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PART 6—ROTORCRAFT AIRWORTHINESS; NORMAL CATEGORY

Miscellaneous Amendments Resulting From First Airworthiness Review

As a result of the First Federal Aviation Agency Airworthiness Review, the Agency published a notice of proposed rule making affecting several parts of the Civil Air Regulations. This notice was published in the FEDERAL REGISTER (26 F.R. 5130) and circulated as Civil Air Regulations Draft Release No. 61-12 dated June 8, 1961. There are contained herein amendments to Part 6 of the Civil Air Regulations which stem from this First FAA Airworthiness Review.

Interested persons have been afforded an opportunity to express their comments in regard to the proposal and, in some cases, the proposal has been modified in accordance with such comments. The more significant amendments being adopted by the Agency are discussed herein.

Two changes are being made which *affect control systems. Section 6.225 now* requires manual control systems to comply with the provisions of that section. Because the word "manual" has erroneously been construed to limit the applicability of this section, it is being amended to make certain that it applies to all control systems. The other change stems from the fact that Part 6 does not now cover the design of dual primary flight control systems. To insure that future dual control systems will be designed to withstand more than single pilot effort, a new § 6.226 is being adopted.

Several changes to the structural provisions relating to parts subjected to alternating stresses, casting factors, and hull and float design are being made. The current regulations require fatigue evaluation of the rotor structure but not of the essential fuselage and rotor pylon structure. Service experience has shown a need for fatigue evaluation of these other structural parts. Therefore, § 6.251 is being amended to require an evaluation of fuselage and rotor pylon *structure, the failure of which would* threaten the structural integrity of the rotorcraft. The present requirements on factors of safety and inspections for structural castings specify a special factor of 2.0 for visual inspection only, and a factor of 1.25 when radiographic inspection and strength tests of 3 sample castings are employed. Section 6.307 is being amended to provide a series of *casting factors and corresponding test* and inspection requirements which reflect current methods and practices. In addition, a minor revision in the format of this section has been made from that which was proposed and the rule now provides for alternative methods of compliance with the requirements therein. It was proposed in Draft Release 61-12 to add a new § 6.343 setting forth minimum design standards for hull and float design of "sea and amphibian type rotorcraft." To avoid having the requirement affect all amphibian rotorcraft, i.e., even those which have an extremely limited capability as an amphibian, the proposal has been confined in applicability only to those rotorcraft which are to be approved for both taking off from and alighting on water. The requirement is being set forth in a new paragraph (c) under § 6.341 rather than as a new § 6.343 because it is concerned with buoyancy. This change necessitates the inclusion of the word "hulls" in § 6.340.

The regulations covering Part 6 fuel systems are not in the same form and do not use terminology similar to that used in other airworthiness parts. To eliminate this inconsistency, new §§ 6.418 and 6.419 are being adopted, and changes are being made to §§ 6.420, 6.421, and 6.424.

Section 6.420 presently requires that, insofar as practicable, the entire fuel *supply can be utilized under certain con*ditions. Such a requirement is unnecessary, even when practicable, because a rotorcraft will continue to be airworthy so long as usable fuel can be used regardless of the quantity of unusable fuel. Therefore, this provision is being deleted in favor of the objective requirement being added in § 6.418, which covers fuel system construction and arrangement to insure a satisfactory fuel flow.

Currently effective § 6.421 defines unusable fuel supply as that quantity at which the first evidence of malfunctioning occurs. This definition is unnecessarily restrictive and is not essential to safety since a rotorcraft is no less airworthy if an unusable fuel supply is selected as a quantity which is in excess of that which would produce a malfunction. Accordingly, the definition of unusable fuel supply is being revised to make it not less than the quantity at which the first evidence of malfunction occurs, the same as in other airworthiness parts.

As a result of comment received on *Draft Release 61-12, specific require*ments for demonstrations or tests are being deleted from §§ 6.420 and 6.421. Adequate authority for any ground or flight tests which might be required continues to rest in presently effective §§ 6.15 and 6.16. The provisions of paragraph (b) of § 6.421 as proposed are being transferred to a new paragraph (c) under § 6.420 as an editorial change, since the provision for fuel feed belongs more appropriately in the fuel flow section than in the unusable fuel supply section. In addition, the requirements for a low fuel quantity warning indicator presently in § 6.420(a), and a means to indicate when the emergency fuel system is in operation presently in § 6.424, are being transferred to § 6.604 which lists required items of equipment. In addition, the powerplant operating limitation dealing with fuel is being brought up to date by including reference to turbine engine fuel in § 6.714.

Presently effective Part 6 contains no requirement pertaining to the bypass of engine oil around a filter element when the element becomes clogged. Although installation of a filter is not required, it is necessary to provide for the bypass of a *clogged filter, if a filter is installed,* to insure continued normal functioning of the rest of the oil system. Accordingly, a new § 6.447 is being adopted to provide for bypass capability, consistent with the same requirement now appearing in all the other airworthiness parts.

Revisions to the regulations concerning electrical systems and equipment are being made involving §§ 6.617 through 6.627. These changes are being made in recognition of the substantial growth in capacity, complexity, and significance to safety of electrical systems on rotorcraft. In particular, new § 6.618 dealing with electric power sources is being added. Revisions are being made to §§ 6.623, 6.626, and 6.627 concerned with master switch arrangement, protective devices, and electric cables, respectively. In conjunction with these changes, §§ 6.623-1, 6.625-1, 6.625-2, and 6.627-1 are being deleted because the material in these sections is being included, or is already contained, in other sections.

Two changes are being made to the lighting requirements. Figure 6-2 now *specifies that position light intensity for* angles 40° to 90° above or below the horizontal be at least 2 candles. Because this results in an irrational discontinuity when related to the other data in figure 6-2, figure 6-2 is being amended to require an intensity of 0.05 I for these angles.

The current anticollision light requirements in § 6.637(a) permit 0.03 steradians blockage. In view of recent qualitative studies, it has been determined that such a limitation might be unduly restrictive. Therefore, § 6.637(a) is being amended to permit 0.5 steradians of obstruction.

Part 6 currently does not require the tail rotor to be marked. Because there have been a number of accidents attributable to persons walking into tail rotors, § 6.738(f) is being added to require that tail rotors be marked conspicuously.

Miscellaneous changes of an editorial or clarifying nature are being made to §§ 6.11, 6.203, 6.237, 6.251, 6.306, 6.605, 6.642, and 6.738. Among the miscellaneous amendments there is one to expressly exclude from the provisions of § 6.11(b) consideration of provisional type certificates. While it was proposed that this be accomplished by a note, it now appears that it is more appropriate to include such a provision within § 6.11 (b) rather than as a note thereto.

Interested persons have been afforded an opportunity to participate in the making of this amendment, and due consideration has been given to all relevant matter presented.

In consideration of the foregoing, Part 6 of the Civil Air Regulations (14 CFR Part 6, as amended) is hereby amended as follows, effective May 3, 1962:

§ 6.11 [Amendment]

1. By amending § 6.11(b) by inserting in the first sentence between the words "required" and "except" the phrase "notwithstanding the applicant may have been issued a provisional type certificate".

§ 6.203 [Amendment]

2. By amending § 6.203(d) by deleting the reference "(see §§ 6.221 and 6.250)" and inserting in lieu thereof "(see §§ 6.221, 6.250, and 6.251)".

§ 6.225 [Amendment]

3. By amending § 6.225 by deleting from the introductory paragraph the word "Manual" and inserting in lieu thereof "All".

4. By adding a new § 6.226 to read as follows:

§ 6.226 Dual primary flight control systems.

If a dual primary flight control system is provided, the system shall be designed for conditions when the pilots operate the controls in opposition and in conjunction. Individual pilot loads equal to 75 percent of those obtained in accordance with § 6.225 shall be applicable.

§ 6.237 [Amendment]

5. By amending § 6.237(a) by amending the definition of W_T to read as follows:

$W = W_T$ for tailwheel units (pounds) equal to whichever of the following is critical:

(1) The static weight on the tailwheel with the rotorcraft resting on all wheels; or

(2) The vertical component of the ground reaction which would occur at the tailwheel assuming the mass of the rotorcraft acting at the center of gravity and exerting a force of 1g downward with the rotorcraft in the maximum nose-up attitude considered in the nose-up landing conditions. (See § 6.246 (b) and (c).)

6. By amending § 6.251 by deleting from the introductory paragraph the phrase "through (d)" and inserting in lieu thereof "through (e)"; and by deleting from paragraph (d) the phrase "in § 6.250 (d) and (f)" and inserting in lieu thereof "in § 6.250 (e) and (f)".

7. By amending § 6.251 by adding a new paragraph (e) to read as follows:

§ 6.251 Fuselage, landing gear, and rotor pylon structure.

* * * * *

(c) Parts of the basic structure which are directly subjected to alternating stresses, the sudden failure of which would threaten the structural integrity of the rotorcraft, shall be designed to withstand the repeated loading conditions likely to occur within the established service life for such parts. The stresses of critical parts shall be determined in flight in all attitudes appropriate to the type of rotorcraft throughout the ranges of limitations prescribed in § 6.204. The service life of such parts shall be established by the applicant on the basis of fatigue tests or other acceptable methods.

8. By amending § 6.306(c) and the note to read as follows:

§ 6.306 Material strength properties and design values.

* * * * *

(c) Values contained in MIL–HDBK–5, MIL–HDBK–17 Part I, ANC–17 Part II, ANC–18, MIL–HDBK–23 Part I, and ANC–23 Part II shall be used unless shown to be inapplicable in a particular case.

NOTE: MIL–HDBK–5, "Strength of Metal Aircraft Elements"; MIL–HDBK–17, "Plastics for Flight Vehicles, Part I—Reinforced Plastics"; ANC–17, "Plastics for Aircraft, Part II—Transparent Glazing Materials"; ANC–18, "Design of Wood Aircraft Structures"; MIL–HDBK–23, "Composite Construction for Flight Vehicles, Part I—Fabrication Inspection Durability and Repair"; and ANC–23, "Sandwich Construction for Aircraft, Part II—Material Properties and Design Criteria", are published by the Department of Defense and the Federal Aviation Agency and may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

9. By amending § 6.307(b) to read as follows:

§ 6.307 Special factors.

* * * * *

(b) *Casting factors.* For structural castings, the factor of safety prescribed in § 6.200 shall be multiplied by the casting factors specified in subparagraph (1) and (2) of this paragraph. The prescribed tests and inspections shall be in addition to those necessary to establish foundry quality control. Castings shall be inspected in accordance with approved specifications.

(1) Each casting, the failure of which would preclude continued safe flight and landing of the rotorcraft or which would result in serious injury to occupants, shall have a casting factor of at least 1.25 and shall receive 100 percent inspection by visual, radiographic, and magnetic particle or penetrant inspection methods or approved equivalent nondestructive inspection methods. Where such castings have a casting factor less than 1.50, 3 sample castings shall be static tested. The test castings shall comply with the strength requirements of § 6.201 at an ultimate load corresponding with a casting factor of 1.25 and shall comply with the deformation requirements at a load equal to 1.15 times limit load.

NOTE: Examples of castings to which this subparagraph applies are: structural attachment fittings; parts of flight control systems; control surface hinges and balance weight attachments; seat, berth, safety belt, and fuel and oil tank supports and attachments; cabin pressure valves.

(2) For structural castings other than those specified in subparagraph (1) of this paragraph, the casting factors and inspections shall be in accordance with the following table except that it shall be acceptable to reduce the percentage of castings inspected by nonvisual methods when an approved quality control procedure is established. For castings procured to a specification which guarantees the mechanical properties of the material in the castings and provides for demonstration of these properties by test of coupons cut from castings on a sampling basis, it shall be acceptable to use a casting factor of 1.0. The inspection requirements for such castings shall be in accordance with those specified in the following table for casting factors of 1.25 to 1.50, and the testing requirements shall be in accordance with subparagraph (1) of this paragraph.

Casting factor	Inspections
2.0 or greater	100 percent visual.
Less than 2.0 greater than 1.5.	100 percent visual, and magnetic particle or penetrant or equivalent nondestructive inspection methods.
1.25 to 1.50	100 percent visual, magnetic particle or penetrant, and radiographic, or approved equivalent nondestructive inspection methods.

(3) Castings which are pressure tested as parts of a hydraulic or other fluid system shall not be required to comply with the provisions of this section unless such castings support rotorcraft structural loads.

(4) The casting factor need not exceed 1.25 with regard to bearing stresses regardless of the method of inspection employed. A casting factor need not be employed with respect to the bearing surface of a part if the bearing factor used (see paragraph (c) of this section) is greater than the casting factor.

10. By amending the center heading preceding § 6.340 to read as follows: "Hulls and Floats."

§ 6.340 [Amendment]

11. By amending § 6.340 by inserting the words "hulls and" between the words "of" and "floats".

12. By amending § 6.341 by amending the heading and by adding a new paragraph (c) to read as follows:

§ 6.341 Buoyancy.

* * * * *

(c) If a rotorcraft, constructed with a hull and auxiliary floats, is to be approved for both taking off from and alighting on water, the hull and auxiliary floats shall be divided into watertight compartments so that, with any single compartment flooded, the buoyancy of the hull and auxiliary floats (and wheel tires if used) will provide a sufficient margin of positive stability to minimize capsizing. (See § 6.741(e).)

13. By adding between the center heading "Fuel System" and § 6.420 a new § 6.418 to read as follows:

§ 6.418 General.

(a) The fuel system shall be constructed and arranged in a manner to insure a flow of fuel at a rate and pressure which have been established for proper engine functioning under all likely operating conditions, including all maneuvers for which the rotorcraft is intended. (For fuel system instruments see § 6.604.)

(b) The fuel system shall be arranged so that no one fuel pump can draw fuel from more than one tank at a time unless means are provided to prevent introducing air into the system.

14. By amending § 6.420 by redesignating paragraph (b) as § 6.419, by amending the remainder of the section to read as follows, and by deleting the associated note:

§ 6.420 Fuel flow.

(a) The fuel system shall provide not less than 100 percent of the fuel flow required by the engines when the rotorcraft is operated under all intended operating conditions and maneuvers.

(b) In determining compliance with the provisions of paragraph (a) of this section, the provisions of subparagraphs (1) through (3) of this paragraph shall apply.

(1) Fuel shall be delivered to the engine at a pressure within the limits specified in the engine type certificate.

(2) The quantity of fuel in the tank being considered shall not exceed the sum of the amount established as the unusable fuel supply for that tank, as determined in accordance with the provisions of § 6.421, and whatever minimum quantity of fuel it may be necessary to add for the purpose of determining compliance.

(3) Such main pumps shall be used as are necessary for each operating condition and rotorcraft attitude for which compliance is determined and, in addition, for each main pump so used, the appropriate emergency pump shall be substituted. (See § 6.424.)

(c) If an engine can be supplied with fuel from more than one tank, the fuel system shall feed promptly when the fuel supply becomes low in one tank and another tank is turned on.

15. By amending § 6.421 to read as follows:

§ 6.421 Unusable fuel supply.

The unusable fuel supply shall be selected by the applicant and shall be established for each tank as not less than the quantity at which the first evidence of malfunctioning occurs under the most adverse condition from the standpoint of fuel feed during all intended operations and flight maneuvers involving use of that tank.

16. By amending § 6.424 to read as follows:

§ 6.424 Fuel pumps.

(a) *Main pumps.* (1) Any fuel pump which is required for proper engine operation or to meet the fuel system requirements of this subpart, except for the provisions of paragraph (b) of this section, shall be considered a main pump.

(2) Provision shall be made to permit the bypass of all positive displacement fuel pumps except fuel injection pumps approved as part of the engine.

NOTE: The phrase "fuel injection pump" means a pump which supplies the proper flow and pressure conditions for fuel injection when such injection is not accomplished in a carburetor. Fuel injection is a special form of carburetion: the charging of air or gas with volatile carbon compounds. It is either an intermittent charging of air by discrete metered quantities of fuel such as occurs in a Diesel cylinder or it is a continuous charging of air by fuel, the fuel flow being proportioned to the airflow through the engine. Examples of continuous injection are injections into the supercharger section of a reciprocating engine or into the combustion chambers of a turbine engine.

(b) *Emergency pumps.* Pumps shall be provided to permit supplying all engines with fuel immediately after the failure of any one main fuel pump except fuel injection pumps approved as part of the engine. The emergency pump shall be actuated automatically or operated continuously so that sufficient fuel pressure will be maintained to prevent engine stoppage.

17. By adding a new § 6.447 to read as follows:

§ 6.447 Oil filters.

If the powerplant installation incorporates an oil filter (strainer), the filter shall be constructed and installed so that oil will continue to flow at the normal rate through the remainder of the system when the flow of oil through the filter element is completely blocked.

18. By amending § 6.604 by adding new paragraphs (l) and (m) to read as follows:

§ 6.604 Powerplant instruments.

* * * * *

(l) A warning device to indicate low fuel in each tank if an engine can be supplied with fuel from more than one tank. The fuel in any tank shall be considered to be low if a five-minute usable fuel supply remains when the rotorcraft is in the most adverse condition, from the standpoint of fuel feed from that tank, whether or not that condition can be sustained for five minutes.

(m) Means to indicate to the pilot when emergency pumps are in operation.

§ 6.605 [Amendment]

19. By amending § 6.605(d) by deleting the reference "6.620 through 6.622" and inserting in lieu thereof "6.618 through 6.621."

20. By adding, between the center heading "Electrical Systems and Equipment" and § 6.620, new §§ 6.617 and 6.618 to read as follows:

§ 6.617 Installation.

Electrical systems in rotorcraft shall be free from hazards in themselves, in their method of operation, and in their effects on other parts of the rotorcraft. Electrical equipment shall be of a type and design adequate for the use intended. Electrical systems shall be installed in such a manner that they are protected from fuel, oil, water, other detrimental substances, and mechanical damage.

§ 6.618 Electric power sources.

(a) Electric power sources, their transmission cables, and their associated control and protective devices shall have sufficient capacity to furnish the required power at the proper voltage to all load circuits which are essential to the safe operation of the rotorcraft.

(b) Compliance with paragraph (a) of this section shall be shown by means of an electrical load analysis, or by electrical measurements, which take into account all electrical loads applied to the electrical system, in probable combinations and for probable durations.

(c) At least one generator shall be installed if the electrical system supplies power to load circuits which are essential to the safe operation of the rotorcraft.

(d) Electric power sources shall function properly when connected in combination or independently. The failure or malfunction of any electric power source shall not impair the ability of any remaining source to supply load circuits which are essential to the safe operation of the rotorcraft.

(e) Electric power source controls shall be such as to permit independent operation of each source.

21. By amending § 6.620 to read as follows:

§ 6.620 Generator.

Generators shall be capable of delivering their continuous rated power.

§ 6.619 [Redesignation]

22. By redesignating § 6.621 as § 6.619 and by adding a new § 6.621 to read as follows:

§ 6.621 Generator controls.

(a) Generator voltage control equipment shall be capable of dependably regulating the generator output within rated limits.

(b) A generator reverse current cutout shall be incorporated and designed to disconnect the generator from the battery and other generators when the generator is developing a voltage of such value that current sufficient to cause malfunctioning can flow into the generator.

23. By amending § 6.622 to read as follows:

§ 6.622 Electric power system instruments.

Means shall be provided to indicate to appropriate crewmembers those electric power system quantities which are essential for the safe operation of the system. For direct current systems, an ammeter which can be switched into each generator feeder shall be acceptable. When only one generator is installed, it shall be acceptable to locate the ammeter in the battery feeder.

24. By amending § 6.623 to read as follows:

§ 6.623 Master switch arrangement.

A master switch arrangement shall be provided to permit expeditious disconnection of all electric power sources from all load circuits. The point of disconnection shall be adjacent to the power sources.

§ 6.623–1 [Deletion]

25. By deleting § 6.623–1.

26. By amending § 6.625 to read as follows:

§ 6.625 Fuses or circuit breakers.

Protective devices (fuses or circuit breakers) shall be installed in the circuits to all electrical equipment, except that such items need not be installed in the main circuits of starter motors or in other circuits where no hazard is presented by their omission. Not more than one circuit, which is essential to safety in flight, shall be protected by a single protective device. All resettable type circuit protective devices shall be designed so that a manual operation is required to restore service after tripping and so that, when an overload or circuit fault exists, they will open the circuit irrespective of the position of the operating control.

NOTE: The aforementioned resettable type circuit protective devices are known commercially as "trip-free"; i.e., the tripping mechanism cannot be overridden by the operating control. Such circuit protective devices can be reset on an overload or circuit fault, but will trip subsequently in accordance with their current-time trip characteristic.

§§ 6.625–1, 6.625–2 [Deletion]

27. By deleting §§ 6.625–1 and 6.625–2 and related footnotes.

28. By amending § 6.626 to read as follows:

§ 6.626 Protective devices installation.

If the ability to reset a circuit breaker or to replace a fuse is essential to safety in flight, such circuit breaker or fuse shall be so located and identified that it can be readily reset or replaced in flight. If fuses are used, one spare of each rating or 50 percent spare fuses of each rating, whichever is the greater, shall be provided.

29. By amending § 6.627 to read as follows:

§ 6.627 Electric cables.

Electric connecting cables shall be of adequate capacity. Cables which would overheat in the event of circuit overload or fault shall be flame-resistant and shall not emit dangerous quantities of toxic fumes.

§ 6.627–1 [Deletion]

30. By deleting § 6.627–1 and related footnotes.

§ 6.634 [Amendment]

31. By amending Figure 6–2 referred to in § 6.634 by deleting the phrase "At least 2 candles" in the intensity column and inserting in lieu thereof "0.05 I".

§ 6.637 [Amendment]

32. By amending § 6.637(a) by deleting the number ".03" and inserting in lieu thereof "0.5".

§ 6.642 [Amendment]

33. By amending § 6.642(a) by deleting the word "danger" and inserting in lieu thereof "probability".

34. By amending § 6.714(c) to read as follows:

§ 6.714 Powerplant limitations.

* * * * *

(c) *Fuel grade or specification designation.* The minimum fuel grade for reciprocating engines or the fuel designation for turbine engines, required for the operation of the engine within the limitations prescribed in paragraphs (a) and (b) of this section.

35. By amending § 6.738(b)(1) by deleting the words "octane number" and inserting in lieu thereof "grade or designation".

36. By amending § 6.738 by adding a new paragraph (f) to read as follows:

§ 6.738 Miscellaneous markings and placards.

* * * * *

(f) *Tail rotor.* The tail rotor shall be marked so that the rotor disc will be conspicuous under all normal ground conditions.

(Secs. 313(a), 601, 603; 72 Stat. 752, 775, 776; 49 U.S.C. 1354(a), 1421, 1423)

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N. E. HALABY,
Administrator.

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