

Title 14—Aeronautics and Space
CHAPTER I—FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

[Docket No. 14625; Amendment Nos. 23-20; 23-41; 27-13; 29-14; 91-141; and 131-135]

AIRWORTHINESS REVIEW PROGRAM

Amendment No. 5: Equipment and Systems Amendments

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: The purpose of these amendments is to update and improve the airworthiness standards applicable to aircraft equipment and systems and to make related changes in the operating rules. These amendments are part of the Airworthiness Review Program.

DATES: Effective date September 1, 1977.

FOR FURTHER INFORMATION CONTACT:

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

Title	FR citation
Form number and clarifying revisions	(40 FR 2576; January 14, 1975)
Rotorcraft anti-collision lights standards	(41 FR 5290; February 5, 1976)
Miscellaneous amendments	(41 FR 55454; December 20, 1976)
Powerplant amendments	(42 FR 13034; March 17, 1977)

These amendments are based on two Notices of Proposed Rule Making—Notice 75-10 published in the *FEDERAL REGISTER* on March 7, 1975 (40 FR 10802); and Notice 75-23 published in the *FEDERAL REGISTER* on May 27, 1975 (40 FR 23048). The amendments based on Notice 75-10 were deferred in the series of amendments titled "Miscellaneous Amendments" so that they could be considered in conjunction with the final disposition of certain proposals in Notice 75-23. The discussions of the comments received for the deferred proposals are included under the heading of the related Notice 75-23 proposals.

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 their adoption are the same as those contained in Notices 75-10 and 75-23.

Two of the proposals of the original Notice concerning rotorcraft anticollision lights (§§ 27.1401 and 29.1401) have been implemented by separate rule-making action, Amendments 27-10 and 29-11, effective February 5, 1976, that were published in the *FEDERAL REGISTER* on February 5, 1976 (41 FR 5290). In addition, several proposals which were contained in Notice 75-23 are not being dealt with here but will be considered in conjunction with the proposals contained in Airworthiness Review Program, Notice No. 7: Airframe Proposals (Notice 75-26; 40 FR 24802; June 10, 1975).

DISCUSSION OF COMMENTS

The following discussion is keyed to the like-numbered proposals contained in Notice 75-23.

Proposal 5-1. One commentator objected to the marking (or tagging) requirement in proposed § 23.1301(a)(2), which would require that the marking or tag include identification, function, and operating limitations, on the ground that it would necessitate a multitude of tags on small items of equipment which could interfere with operation of the aircraft or otherwise constitute a hazard. Another commentator contended that the service record does not justify a need for the requirement. Another commentator recommended that this requirement be expanded to require that the marking or tag include information to show that the equipment had been produced under an approved FAA quality control system, or that it had been approved by the FAA for installation on a particular type of aircraft. After further review, the FAA agrees with the first commentator and believes that the proposed marking or tagging requirement should be withdrawn. Accordingly, the requirement in proposed § 23.1301(a)(2) is withdrawn. However, current § 23.1301(a)(2) is amended by deleting the words "if appropriate" for consistency with §§ 25.1301, 27.1301, and 29.1301.

One commentator objected to the requirement in proposed § 23.1301(b) on the ground that it would be extremely difficult, or impossible, in the design of an item of equipment, or of its installation, to provide absolute assurance that it is incapable of interfering with the operation of interfacing equipment under all possible failure conditions. Another commentator stated that the wording of the proposal could be interpreted to mean that fully redundant equipment systems must be installed. The FAA agrees that proposed § 23.1301(b) would be unnecessarily restrictive, and it is withdrawn. In view of the withdrawal of proposed § 23.1301(b), the paragraphs in § 23.1301, as adopted, have been redesignated.

The proposed revision of the lead-in of current § 23.1301(a) was intended to expand the applicability of that paragraph to cover all optional equipment, consistent with corresponding language in current §§ 25.1301, 27.1301, and

29.1301. One commentator objected because it would require markings on additional items of optional equipment. The FAA believes that the marking of all equipment items contributes significantly to safety by helping to prevent their improper installation and operation, and the lead-in of § 23.1301(a) is revised as proposed.

Proposals 5-21, 5-39, and 5-53 to revise §§ 25.1301(b), 27.1301, and 29.1301, respectively, are withdrawn for the reasons stated herein with respect to proposed § 23.1301.

Proposal 5-2. The deletion of current § 23.1309(a) was proposed because it would have been superfluous if proposed § 23.1301(b) (see Proposal 5-1) had been adopted. Proposed § 23.1301(b) is withdrawn. Consequently, the proposed deletion of current § 23.1309(a) is also withdrawn.

Proposal 5-3. Several commentators questioned proposed §§ 23.1321(a), 25.1321(a), 27.1321(a) and 29.1321(a) (Proposals 5-3, 5-23, 5-42, and 5-56, respectively), concerning the visibility of instruments with a visual indicator for use in flight by any pilot. It was stated that the proposed standard did not adequately provide for instruments that were monitored infrequently during flight as contrasted with instruments more critical to flight safety. With respect to rotorcraft, one commentator also objected on the ground that the space available for mounting instruments was extremely limited. The FAA agrees that priority of instruments and instrument location needs to be more definitive. Therefore, proposed §§ 23.1321(a), 25.1321(a), 27.1321(a) and 29.1321(a) are withdrawn.

Several commentators objected to the phrase "under all cockpit lighting conditions" in proposed §§ 23.1321(e), 25.1321(e), 27.1321(d), and 29.1321(g), contending that it includes everything from lightning to total darkness resulting from complete electrical failure at night. In light of these comments and after further FAA review, proposed §§ 23.1321(e), 25.1321(e), 27.1321(d), and 29.1321(g) are revised to require consideration of all probable cockpit lighting conditions with respect to the visibility of malfunction indicators.

For another comment related to proposed § 23.1321(e), see Proposal 5-23.

Proposal 5-4. One commentator objected to proposed § 23.1323 on the ground that the resulting economic burden to aircraft owners is unwarranted. Another commentator objected to proposed § 27.1323(a) contending that it was unnecessary to calibrate the airspeed indicating instrument. The FAA disagrees with these comments. A requirement for the calibration of the airspeed indicating instrument is necessary to ensure that excessive error is not introduced into the system by the installation of a replacement instrument after the aircraft goes into service. In addition, the FAA believes that although the proposed calibration standards differ from the current standards, they impose little, if any, additional burden in showing compliance.

Another commentator (who concurred with the intent of the proposal to revise § 23.1323) questioned whether the allowable error, in proposed § 23.1323(b), should be expressed in terms of calibrated airspeed rather than indicated airspeed and whether the airspeed ranges specified in proposed §§ 23.1323(b)(1) and (b)(2) were unnecessarily severe accuracy requirements. The FAA agrees that the error allowed by proposed § 23.1323(b) should be expressed in terms of calibrated airspeed to be in accord with normal practices. However, the FAA believes that the airspeed ranges in proposed §§ 23.1323(b)(1) and (b)(2) are needed to encompass the airspeed limitations in proposed § 23.1545. The FAA also believes that, as a practical matter, the accuracy requirements in proposed § 23.1323 are not significantly more restrictive than the current requirements.

Accordingly, § 23.1323 is revised as proposed, except that the term "indicated airspeed" in paragraph (b) is changed to "calibrated airspeed."

Proposal 5-5. One commentator objected to the proposal to add a new § 23.1325(d), which would be identical to the standard required by § 23.1325(e), on the ground that general aviation airplanes should not be required to conform to transport category airplane standards. A key function of the altimeter system is to enable the pilot to maintain his assigned or required altitude during flight for the purpose of maintaining vertical separation from other aircraft. There is therefore a need for altimeter system accuracy for all aircraft.

Another commentator stated that the proposal would place accuracy requirements on static pressure systems that are more stringent than the requirements proposed for airspeed indicating systems in Proposal 5-4. The commentator stated that, under Proposal 5-4, a 5-knot error at 100 knots would be acceptable and this corresponds to an altitude error of more than 30 feet which would not be acceptable under proposed § 23.1325(d). The commentator suggested that the proposed altitude error tolerance of ± 30 feet (per 100 knots speed) be increased to ± 50 feet. The FAA disagrees with the commentator's suggestion. The proposed standard is identical to the standard required for transport category airplanes, which has been administered without difficulty in the past.

Proposal 5-6. One commentator objected to the proposal to amend § 23.1327 on the ground that it would allow an indefinite amount of interference, which would confuse the pilot. The FAA believes that the placard that would be required by proposed § 23.1327(c) would serve to alert the pilot to the fact that certain electrical loads, when switched on, cause excessive deviations of the magnetic nonstabilized direction indicator. The commentator further stated that if an additional magnetic direction indicator (having a deviation less than 10 degrees) is installed, there would no longer be a need for the magnetic non-

stabilized direction indicator. The FAA agrees that an additional magnetic nonstabilized direction indicator is not a practical alternative, and proposed § 23.1327 is revised to delete that alternative. However, the FAA believes that the proposed exception is appropriate for those instances in which a magnetic stabilized direction indicator or gyroscopic direction indicator is installed along with a magnetic nonstabilized direction indicator. The commentator also contended that the gyroscopic direction indicator alternative is not a practical solution because it must be reset frequently, thus increasing the pilot's workload. The FAA does not believe that the need to periodically reset the gyroscopic direction indicator adds significantly to the pilot's workload. Finally, this commentator stated that proposed § 23.1327(c) would allow interference that is contrary to current §§ 23.1327(a) and 23.1301(a)(4). With respect to current § 23.1327(a), the FAA believes the comment is valid, and that paragraph is revised for clarification. In view of this change, the requirements in current § 23.1327(a) and proposed § 23.1327(b) are combined into § 23.1327(a), and proposed § 23.1327(c) is redesignated § 23.1327(b). With respect to current § 23.1301(a)(4), the FAA does not believe the comment is valid, since the system consisting of a magnetic nonstabilized direction indicator and either a magnetic stabilized type or a gyroscopic type would meet that requirement.

Another commentator suggested that short term deviations (up to 30 seconds), caused by switching transients should be allowed without placarding the installation. The FAA does not agree. In general, the duration of switching transients is so short that their effect on the magnetic nonstabilized direction indicator is negligible. However, if switching does result in deviations exceeding 10 degrees for substantial intervals, the FAA believes the pilot must be so informed (by placarding) to avoid being misled or confused.

Proposal 5-7. The proposal to amend § 23.1329 is similar to proposals to amend §§ 23.1329 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 §§ 23.1329, 27.1329, and 29.1329 were set forth 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. The FAA is still reviewing all of these proposals, which concern automatic pilot systems. To avoid delaying the adoption of the amendments contained in Airworthiness Review Program Amendment No. 5, the disposition of these proposals has been deferred until final rule-making action is taken with respect to the proposals contained in Airworthiness Review Program, Notice No. 7; Airframe Proposals (Notice 75-26; 40 FR 24802; June 10, 1975).

Proposals 5-8 and 2-37. For comments related to the proposal to revise § 23.1335,

and for an explanation of the revisions to proposed § 23.1335, see Proposal 5-27.

Disposition of Proposal 2-37 to delete § 23.1335 (Notice 75-10) was deferred so that it could be considered in connection with Proposal 5-8. Proposal 2-37 is being withdrawn in view of the adoption, with revisions, of Proposal 5-8.

Proposal 5-9. One commentator suggested that the phrase "not used solely for starting engines" in proposed § 23.1351(f) could be misinterpreted. The explanation in the notice stated that the proposal was intended to prevent damage to the aircraft's electrical system if reverse polarity or reverse phase sequence of the external power source occurred. Therefore, as suggested by the commentator, proposed §§ 23.1351(f), 25.1351(c), 27.1351(e), and 29.1351(d) (designated as § 29.1351(c)) are clarified to require protection if "external power can be electrically connected to equipment other than that used for engine starting."

One commentator objected to proposed §§ 27.1351(e) and 29.1351(d) on the ground that they do not provide a reasonable limit on the extent to which one has to go to ensure that a reverse polarity connection cannot be made. The FAA believes that the proposals are clear and unambiguous as to their intent and as to what is required. The FAA believes that a more detailed requirement would be unnecessarily restrictive.

One commentator objected to proposed § 25.1351(c) on the ground that it does not cover every external power condition that should be protected against, and that its objective is already covered by current regulations on electrical systems and equipment. The purpose of the proposal is to provide for protection against those hazardous conditions involving external power that have occurred in service. With respect to the current regulations on electrical systems and equipment, they are not sufficiently specific to adequately deal with the subject matter of these proposals.

Proposal 5-10. No unfavorable comments were received on the proposed revisions of §§ 23.1353(b)(1), 25.1353(c)(1)(i), 27.1353(b)(1) and 29.1353(c)(1)(i) and those sections are amended as proposed.

Several commentators recommended that proposed §§ 23.1353(g), 25.1353(c)(6), 27.1353(g) and 29.1353(c)(6), be revised to apply to lead-acid batteries in addition to nickel cadmium batteries and to apply to batteries not used for starting as well as those used for starting. The FAA does not agree. There is no history of hazardous effects on structure or essential systems caused by excessive heating of lead-acid batteries. With respect to nickel cadmium batteries, excessive heating has only been associated with those batteries that were being used for starting.

One commentator stated that the content of proposed § 23.1353(g) is already covered by the first sentence of § 23.1353(b), which states that "safe cell temperatures and pressures must be maintained during any probable charging and discharging condition". The FAA does not

agree. That requirement covers the normal range of battery operating conditions and does not provide for the thermal runaway condition that has occurred in service with nickel cadmium batteries.

Another commentator contended that the temperature generated by a short circuit cannot be foreseen accurately and that it would be more advisable to take measures to prevent such short circuits instead of trying to counter their effects. The FAA believes that the temperature (and heat) generated by a short circuit can be determined with sufficient accuracy for design purposes. In addition, the FAA knows of no practical means that would prevent the internal short circuits of the battery that are caused by thermal runaway.

One commentator objected to proposed § 27.1353(g) because he considered that the proposal could be construed to require protection against damage that would not be hazardous. The FAA does not believe that the proposed language has that connotation. The intent of the term "hazardous effect" is to exclude non-hazardous damage that may occur.

One commentator suggested that warning systems, when provided, that alert the crew to take corrective action should be considered in determining the degree of thermal protection required for the surrounding structure. The FAA does not agree. Thermal protection is needed in case the warning is not observed by the crew, or the warning system itself fails.

Proposed §§ 23.1353(g), 25.1353(c) (6), 27.1353(g) and 29.1353(c) (6) are adopted without substantive change; however, they are designated as §§ 23.1353(f), 25.1353(c) (5), 27.1353(f), and 29.1353(c) (5), respectively.

Proposal 5-11. No unfavorable comments were received on the proposal to revise § 23.1357(b). Accordingly, the proposal is adopted without substantive change.

Proposal 5-12. No unfavorable comments were received on the proposal to amend § 23.1361(b). Accordingly, the proposal is adopted without substantive change.

Proposal 5-13. Several commentators objected to the increase in the anticollision light field of coverage requirement in the proposal to amend § 23.1401 on the ground that a light meeting the proposed requirement would be more expensive. One commentator contended that two anticollision lights would probably be needed to meet the proposed requirement, whereas only one was necessary to meet the current requirement in many instances. The FAA believes that the increased field of coverage can be attained with presently available anticollision lights by simply replacing the lens with another which redistributes the light output. The cost of the modified anticollision light would be about the same as that of those now in use. With regard to the need for two lights, the FAA believes that a single anticollision light that can be located on an airplane to meet a ± 30 degrees coverage require-

ment without exceeding obstructed-visibility limits will in most instances meet the ± 75 degrees coverage requirement without exceeding those limits.

One commentator objected on the ground that increasing anticollision light coverage does not improve safety in the air rescue situation, since normal crash landing techniques call for disabling all electrical power and the hazards associated with reapplying power to the anticollision lights outweigh the benefits. The FAA disagrees. The restoration, or continuation, of electrical power is not hazardous in all situations. The commentator further stated that position lights make the airplane visible to the control tower from directly below, and that, with the increased coverage requirements, the obstructed-visibility limits should be increased proportionately. The FAA believes that the intensity of position lights in the 30 to 75 degree range is small compared to the proposed anticollision light standards, and would be ineffective. With regard to the obstructed-visibility limits, the FAA believes that the present limits can still be met with anticollision lights having the increased field of coverage. The commentator also contended that it is likely the proposed increase in anticollision lights field of coverage could preclude compliance with the requirement that the crew's vision be unimpaired. While the FAA believes that an increase in field of coverage requirements for rotorcraft anticollision lights even at reduced intensity levels would adversely affect crew vision because of objectionable multiple reflections in the cockpit from the rotor blades, the FAA does not believe that redistribution of the light emitted by anticollision lights on airplanes to cover ± 75 degrees instead of ± 30 degrees would adversely affect the crew's vision.

In response to the proposal to amend § 25.1401, two commentators suggested that any proposal concerning anticollision lights should be discussed with the International Civil Aviation Organization (ICAO). However, the proposals as adopted will provide the same color requirement as the international standard. With regard to field of coverage, which is not an international standard but is set forth in an ICAO acceptable means of compliance, the adopted field of coverage requirement would meet that acceptable means of compliance. The FAA plans to propose a similar change in the ICAO field of coverage acceptable means of compliance.

Accordingly, the proposals to amend §§ 23.1401 and 25.1401 are adopted without substantive change.

Proposal 5-14. For comments related to the proposal to add a new § 23.1438, and for an explanation of revisions made to proposed § 23.1438, see Proposal 5-33.

Proposal 5-15. For comments related to the proposal to add new §§ 23.1447 (c) and (d), and for an explanation of the revisions made to proposed §§ 23.1447 (c) and (d), see Proposal 5-34.

Proposal 5-16. For comments related to the proposal to add a new § 23.1450, and for an explanation of the revisions

made to proposed § 23.1450, see Proposal 5-35.

Proposal 5-17. One commentator suggested that proposed § 23.1461(b) (2) be expanded to require demonstration of satisfactory overspeed and overtemperature margins, establishment of safe fatigue lives, and a fault analysis to show freedom from defects such as burst due to shaft failure and failure due to undetected loss of cooling air. The FAA believes that proposed § 23.1461(b) adequately deals with overspeed and overtemperature conditions and the term "malfunctions" in proposed § 23.1461(b) includes the "defects" mentioned by the commentator. With regard to establishing safe fatigue lives, the FAA does not believe that the need for such a requirement has been demonstrated. For other comments related to this proposal, see Proposal 5-38.

The proposal to add a new § 23.1461 is adopted without substantive change.

Proposal 5-18. The FAA is currently still reviewing the proposals to amend §§ 23.1545, 27.1545, and 29.1545, concerning marking requirements for airspeed indicators. To avoid delaying the adoption of the amendments contained in Airworthiness Review Program Amendment No. 5, the disposition of these proposals has been deferred until final rule-making action is taken with respect to the proposals contained in Airworthiness Review Program, Notice No. 7: Airframe Proposals (Notice 75-26; 40 FR 24802; June 10, 1975).

Proposal 5-19. A commentator recommended that proposed § 23.1547(e) be revised by inserting the words "the operation of" before the words "electrical equipment" to be consistent with the language in Proposal 5-6. The FAA agrees, and proposed § 23.1547(e) is revised accordingly. The commentator further suggested that the placard be required to state "which conditions, or combination of conditions" rather than "which electrical loads, or combination of loads" because deviation is not solely related to electrical loads, and to state the maximum deviation that occurs for those conditions (or combination of conditions) which cause a deviation of more than 10 degrees, so that the pilot is informed of the maximum expected error. The FAA believes that the proposed language covers the sources of excessive deviation that are allowed. With regard to the maximum deviation, the FAA believes that in view of the placarding requirements proposed, a requirement concerning maximum deviation is unnecessary.

Proposals 5-20 and 2-53. Several commentators objected to the provision in proposed § 25.831(e) (Proposal 5-20) that would require a means for independent control of both temperature and quantity of ventilating air in each compartment or area occupied by crewmembers.

In light of the comments received, and after further review, the FAA believes that with respect to crewmember compartments or areas which are ventilated by air interchange with other compartments or areas, a requirement to provide

Independent control of ventilating air temperature and quantity would impose a burden of complexity and cost not commensurate with its probable contribution to safety. However, with respect to those crewmember compartments and areas which are not ventilated by air interchange with other compartments or areas under all operating conditions, the FAA believes that a means for independent control of ventilating air temperature and quantity must be provided for the occupants to ensure that their ability to perform safety-related functions is not impaired. Proposed § 25.831(e) is revised accordingly.

One commentator recommended that the 800 cubic feet specified in proposed § 25.831(f)(1), and the 5 degrees F. specified in proposed § 25.831(f)(2), be revised to 1100 cubic feet and 10 degrees F., respectively. This commentator contended that a 1100 cubic-foot limit would not affect safety adversely, and that a 10 degree F. temperature differential between flight crew and passenger compartments would not contribute significantly to crew or passenger discomfort. The FAA does not have sufficient information at the present time to justify relaxing the current requirement to the extent recommended by the commentator.

One commentator suggested that the temperature and ventilation controls referred to in proposed § 25.831(f)(3) should be accessible to both pilots. The FAA agrees, and proposed § 25.831(f)(3) is revised to require that the temperature and ventilation controls be accessible to the flight crew.

Disposition of Proposal 2-63 to amend § 25.831 (Notice 75-10) was deferred so that it could be considered in connection with Proposal 5-20. Proposal 2-63 is withdrawn in view of the adoption, with revisions, of Proposal 5-20.

Proposal 5-21. For comments related to proposed § 25.1301(b) and for the withdrawal of proposed § 25.1301(b), see Proposal 5-1.

Proposal 5-22. The proposed changes to §§ 25.1309 (a) and (e) with respect to inserting the word "chapter" in place of "subchapter" were also proposed for § 27.1309(a) and § 29.1309 (a) and (d) (Proposals 5-40 and 5-55, respectively).

Several commentators objected to the proposed change from "subchapter" to "chapter" because it would broaden the scope of the requirement to include equipment, systems, and installations required by the subchapters dealing with various operating rules. One commentator contended that the proposal would require that equipment prescribed in an operating subchapter be designed and installed in each aircraft in order to obtain a type certificate. In the light of these comments, and after further review, the FAA believes that the proposed change of the word "subchapter" to "chapter" in §§ 25.1309 (a) and (e), 27.1309(a) and 29.1309 (a) and (d) would impose an unreasonable burden on the aircraft manufacturer. Accordingly, this proposed change has not been made.

Two commentators objected to proposed § 25.1309(b)(1) on the ground that the added provision dealing with the loss of all propulsive power is already adequately covered in present § 25.871(d), and that the occurrence of any failure condition which would preclude controlled flight to an emergency landing after loss of all propulsive power would have to be "extremely improbable" and this cannot be achieved. The FAA agrees, and proposed § 25.1309(b)(1) is withdrawn.

One commentator objected to proposed § 25.1309(b)(2) on the ground that "operational or performance capability", without qualification, is not a matter for safety regulation. In the light of this comment, and after further consideration, the FAA believes that the phrase "operational or performance capability of the airplane" could be misinterpreted and could cause difficulties in administering the requirement. Therefore, the FAA believes that the language in the current rule should not be changed in this regard. In addition, other commentators noted that the phrase "or the ability of the crew to cope with adverse operating conditions" in current § 25.1309(b)(2) had been omitted from proposed § 25.1309 (b)(2) without explanation, and recommended that it be restored as necessary for safety. The FAA agrees. The phrase was inadvertently omitted from the proposal. Accordingly § 25.1309(b)(2) as adopted retains the language in current § 25.1309(b)(2), except that the phrase "result in injury to the occupants, or" is deleted.

One commentator objected to proposed § 25.1309(d) contending that the method of compliance set forth in paragraph (d), which is applicable to paragraph (b), mandates unreasonably burdensome procedures. The requirements objected to by the commentator are contained in current § 25.1309. The FAA does not believe that requiring compliance with those provisions is unreasonably burdensome. Analyses along the lines prescribed in proposed § 25.1309(d) are being conducted by some manufacturers on a voluntary basis.

One commentator recommended that the term "flight simulator" in proposed § 25.1309(d) be changed to "simulator" to allow the use of simulators other than flight simulators. The FAA agrees, and proposed § 25.1309(d) is revised accordingly.

One commentator objected to proposed §§ 25.1309 (c) and (d) because they are less stringent than the present requirements, which call for an analysis, and tests where necessary, showing that systems, controls, and associated monitoring and warning means are designed "so that crew errors that would create additional hazards are improbable". As pointed out in the explanation for Proposal 5-22, the FAA has concluded that requiring a showing of compliance with present § 25.1309(d) is unreasonably burdensome. In particular, the FAA believes that it is not practicable to quantify the probability of crew errors. The FAA believes that the requirement,

"* * * to minimize crew errors which would create additional hazards", in proposed § 25.1309(c) would provide an adequate level of safety. Accordingly, proposed § 25.1309(c) is adopted without substantive change and the lead-in of § 25.1309(d) is amended to delete the reference to paragraph (c).

The proposed changes to §§ 25.1309 (e) and (f) with respect to the two-engine-inoperative condition on aircraft with three engines are substantively identical to the proposed changes to §§ 29.1309 (d) and (e) (Proposal 5-55). One commentator objected to proposed §§ 25.1309 (e)(3) and (f), and proposed §§ 29.1309 (d)(3) and (e), on the ground that they do not provide adequate guidance as to which loads are required during the proposed two-engine-inoperative condition on aircraft with three engines. This commentator recommended that the term "flight safety loads" be used instead of "essential loads" for that condition. The FAA does not agree. The FAA believes that proposed §§ 25.1309(f) and 29.1309(e) are clear in that the monitoring of power loads is allowed in those circumstances and loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines. One commentator objected to the proposed two-engine-inoperative condition on aircraft with three engines on the ground that it would impose a requirement for an unreasonable amount of power, in that both units of dual systems would be required to operate during that condition. The FAA disagrees. The procedure set forth in proposed §§ 25.1309(f) and 29.1309(e), which would apply to the two-engine-inoperative condition on three-engine aircraft, would allow the monitoring of one unit of a dual system in those circumstances. Another commentator objected to proposed § 29.1309(d)(3)(ii) contending that the requirement was unreasonable for rotorcraft since they cannot maintain flight with only one third of installed power. The FAA does not agree that the requirement is unreasonable for rotorcraft. The proposal would ensure that at least those power loads necessary for controlled descent to a safe landing are supplied for the two-engine-inoperative condition on a three-engine rotorcraft. Accordingly, proposed §§ 25.1309 (e)(3) and (f), § 29.1309(d)(3) and the proposed change to § 29.1309 (e) are adopted without substantive change.

Proposal 5-23. For a discussion of the comments related to proposed § 25.1321 (a) and the withdrawal of that proposal, see Proposal 5-3.

With regard to proposed § 25.1321(e), one commentator suggested that it be revised to apply only to those instruments required under current §§ 25.1303 and 25.1305. The commentator stated that the special lighting provisions that would be required for optional equipment by proposed § 25.1321(e) could be distracting under certain emergencies and could create unnecessary loads on the available power supply. The FAA

does not believe that a distinction in this regard is warranted between required and optional instruments. The FAA believes that if a malfunction indicator has been provided for the crew it should be effective under all probable cockpit lighting conditions.

For other comments related to Proposed § 25.1331(e), see Proposal 5-3.

Proposals 5-24 and 2-24. The disposition of the proposals to amend § 25.1329 has been deferred until final rule-making action is taken with respect to the proposals contained in Airworthiness Review Program, Notice No. 7: Airframe Proposals (Notice 75-26; 40 FR 24802; June 10, 1975). See Proposal 5-7.

Proposals 5-25 and 2-25. Several commentators objected to the proposed deletion of the words "or adjacent to" in current § 25.1331(a)(1) contending that it would restrict flexibility in design and that an integral power failure warning would not necessarily increase warning reliability. The FAA believes that a power failure warning device incorporated within the instrument itself, as opposed to an external device, is more likely to be noticed by the pilot, and would be less vulnerable to wiring or connector failures that may result in loss of the warning function.

One commentator suggested that proposed § 25.1331(a)(3) should apply only to those instruments that present primary navigation data, since navigation is conducted primarily with reference to such instruments and duplication of warning on secondary navigation instruments does not necessarily improve warning reliability. The FAA believes that the instruments covered by proposed § 25.1331(a) are all "primary" in the sense implied by the commentator.

Several commentators, referring to proposed § 25.1331(a)(3), stated that the additional mechanisms and devices necessary to meet this requirement would complicate the design of the instrument to the extent that its reliability would be degraded. The FAA believes that a properly designed warning system would not significantly reduce instrument reliability. Instruments having such warning systems have performed reliably in service.

Several commentators contended that a practicable design meeting proposed § 25.1331(a)(3) is not within the state of the art and that in some instances a triple system, with comparators to monitor and compare signals, would be required. The FAA's intent is to require no more than a single system for failure warning. Compliance could be shown, in general, without comparators. Such systems are in use today and are well within the state of the art.

One commentator suggested that the visual warning system that would be required by proposed § 25.1331(a)(3) would tend to reduce or eliminate the sound safe practice of pilots cross-checking instruments to authenticate the information presented. The FAA disagrees. The FAA does not believe that the proposed rule would affect the pilot's cross-checking

procedures. In addition, the FAA believes that the warning system would reveal unsafe conditions more effectively and, in some instances, would warn of unsafe conditions that cross-checking would not detect.

Accordingly, the proposed change to § 25.1331(a)(1) and the proposed new § 25.1331(a)(3) are adopted without substantive change.

Disposition of Proposal 2-25 to revise § 25.1331(a)(2) (Notice 75-10) was deferred so that it could be considered in connection with Proposal 5-25. No unfavorable comments were received on the proposal to revise § 25.1331(a)(2); however, the phrase "provided that instrument operation is maintained" is deleted from proposed § 25.1331(a)(2) since it is superfluous and could be confusing.

Proposal 5-26. One commentator objected to proposed § 25.1333(b), contending that an instrument display essential to the safety of flight should not have to be switched on when needed. Before an instrument can be switched on, the pilot must first recognize the problem, decide what to do, and then act. The result, the commentator stated, is a time delay that cannot be tolerated at certain critical points in flight, such as immediately after takeoff, and immediately before landing, especially during instrument flight conditions. Another commentator stated that crew action should be allowed for the purpose of restoring power supplies, or selecting an alternative information source, or the like, provided that it is not necessary to do so immediately.

In the light of these comments, and after further review, the FAA believes that this proposal may affect safety adversely. Accordingly, proposed § 25.1333(b) is withdrawn. The proposed editorial change to § 25.1333(a) is adopted.

Proposal 5-27. One commentator objected to proposed § 25.1335 on the ground that mode indication other than mode selector switch position would be impractical and too costly a retrofit. The FAA notes that the proposed requirement would apply only to airplanes for which an application for a type certificate is filed after the effective date of this amendment. Consequently, no retrofit is required. The commentator further stated that the probable complexity of the proposed mode indication device could detract from the reliability of the system and that systems already fitted with the proposed mode indication device have not proven to be 100 percent foolproof. With regard to the complexity of the mode indication device, the FAA does not believe that systems now fitted with the proposed mode indication device have suffered a significant loss in reliability. In addition, the proposed mode indication device would greatly increase the probability that the current mode of operation is properly indicated to the flight crew.

One commentator criticized the proposed phrase "independent of the mode selector switch" because it would tend to dictate design. Another commentator objected to the same phrase on the ground

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 since they are incorporated in it. The FAA agrees with these comments. The phrase "independent of the mode selector switch" is deleted from proposed § 25.1335 and another sentence is added thereto reading "Selector switch position is not acceptable as a means of indication."

One commentator objected to proposed § 25.1335 on the ground that some flight director systems are designed so that the position of the mode selector switch is adequate for mode indication. The FAA knows of no flight director system in which the position of the mode selector switch constitutes a reliable indication of the current mode of operation. Service experience has shown that the two do not necessarily agree. This commentator also stated that the proposed requirement is not practical for small airplanes and is not consistent with requirements that apply to other systems on small airplanes. The FAA believes that the hazards associated with incorrect indication of the flight director system's mode of operation warrant the proposed requirement.

Proposal 5-28. For comments related to the proposal to add a new § 25.1351(c), see Proposal 5-9.

Several commentators stated that proposed §§ 25.1351(d) and 29.1351(c) do not conform to the special condition on which they were based, since they would require the aircraft to operate safely for 5 minutes without normal generator or battery power, whereas the special condition allowed the use of battery power. The FAA agrees that proposed §§ 25.1351(d) and 29.1351(c) should be revised for consistency with recently issued special conditions. The proposals are therefore revised by adding, after the word "power" in the first sentence, the parenthetical phrase "(electrical power sources excluding the battery)".

One commentator stated that §§ 25.1351(d) and 29.1351(c) were unreasonable in that they would require compliance at the maximum certificated altitude, with critical type fuel, and after loss of electrical power, which is a combination that has not occurred in service. The FAA believes that this set of conditions could exist in service, and that it must be considered in the interests of safety. One commentator suggested that the phrase "including a wire bundle or junction box fire" in proposed §§ 25.1351(d)(1) and 29.1351(c)(1) be deleted since these are not "single" malfunctions. The FAA does not agree that they should be deleted. The FAA believes that the occurrence of a fire in a wire bundle or in a junction box should be considered in this context as a single event or malfunction, even though it may result in several circuit failures.

One commentator suggested that proposed §§ 25.1351(d) and 29.1351(c) should provide for continued flight after the specified 5 minute interval. The re-

ommended change is beyond the scope of the notice. In addition, the FAA does not have sufficient information at the present time to justify such a requirement.

Another commentator questioned whether engine thrust reduction and descent, or engine(s) flameout, descent, and subsequent engine restart at a reasonable altitude, would meet the requirements of the proposed rule. The FAA believes that proposed § 25.1351(d) provides for the situation described by the commentator as long as the airplane can be operated safely.

One commentator objected to proposed § 29.1351(c), contending that the requirement was unnecessary for rotorcraft and would result in the introduction of electrical systems of unnecessary complexity and increased likelihood of mismanagement. The FAA does not agree. The loss of normal generator power is potentially hazardous in all transport category aircraft and must be considered in electrical system design. As to the effect on electrical system complexity and the probability of mismanagement, the FAA has not observed a significant increase in complexity or cases of mismanagement on aircraft that have already been required to comply under a special condition.

Accordingly, proposed §§ 25.1351(d) and 29.1351(c) (designated as § 29.1351(d) for consistency with § 25.1351) are adopted with the revision discussed herein.

Proposal 5-29. For comments related to proposed §§ 25.1353(c)(1)(i) and 25.1353(c)(6) see Proposal 5-10.

Proposal 5-30. For comments related to the proposal to amend § 25.1401 see Proposal 5-13.

Proposal 5-31. One commentator objected to proposed § 25.1421(a) on the ground that since a megaphone is not required to be designed to withstand the ultimate inertia forces specified in § 25.561(b)(3), the airframe manufacturer cannot guarantee that a megaphone will perform its function after being subjected to those forces. The FAA agrees that the requirement of proposed § 25.1421 that "the megaphone be so protected that it will perform its function after being subjected to the ultimate inertia forces specified in § 25.561(b)(3)" is too restrictive in the absence of appropriate design standards for the megaphone itself. Accordingly, proposed § 25.1421(a) is revised to read, "If a megaphone is installed, a restraining means must be provided that is capable of restraining the megaphone when it is subjected to the ultimate inertia forces specified in § 25.561(b)(3)."

In addition, the FAA notes that current § 25.1561(b) requires that each location, such as a locker compartment, that carries life saving equipment (which includes megaphones) must be marked accordingly. Proposed § 25.1421(b) would add little to that requirement, and could raise questions about the meaning of § 25.1561(b) with respect to other life saving equipment. For these reasons, proposed § 25.1421(b) is withdrawn.

Proposal 5-32. Several commentators objected to proposed § 25.1435(a)(2), contending that pressure and fluid quantity gages are not necessary for all hydraulic systems. Another commentator stated that the proposal specifies a design detail rather than a requirement and would rule out other displays such as digital callouts. After further review, the FAA believes that pressure and fluid quantity gages are not needed for all hydraulic systems covered by proposed § 25.1435(a)(2). Indicating means other than gages, including warning lights, may be adequate for some systems. Accordingly, the lead-in of proposed § 25.1435(a)(2) is revised to require "a means to indicate" instead of a gage, for system pressure and for fluid quantity.

No unfavorable comments were received concerning proposed § 25.1435(a)(2)(i) and it is adopted without substantive change.

One commentator suggested that the malfunctions referred to in proposed § 25.1435(a)(2)(ii) be limited to those associated with low fluid pressure or level. The FAA does not agree. An indicating means for system pressure and fluid quantity would aid the pilots in detecting malfunctions other than low pressure or low fluid quantity. Proposed § 25.1435(a)(2)(ii) is adopted without substantive change.

One commentator stated that the value of 125 percent in proposed § 25.1435(a)(4) was unrealistic and recommended a value of 133 percent. The FAA disagrees. The 125 percent value is in the current rule and the FAA believes that it is appropriate. Proposed § 25.1435(a)(4)(ii) is adopted without substantive change.

No unfavorable comment was received concerning proposed § 25.1435(a)(7) and it is adopted without substantive change.

One commentator suggested that proposed § 25.1435(a)(8) should be revised to take into account the hazardous effects of system failures due to abnormally high temperatures which may occur under certain fault conditions. The FAA does not have sufficient information at the present time to justify such a requirement. Proposed § 25.1435(a)(8) is adopted without substantive change.

Proposal 5-33. One commentator stated that if the term "components" in proposed §§ 25.1438(a) and (b) included all parts of the system it would not be compatible with other sections of Part 25, which use the term "elements". The FAA intended that the term "components" include all parts of the system. Therefore, in order to be consistent with current § 25.1435, which uses the term "elements", that term is substituted for the term "components" in proposed §§ 25.1438(a) and (b).

Another commentator recommended that the 1.5 factor in proposed § 25.1438(a) be reduced to 1.33 to be consistent with current § 25.365(d), which deals with pressurized cabin loads. The FAA does not agree. The FAA does not believe that the factors specified for pressurized cabin loads are appropriate for

pressurization system elements. These elements are more comparable to hydraulic system elements for which a 1.5 factor is prescribed in current § 25.1425(a)(1). Proposed § 25.1438(a) is adopted without substantive change.

One commentator questioned the need to specify a higher burst pressure for pneumatic systems than for pressurization systems, contending that pneumatic systems do not necessarily operate at higher pressure and that some are derived from pressurization systems. The FAA's experience has been that pneumatic systems in airplanes are operated at higher pressures, even when a common pressure source is provided for both pneumatic and pressurization systems.

One commentator objected to the provision in proposed § 25.1438(b) requiring a burst pressure test of 4.0 times maximum normal operating pressure, contending that the industry has historically designed and tested pneumatic systems to a burst pressure of 3.0 times maximum normal operating pressure and that service experience over millions of flight hours has proven the integrity of those systems. Another commentator pointed out that pneumatic deicer boots in general use today cannot sustain a pressure of 4.0 times the maximum normal operating pressure. The FAA agrees with these comments, and proposed § 25.1438(b) is revised to specify a burst pressure of 3.0 times maximum normal operating pressure.

Two commentators recommended that the 4.0 factor in proposed § 25.1438(b) be reduced selectively in particular circumstances, contending that a lower factor might be acceptable for certain materials, or when adequate fatigue testing has been done or service experience supports it. The FAA believes that this recommendation (insofar as it would be applicable to a 3.0 burst pressure factor) may have merit but has insufficient data at the present time upon which to base such lower factors.

Another commentator suggested that the 1.5 factor in proposed § 25.1438(b) should be increased to monitor the effects of manufacturing techniques. The FAA does not agree. These effects are monitored by means of FAA's quality control requirements, as set forth in Part 21.

One commentator suggested revision of proposed § 25.1438 to allow the use of analysis, or a combination of analysis and test, as an alternative method of compliance to eliminate unnecessary testing. The FAA agrees that there are instances where an analysis, or a combination of analysis and test, may be equivalent to a test under proposed § 25.1438(a) or (b). Accordingly, a new § 25.1438(c) is added to provide this alternative.

Proposal 5-34. One commentator objected to the provision in proposed § 25.1447(c)(1) which would require that oxygen dispensing units be automatically presented before the cabin pressure altitude exceeds 14,000 feet, contending that long-standing FAA policy

has been that the altitude for automatic presentation should be 15,000 feet and service experience over the last 16 years has not shown a need to reduce that altitude. The commentator further stated that the flight crew is given a warning when or before the cabin pressure altitude reaches 10,000 feet and is therefore alerted (in the event of a gradual increase in cabin pressure altitude) to the need for appropriate action either to maintain a safe cabin pressure altitude or manually deploy the dispensing units. Another commentator suggested that the presentation altitude be 14,500 feet, rather than 14,000 feet, to take equipment tolerances into account.

In light of the comments received and after further review, the FAA believes that there is insufficient evidence at the present time to justify a requirement for the automatic presentation of oxygen dispensing units before the cabin pressure altitude exceeds 14,000 feet, and that the widely-used value of 15,000 feet provides an adequate level of safety. Proposed § 25.1447(c)(1) is revised accordingly.

Several commentators disagreed with the provision in proposed § 25.1447(c)(1) that would require that each occupant be provided with a manual means to make the oxygen dispensing unit immediately available, contending that manual back-up for the automatic presentation system should be provided for use by the crew only, to avoid tampering by the passengers. Another commentator stated that the average passenger would not be capable of operating such manual means properly and quickly, and that manual means are not feasible for ceiling or hatrack mounted dispensing units.

The FAA believes that a manual means must be provided to back up the automatic presentation system, but is persuaded that it may not be in the interest of safety to require that a manual means be provided for passengers. Accordingly, proposed § 25.1447(c)(1) is revised to require only that a manual means for the deployment of the dispensing units be provided for the crew.

No unfavorable comment was received concerning proposed § 25.1447(c)(2) and it is adopted as proposed.

Proposal 5-35. Several commentators recommended that proposed § 25.1450 be revised to require a means to indicate that the generator (or replacement element) has not been used and is capable of providing its rated amount of oxygen. The FAA believes that, in view of current § 25.1441(c), there is no need for this additional requirement.

Several commentators objected to proposed § 25.1450(b)(2)(i) on the ground that a positive flow indicating device located on the generator would provide insufficient safety improvement for the cost involved. After further review, the FAA does not believe that there exists adequate justification for the proposed requirement at the present time and it is withdrawn.

One commentator suggested that the word "installation" be added after the

word "generator" in the lead-in of proposed § 25.1450(b) because, as proposed, the surface temperature of the actual generator must be contained by its installation. The FAA sees no need for this revision.

One commentator questioned the desirability of replacing generator elements during flight. The FAA believes that the practical problems of manually replacing and stowing expended generator elements, which reach high temperatures, make it very unlikely that generators requiring manual in-flight replacement of elements would be utilized. Instead, generator elements would be replaced during ground maintenance. For this reason, proposed § 25.1450(c)(2) is withdrawn.

One commentator objected to proposed § 25.1450(c)(1)(ii) contending that the proposal should not require that the generator placard contain the duration of the replacement element since a means to determine flow in the dispensing equipment is provided. The FAA does not agree; it is necessary that the duration of the replacement element be on the placard to reduce the probability that an element of insufficient capacity is inserted when the generator is serviced.

Proposal 5-36. Several commentators objected to proposed §§ 25.1457(b) and 29.1457(b). The FAA believes that the comments received raise valid questions as to whether compliance with proposed §§ 25.1457(b) and 29.1457(b) would necessarily improve cockpit voice recorder intelligibility, and whether requiring multiplexing or separate area microphone recording channels (involving extensive redesign of the cockpit voice recorder) could be justified on a cost-benefit basis. Accordingly, proposed §§ 25.1457(b) and 29.1457(b) are withdrawn.

Several commentators objected to proposed §§ 25.1457(d)(1) and 29.1457(d)(1) because the additional load on the emergency bus would reduce the power available to sustain safe flight in an emergency. The FAA agrees, and proposed §§ 25.1457(d)(1) and 29.1457(d)(1) are withdrawn.

Two commentators objected to proposed §§ 25.1457(e) and 29.1457(e) contending that, although the random storage method may have caused problems in earlier years, the cockpit voice recorder manufacturers have since taken steps to eliminate the problem by improvements in design, and there is therefore no justification for specifying that the tape be stored on reels, which is an unnecessarily restrictive requirement. In light of this comment and after further review by the FAA, §§ 25.1457(e) and 29.1457(e) are withdrawn. In view of the withdrawal of proposed §§ 25.1457(b), (d)(1), and (e) and 29.1457(b), (d)(1), and (e) the related provisions of proposed §§ 121.359(c)(3) and (c)(4) and 127.127(b) are also withdrawn.

Several commentators suggested that the underwater locating device specified in proposed §§ 25.1457(g)(3) and 121.359(c)(2)(iii) was superfluous when the

flight recorder (which must have an underwater locating device under current § 121.343(f)) and the cockpit voice recorder are co-located. The FAA agrees that an exception is warranted in this circumstance, provided that the installation of the flight recorder and the cockpit voice recorder is such that they are not likely to be separated during crash impact. Accordingly, proposed § 121.359(c)(2)(iii) is adopted with this exception. No revision to proposed § 25.1457(g)(3) is needed and proposed § 25.1457(g) is adopted without substantive change.

Two commentators objected to proposed § 121.359(c)(2) on the ground that up to 3 years would be needed by the airlines to make the airplane modifications prescribed. The FAA agrees, and the lead-in of proposed § 121.359(c)(2) is revised to allow 3 years (from the effective date of this amendment) for compliance. Proposed § 121.359(c) is adopted with the revisions discussed herein.

Proposal 5-37. Several commentators objected to proposed § 25.1459(a)(4), which would require a means for pre-flight checking of the flight recorder for proper operation. One commentator stated it is not technically within the state-of-the-art to meet this test requirement for foil-recording systems, and that the proposed requirement is unnecessarily restrictive. Another commentator contended that there would be a prohibitive increase in flight-crew and ground-crew workload to conduct the proposed test. In light of these comments, and after further review by the FAA, the FAA believes that proposed § 25.1459(a)(4) would be unnecessarily restrictive. Accordingly, proposed § 25.1459(a)(4) is withdrawn.

No unfavorable comments were received concerning proposed § 25.1459(d) and the proposed deletion of current § 25.1459(a)(7). Accordingly, § 25.1459(a)(7) is deleted and proposed § 25.1459(d) is adopted without substantive change. In addition, since the intent of the proposal was that it only apply to airplanes type certificated in the future, § 121.343(e), which requires compliance with the provisions of § 25.1459, is clarified by revising the first sentence of the lead-in to state that the applicable requirements are those of § 25.1459 in effect one day prior to this amendment.

Proposal 5-38. One commentator objected to proposed § 25.1461, contending that there is no need for it since current §§ 25.1309 and 25.901(c) provide adequate coverage for this item. The FAA does not agree. Sections 25.1309 and 25.901(c) list general requirements, the former for all classes of equipment and the latter for powerplant installations. These general requirements do not contain the detailed airworthiness standards specifically applicable to high energy rotors that the FAA believes are necessary for the reasons stated in the explanation of this proposal.

Another commentator suggested that the proposal be clarified as to whether § 25.1461(a) requires compliance with either paragraph (b), or (c), or (d). The FAA believes that the proposed language is clear in this respect. The applicant is

required to comply with one of those paragraphs, and he may select any one of them.

For another comment related to this proposal, see Proposal 5-17.

The proposal to add a new § 25.1461 is adopted without substantive change.

Proposal 5-39. For comments related to proposed § 27.1301 and for the withdrawal of proposed § 27.1301, see Proposal 5-1.

Proposal 5-40. For comments related to the proposal to amend § 27.1309(a), and for the withdrawal of this proposal, see Proposal 5-22.

Proposals 5-41 and 2-129. The disposition of the proposals to add new §§ 27.1311 and 27.1329 has been deferred until final rule-making action is taken with respect to the proposals contained in Airworthiness Review Program, Notice No. 7: Airframe Proposals (Notice 75-26; 40 FR 24802; June 10, 1975). See Proposal 5-7.

Proposal 5-42. For comments related to proposed § 27.1321(a), and the withdrawal of proposed § 27.1321(a), see Proposal 5-3.

For comments related to proposed § 27.1321(d), see Proposals 5-3 and 5-23.

Proposal 5-43. For a comment related to the proposal to add a new § 27.1323(a), see Proposal 5-4. No unfavorable comments were received concerning proposed § 27.1323(b). The proposal to amend § 27.1323 is adopted without substantive change.

Proposals 5-44, 2-35, 2-83, 2-128 and 2-183. Several commentators objected to proposed § 27.1325(b) in Proposal 5-44 on the ground that Part 27 rotorcraft are not normally certificated for flight under IFR or icing conditions. Since static vent icing may occur during both VFR and IFR conditions, the FAA believes there is ample justification for requiring an anti-icing means or an alternate source of static pressure for the certification of all rotorcraft employing a static pressure system for required instruments.

One commentator stated that even if a static pressure system failure occurred, it would not jeopardize safe flight and a safe landing. The FAA disagrees. A static pressure failure would result in the loss of reliable airspeed and altitude information.

Another commentator stated that the implication of proposed § 27.1325(b) in Proposal 5-44, when compared with current § 23.1325(b) (3), is that the reading of the altimeter when on the alternate static pressure system cannot differ from the reading of the altimeter when on the primary static pressure system. The FAA agrees and proposed § 27.1325(b) is revised by adding a sentence identical to the last sentence of current § 23.1325(b) (3) which indicates that error is allowed and requires a correction card for errors greater than 50 feet.

Disposition of Proposals 2-35, 2-83, 2-128 and 2-183 to amend §§ 23.1325, 25.1325, 27.1325 and 29.1325, respectively (Notice 75-10) was deferred so that they could be considered in connection with Proposal 5-44.

One commentator stated that proposed § 23.1325(c), which would provide for more complete duality of static pressure sources, should not be applied to unpressurized aircraft if it is demonstrated that the static pressure system calibration, when each static pressure source is selected, is not changed by the other static pressure source being open or blocked.

The FAA believes this suggestion has merit with respect to the proposed requirement that when a static pressure source is selected the other static pressure source must be blocked off. However, the exception would only be appropriate if it is demonstrated that the static pressure system calibration, when each static pressure source is selected, is not changed by the other static pressure source being open or blocked.

Accordingly, proposed §§ 23.1325(c), 25.1325(g), 27.1325(b), and 29.1325(f) (Proposals 2-35, 2-83, 2-128, and 2-183, respectively) are adopted without substantive change (proposed § 27.1325(b) in Proposal 2-128 and proposed § 29.1325(f) in Proposal 2-183 are redesignated §§ 27.1325(c) and 29.1325(g), respectively, in view of the adoption of Proposals 5-44 and 5-57) and new §§ 23.1325(d), 25.1325(h), 27.1325(d), and 29.1325(h) contain the exception discussed here.

Proposal 5-45. For comments related to the proposal to amend § 27.1327, and for an explanation of revisions to current § 27.1327(a) and proposed § 27.1327(b) and (c), see Proposal 5-6.

Proposal 5-46. For comments related to the proposal to add a new § 27.1335, and for an explanation of the revisions to proposed § 27.1335, see Proposal 5-27.

Proposal 5-47. For comments related to the proposal to add a new § 27.1351(e) see Proposal 5-9.

Proposal 5-48. For comments related to proposed §§ 27.1353(b) (1) and 27.1353(g) see Proposal 5-10.

Proposal 5-49. No unfavorable comments were received on the proposal to amend § 27.1357(b). Accordingly, the proposal is adopted without substantive change.

Proposal 5-50. The proposed amendment of § 27.1401 relating to anticollision light field of coverage, color, and minimum intensity requirements has been adopted, with revisions, in a separate rule-making action (Amtdt. 27-10; 41 FR 6290), as noted previously in this preamble.

Proposal 5-51. The disposition of the proposal to amend § 27.1545 has been deferred until final rule-making action is taken with respect to the proposals contained in Airworthiness Review Program, Notice No. 7: Airframe Proposals (Notice 75-26; 40 FR 24802; June 10, 1975). See Proposal 5-18.

Proposal 5-52. For comments related to the proposal to add a new § 27.1547(e), and for an explanation of the revisions to proposed § 27.1547(e), see Proposal 5-19.

Proposal 5-53. For comments related to proposed § 29.1301 and for the withdrawal of proposed § 29.1301, see Proposal 5-1.

Proposal 5-54. One commentator questioned the exception in proposed § 29.1303(g) in that it only applies to those rotorcraft with a third attitude indicating system and does not apply to those rotorcraft that are only required to have one attitude indicating system but have two. The FAA does not have sufficient information at this time to justify extending the proposed exception, as recommended by the commentator.

Another commentator suggested that the 30-minute minimum interval specified in proposed § 29.1303(g) (3) should be changed to "half the endurance of the rotorcraft". The FAA believes the proposed requirement would give the flight crew sufficient time to take corrective action, or land, as the situation may dictate.

Accordingly, § 29.1303(g) is adopted as proposed.

Proposal 5-55. For comments related to the proposal to amend § 29.1309, see Proposal 5-22.

Proposal 5-56. For comments related to proposed § 29.1321(a) and the withdrawal of proposed § 29.1321(a), see Proposal 5-3.

For comments related to proposed § 29.1321(g) see Proposals 5-3 and 5-23.

Proposal 5-57. For comments related to proposed § 29.1325(c), see Proposal 5-44. In light of the comments received and after further review, the FAA believes that there is not sufficient justification to adopt a requirement for Part 29 rotorcraft that is more restrictive than that in proposed § 27.1325(b) for Part 27 rotorcraft. Accordingly, proposed § 29.1325(c), as adopted, is revised to be substantively identical to § 27.1325(b) as adopted.

Proposals 5-58 and 2-184. The disposition of the proposals to amend § 29.1311 has been deferred until final rule-making action is taken with respect to the proposals contained in Airworthiness Review Program, Notice No. 7: Airframe Proposals (Notice 75-26; 40 FR 24802; June 10, 1975). See Proposal 5-7.

Proposal 5-59. For comments related to the proposal to add a new § 29.1335, and for an explanation of the revisions to proposed § 29.1335, see Proposal 5-27.

Proposal 5-60. For comments related to the proposal to add a new § 29.1351(c), see Proposal 5-28. For comments related to the proposal to add a new § 29.1351(d), see Proposal 5-9.

Proposal 5-61. For comments related to proposed §§ 29.1353(c) (1) (1) and 29.1353(c) (6), see Proposal 5-10.

Proposal 5-62. A commentator suggested that it would be more appropriate to cover the content of proposed § 29.1355(b) (1) in § 29.1309 or § 29.1351. The FAA does not agree. Proposed § 29.1355(b) (1) states a requirement concerning distribution systems and distribution systems are the subject matter of current § 29.1355. Accordingly, § 29.1355(b) (1) is adopted without substantive change.

Proposal 5-63. The proposed amendment of § 29.1401 relating to anticollision light field of coverage, color, and minimum intensity requirements has been adopted, with revisions, in a separate

rule-making action (Amdt. 29-11; 41 FR 5290), as noted previously in this preamble.

Proposal 5-64. For comments related to the proposal to revise §§ 29.1457(b), (d) (1), and (e), and for the withdrawal of that proposal, see Proposal 5-36.

Proposal 5-65. The disposition of the proposal to amend § 29.1545 has been deferred until final rule-making action is taken with respect to the proposals contained in Airworthiness Review Program, Notice No. 7: Airframe Proposals (Notice 75-26; 40 FR 24802; June 10, 1975). See Proposal 5-18.

Proposal 5-66. For a comment related to the proposed revision of § 91.33(d) (3), see Proposal 5-54.

Section 91.33(d) (3) is adopted as proposed.

Proposal 5-67. One commentator objected to the proposal to amend § 91.36 because he believed it would allow compliance with either current § 91.36(b) or proposed § 91.36(c). The commentator misinterpreted the proposal. The proposal would require compliance with § 91.36 (a), (b), and (c).

Another commentator contended that the term "performance standards" in proposed § 91.36(c) would cause confusion and suggested that the word "performance" be deleted. Since the intent of the proposal was to require compliance with all of the minimum standards in the specified TSOs, the FAA agrees with the comment and the word "performance" is deleted in the amendment.

Two commentators suggested revisions to proposed § 91.36(c) that would, in effect, allow the continued operation of currently installed pressure altitude reporting equipment using altimeters and digitizers that do not meet the standards in TSO-C10b and TSO-C88 respectively. The FAA believes that unless these standards are met, there is no assurance that altimeters and digitizers will perform their important altitude reporting function under all probable operating conditions during flight. For this reason, the commentators' suggestion is not adopted. However, after further consideration, the FAA believes that the proposed one-year installation period (after the effective date of the amendment) may not allow enough time to procure and install altimeters and digitizers which comply. Accordingly, the amendment as adopted prescribes a two-year installation period.

One commentator recommended that proposed § 91.36(c) be revised by replacing the term "digitizers" with the term "automatic pressure altitude digitizer equipment" (which is the complete term used in current TSO-C88) because the use of the term "digitizers" would allow approval of equipment that did not meet the standards in TSO-C88. The FAA does not believe that the recommended revision is necessary. It is clear that the equipment referred to must meet the standards in TSO-C88.

The proposal to amend § 91.36 is adopted with the revisions discussed herein.

Proposal 5-68. After further consideration of the proposal to amend § 121.337,

and in light of the comments received, the FAA believes that the issues involved warrant further study. Accordingly, the proposal to amend § 121.337 is withdrawn.

Proposal 5-69. Several commentators objected to proposed § 121.343(a). The objections included the following:

- Each new airplane design is sufficiently different to preclude identifying identical components, and system status, that would have the same effect upon controlled flight.

- Flight recorders meeting the current requirements are providing the answers for accident investigation. There is no hard evidence that additional parameters are needed.

- The proposed additional parameters represent a growth of over 100 percent in existing flight recorder systems, with a corresponding growth in system complexity. The result would be a sharp decrease in the reliability of not only the flight recorder but also of the equipment monitored, much of it essential to safe flight.

- The proposed additional parameters would require the installation of systems and components of major cost whose sole purpose is to aid accident investigation. One commentator estimated that the modification program would cost the airline industry \$35 million, including airplane out-of-service costs. There would also be greatly increased maintenance costs because of the increased complexity of the system.

- The proposed additional parameters have not been justified on a cost-benefit basis, and no rationale has been given to justify the selection of the proposed parameters from all of the parameters that could be recorded.

- Although some of the proposed additional parameters may enhance the recording system, the implementation of even these would take at least three years.

- The proposal does not provide ranges, accuracies, or recording intervals for the additional parameters.

In the light of these comments, and after further review, the FAA believes that the need for the proposed additional flight recorder parameters has not been justified. Moreover, the FAA now believes that standards setting forth acceptable ranges, accuracies, and recording intervals, for such additional parameters should be developed concurrently with the requirement that they be provided.

Accordingly, proposed § 121.343(a) is withdrawn.

Proposal 5-70. For comments related to the proposal to revise § 121.359(c) and for an explanation of the revisions to proposed § 121.359(c), see Proposal 5-36.

Proposal 5-71. For comments related to the proposal to revise § 127.127(b) and for the withdrawal of that proposal, see Proposal 5-36.

DRAFTING INFORMATION

The principal authors of this document are Irving Fagin, Flight Standards Service, and James M. Barron and Keith S. May, Office of the Chief Counsel.

ADOPTION OF THE AMENDMENTS

Accordingly, Parts 23, 25, 27, 29, 91, and 121 of the Federal Aviation Regulations (14 CFR Parts 23, 25, 27, 29, 91, and 121) are amended as follows, effective September 1, 1977.

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

1. By revising § 23.1301 to read as follows:

§ 23.1301 Function and installation.

Each item of installed equipment must—

- (a) Be of a kind and design appropriate to its intended function.
- (b) Be labeled as to its identification, function, or operating limitations, or any applicable combination of these factors;
- (c) Be installed according to limitations specified for that equipment; and
- (d) Function properly when installed.

2. By adding a new § 23.1321(e) to read as follows:

§ 23.1321 Arrangement and visibility.

- (e) If a visual indicator is provided to indicate malfunction of an instrument, it must be effective under all probable cockpit lighting conditions.

3. By revising § 23.1323 to read as follows:

§ 23.1323 Airspeed indicating system.

(a) Each airspeed indicating instrument must be calibrated to indicate true airspeed (at sea level with a standard atmosphere) with a minimum practicable instrument calibration error when the corresponding pitot and static pressures are applied.

(b) Each airspeed system must be calibrated in flight to determine the system error. The system error, including position error, but excluding the airspeed indicator instrument calibration error, may not exceed three percent of the calibrated airspeed or five knots, whichever is greater, throughout the following speed ranges:

- (1) 1.3 V_{S1} to V_{MO}/M_{MO} or V_{NE} , whichever is appropriate with flaps retracted.
- (2) 1.3 V_{S1} to V_{NE} with flaps extended.

4. By adding new §§ 23.1325 (c), (d) and (e) to read as follows:

§ 23.1325 Static pressure system.

(c) Except as provided in paragraph (d) of this section, if the static pressure system incorporates both a primary and an alternate static pressure source, the means for selecting one or the other source must be designed so that—

- (1) When either source is selected, the other is blocked off; and

- (2) Both sources cannot be blocked off simultaneously.

(d) For unpressurized airplanes, paragraph (c) (1) of this section does not apply if it can be demonstrated that the static pressure system calibration, when either static pressure source is selected, is not changed by the other static pressure source being open or blocked.

(e) Each system must be designed and installed so that the error in indicated pressure altitude, at sea level, with a standard atmosphere, excluding instrument calibration error, does not result in an error of more than ± 30 feet per 100 knots speed for the appropriate configuration in the speed range between 1.3 V_s with flaps extended and 1.8 V_s with flaps retracted. However, the error need not be less than ± 30 feet.

5. By revising § 23.1327 to read as follows:

§ 23.1327 Magnetic direction indicator.

(a) Except as provided in paragraph (b) of this section—

(1) Each magnetic direction indicator must be installed so that its accuracy is not excessively affected by the airplane's vibration or magnetic fields; and

(2) The compensated installation may not have a deviation, in level flight, greater than ten degrees on any heading.

(b) A magnetic nonstabilized direction indicator may deviate more than ten degrees due to the operation of electrically powered systems such as electrically heated windshields if either a magnetic stabilized direction indicator, which does not have a deviation in level flight greater than ten degrees on any heading, or a gyroscopic direction indicator, is installed. Deviations of a magnetic nonstabilized direction indicator of more than 10 degrees must be placarded in accordance with § 23.1547(e).

6. By revising § 23.1335, including the heading, to read as follows:

§ 23.1335 Flight director systems.

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch position is not acceptable as a means of indication.

7. By adding a new § 23.1351(f) to read as follows:

§ 23.1351 General.

(f) *External power.* If provisions are made for connecting external power to the airplane, and that external power can be electrically connected to equipment other than that used for engine starting, means must be provided to ensure that no external power supply having a reverse polarity, or a reverse phase sequence, can supply power to the airplane's electrical system.

8. By revising § 23.1353(b) (1) and by adding a new § 23.1353(f) to read as follows:

§ 23.1353 Storage battery design and installation.

(b)
(1) At maximum regulated voltage or power;

(f) Each nickel cadmium battery installation capable of being used to start an engine or auxiliary power unit must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

9. By revising § 23.1357(b) to read as follows:

§ 23.1357 Circuit protective devices.

(b) A protective device for a circuit essential to flight safety may not be used to protect any other circuit.

§ 23.1361 [Amended]

10. By amending § 23.1361(b) by adding, at the end thereof, the sentence, "These circuits must be isolated, or physically shielded, to prevent their igniting flammable fluids or vapors that might be liberated by the leakage or rupture of flammable fluid systems."

§ 23.1401 [Amended]

11. By amending § 23.1401 by striking the number "30" in both places in paragraph (b) and inserting in place thereof (in both places) the number "75", and by adding a line at the end of the table in paragraph (f) to read as follows:

"30" to 75" 20".

12. By adding a new § 23.1438 to read as follows:

§ 23.1438 Pressurization and pneumatic systems.

(a) Pressurization system elements must be burst pressure tested to 2.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(b) Pneumatic system elements must be burst pressure tested to 3.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(c) An analysis, or a combination of analysis and test, may be substituted for any test required by paragraph (a) or (b) of this section if the Administrator finds it equivalent to the required test.

13. By adding new §§ 23.1447 (c) and (d) to read as follows:

§ 23.1447 Equipment standards for oxygen dispensing units.

(c) If certification for operation above 30,000 feet is requested, the dispensing units providing the required oxygen flow rate must be automatically presented to each occupant before the cabin pressure altitude exceeds 15,000 feet.

(d) If an automatic dispensing unit (hose and mask, or other unit) system is installed, the crew must be provided with a manual means to make the dispensing units immediately available in the event of failure of the automatic system.

14. By adding a new § 23.1450, following § 23.1449, in Subpart F, to read as follows:

§ 23.1450 Chemical oxygen generators.

(a) For the purpose of this section, a chemical oxygen generator is defined as a device which produces oxygen by chemical reaction.

(b) Each chemical oxygen generator must be designed and installed in accordance with the following requirements:

(1) Surface temperature developed by the generator during operation may not create a hazard to the airplane or to its occupants.

(2) Means must be provided to relieve any internal pressure that may be hazardous.

(c) In addition to meeting the requirements in paragraph (b) of this section, each portable chemical oxygen generator that is capable of sustained operation by successive replacement of a generator element must be placarded to show—

(1) The rate of oxygen flow, in liters per minute;

(2) The duration of oxygen flow, in minutes, for the replaceable generator element; and

(3) A warning that the replaceable generator element may be hot, unless the element construction is such that the surface temperature cannot exceed 100 degrees F.

15. By adding a new § 23.1461, following § 23.1450, in Subpart F, to read as follows:

§ 23.1461 Equipment containing high energy rotors.

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

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

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

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

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

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

16. By adding a new § 23.1547(e) to read as follows:

§ 23.1547 Magnetic direction indicator.

(e) If a magnetic nonstabilized direction indicator can have a deviation of more than 10 degrees caused by the operation of electrical equipment, the placard must state which electrical loads, or combination of loads, would cause a deviation of more than 10 degrees when turned on.

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

17. By revising § 25.831(e) and by adding a new § 25.831(f) to read as follows:

§ 25.831 Ventilation.

(e) Except as provided in paragraph (f) of this section, means must be provided to enable the occupants of the following compartments and areas to control the temperature and quantity of ventilating air supplied to their compartment or area independently of the temperature and quantity of air supplied to other compartments and areas:

- (1) The flight crew compartment.
- (2) Crewmember compartments and areas other than the flight crew compartment unless the crewmember compartment or area is ventilated by air interchange with other compartments or areas under all operating conditions.

(f) Means to enable the flight crew to control the temperature and quantity of ventilating air supplied to the flight crew compartment independently of the temperature and quantity of ventilating air supplied to other compartments are not required if all of the following conditions are met:

- (1) The total volume of the flight crew and passenger compartments is 800 cubic feet or less.
- (2) The air inlets and passages for air to flow between flight crew and passenger compartments are arranged to provide compartment temperatures within 5 degrees F. of each other and adequate ventilation to occupants in both compartments.
- (3) The temperature and ventilation controls are accessible to the flight crew.

18. By amending the lead-in of § 25.1309(d) and by revising §§ 25.1309(b) (2), (c), (e) (3) and (f) to read as follows:

§ 25.1309 Equipment, systems, and installations.

(b)

(2) The occurrence of any other failure condition which would reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions is improbable.

(c) Warning information must be provided to alert the crew to unsafe system operating conditions, and to enable them to take appropriate corrective action. Systems, controls, and associated monitoring and warning means must be designed to minimize crew errors which could create additional hazards.

(d) Compliance with the requirements of paragraph (b) of this section must be shown by analysis, and where necessary, by appropriate ground, flight, or simulator tests. The analysis must consider—

(e)

(3) Essential loads after failure of—

- (i) Any one engine on two-engine airplanes; and
- (ii) Any two engines on three-or-more engine airplanes.

(f) In determining compliance with paragraphs (e) (2) and (3) of this section, the power loads may be assumed to be reduced under a monitoring procedure

consistent with safety in the kinds of operation authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines.

19. By adding a new § 25.1321(e) to read as follows:

§ 25.1321 Arrangement and visibility.

(e) If a visual indicator is provided to indicate malfunction of an instrument, it must be effective under all probable cockpit lighting conditions.

20. By adding new §§ 25.1325(g) and (h) to read as follows:

§ 25.1325 Static pressure systems.

(g) Except as provided in paragraph (h) of this section, if the static pressure system incorporates both a primary and an alternate static pressure source, the means for selecting one or the other source must be designed so that—

- (1) When either source is selected, the other is blocked off; and
- (2) Both sources cannot be blocked off simultaneously.

(h) For unpressurized airplanes, paragraph (g) (1) of this section does not apply if it can be demonstrated that the static pressure system calibration, when either static pressure source is selected, is not changed by the other static pressure source being open or blocked.

21. By amending § 25.1331 by striking the phrase “, or adjacent to,” in paragraph (a) (1), and by revising § 25.1331 (a) (2), and adding a new paragraph (a) (3), to read as follows:

§ 25.1331 Instruments using a power supply.

(a)

(2) Each instrument must, in the event of the failure of one power source, be supplied by another power source. This may be accomplished automatically or by manual means.

(3) If an instrument presenting navigation data receives information from sources external to that instrument and loss of that information would render the presented data unreliable, the instrument must incorporate a visual means to warn the crew, when such loss of information occurs, that the presented data should not be relied upon.

§ 25.1333 [Amended]

22. By striking the period at the end of § 25.1333(a) and inserting a semicolon in place thereof.

23. By adding a new § 25.1335 to read as follows:

§ 25.1335 Flight director systems.

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch position is not acceptable as a means of indication.

24. By adding new §§ 25.1351 (c) and (d) to read as follows:

§ 25.1351 General.

(c) *External power.* If provisions are made for connecting external power to the airplane, and that external power can be electrically connected to equipment other than that used for engine starting, means must be provided to ensure that no external power supply having a reverse polarity, or a reverse phase sequence, can supply power to the airplane's electrical system.

(d) *Operation without normal electrical power.* It must be shown by analysis, tests, or both, that the airplane can be operated safely in VFR conditions, for a period of not less than five minutes, with the normal electrical power (electrical power sources excluding the battery) inoperative, with critical type fuel (from the standpoint of flameout and restart capability), and with the airplane initially at the maximum certificated altitude. Parts of the electrical system may remain on if—

- (1) A single malfunction, including a wire bundle or junction box fire, cannot result in loss of the part turned off and the part turned on;
- (2) The parts turned on are electrically and mechanically isolated from the parts turned off; and
- (3) The electrical wire and cable insulation, and other materials, of the parts turned on are self-extinguishing when tested in accordance with § 25.1359 (d).

25. By revising § 25.1353(c) (1) (i) and by adding a new § 25.1353(c) (5) to read as follows:

§ 25.1353 Electrical equipment and installations.

(c)

(1)

(i) At maximum regulated voltage or power;

(5) Each nickel cadmium battery installation capable of being used to start an engine or auxiliary power unit must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

§ 25.1401 [Amended]

26. By amending § 25.1401 by striking the number “30” in both places in paragraph (b) and inserting in place thereof (in both places) the number “75”, and by adding a line at the end of the table in paragraph (f) to read as follows: “30° to 75° . . . 20”.

27. By adding a new § 25.1421, following § 25.1419, and before the heading “Miscellaneous Equipment”, to read as follows:

§ 25.1421 Megaphones.

If a megaphone is installed, a restraining means must be provided that is capable of restraining the megaphone when it is subjected to the ultimate inertia forces specified in § 25.561(b) (3).

28. By amending § 25.1435 by striking the language in § 25.1435(a)(3) and in place thereof inserting the term "[Reserved]", by revising §§ 25.1435 (a)(2) and (a)(4)(i), and by adding new §§ 25.1435 (a)(7) and (a)(8), to read as follows:

§ 25.1435 Hydraulic systems.

(a)
(2) A means to indicate system pressure and a means to indicate fluid quantity, both located at a flight crewmember station, must be provided for each hydraulic system that—

(i) Performs a function that is essential for continued safe flight and landing; or

(ii) In the event of hydraulic system malfunction, requires corrective action by the crew to ensure continued safe flight and landing.

(3) [Reserved]

(4)
(i) Except as provided in paragraph (a)(7) of this section, will not exceed 125 percent of the design operating pressure, excluding pressure at the outlets specified in paragraph (a)(4)(i) of this section. Design operating pressure is the maximum steady operating pressure.

(7) Transient pressure in a part of the system may exceed the limit specified in paragraph (a)(4)(i) of this section if—

(i) A survey of those transient pressures is conducted to determine their magnitude and frequency; and

(ii) Based on the survey, the fatigue strength of that part of the system is substantiated by analysis or tests, or both.

(8) Each hydraulic pump must be designed and installed so that loss of hydraulic fluid to the pump cannot create a hazard that might prevent continued safe flight and landing.

29. By adding a new § 25.1438, following § 25.1435, to read as follows:

§ 25.1438 Pressurization and pneumatic systems.

(a) Pressurization system elements must be burst pressure tested to 2.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(b) Pneumatic system elements must be burst pressure tested to 3.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(c) An analysis, or a combination of analysis and test, may be substituted for any test required by paragraph (a) or (b) of this section if the Administrator finds it equivalent to the required test.

30. By revising §§ 25.1447(c)(1) and (c)(2), to read as follows:

§ 25.1447 Equipment standards for oxygen dispensing units.

(c)

(1) There must be an oxygen dispensing unit connected to oxygen supply terminals immediately available to each

occupant, wherever seated. If certification for operation above 30,000 feet is requested, the dispensing units providing the required oxygen flow must be automatically presented to the occupants before the cabin pressure altitude exceeds 15,000 feet and the crew must be provided with a manual means to make the dispensing units immediately available in the event of failure of the automatic system. The total number of dispensing units and outlets must exceed the number of seats by at least 10 percent. The extra units must be as uniformly distributed throughout the cabin as practicable.

(2) Each flight crewmember on flight deck duty must be provided with demand equipment. In addition, each flight crewmember must be provided with a quick-donning type of oxygen dispensing unit, connected to an oxygen supply terminal, that is immediately available to him when seated at his station, and that is designed and installed so that it—

(i) Can be placed on the face from its ready position, properly secured, sealed, and supplying oxygen upon demand, with one hand within five seconds and without disturbing eyeglasses or causing delay in proceeding with emergency duties; and

(ii) Allows, while in place, the performance of normal communication functions.

31. By adding a new § 25.1450, following § 25.1449, to read as follows:

§ 25.1450 Chemical oxygen generators.

(a) For the purpose of this section, a chemical oxygen generator is defined as a device which produces oxygen by chemical reaction.

(b) Each chemical oxygen generator must be designed and installed in accordance with the following requirements:

(1) Surface temperature developed by the generator during operation may not create a hazard to the airplane or to its occupants.

(2) Means must be provided to relieve any internal pressure that may be hazardous.

(c) In addition to meeting the requirements in paragraph (b) of this section, each portable chemical oxygen generator that is capable of sustained operation by successive replacement of a generator element must be placarded to show—

(1) The rate of oxygen flow, in liters per minute;

(2) The duration of oxygen flow, in minutes, for the replaceable generator element; and

(3) A warning that the replaceable generator element may be hot, unless the element construction is such that the surface temperature cannot exceed 100 degrees F.

32. By revising § 25.1457(g) to read as follows:

§ 25.1457 Cockpit voice recorders.

(g) Each recorder container must—

(1) Be either bright orange or bright yellow;

(2) Have reflective tape affixed to its external surface to facilitate its location under water; and

(3) Have an underwater locating device, when required by the operating rules of this chapter, on or adjacent to the container which is secured in such manner that they are not likely to be separated during crash impact.

33. By amending § 25.1459 by deleting paragraph (a)(7); by striking the word "and" at the end of paragraph (a)(3); by striking the period at the end of paragraph (a)(4) and inserting a semicolon in its place; by striking the period at the end of paragraph (a)(5) and inserting in its place a semicolon followed by the word "and"; and by revising § 25.1459(d) to read as follows:

§ 25.1459 Flight recorders.

(d) Each recorder container must—

(1) Be either bright orange or bright yellow;

(2) Have reflective tape affixed to its external surface to facilitate its location under water; and

(3) Have an underwater locating device, when required by the operating rules of this chapter, on or adjacent to the container which is secured in such a manner that they are not likely to be separated during crash impact.

34. By adding a new § 25.1461, following § 25.1459, in Subpart F, to read as follows:

§ 25.1461 Equipment containing high energy rotors.

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

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

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

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

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

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

PART 27—AIRWORTHINESS STANDARDS: NORMAL CATEGORY ROTORCRAFT

35. By adding a new § 27.1321(d) to read as follows:

§ 27.1321 Arrangement and visibility.

(d) If a visual indicator is provided to indicate malfunction of an instrument,

it must be effective under all probable cockpit lighting conditions.

36. By amending § 27.1323 by redesignating paragraph (b) as paragraph (c); by revising paragraph (a) and redesignating it as paragraph (b), and by adding a new paragraph (a), to read as follows:

§ 27.1323 Airspeed indicating system.

(a) Each airspeed indicating instrument must be calibrated to indicate true airspeed (at sea level with a standard atmosphere) with a minimum practicable instrument calibration error when the corresponding pitot and static pressures are applied.

(b) The airspeed indicating system must be calibrated in flight at forward speeds of 20 knots and over.

37. By amending § 27.1325 by revising the section heading; by designating the present paragraph as paragraph (a); and by adding new paragraphs (b), (c), and (d) to read as follows:

§ 27.1325 Static pressure systems.

(b) Each static pressure port must be designed and located in such manner that the correlation between air pressure in the static pressure system and true ambient atmospheric static pressure is not altered when the rotorcraft encounters icing conditions. An anti-icing means or an alternate source of static pressure may be used in showing compliance with this requirement. If the reading of the altimeter, when on the alternate static pressure system, differs from the reading of the altimeter when on the primary static system by more than 50 feet, a correction card must be provided for the alternate static system.

(c) Except as provided in paragraph (d) of this section, if the static pressure system incorporates both a primary and an alternate static pressure source, the means for selecting one or the other source must be designed so that—

(1) When either source is selected, the other is blocked off; and

(2) Both sources cannot be blocked off simultaneously.

(d) For unpressurized rotorcraft, paragraph (c)(1) of this section does not apply if it can be demonstrated that the static pressure system calibration, when either static pressure source is selected, is not changed by the other static pressure source being open or blocked.

38. By revising § 27.1327 to read as follows:

§ 27.1327 Magnetic direction indicator.

(a) Except as provided in paragraph (b) of this section—

(1) Each magnetic direction indicator must be installed so that its accuracy is not excessively affected by the rotorcraft's vibration or magnetic fields; and

(2) The compensated installation may not have a deviation, in level flight, greater than 10 degrees on any heading.

(b) A magnetic nonstabilized direction indicator may deviate more than 10

degrees due to the operation of electrically powered systems such as electrically heated windshields if either a magnetic stabilized direction indicator, which does not have a deviation in level flight greater than 10 degrees on any heading, or a gyroscopic direction indicator, is installed. Deviations of a magnetic nonstabilized direction indicator of more than 10 degrees must be placarded in accordance with § 27.1547(e).

39. By adding a new § 27.1335 to read as follows:

§ 27.1335 Flight director systems.

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch position is not acceptable as a means of indication.

40. By adding a new § 27.1351(e) to read as follows:

§ 27.1351 General.

(e) *External power.* If provisions are made for connecting external power to the rotorcraft, and that external power can be electrically connected to equipment other than that used for engine starting, means must be provided to ensure that no external power supply having a reverse polarity, or a reverse phase sequence, can supply power to the rotorcraft's electrical system.

41. By revising § 27.1353(b)(1) and by adding a new paragraph (f) to read as follows:

§ 27.1353 Storage battery design and installation.

(b)
(1) At maximum regulated voltage or power;

(f) Each nickel cadmium battery installation capable of being used to start an engine or auxiliary power unit must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

42. By revising § 27.1357(b) to read as follows:

§ 27.1357 Circuit protective devices.

(b) A protective device for a circuit essential to flight safety may not be used to protect any other circuit.

43. By adding a new § 27.1547(e) to read as follows:

§ 27.1547 Magnetic direction indicator.

(e) If a magnetic nonstabilized direction indicator can have a deviation of more than 10 degrees caused by the operation of electrical equipment, the placard must state which electrical loads, or combination of loads, would cause a deviation of more than 10 degrees when turned on.

PART 29—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT

44. By revising § 29.1303(g) to read as follows:

§ 29.1303 Flight and navigation instruments.

The following are required flight and navigational instruments:

(g) A gyroscopic rate-of-turn indicator combined with an integral slip-skid indicator (turn-and-bank indicator) except that only a slip-skid indicator is required on rotorcraft with a third attitude instrument system that—

(1) Is useable through flight attitudes of ± 80 degrees of pitch and ± 120 degrees of roll;

(2) Is powered from a source independent of the electrical generating system;

(3) Continues reliable operation for a minimum of 30 minutes after total failure of the electrical generating system;

(4) Operates independently of any other attitude indicating system;

(5) Is operative without selection after total failure of the electrical generating system;

(6) Is located on the instrument panel in a position acceptable to the Administrator that will make it plainly visible to and useable by any pilot at his station; and

(7) Is appropriately lighted during all phases of operation.

45. By amending § 29.1309 by deleting the word "four" in § 29.1309(e) and inserting the word "three" in place thereof; and by revising § 29.1309(d)(3)(i) and (ii) to read as follows:

§ 29.1309 Equipment, systems, and installations.

(d)
(3)

(i) Any one engine, on rotorcraft with two engines; and

(ii) Any two engines, on rotorcraft with three or more engines.

46. By adding a new § 29.1321(g) to read as follows:

§ 29.1321 Arrangement and visibility.

(g) If a visual indicator is provided to indicate malfunction of an instrument, it must be effective under all probable cockpit lighting conditions.

47. By amending § 29.1325 by revising the section heading; by redesignating paragraphs (c), (d), and (e) as paragraphs (d), (e), and (f), respectively; and by adding new paragraphs (c), (g), and (h) to read as follows:

§ 29.1325 Static pressure and pressure altimeter systems.

(c) Each static pressure port must be designed and located in such manner that the correlation between air pressure in the static pressure system and true ambient atmospheric static pressure is

not altered when the rotorcraft encounters icing conditions. An anti-icing means or an alternate source of static pressure may be used in showing compliance with this requirement. If the reading of the altimeter, when on the alternate static pressure system, differs from the reading of the altimeter when on the primary static system by more than 80 feet, a correction card must be provided for the alternate static system.

(g) Except as provided in paragraph (h) of this section, if the static pressure system incorporates both a primary and an alternate static pressure source, the means for selecting one or the other source must be designed so that—

(1) When either source is selected, the other is blocked off; and

(2) Both sources cannot be blocked off simultaneously.

(h) For unpressurized rotorcraft, paragraph (g)(1) of this section does not apply if it can be demonstrated that the static pressure system calibration, when either static pressure source is selected, is not changed by the other static pressure source being open or blocked.

48. By adding a new § 29.1335, following § 29.1333, to read as follows:

§ 29.1335 Flight director systems.

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch position is not acceptable as a means of indication.

49. By adding new §§ 29.1351(c) and (d) to read as follows:

§ 29.1351 General.

(c) *External power.* If provisions are made for connecting external power to the rotorcraft, and that external power can be electrically connected to equipment other than that used for engine starting, means must be provided to ensure that no external power supply having a reverse polarity, or a reverse phase sequence, can supply power to the rotorcraft's electrical system.

(d) *Operation without normal electrical power.* It must be shown by analysis, tests, or both, that the rotorcraft can be operated safely in VFR conditions, for a period of not less than five minutes, with the normal electrical power (electrical power sources excluding the battery) inoperative, with critical type fuel (from the standpoint of flameout and restart capability), and with the rotorcraft initially at the maximum certificated altitude. Parts of the electrical system may remain on if—

(1) A single malfunction, including a wire bundle or junction box fire, cannot result in loss of the part turned off and the part turned on;

(2) The parts turned on are electrically and mechanically isolated from the parts turned off; and

(3) The electrical wire and cable insulation, and other materials, of the parts turned on are self-extinguishing when tested in accordance with § 25.1359 (d) in effect on September 1, 1977.

50. By revising § 29.1353(c)(1)(i) and by adding a new § 29.1353(c)(5) to read as follows:

§ 29.1353 Electrical equipment and installations.

(c)

(1)

(i) At maximum regulated voltage or power;

(5) Each nickel cadmium battery installation capable of being used to start an engine or auxiliary power unit must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

51. By revising § 29.1355(b)(1) to read as follows:

§ 29.1355 Distribution system.

(b) Each system must be designed so that—

(1) For category A rotorcraft, essential load circuits can be supplied in the event of reasonably probable faults or open circuits; and

PART 91—GENERAL OPERATING AND FLIGHT RULES

52. By revising § 91.33(d)(3) to read as follows:

§ 91.33 Powered civil aircraft with standard category U.S. airworthiness certificates; instrument and equipment requirements.

(d) *Instrument flight rules.* For IFR flight the following instruments and equipment are required:

(3) Gyroscopic rate-of-turn indicator, except on the following aircraft:

(i) Large airplanes with a third attitude instrument system useable through flight attitudes of 360 degrees of pitch and roll and installed in accordance with § 121.305(j) of this chapter; and

(ii) Rotorcraft, type certificated under Part 29 of this chapter, with a third attitude instrument system useable through flight attitudes of ± 80 degrees of pitch and ± 120 degrees of roll and installed in accordance with § 29.1303(g) of this chapter.

53. By amending § 91.36 by striking the word "or" at the end of paragraph (a); by striking the period at the end of paragraph (b) and inserting in place thereof a semicolon followed by the word

"or"; and by adding a new paragraph (c) to read as follows:

§ 91.36 Data correspondence between automatically reported pressure altitude data and the pilot's altitude reference.

(c) After September 1, 1979, unless the altimeters and digitizers in that equipment meet the standards in TSO-C10b and TSO-C88, respectively.

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

54. By amending § 121.343 by revising the first sentence of the lead-in of paragraph (e) to read as follows:

§ 121.343 Flight recorders.

(e) Each flight recorder required by this section must be installed in accordance with the requirements of § 25.1459 of this chapter in effect on August 31, 1977

55. By revising § 121.359(c) to read as follows:

§ 121.359 Cockpit voice recorders.

(c) The cockpit voice recorder required by this section must meet the following application standards:

(1) The requirements of Part 25 of this chapter in effect on August 31, 1977.

(2) After September 1, 1980, each recorder container must—

(i) be either bright orange or bright yellow;

(ii) Have reflective tape affixed to the external surface to facilitate its location under water; and

(iii) Have an approved underwater locating device on or adjacent to the container which is secured in such a manner that they are not likely to be separated during crash impact, unless the cockpit voice recorder, and the flight recorder required by § 121.343, are installed adjacent to each other in such a manner that they are not likely to be separated during crash impact.

(Secs. 313(a), 601, 603, 604, and 605 of the Federal Aviation Act of 1958 (49 U.S.C. 1354 (a), 1421, 1423, 1424, and 1425); and the sec. 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)).)

NOTE.—The Federal Aviation Administration has determined that this document does not contain a major proposal requiring preparation of an Economic Impact Statement under Executive Order 11821, as amended by Executive Order 11949, and OMB Circular A-107.

Issued in Washington, D.C. on July 11, 1977.

QUENTIN S. TAYLOR,
Acting Administrator.

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