is more appropriately stated in § 121.318, and that section is revised accordingly. The provision for a delayed effective date has been retained but extended to 2 years.

The proposal to add a new § 121.309(a)(3) is withdrawn since the proposed requirements are adequately covered in § 121.309(b)(4).

While no unfavorable comments were received on the proposal to amend § 121.309(b)(3), upon further review the FAA believes that the current requirement adequately covers identification and marking of equipment operation. Accordingly, the proposal is withdrawn.

Proposal 7-81. Several commentators objected to the proposal to amend § 121.310(a), which would require that existing aircraft comply with the emergency evacuation slide requirements in proposed § 25.809(f)(1) within 2 years of the effective date of this amendment. The commentators stated that 2 years would not be enough time to develop and test emergency evacuation slides complying with proposed § 25.809(f)(1) and to retrofit them to existing aircraft. One commentator further objected that the design development and testing needed would con-

stitute an undue burden for the operator, and that there is no assurance that the proposed criteria could be applied retroactively to all airplanes. The FAA agrees, and the proposal to amend § 121.310(a) is withdrawn.

One commentator stated that the requirement in proposed new § 121.310(d)(4), that each emergency light have a cockpit control device with "on," "off," and "armed" positions 1 year after the effective date of the amendment, may be too restrictive, particularly for large fleet operators. Upon further consideration, the FAA believes the retrofit requirement should be extended to two years. Proposed new § 121.310(d)(4) is revised accordingly.

For a discussion of the revision to proposed § 121.310(1), see Proposal 7-44.

Proposal 7-82. One commentator objected to the proposal to revise § 121.319(b)(1) to require two-way communication between the pilot compartment and all the galleys and other flight attendant stations on the ground that the proposed requirement would result in unnecessary redundancy and would not be cost effective. The commentator agreed with a requirement for interphones for only those galleys physically isolated from the passenger compartment. Two other commentators stated that adequate communication could be provided without interphones at each flight attendant station and galley because of the close proximity of some flight attendant stations to galleys. Another commentator suggested that the interphone be required only at required flight attendant stations. The FAA agrees that the intent of the proposal can be accomplished without requiring a means of communication to all galleys and other flight attendant stations. Accordingly, the proposal is revised to require a means of two-way communication between the pilot compartment and each galley which is located on other than the main passenger deck level and each passenger compartment.

One commentator stated that the installation of the proposed two-way communication system would require the modification of aircraft and therefore requested a delayed effective date. The FAA agrees and the proposal is revised to provide 2 years for compliance with the new requirement.

Additionally, §§ 121.313 (b)(3), (b)(4), and (b)(5) are revised for consistency with the proposal for § 121.319(b)(1) by deleting the words "the passenger compartment" and substituting the words "each passenger compartment" in their place.

Proposal 7-83. One commentator stated that under the proposed rule it is conceivable that an aircraft of 300

passenger capacity might have its raft requirements satisfied with three rafts of 100 person capacity each, and considered such compliance to be impractical from the standpoint of passenger flow, urgency of evacuation at the time of ditching, and the number of exits available to those surviving passengers. The commentator recommended that the minimum number of life rafts be equivalent to the number of exits for launching of life rafts and for exiting of passengers of the ditched aircraft. The FAA does not have sufficient information at the present time to justify requiring more life rafts than would be required by proposed § 121.339(a)(2).

One commentator recommended that the proposal to amend § 121.339(a)(2) be revised to use the wording in § 25.1415(b)(1). The FAA agrees. The proposed amendment to § 121.339(a)(2) was intended to update it to agree with the requirements of § 25.1415(b)(1). The proposal is revised accordingly.

Proposal 7-84. The proposal to delete paragraph (a) of Appendix D to Part 121 is withdrawn. For discussion of the withdrawal, see Proposal 7-78.

ADOPTION OF THE AMENDMENTS

Accordingly, Parts 23, 25, 27, 29, and 121 of the Federal Aviation Regulations (14 CFR Parts 23, 25, 27, 29, and 121), are amended as follows, effective December 1, 1978.

PART 23—AIRWORTHINESS STANDARDS: NORMAL, UTILITY, AND ACROBATIC CATEGORY AIRPLANES

1. By revising § 23.345(c) to read as follows:

§ 23.345 High lift devices.

(c) In designing the flaps and supporting structures, the following must be accounted for:

(1) A head-on gust having a velocity of 25 feet per second (EAS).

(2) The slipstream effects specified in § 23.457(b).

2. By deleting the word "be" and the dash at the end of the lead-in of § 23.603(a) and inserting in their place a dash; by inserting the word "Be" at the beginning of § 23.603(a)(1) and deleting the word "and" at the end of § 23.603(a)(1); by deleting the period at the end of § 23.603(a)(2) and inserting a semicolon and the word "and" in its place; and by adding a new § 23.603(a)(3) to read as follows:

§ 23.603 Materials and workmanship.

(a) * * *

(3) Take into account the effects of environmental conditions, such as temperature and humidity, expected in service.

3. By redesignating § 23.605 as § 23.605(a) and adding a new § 23.605(b) to read as follows:

§ 23.605 Fabrication methods.

(b) Each new aircraft fabrication method must be substantiated by a test program.

4. By revising the lead-in of § 23.613(c) to read as follows:

§ 23.613 Material strength properties and design values.

(c) Design values must be those contained in the following publications (obtainable from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402) or other values approved by the Administrator:

5. By revising § 23.629 to read as follows:

§ 23.629 Flutter.

(a) It must be shown by one of the methods specified in paragraph (b), (c), or (d) of this section, or a combination of these methods, that the airplane is free from flutter, control reversal, and divergence for any condition of operation within the limit V-n envelope, and at all speeds up to the speed specified for the selected method. In addition—

(1) Adequate tolerances must be established for quantities which affect flutter, including speed, damping, mass balance, and control system stiffness; and

(2) The natural frequencies of main structural components must be determined by vibration tests or other approved methods.

(b) A rational analysis may be used to show that the airplane is free from flutter, control reversal, and divergence if the analysis shows freedom from flutter for all speeds up to 1.2V_D.

(c) Flight flutter tests may be used to show that the airplane is free from flutter, control reversal, and divergence if it is shown by these tests that—

(1) Proper and adequate attempts to induce flutter have been made within the speed range up to V_D;

(2) The vibratory response of the structure during the test indicates freedom from flutter;

(3) A proper margin of damping exists at V_D ; and

(4) There is no large and rapid reduction in damping as V_D is approached.

(d) Compliance with the rigidity and mass balance criteria (pages 4-12), in Airframe and Equipment Engineering Report No. 45 (as corrected) "Simplified Flutter Prevention Criteria" (published by the Federal Aviation Administration) may be accomplished to show that the airplane is free from flutter, control reversal, or divergence if—

(1) V for the airplane is less than 260 knots (EAS) at altitudes below 14,000 feet and less than Mach 0.6 at altitudes at and above 14,000 feet.

(2) The wing and aileron flutter prevention criteria, as represented by the wing torsional stiffness and aileron balance criteria, are limited in use to airplanes without large mass concentrations (such as engines, floats, or fuel tanks in outer wing panels) along the wing span, and

(3) The airplane—

(i) Does not have a T-tail or boom tail.

(ii) Does not have unusual mass distributions or other unconventional design features that affect the applicability of the criteria, and

(iii) Has fixed-fin and fixed-stabilizer surfaces.

(e) For multiengine turbopropeller powered airplanes, the dynamic evaluation must include—

(1) Whirl mode degree of freedom which takes into account the stability of the plane of rotation of the propeller and significant elastic, inertial, and aerodynamic forces, and

(2) Engine-propeller-nacelle stiffness and damping variations appropriate to the particular configuration.

(f) Freedom from flutter, control reversal, and divergence up to V_D/M_D must be shown as follows:

(1) For airplanes that meet the criteria of paragraphs (d)(1) through (d)(3) of this section, after the failure, malfunction, or disconnection of any single element in any tab control system.

(2) For airplanes other than those described in paragraph (f)(1) of this section, after the failure, malfunction, or disconnection of any single element in the primary flight control system, any tab control system, or any flutter damper.

6. By revising § 23.723(a) to read as follows:

§ 23.723 Shock absorption tests.

(a) It must be shown that the limit load factors selected for design in accordance with § 23.473 for takeoff and landing weights, respectively, will not be exceeded. This must be shown by energy absorption tests except that

analysis based on tests conducted on a landing gear system with identical energy absorption characteristics may be used for increases in previously approved takeoff and landing weights.

* * * * *

7. By adding a new § 23.785(1) to read as follows:

§ 23.785 Seats and berths.

* * * * *

(1) Each seat track must be fitted with stops to prevent the seat from sliding off the track.

8. By adding a new § 23.853(e) to read as follows:

§ 23.853 Compartment interiors.

* * * * *

(e) Airplane materials located on the cabin side of the firewall must be self-extinguishing or be located at such a distance from the firewall, or otherwise protected, so that ignition will not occur if the firewall is subjected to a flame temperature of not less than 2,000 degrees F for 15 minutes. For self-extinguishing materials (except electrical wire and cable insulation and small parts that the Administrator finds would not contribute significantly to the propagation of a fire), a vertical self-extinguishing test must be conducted in accordance with Appendix F of this part or an equivalent method approved by the Administrator. The average burn length of the material may not exceed 6 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the material test specimen may not continue to flame for more than an average of 3 seconds after falling.

9. By adding a new § 23.863 to read as follows:

§ 23.863 Flammable fluid fire protection.

(a) In each area where flammable fluids or vapors might escape by leakage of a fluid system, there must be means to minimize the probability of ignition of the fluids and vapors, and the resultant hazard if ignition does occur.

(b) Compliance with paragraph (a) of this section must be shown by analysis or tests, and the following factors must be considered:

(1) Possible sources and paths of fluid leakage, and means of detecting leakage.

(2) Flammability characteristics of fluids, including effects of any combustible or absorbing materials.

(3) Possible ignition sources, including electrical faults, overheating of

equipment, and malfunctioning of protective devices.

(4) Means available for controlling or extinguishing a fire, such as stopping flow of fluids, shutting down equipment, fireproof containment, or use of extinguishing agents.

(5) Ability of airplane components that are critical to safety of flight to withstand fire and heat.

(c) If action by the flight crew is required to prevent or counteract a fluid fire (e.g. equipment shutdown or actuation of a fire extinguisher), quick acting means must be provided to alert the crew.

(d) Each area where flammable fluids or vapors might escape by leakage of a fluid system must be identified and defined.

10. By revising § 23.1307(a) to read as follows:

§ 23.1307 Miscellaneous equipment.

(a) There must be an approved seat or berth for each occupant.

* * * * *

11. By adding a new § 23.1329(g) to read as follows:

§ 23.1329 Automatic pilot system.

* * * * *

(g) If the automatic pilot system can be coupled to airborne navigation equipment, means must be provided to indicate to the flight crew the current mode of operation. Selector switch position is not acceptable as a means of indication.

12. By adding a new § 23.1416 to read as follows:

§ 23.1416 Pneumatic de-icer boot system.

If certification with ice protection provisions is desired and a pneumatic de-icer boot system is installed—

(a) The system must meet the requirements specified in § 23.1419.

(b) The system and its components must be designed to perform their intended function under any normal system operating temperature or pressure, and

(c) Means to indicate to the flight crew that the pneumatic de-icer boot system is receiving adequate pressure and is functioning normally must be provided.

13. By revising §§ 23.1545(a) and 23.1545(b)(5), and by adding a new § 23.1545(b)(6), to read as follows:

§ 23.1545 Airspeed indicator.

(a) Each airspeed indicator must be marked as specified in paragraph (b) of this section, with the marks located at the corresponding indicated airspeeds.

(b) * * *

(5) For the one-engine-inoperative best rate of climb speed, V_x , a blue sector extending from the V_y speed at sea level to the V_y speed at—

(i) An altitude of 5,000 feet, if the one-engine-inoperative best rate of climb at that altitude is less than 100 feet per minute, or

(ii) The highest 1,000-foot altitude (at or above 5,000 feet) at which the one-engine-inoperative best rate of climb is 100 feet per minute or more.

Each side of the sector must be labeled to show the altitude for the corresponding V_x .

(6) For the minimum control speed (one-engine-inoperative), V_{mc} , a red radial line.

14. By adding a new § 23.1557(f) to read as follows:

§ 23.1557 Miscellaneous markings and placards.

(f) *Unusable fuel.* If the unusable fuel supply in any tank exceeds five percent of the tank capacity, or one gallon, whichever is greater, a placard must be installed next to the fuel quantity indicator for that tank, stating that the fuel remaining when the quantity indicator reads "zero" in level flight cannot be used safely in flight.

§ 23.1583 [Amended]

15. By deleting § 23.1583(i) and marking it "[Reserved]".

16. By adding new §§ 23.1585(f) and (g) to read as follows:

§ 23.1585. Operating procedures.

(f) If the unusable fuel supply in any tank exceeds 5 percent of the tank capacity, or 1 gallon, whichever is greater, information must be furnished which indicates that when the fuel quantity indicator reads "zero" in level flight, any fuel remaining in the fuel tank cannot be used safely in flight.

(g) Information on the total quantity of usable fuel for each fuel tank must be furnished.

17. By adding a new Appendix F to Part 23 to read as follows:

APPENDIX F

An acceptable Test Procedure for Self-Extinguishing Materials for showing compliance with § 23.853(e).

(a) *Conditioning.* Specimens must be conditioned to 70 degrees F, plus or minus 5 degrees, and at 50 percent plus or minus 5 percent relative humidity until moisture equilibrium is reached or for 24 hours. Only one specimen at a time may be removed from the conditioning environment immediately before subjecting it to the flame.

(b) *Specimen configuration.* Materials must be tested either as a section cut from a fabricated part as installed in the airplane or as a specimen simulating a cut section, such as a specimen cut from a flat sheet of the material or a model of the fabricated part. The specimen may be cut from any location in a fabricated part; however, fabricated units, such as sandwich panels, may not be separated for test. The specimen thickness must be no thicker than the minimum thickness to be qualified for use in the airplane, except that thick foam parts must be tested in $\frac{1}{2}$ -inch thickness. In the case of fabrics, both the warp and fill direction of the weave must be tested to determine the most critical flammability conditions. When performing the test prescribed in paragraph (d) of this appendix, the specimen must be mounted in a metal frame so that: (1) The two long edges and the upper edge are held securely; (2) the exposed area of the specimen is at least 2 inches wide and 12 inches long, unless the actual size used in the airplane is smaller; and (3) the edge to which the burner flame is applied must not consist of the finished or protected edge of the specimen but must be representative of the actual cross section of the material or part installed in the airplane.

(c) *Apparatus.* Except as provided in paragraph (e) of this appendix, tests must be conducted in a draft-free cabinet in accordance with Federal Test Method Standard 191 Method 5903 (revised Method 5902) which is available from the General Services Administration, Business Service Center, Region 3, Seventh and D Streets SW, Washington, D.C. 20407, or with some other approved equivalent method. Specimens which are too large for the cabinet must be tested in similar draft-free conditions.

(d) *Vertical test.* A minimum of three specimens must be tested and the results averaged. For fabrics, the direction of weave corresponding to the most critical flammability conditions must be parallel to the longest dimension. Each specimen must be supported vertically. The specimen must be exposed to a Bunsen or Tirrill burner with a nominal $\frac{3}{8}$ -inch I.D. tube adjusted to give a flame of $1\frac{1}{2}$ inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1,550 degrees F. The lower edge of the specimen must be three-fourths inch above the top edge of the burner. The flame must be applied to the center line of the lower edge of the specimen. The flame must be applied for 60 seconds and then removed. Flame time, burn length, and flaming time of drippings, if any, must be recorded. The burn length determined in accordance with paragraph (e) of this appendix must be measured to the nearest one-tenth inch.

(e) *Burn length.* Burn length is the distance from the original edge to the farthest evidence of damage to the test specimen due to flame impingement, including areas of partial or complete consumption, charring, or embrittlement, but not including areas sooted, stained, warped, or discolored, nor areas where material has shrunk or melted away from the heat source.

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

18. By deleting § 25.331(e)(3) and marking it "[Reserved]," revising §§ 25.331(c)(1) and (c)(2), and adding a sentence to the end of § 25.331(a)(4) to read as follows.

§ 25.331 General

(a) * * *

(4) * * *. The in-trim and out-of-trim flight conditions specified in § 25.255 must be considered.

(c) * * *

(1) *Maximum elevator displacement at V_A .* The airplane is assumed to be flying in steady level flight (point A, § 25.333(b)) and, except as limited by pilot effort in accordance with § 25.397(b), the pitching control is suddenly moved to obtain extreme positive pitching acceleration (nose up). The dynamic response or, at the option of the applicant, the transient rigid body response of the airplane, must be taken into account in determining the tail load. Airplane loads which occur subsequent to the normal acceleration at the center of gravity exceeding the maximum positive limit maneuvering load factor, n , need not be considered.

(2) *Specified control displacement.* A checked maneuver, based on a rational pitching control motion vs. time profile, must be established in which the design limit load factor specified in § 25.337 will not be exceeded. Unless lesser values cannot be exceeded, the airplane response must result in pitching accelerations not less than the following.

(i) A positive pitching acceleration (nose up) is assumed to be reached concurrently with the airplane load factor of 1.0 (Points A to D, § 25.333(b)). The positive acceleration must be equal to at least

$$39n/V(n-1.5), \text{ (Radians/Sec.}^2\text{)}$$

where—

n is the positive load factor at the speed under consideration, and V is the airplane equivalent speed in knots.

(ii) A negative pitching acceleration (nose down) is assumed to be reached concurrently with the positive maneuvering load factor (points A to D, § 25.333(b)). The negative pitching acceleration must be equal to at least

$$-26n/V(n-1.5), \text{ (Radians/Sec.}^2\text{)}$$

where—

n is the positive load factor at the speed under consideration, and V is the airplane equivalent speed in knots.

19. By striking the words "as speed brakes" from the lead-in of § 25.345(c); and by adding a new § 25.345(d) to read as follows:

§ 25.345 High lift devices.

(d) The airplane must be designed for landing at the maximum takeoff weight with a maneuvering load factor of 1.5g and the flaps and similar high lift devices in the landing configuration.

§ 25.351 [Amended]

20. By striking the symbol "V_A" in the lead-in of § 25.351(a) and replacing it with the symbol "V_D".

21. By striking the words "The limit engine torque" in § 25.361(a)(1) and replacing them with the words "A limit engine torque"; by striking the words "The limit engine torque corresponding to maximum continuous power and propeller speed" in § 25.361(a)(2) and replacing them with the words "A limit engine torque as specified in § 25.361(c)"; by striking the words "the limit engine torque" in § 25.361(a)(3) and replacing them with the words "a limit engine torque"; and by revising § 25.361(b) and the lead-in of § 25.361(c) to read as follows:

§ 25.361 Engine torque.

(b) For turbine engine installations, the engine mounts and supporting structure must be designed to withstand each of the following:

(1) A limit engine torque load imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming).

(2) A limit engine torque load imposed by the maximum acceleration of the engine.

(c) The limit engine torque to be considered under paragraph (a)(2) of this section must be obtained by multiplying the mean torque for maximum continuous power by a factor of—

22. By adding a new § 25.499(e) to read as follows:

§ 25.499 Nose-wheel yaw.

(e) With the airplane at design ramp weight, and the nose gear in any steerable position, the combined application of full normal steering torque and a vertical force equal to the maximum static reaction on the nose gear must be considered in designing the nose gear, its attaching structure, and the forward fuselage structure.

23. By deleting the word "and" at the end of § 25.603(a); by deleting the period at the end of § 25.603(b) and inserting a semicolon and the word "and" in its place; and by adding a new § 25.603(c) to read as follows:

§ 25.603 Materials.

(c) Take into account the effects of environmental conditions, such as temperature and humidity, expected in service.

24. By redesignating § 25.605 as § 25.605(a) and by adding a new § 25.605(b) to read as follows:

§ 25.605 Fabrication methods.

(b) Each new aircraft fabrication method must be substantiated by a test program.

25. By revising the lead-in of § 25.613(e) to read as follows:

§ 25.613 Material strength properties and design values.

(e) Design values must be those contained in the following publications (obtainable from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402) or other values approved by the Administrator:

26. By revising §§ 25.629 (d)(1), (d)(4)(v), and (d)(4)(vi) to read as follows:

§ 25.629 Flutter, deformation, and fail-safe criteria.

(d) * * *

(1) It must be shown, by analysis or tests, that the airplane is free from such flutter or divergence that would preclude safe flight, at any speed up to V_D, after each of the following:

(i) Each of the failures, malfunctions, or adverse conditions listed in subparagraph (4) of this paragraph.

(ii) Any other combination of failures not shown to be extremely improbable.

(4) * * *

(v) Failure of each principal structural element selected for compliance with § 25.571(b). Safety following a failure may be substantiated by showing that losses in rigidity or changes in frequency, mode shape, or damping are within the parameter variations

shown to be satisfactory in the flutter and divergence investigations.

(vi) Any single failure or malfunction, or combinations thereof, in the flight control system considered under §§ 25.671, 25.672, and 25.1309, and any single failure in any flutter damper system. Investigation of forced structural vibration other than flutter, resulting from failures, malfunctions, or adverse conditions in the automatic flight control system may be limited to airspeeds up to V_C.

27. By revising § 25.697(b) to read as follows:

§ 25.697 Lift and drag devices, controls.

(b) Each lift and drag device control must be designed and located to make inadvertent operation improbable. Lift and drag devices intended for ground operation only must have means to prevent the inadvertent operation of their controls in flight if that operation could be hazardous.

28. By revising § 25.701(a) to read as follows:

§ 25.701 Flap interconnection.

(a) Unless the airplane has safe flight characteristics with the flaps retracted on one side and extended on the other, the motion of flaps on opposite sides of the plane of symmetry must be synchronized by a mechanical interconnection or approved equivalent means.

29. By revising § 25.723(a) to read as follows:

§ 25.723 Shock absorption tests.

(a) It must be shown that the limit load factors selected for design in accordance with § 25.473 for takeoff and landing weights, respectively, will not be exceeded. This must be shown by energy absorption tests except that analysis based on tests conducted on a landing gear system with identical energy absorption characteristics may be used for increases in previously approved takeoff and landing weights.

30. By adding a new § 25.773(d) to read as follows:

§ 25.773 Pilot compartment view.

(d) Fixed markers or other guides must be installed at each pilot station to enable the pilots to position themselves in their seats for an optimum

combination of outside visibility and instrument scan. If lighted markers or guides are used they must comply with the requirements specified in § 25.1381.

§ 25.777 [Amended]

31. By deleting the measurement "6'0" from § 25.777(c) and replacing it with the measurement "6'3"; by deleting the word "belt" in § 25.777(c) and replacing it with the words "belt and shoulder harness (if provided)"; and by deleting the word "belts" in § 25.777(f) and replacing it with the words "belt and shoulder harness (if provided)".

32. By amending § 25.789 by inserting the words "or galley" after the words "crew compartment" and redesignating the paragraph as paragraph (a), and by revising the title and adding a new paragraph (b) to read as follows:

§ 25.789 Retention of items of mass in passenger and crew compartments and galleys.

(b) Each interphone restraint system must be designed so that when subjected to the load factors specified in § 25.561(b)(3), the interphone will remain in its stowed position.

33. By revising §§ 25.803(c) and (d) to read as follows:

§ 25.803 Emergency evacuation.

(c) Except as provided in paragraph (d) of this section, for airplanes having a seating capacity of more than 44 passengers, it must be shown by actual demonstration that the maximum seating capacity, including the number of crewmembers required by the operating rules for which certification is requested, can be evacuated from the airplane to the ground within 90 seconds. The demonstration must be conducted under the following conditions:

(1) It must be conducted either during the dark of the night or during daylight with the dark of the night simulated. If the demonstration is conducted indoors during daylight hours, it must be conducted with each window covered and each door closed to minimize the daylight effect. Illumination on the floor or ground may be used, but it must be kept low and shielded against shining into the airplane's windows or doors.

(2) The airplane must be in a normal attitude with landing gear extended.

(3) Stands or ramps may be used for descent from the wing to the ground, and safety equipment such as mats or inverted life rafts may be placed on the floor or ground to protect participants. No other equipment that is not

part of the airplane's emergency evacuation equipment may be used to aid the participants in reaching the ground.

(4) Except as provided in paragraph (c)(1) of this section, only the airplane's emergency lighting system may provide illumination.

(5) All emergency equipment required for the planned operation of the airplane must be installed.

(6) Each external door and exit, and each internal door or curtain, must be in the takeoff configuration.

(7) Each crewmember must be seated in the normally assigned seat for takeoff and must remain in that seat until receiving the signal for commencement of the demonstration. Each crewmember must be—

(i) For compliance with this section or § 121.291 of this chapter, a member of a regularly scheduled line crew, or

(ii) For compliance with this section, a person having knowledge of the operation of exits and emergency equipment.

(8) A representative passenger load of persons in normal health must be used as follows:

(i) At least 30 percent must be females.

(ii) At least 5 percent must be over 60 years of age with a proportionate number of females.

(iii) At least 5 percent but not more than 10 percent, must be children under 12 years of age, prorated through that age group.

(iv) Three life-size dolls, not included as part of the total passenger load, must be carried by passengers to simulate live infants 2 years old or younger.

(v) Crewmembers, mechanics, and training personnel, who maintain or operate the airplane in the normal course of their duties, may not be used as passengers.

(9) No passenger may be assigned a specific seat except as the Administrator may require. Except as required by paragraph (c)(12) of this section, no employee of the applicant may be seated next to an emergency exit.

(10) Seat belts and shoulder harnesses (as required) must be fastened.

(11) Before the start of the demonstration approximately one-half of the total average amount of carry-on baggage, blankets, pillows, and other similar articles must be distributed at several locations in the aisles and emergency exits access ways to create minor obstructions.

(12) Each crewmember must be seated in his normally assigned seat for takeoff and must remain in that seat until receiving the signal for commencement of the demonstration.

(13) No prior indication may be given to any crewmember or passenger

of the particular exits to be used in the demonstration.

(14) The applicant may not practice, rehearse, or describe the demonstration for the participants nor may any participant have taken part in this type of demonstration within the preceding 6 months.

(15) The pretakeoff passenger briefing required by § 121.571 of this chapter may be given. The passengers may also be advised to follow directions of crewmembers, but not be instructed on the procedures to be followed in the demonstration.

(16) If safety equipment as allowed by paragraph (c)(3) of this section is provided, either all passenger and cockpit windows must be blacked out or all of the emergency exits must have safety equipment in order to prevent disclosure of the available emergency exits.

(17) Not more than 50 percent of the emergency exits in the sides of the fuselage of an airplane that meet all of the requirements applicable to the required emergency exits for that airplane may be used for the demonstration. Exits that are not to be used in the demonstration must have the exit handle deactivated or must be indicated by red lights, red tape, or other acceptable means, placed outside the exits to indicate fire or other reason why they are unusable. The exits to be used must be representative of all of the emergency exits on the airplane and must be designated by the applicant, subject to approval by the Administrator. At least one floor level exit must be used.

(18) All evacuees, except those using an over-the-wing exit, must leave the airplane by a means provided as part of the airplane's equipment.

(19) The applicant's approved procedures must be fully utilized during the demonstration.

(20) The evacuation time period is completed when the last occupant has evacuated the airplane and is on the ground. Provided that the acceptance rate of the stand or ramp is no greater than the acceptance rate of the means available on the airplane for descent from the wing during an actual crash situation, evacuees using stands or ramps allowed by paragraph (c)(3) of this section are considered to be on the ground when they are on the stand or ramp.

(d) A combination of analysis and tests may be used to show that the airplane is capable of being evacuated within 90 seconds under the conditions specified in § 25.803(c) of this section if the Administrator finds that the combination of analysis and tests will provide data with respect to the emergency evacuation capability of the air-

plane equivalent to that which would be obtained by actual demonstration.

34. By revising § 25.807(a)(7)(vi) to read as follows:

§ 25.807 Passenger emergency exits.

- (a) * * *
- (7) * * *

(vi) There must be at least one flight attendant seat, which meets the requirements of §§ 25.785 (h) and (i), adjacent to each such exit.

35. By adding new §§ 25.809 (f)(1)(iv) and (f)(1)(v) to read as follows:

§ 25.809 Emergency exit arrangement.

- (f) * * *
- (1) * * *

(iv) It must have the capability, in 25-knot winds directed from the most critical angle, to deploy and, with the assistance of only one person, to remain usable after full deployment to evacuate occupants safely to the ground.

(v) For each system installation (mockup or airplane installed), five consecutive deployment and inflation tests must be conducted (per exit) without failure, and at least three tests of each such five-test series must be conducted using a single representative sample of the device. The sample devices must be deployed and inflated by the system's primary means after being subjected to the inertia forces specified in § 25.561(b). If any part of the system fails or does not function properly during the required tests, the cause of the failure or malfunction must be corrected by positive means and after that the full series of five consecutive deployment and inflation tests must be conducted without failure.

36. By revising § 25.811(e) to read as follows:

§ 25.811 Emergency exit marking.

(e) The location of the operating handle and instructions for opening exits from the inside of the airplane must be shown in the following manner.

(1) Each passenger emergency exit must have, on or near the exit, a marking that is readable from a distance of 30 inches.

(2) Each Type I and Type A passenger emergency exit operating handle must—

(i) Be self-illuminated with an initial brightness of at least 160 microlamberts; or (ii) Be conspicuously located and well illuminated by the emergency lighting even in conditions of occupant crowding at the exit.

(3) Each Type III passenger emergency exit operating handle must be self-illuminated with an initial brightness of at least 160 microlamberts. If the operating handle is covered, self-illuminated cover removal instructions having an initial brightness of at least 160 microlamberts must also be provided.

(4) Each Type A, Type I, and Type II passenger emergency exit with a locking mechanism released by rotary motion of the handle must be marked—

(i) With a red arrow, with a shaft at least three-fourths of an 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.

(ii) So that the centerline of the exit handle is within ±1 inch of the projected point of the arrow when the handle has reached full travel and has released the locking mechanism; and

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

37. By deleting the parenthetical expression in § 25.812(e)(1) and by revising §§ 25.812 (e)(2) and (e)(3) to read as follows:

§ 25.812 Emergency lighting.

(e) * * *

(2) There must be a flight crew warning light which illuminates when power is on in the airplane and the emergency lighting control device is not armed.

(3) The cockpit control device must have an "on," "off," and "armed" position so that when armed in the cockpit or turned on at either the cockpit or flight attendant station the lights will either light or remain lighted upon interruption (except an interruption caused by a transverse vertical separation of the fuselage during crash landing) of the airplane's normal electric power. There must be a means to safeguard against inadvertent operation of the control device from the "armed" or "on" positions.

38. By revising § 25.813(c)(1) to read as follows:

§ 25.813 Emergency exit access.

(c) * * *

(1) For airplanes that have a passenger seating configuration, excluding pilot's seats, of 20 or more, the projected opening of the exit provided may not be obstructed and there must be no interference in opening the exit by seats, berths, or other protrusions (including seatbacks in any position) for a distance from that exit not less than the width of the narrowest passenger seat installed on the airplane.

39. By revising § 25.863(a) and adding a new § 25.863(d) to read as follows:

§ 25.863 Flammable fluid fire protection.

(a) In each area where flammable fluids or vapors might escape by leakage of a fluid system, there must be means to minimize the probability of ignition of the fluids and vapors, and the resultant hazards if ignition does occur.

(d) Each area where flammable fluids or vapors might escape by leakage of a fluid system must be identified and defined.

40. By adding a new § 25.901(d) to read as follows:

25.901 Installation.

(d) Each auxiliary power unit installation must meet the applicable provisions of this subpart.

41. By revising the heading of § 25.1103, by revising §§ 25.1103 (a), (b)(2), and (d), and by adding new §§ 25.1103 (e) and (f), to read as follows:

§ 25.1103 Induction system ducts and air duct systems.

(a) Each induction system duct upstream of the first stage of the engine supercharger and of the auxiliary power unit compressor must have a drain to prevent the hazardous accumulation of fuel and moisture in the ground attitude. No drain may discharge where it might cause a fire hazard.

(b) * * *

(2) Fire resistant if it is in any fire zone for which a fire-extinguishing system is required, except that ducts for auxiliary power units must be fire-proof within the auxiliary power unit fire zone.

(d) For turbine engine and auxiliary power unit bleed air duct systems, no hazard may result if a duct failure occurs at any point between the air duct source and the airplane unit served by the air.

(e) Each auxiliary power unit induction system duct must be fireproof for a sufficient distance upstream of the auxiliary power unit compartment to prevent hot gas reverse flow from burning through auxiliary power unit ducts and entering any other compartment or area of the airplane in which a hazard would be created resulting from the entry of hot gases. The materials used to form the remainder of the induction system duct and plenum chamber of the auxiliary power unit must be capable of resisting the maximum heat conditions likely to occur.

(f) Each auxiliary power unit induction system duct must be constructed of materials that will not absorb or trap hazardous quantities of flammable fluids that could be ignited in the event of a surge or reverse flow condition.

42. By adding a new § 25.1142 to read as follows:

§ 25.1142 Auxiliary power unit controls.

Means must be provided on the flight deck for starting, stopping, and emergency shutdown of each installed auxiliary power unit.

43. By revising § 25.1195(b) to read as follows:

§ 25.1195 Fire extinguishing systems.

(b) The fire extinguishing system, the quantity of the extinguishing agent, the rate of discharge, and the discharge distribution must be adequate to extinguish fires. It must be shown by either actual or simulated flights tests that under critical airflow conditions in flight the discharge of the extinguishing agent in each designated fire zone specified in paragraph (a) of this section will provide an agent concentration capable of extinguishing fires in that zone and of minimizing the probability of reignition. An individual "one-shot" system may be used for auxiliary power units, fuel burning heaters, and other combustion equipment. For each other designated fire zone, two discharges must be provided each of which produces adequate agent concentration.

44. By revising § 25.1207 to read as follows:

§ 25.1207 Compliance.

Unless otherwise specified, compliance with the requirements of

§§ 25.1181 through 25.1203 must be shown by a full scale fire test or by one or more of the following methods:

- (a) Tests of similar powerplant configurations;
(b) Tests of components;
(c) Service experience of aircraft with similar powerplant configurations;
(d) Analysis.

§ 25.1307 [Amended]

45. By striking the words "and safety belt," from § 25.1307(a).

46. By adding a new § 25.1329(h) to read as follows:

§ 25.1329 Automatic pilot system.

(h) If the automatic pilot system can be coupled to airborne navigation equipment, means must be provided to indicate to the flight crew the current mode of operation. Selector switch position is not acceptable as a means of indication.

47. By revising §§ 25.1411 (a) and (d) to read as follows:

§ 25.1411 General.

(a) Accessibility. (1) Required safety equipment to be used by the crew in an emergency must be readily accessible.

(2) At least one public address system microphone intended for flight attendant use must be positioned at each floor level exit in a passenger compartment and be readily accessible to a flight attendant seated in any seat adjacent to that exit.

(d) Liferafts. (1) The stowage provisions for the liferafts described in § 25.1415 must accommodate enough rafts for the maximum number of occupants for which certification for ditching is requested.

(2) Liferafts must be stowed near exits through which the rafts can be launched during an unplanned ditching.

(3) Rafts automatically or remotely released outside the airplane must be attached to the airplane by means of the static line prescribed in § 25.1415.

(4) The stowage provisions for each portable liferaft must allow rapid detachment and removal of the raft for use at other than the intended exits.

48. By adding a new § 25.1416 to read as follows:

§ 25.1416 Pneumatic de-icer boot system.

If certification with ice protection provisions is desired and a pneumatic de-icer boot system is installed—

(a) The system must meet the requirements specified in § 25.1419.

(b) The system and its components must be designed to perform their intended function under any normal system operating temperature or pressure, and

(c) Means to indicate to the flight crew that the pneumatic de-icer boot system is receiving adequate pressure and is functioning normally must be provided.

49. By adding a new § 25.1522 to read as follows:

§ 25.1522 Auxiliary power unit limitations.

If an auxiliary power unit that meets the requirements of TSO-C77 (§ 37.183) is installed in the airplane, the limitations established for that auxiliary power unit under the TSO, including the categories of operation, must be specified as operating limitations for the airplane.

§ 25.1561 [Amended]

50. By inserting the words "the easy" between the words "facilitate" and "removal" in § 25.1561(c).

§ 25.1583 [Amended]

51. By deleting § 25.1583(g) and marking it "[Reserved]".

52. By adding new §§ 25.1585 (d) and (e) to read as follows:

§ 25.1585 Operating procedures.

(d) Information must be furnished which indicates that when the fuel quantity indicator reads "zero" in level flight, any fuel remaining in the fuel tank cannot be used safely in flight.

(e) Information on the total quantity of usable fuel for each fuel tank must be furnished.

PART 27—AIRWORTHINESS STANDARDS. NORMAL CATEGORY ROTORCRAFT

53. By revising § 27.79(b)(2) to read as follows:

§ 27.79 Limiting height-speed envelope.

(b) For multiengine helicopters, one engine inoperative (where engine isolation features insure continued operation of the remaining engines), and the remaining engines at the greatest power for which certification is requested, and

54. By deleting the word "and" at the end of § 27.603(a); by deleting the

period at the end of § 27.603(b) and inserting a semicolon and the word "and" in its place; and by adding a new § 27.603(c) to read as follows.

§ 27.603 Materials.

(c) Take into account the effects of environmental conditions, such as temperature and humidity, expected in service.

55. By redesignating § 27.605 as § 27.605(a) and adding a new § 27.605(b) to read as follows:

§ 27.605 Fabrication methods.

(b) Each new aircraft fabrication method must be substantiated by a test program.

56. By revising the lead-in of § 27.613(d) to read as follows:

§ 27.613 Material strength properties and design values.

(d) Design values must be those contained in the following publications (available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402) or other values approved by the Administrator:

57. By revising § 27.675(d)(1) to read as follows:

§ 27.675 Stops.

(1) Stops that are appropriate to the blade design must be provided to limit travel of the blade about its hinge points; and

58. By adding a new § 27.863 to read as follows:

§ 27.863 Flammable fluid fire protection.

(a) In each area where flammable fluids or vapors might escape by leakage of a fluid system, there must be means to minimize the probability of ignition of the fluids and vapors, and the resultant hazards if ignition does occur.

(b) Compliance with paragraph (a) of this section must be shown by analysis or tests, and the following factors must be considered:

(1) Possible sources and paths of fluid leakage, and means of detecting leakage.

(2) Flammability characteristics of fluids, including effects of any combustible or absorbing materials.

(3) Possible ignition sources, including electrical faults, overheating of equipment, and malfunctioning of protective devices.

(4) Means available for controlling or extinguishing a fire, such as stopping flow of fluids, shutting down equipment, fireproof containment, or use of extinguishing agents.

(5) Ability of rotorcraft components that are critical to safety of flight to withstand fire and heat.

(c) If action by the flight crew is required to prevent or counteract a fluid fire (e.g. equipment shutdown or actuation of a fire extinguisher) quick acting means must be provided to alert the crew.

(d) Each area where flammable fluids or vapors might escape by leakage of a fluid system must be identified and defined.

59. By revising § 27.1545(a) to read as follows:

§ 27.1545 Airspeed indicator.

(a) Each airspeed indicator must be marked as specified in paragraph (b) of this section, with the marks located at the corresponding indicated airspeeds.

§ 27.1583 [Amended]

60. By deleting § 27.1583(f) and marking it "[Reserved]".

61. By adding new §§ 27.1585 (e) and (f) to read as follows:

§ 27.1585 Operating procedures

(e) If the unusable fuel supply in any tank exceeds five percent of the tank capacity, or one gallon, whichever is greater, information must be furnished which indicates that when the fuel quantity indicator reads "zero" in level flight, any fuel remaining in the fuel tank cannot be used safely in flight.

(f) Information on the total quantity of usable fuel for each fuel tank must be furnished.

PART 29—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT

61. By deleting the period at the end of § 29.75(b)(5) and inserting a semicolon and the word "and" in its place; and by adding a new § 29.75(b)(6) and revising §§ 29.75 (c)(2)(i) and (c)(2)(ii) to read as follows:

§ 29.75 Landing.

(b) ***

(6) 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 from the approach and landing paths established in accordance with paragraphs (b)(2) through (b)(4) of this section.

(c) ***

(2) ***

(i) Paragraph (c)(1) of this section; or

(ii) Paragraphs (b)(2) through (b)(6) of this section.

63. By deleting the word "and" at the end of § 29.603(a); by deleting the period at the end of § 29.603(b) and inserting a semicolon and the word "and" in its place; and by adding a new § 29.603(c) to read as follows:

§ 29.603 Materials.

(c) Take into account the effects of environmental conditions, such as temperature and humidity, expected in service.

64. By redesignating § 29.605 as § 29.605(a) and adding a new § 29.605(b) to read as follows:

§ 29.605 Fabrication methods.

(b) Each new aircraft fabrication method must be substantiated by a test program.

65. By revising the lead-in of § 29.613(d) to read as follows:

§ 29.613 Material strength properties and design values.

(d) Design values must be those contained in the following publications (available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402) or other values approved by the Administrator:

66. By revising § 29.675(d)(1) to read as follows:

§ 29.675 Stops.

(d) ***

(1) Stops that are appropriate to the blade design must be provided to limit travel of the blade about its hinge points; and

67. By deleting § 29.853(b) and by marking it "[Reserved]" and by revising § 29.853(a) to read as follows:

§ 29.853 **Compartment interiors.**

(a) The materials (including finishes or decorative surfaces applied to the materials) must meet the following test criteria as applicable:

(1) Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of Part 25 of this chapter, or other approved equivalent methods. The average burn length may not exceed 6 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 3 seconds after falling.

(2) Floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and non-decorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation and insulation covering, air ducting, joint and edge covering, cargo compartment liners, insulation blankets, cargo covers, and transparencies, molded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing) that are constructed of materials not covered in paragraph (a)(3) of this section, must be self-extinguishing when tested vertically in accordance with the applicable portion of Appendix F of Part 25 of this chapter, or other approved equivalent methods. The average burn length may not exceed 3 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.

(3) Acrylic windows and signs, parts constructed in whole or in part of elastomeric materials, edge lighted instrument assemblies consisting of two or more instruments in a common housing, seat belts, shoulder harnesses, and cargo and baggage tiedown equipment, including containers, bins, pallets, etc., used in passenger or crew compartments, may not have an average burn rate greater than 2.5 inches per minute when tested horizontally in accordance with the applicable portions of Appendix F of Part 25 of this

chapter, or other approved equivalent methods.

(4) Except for electrical wire and cable insulation, and for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that the Administrator finds would not contribute significantly to the propagation of a fire, materials in items not specified in paragraphs (a)(1), (a)(2), or (a)(3) of this section may not have a burn rate greater than 4 inches per minute when tested horizontally in accordance with the applicable portions of appendix F of part 25 of this chapter, or other approved equivalent methods.

68. By amending § 29.863 to read as follows:

§ 29.863 **Flammable fluid fire protection.**

(a) In each area where flammable fluids or vapors might escape by leakage of a fluid system, there must be means to minimize the probability of ignition of the fluids and vapors, and the resultant hazards if ignition does occur.

(b) Compliance with paragraph (a) of this section must be shown by analysis or tests, and the following factors must be considered:

(1) Possible sources and paths of fluid leakage, and means of detecting leakage.

(2) Flammability characteristics of fluids, including effects of any combustible or absorbing materials.

(3) Possible ignition sources, including electrical faults, overheating of equipment, and malfunctioning of protective devices.

(4) Means available for controlling or extinguishing a fire, such as stopping flow of fluids, shutting down equipment, fireproof containment, or use of extinguishing agents.

(5) Ability of rotorcraft components that are critical to safety of flight to withstand fire and heat.

(c) If action by the flight crew is required to prevent or counteract a fluid fire (e.g. equipment shutdown or actuation of a fire extinguisher), quick acting means must be provided to alert the crew.

(d) Each area where flammable fluids or vapors might escape by leakage of a fluid system must be identified and defined.

69. By adding a new § 29.901(d) to read as follows:

§ 29.901 **Installation.**

(d) Each auxiliary power unit installation must meet the applicable provisions of this subpart.

70. By deleting § 29.923(1) and marking it "[Reserved]", by revising §§ 29.923(a), (b), (c), (d), (e), (f), (h), (j), and (k), and by adding new § 29.923(o) to read as follows:

§ 29.923 **Rotor drive system and control mechanism tests.**

(a) *Endurance tests, general.* Each rotor drive system and rotor control mechanism must be tested, as prescribed in paragraphs (b) through (n) of this section, for at least 200 hours plus the time required to meet paragraphs (b)(2) and (k) of this section. These tests must be conducted as follows:

(1) Ten-hour test cycles must be used.

(2) The tests must be conducted on the rotorcraft.

(3) The test torque must be—

(i) Determined by the powerplant limitations; and

(ii) Absorbed by the actual rotors to be installed.

(b) *Endurance tests, takeoff torque run.* The takeoff torque run endurance test must be conducted as follows:

(1) Except as prescribed in paragraph (b)(2) of this section, the takeoff torque run must consist of 1 hour of alternate runs of 5 minutes at the torque corresponding to takeoff power and speed, and 5 minutes at as low an engine idle speed as practicable. The engine must be declutched from the rotor drive system, and the rotor brake, if furnished and so intended, must be applied during the first minute of the idle run. During the remaining 4 minutes of the idle run, the clutch must be engaged so that the engine drives the rotors at the minimum practical r.p.m. Acceleration of the engine and the rotor drive system must be done at the maximum rate. When declutching the engine, it must be decelerated rapidly enough to allow the operation of the overrunning clutch.

(2) For helicopters for which the use of 2½-minute power is requested, the takeoff torque run must be conducted as prescribed in paragraph (b)(1) of this section, except for the third and sixth run for which the torque corresponding to takeoff power and speed is prescribed in that paragraph. For these two takeoff torque runs, the following apply.

(i) Each run must consist of at least one period of 2½ minutes with the torque corresponding to takeoff power and speed on all engines.

(ii) Each run must consist of at least one period, for each engine in sequence, during which that engine simulates a power failure and the remaining engines are run at the torque corresponding to 2½-minute power and speed for 2½ minutes.

(c) *Endurance tests, maximum continuous run.* Three hours of continuous operation at the torque corresponding to maximum continuous power and speed must be conducted as follows:

(1) The main rotor controls must be operated at a minimum of 15 times each hour through the main rotor pitch positions of maximum vertical thrust, maximum forward thrust component, maximum aft thrust component, maximum left thrust component, and maximum right thrust component, except that the control movements need not produce loads or blade flapping motion exceeding the maximum loads of motions encountered in flight.

(2) The directional controls must be operated at a minimum of 15 times each hour through the control extremes of maximum right turning torque, neutral torque as required by the power applied to the main rotor, and maximum left turning torque.

(3) Each maximum control position must be held for at least 10 seconds, and the rate of change of control position must be at least as rapid as that for normal operation.

(d) *Endurance tests; 90 percent of maximum continuous run.* One hour of continuous operation at the torque corresponding to 90 percent of maximum continuous power must be conducted at maximum continuous speed.

(e) *Endurance tests; 80 percent of maximum continuous run.* One hour of continuous operation must be conducted at the torque corresponding to 80 percent of maximum continuous power and minimum speed intended for this power.

(f) *Endurance tests; 60 percent of maximum continuous run.* Two hours, or, for helicopters for which the use of 30-minute power is requested, 1 hour of continuous operation at the torque corresponding to 60 percent of maximum continuous power must be conducted at the minimum rotational speed intended for this power.

(h) *Endurance tests; overspeed run.* One hour of continuous operation must be conducted at the torque corresponding to maximum continuous power and at the maximum rotational speed expected in service, assuming that speed and torque limiting devices, if any, function properly.

(j) *Endurance tests, clutch and brake engagements.* A total of at least 400 clutch and brake engagements, including the engagements of paragraph (b) of this section, must be made during the takeoff torque runs and, if necessary, at each change of torque and

speed throughout the test. In each clutch engagement, the shaft on the driven side of the clutch must be accelerated from rest. The clutch engagements must be accomplished at the speed and by the method prescribed by the applicant. During deceleration after each clutch engagement, the engines must be stopped rapidly enough to allow the engines to be automatically disengaged from the rotors and rotor drives. If a rotor brake is installed for stopping the rotor, the clutch, during brake engagements, must be disengaged above 40 percent of maximum continuous rotor speed and the rotors allowed to decelerate to 40 percent of maximum continuous rotor speed, at which time the rotor brake must be applied. If the clutch design does not allow stopping the rotors with the engine running, or if no clutch is provided, the engine must be stopped before each application of the rotor brake, and then immediately be started after the rotors stop.

(k) *Endurance tests, 30-minute torque run.* For helicopters for which the use of 30-minute power is requested, a run at the torque corresponding to 30-minute power and speed must be conducted as follows:

(1) For each engine, in sequence, that engine must be inoperative and the remaining engines must be run for a 30-minute period.

(2) The number of periods prescribed in paragraph (k)(1) of this section may not be less than the number of engines, nor may it be less than two.

(o) Each part tested as prescribed in this section must be in a serviceable condition at the end of the tests. No intervening disassembly which might affect test results may be conducted.

71. By revising § 29.927(b), and adding new §§ 29.927 (d) and (e) to read as follows:

§ 29.927 Additional tests.

(b) If turbine engine torque output to the transmission can exceed the highest engine or transmission torque limit, 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 torque 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 fifteen minutes.

(d) *Overspeed test.* The rotor drive system must be subjected to 50 overspeed runs, each 30±3 seconds in duration at a speed of at least 120 percent of maximum continuous speed. These runs must be conducted as follows:

(1) Overspeed runs must be alternated with stabilizing runs of from 1 to 5 minutes duration each at 60 to 80 percent of maximum continuous speed.

(2) Acceleration and deceleration must be accomplished in a period not longer than 10 seconds, and the time for changing speeds may not be deducted from the specified time for the overspeed runs.

(3) Overspeed runs must be made with the rotors in the flattest pitch for smooth operation.

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

72. By revising §§ 29.1091 (a), (b), and (f)(1) to read as follows:

§ 29.1091 Air induction.

(a) The air induction system for each engine and auxiliary power unit must supply the air required by that engine and auxiliary power unit under the operating conditions for which certification is requested.

(b) Each engine and auxiliary power unit air induction system must provide air for proper fuel metering and mixture distribution with the induction system valves in any position.

(f) For turbine engine powered rotorcraft and rotorcraft incorporating auxiliary power units—

(1) There must be means to prevent hazardous quantities of fuel leakage or overflow from drains, vents, or other components of flammable fluid sys-

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tems from entering the engine or auxiliary power unit intake system; and

* * * * *

73. By revising the heading and paragraphs (a) and (d) of § 29.1103, and by adding new § 29.1103(e) and (f), to read as follows:

§ 29.1103 Induction systems ducts and air duct systems.

(a) Each induction system duct upstream of the first stage of the engine supercharger and of the auxiliary power unit compressor must have a drain to prevent the hazardous accumulation of fuel and moisture in the ground attitude. No drain may discharge where it might cause a fire hazard.

* * * * *

(d) Each duct within any fire zone for which a fire-extinguishing system is required must be at least—

(1) Fireproof, if it passes through any firewall; or

(2) Fire resistant, for other ducts, except that ducts for auxiliary power units must be fireproof within the auxiliary power unit fire zone.

(e) Each auxiliary power unit induction system duct must be fireproof for a sufficient distance upstream of the auxiliary power unit compartment to prevent hot gas reverse flow from burning through auxiliary power unit ducts and entering any other compartment or area of the rotorcraft in which a hazard would be created resulting from the entry of hot gases. The materials used to form the remainder of the induction system duct and plenum chamber of the auxiliary power unit must be capable of resisting the maximum heat conditions likely to occur.

(f) Each auxiliary power unit induction system duct must be constructed of materials that will not absorb or trap hazardous quantities of flammable fluids that could be ignited in the event of a surge or reverse flow condition.

74. By adding a new § 29.1142 to read as follows:

§ 29.1142 Auxiliary power unit controls.

Means must be provided on the flight deck for starting, stopping, and emergency shutdown of each installed auxiliary power unit.

75. By adding a new § 29.1195(d) to read as follows:

§ 29.1195 Fire extinguishing systems.

* * * * *

(d) It must be shown by either actual or simulated flight tests that under critical airflow conditions, in

flight the discharge of the extinguishing agent in each designated fire zone will provide an agent concentration capable of extinguishing fires in that zone and of minimizing the probability of reignition.

76. By adding a new § 29.1522 to read as follows:

§ 29.1522 Auxiliary power unit limitations.

If an auxiliary power unit that meets the requirements of TSO-C77 is installed in the rotorcraft, the limitations established for that auxiliary power unit under the TSO including the categories of operation must be specified as operating limitations for the rotorcraft.

77. By revising § 29.1545(a) to read as follows:

§ 29.1545 Airspeed indicator.

(a) Each airspeed indicator must be marked as specified in paragraph (b) of this section, with the marks located at the corresponding indicated airspeeds.

* * * * *

§ 29.1583 [Amended]

78. By deleting § 29.1583(g) and marking it "[Reserved]".

79. By adding new §§ 29.1585(e) and (f) to read as follows:

§ 29.1585 Operating procedures.

* * * * *

(e) If the unusable fuel supply in any tank exceeds 5 percent of the tank capacity, or 1 gallon, whichever is greater, information must be furnished which indicates that when the fuel quantity indicator reads "zero" in level flight, any fuel remaining in the fuel tank cannot be used safely in flight.

(f) Information on the total quantity of usable fuel for each fuel tank must be furnished.

PART 121—CERTIFICATION AND OPERATIONS: DOMESTIC, FLAG, AND SUPPLEMENTAL AIR CARRIERS AND COMMERCIAL OPERATORS OF LARGE AIRCRAFT

80. By revising § 121.291(a) by inserting at the beginning a phrase that reads "For airplanes that were not shown to be in compliance with § 25.803(c)(7)(i) of this chapter in effect on December 1, 1978, during type certification," and by adding a new § 121.291(c) to read as follows:

§ 121.291 Demonstration of emergency evacuation procedures.

* * * * *

(c) For airplanes that were shown to be in compliance with § 25.803(c)(7)(i) of this chapter in effect on December 1, 1978, during type certification, the operator must show that its emergency evacuation procedures and the training provided its crewmembers with respect to those procedures will provide emergency evacuation results equivalent to those obtained under § 25.803(c) of this chapter during airplane type certification.

81. By adding new §§ 121.310(d)(4) and 121.310(1) to read as follows:

§ 121.310 Additional emergency equipment.

* * * * *

(d) ***

(4) After December 1, 1980, each light must have a cockpit control device that has an "on", "off", and "armed" position.

* * * * *

(1) *Portable lights.* After December 1, 1980, no person may operate a passenger-carrying airplane unless it is equipped with flashlight stowage provisions accessible from each flight attendant seat.

82. By revising § 121.318(b)(2) to read as follows:

§ 121.318 Public address system.

* * * * *

(b) ***

(2) It must be accessible for use from at least one normal flight attendant station in the passenger compartment, and, after December 1, 1980, at least one public address system microphone intended for flight attendant use must be positioned at each floor level exit in a passenger compartment and be readily accessible to a flight attendant seated in any seat adjacent to that exit.

* * * * *

83. By revising §§ 121.319 (b)(1), (b)(3), (b)(4), and (b)(5)(i) to read as follows:

§ 121.319 Crewmember interphone system.

* * * * *

(b) ***

(1) After December 1, 1980, it must provide a means of two-way communication between the pilot compartment and—

(i) Each passenger compartment; and

(ii) Each galley located on other than the main passenger deck level.

(3) It must be accessible for use from at least one normal flight attendant station in each passenger compartment;

(4) It must be capable of operation within 10 seconds by a flight attendant at those stations in each passenger compartment from which its use is accessible; and

(5) * * *

(i) It must be accessible for use at enough flight attendant stations so that all floor level emergency exits in each passenger compartment are observable from one or more of those stations so equipped;

84. By adding a sentence to § 121.339(a)(2) to read as follows:

§ 121.339 Emergency equipment for extended over-water operations.

(a) * * *

(2) * * * Unless excess rafts of enough capacity are provided, the buoyancy and seating capacity beyond the rated capacity of the rafts must accommodate all occupants of the airplane in the event of a loss of one raft of the largest rated capacity.

(Secs. 313(a), 601, 603, 604, Federal Aviation Act of 1958 (49 U.S.C. 1354(a), 1421, 1423, 1424), sec. 6(c), Department of Transportation Act (49 U.S.C. 1655(c)).)

Issued in Washington, D.C., on October 20, 1978.

LANGHORNE BOND,
Administrator.

[FR Doc. 78-30348 Filed 10-27-78; 8:45 am]



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[1505-01-M]

Title 14—Aeronautics and Space

CHAPTER I—FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

[Docket Nos. 14324, 14606, 14625, 14685, and 14779; Amdt. Nos. 23-23; 25-46; 27-16; 29-17; and 121-149]

AIRWORTHINESS REVIEW PROGRAM
AMENDMENT NO. 7

Airframe Amendments; Final Rule

Correction

In FR Doc. 78-30348 appearing at page 50578 in the issue for Monday, October 30, 1978, make the following changes:

(1) On page 50593, middle column, the section heading now reading "§ 23.785 Seats and berths." should have read "§ 23.785 Seats, berths, safety belts, and harnesses."

(2) On page 50594, third column, the formula in § 25.331(c)(2)(i) should have read as follows:

$$\frac{39n}{V} (n-15), \quad (\text{Radians/Sec.}^2)$$

where—

n is the positive load factor at the speed under consideration; and
V is the airplane equivalent speed in knots.

(3) In the same section, in paragraph (c)(1)(ii), in the fifth line, "The negative pitching * * *" should have read "This negative pitching * * *," and the formula should have read as follows:

$$\frac{-26n}{V} (n-15), \quad (\text{Radians/Sec.}^2)$$

where—

n is the positive load factor at the speed under consideration; and V is the airplane equivalent speed in knots.

(4) On page 50597, in § 25.811, the first paragraph at the top of the center column, the text labeled "(ii)" in the third line should have been set forth as a separate paragraph.

[1505-01-M]

Title 14—Aeronautics and Space

CHAPTER I—FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

[Docket Nos. 14324, 14606, 14625, 14685, and 14779; Amdt. Nos. 23-23; 25-46; 27-16; 29-17; and 121-149]

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

**Airworthiness Review Program
Amendment No. 7; Airframe
Amendments; Final Rule**

Correction

On page 52495 in the issue for Monday, November 13, 1978, there appeared a correction to FR Doc. 78-30348 which had appeared in the issue of October 30, 1978. Because of printing limitations, the reproductions of the formulas for § 25.331 (c)(2)(i) and (c)(2)(ii) did not come out perfectly. Therefore, please note that the portion of both formulas which reads "(n-15)" should have appeared with a decimal point as follows: "(n-1.5)".