

FEDERAL AVIATION REGULATIONS

PERTINENT TO THE INSTALLATION OF THE ALPHA SYSTEMS ANGLE OF ATTACK SYSTEM.

Part 21; CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS

§ 21.93

Classification of changes in type design.

(a) In addition to changes in type design specified in paragraph (b) of this section, ***changes in type design are classified as minor and major. A "minor change" is one that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of the product. All other changes are "major changes" (except as provided in paragraph (b) of this section).***

(b) For the purpose of complying with part 36 of this chapter, and except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this section, any voluntary change in the type design of an aircraft that may increase the noise levels of that aircraft is an "acoustical change" (in addition to being a minor or major change as classified in paragraph (a) of this section) for the following aircraft:

(1) Transport category large airplanes.

(2) Jet (Turbojet powered) airplanes (regardless of category). For airplanes to which this paragraph applies, "acoustical changes" do not include changes in type design that are limited to one of the following

(i) Gear down flight with one or more retractable landing gear down during the entire flight, or

(ii) Spare engine and nacelle carriage external to the skin of the airplane (and return of the pylon or other external mount), or

(iii) Time-limited engine and/or nacelle changes, where the change in type design specifies that the airplane may not be operated for a period of more than 90 days unless compliance with the applicable acoustical change provisions of part 36 of this chapter is shown for that change in type design.

(3) Propeller driven commuter category and small airplanes in the primary, normal, utility, acrobatic, transport, and restricted categories, except for airplanes that are:

(i) Designated for "agricultural aircraft operations" (as defined in Sec. 137.3 of this chapter, effective January 1, 1966) to which Sec. 36.1583 of this chapter does not apply, or

(ii) Designated for dispensing fire fighting materials to which Sec. 36.1583 of this chapter does not apply, or

(iii) U.S. registered, and that had flight time prior to January 1, 1955 or

(iv) Land configured aircraft reconfigured with floats or skis. This reconfiguration does not

permit further exception from the requirements of the section upon any acoustical change not enumerated in Sec. 21.93(b).

(4) Helicopters except:

(i) Those helicopters that are designated exclusively:

(A) for "agricultural aircraft operations", as defined in Sec. 137.3 of this chapter, as effective on January 1, 1966;

(B) for dispensing fire fighting materials; or

(C) for carrying external loads, as defined in Sec. 133.1(b) of this chapter, as effective on December 20, 1976.

(ii) Those helicopters modified by installation or removal of external equipment. For purposes of this paragraph, "external equipment" means any instrument, mechanism, part, apparatus, appurtenance, or accessory that is attached to, or extends from, the helicopter exterior but is not used nor is intended to be used in operating or controlling a helicopter in flight and is not part of an airframe or engine. An "acoustical change" does not include:

(A) addition or removal of external equipment;

(B) changes in the airframe made to accommodate the addition or removal of external equipment, to provide for an external load attaching means, to facilitate the use of external equipment or external loads, or to facilitate the safe operation of the helicopter with external equipment mounted to, or external loads carried by, the helicopter;

(C) reconfiguration of the helicopter by the addition or removal of floats and skis;

(D) flight with one or more doors and/or windows removed or in an open position; or

(E) any changes in the operational limitations placed on the helicopter as a consequence of the addition or removal of external equipment, floats, and skis, or flight operations with doors and/or windows removed or in an open position.

(c) For purposes of complying with part 34 of this chapter, any voluntary change in the type design of the airplane or engine which may increase fuel venting or exhaust emissions is an "emissions change."

§ 21.303

Replacement and modification parts.

(a) Except as provided in paragraph (b) of this section, no person may produce a modification or replacement part for sale for installation on a type certificated product unless it is produced pursuant to a Parts Manufacturer Approval issued under this subpart.

(b) This section does not apply to the following:

(1) Parts produced under a type or production certificate.

(2) Parts produced by an owner or operator for maintaining or altering his own product.

(3) Parts produced under an FAA Technical Standard Order.

(4) Standard parts (such as bolts and nuts) conforming to established industry or United States specifications.

(c) An application for a Parts Manufacturer Approval is made to the [Manager of the Aircraft Certification Office for the geographic area] in which the manufacturing facility is located and must include the following:

(1) The identity of the product on which the part is to be installed.

(2) The name and address of the manufacturing facilities at which these parts are to be manufactured.

(3) The design of the part, which consists of--

- (i) Drawings and specifications necessary to show the configuration of the part; and
- (ii) Information on dimensions, materials, and processes necessary to define the structural strength of the part.

(4) Test reports and computations necessary to show that the design of the part meets the airworthiness requirements of the Federal Aviation Regulations applicable to the product on which the part is to be installed, unless the applicant shows that the design of the part is identical to the design of a part that is covered under a type certificate. If the design of the part was obtained by a licensing agreement, evidence of that agreement must be furnished.

(d) An applicant is entitled to a Parts Manufacturer Approval for a replacement or modification part if--

(1) The Administrator finds, upon examination of the design and after completing all tests and inspections, that the design meets the airworthiness requirements of the Federal Aviation Regulations applicable to the product on which the part is to be installed; and

(2) He submits a statement certifying that he has established the fabrication inspection system required by paragraph (h) of this section.

(e) Each applicant for a Parts Manufacturer Approval must allow the Administrator to make any inspection or test necessary to determine compliance with the applicable Federal Aviation Regulations. However, unless otherwise authorized by the Administrator--

(1) No part may be presented to the Administrator for an inspection or test unless compliance with paragraphs (f)(2) through (f)(4) of this section has been shown for that part; and

(2) No change may be made to a part between the time that compliance with paragraphs (f)(2) through (f)(4) of this section is shown for that part and the time that the part is presented to the Administrator for the inspection or test.

(f) Each applicant for a Parts Manufacturer Approval must make all inspections and tests necessary to determine--

(1) Compliance with the applicable airworthiness requirements;

(2) That materials conform to the specifications in the design;

(3) That the part conforms to the drawings in the design; and

(4) That the fabrication processes, construction, and assembly conform to those specified in the design.

(g) The Administrator does not issue a Parts Manufacturer Approval if the manufacturing facilities for the part are located outside of the United States, unless the Administrator finds that the location of the manufacturing facilities places no burden on the FAA in administering applicable airworthiness requirements.

(h) Each holder of a Parts Manufacturer Approval shall establish and maintain a fabrication inspection system that ensures that each completed part conforms to its design data and is safe for installation on applicable type certificated products. The system shall include the following:

(1) Incoming materials used in the finished part must be as specified in the design data.

(2) Incoming materials must be properly identified if their physical and chemical properties cannot otherwise be readily and accurately determined.

(3) Materials subject to damage and deterioration must be suitably stored and adequately protected.

(4) Processes affecting the quality and safety of the finished product must be accomplished in accordance with acceptable specifications.

(5) Parts in process must be inspected for conformity with the design data at points in production where accurate determination can be made. Statistical quality control procedures may be employed where it is shown that a satisfactory level of quality will be maintained for

the particular part involved.

(6) Current design drawings must be readily available to manufacturing and inspection personnel, and used when necessary.

(7) Major changes to the basic design must be adequately controlled and approved before being incorporated in the finished part.

(8) Rejected materials and components must be segregated and identified in such a manner as to preclude their use in the finished part.

(9) Inspection records must be maintained, identified with the completed part, where practicable, and retained in the manufacturer's file for a period of at least 2 years after the part has been completed.

(i) A Parts Manufacturer Approval issued under this section is not transferable and is effective until surrendered or withdrawn or otherwise terminated by the Administrator.

(j) The holder of a Parts Manufacturer Approval shall notify the FAA in writing within 10 days from the date the manufacturing facility at which the parts are manufactured is relocated or expanded to include additional facilities at other locations.

(k) Each holder of a Parts Manufacturer Approval shall determine that each completed part conforms to the design data and is safe for installation on type certificated products.

Part 23; AIRWORTHINESS STANDARDS

§ 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.]**

§ 23.1309

Equipment, systems, and installations.

(a) Each item of equipment, each system, and each installation:

(1) When performing its intended function, may not adversely affect the response, operation, or accuracy of any--

(i) Equipment essential to safe operation; or

(ii) Other equipment unless there is a means to inform the pilot of the effect.

(2) In a single-engine airplane, must be designed to minimize hazards to the airplane in the event of a probable malfunction or failure.

(3) In a multiengine airplane, must be designed to prevent hazards to the airplane in the event of a probable malfunction or failure.

(4) In a commuter category airplane, must be designed to safeguard against hazards to the airplane in the event of their malfunction or failure.

(b) The design of each item of equipment, each system, and each installation must be examined separately and in relationship to other airplane systems and installations to determine if the airplane is dependent upon its function for continued safe flight and landing and, for airplanes not limited to VFR conditions, if failure of a system would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions. Each item of equipment, each system, and each installation identified by this examination as one upon which the airplane is dependent for proper functioning to ensure continued safe flight and landing, or whose failure would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions, must be designed to comply with the following additional requirements:

(1) It must perform its intended function under any foreseeable operating condition.

(2) When systems and associated components are considered separately and in relation to other systems--

(i) The occurrence of any failure condition that would prevent the continued safe flight and landing of the airplane must be extremely improbable; and

(ii) The occurrence of any other failure condition that would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions must be improbable.

(3) 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 that could create additional hazards.

(4) Compliance with the requirements of paragraph (b)(2) of this section may be shown by analysis and, where necessary, by appropriate ground, flight, or simulator test. The analysis must consider--

(i) Possible modes of failure, including malfunctions and damage from external sources;

(ii) The probability of multiple failures and the probability of undetected faults;

(iii) The resulting effects of the airplane and occupants, considering the stage of flight and operating conditions; and

(iv) The crew warning cues, corrective action required, and the crew's capability of determining faults.

(c) Each item of equipment, each system, and each installation whose functioning is required by this chapter and that requires a power supply is an "essential load" on the power supply. The power sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:

(1) Loads connected to the power distribution system with the system functioning normally.

(2) Essential loads after failure of--

(i) Any one engine on two-engine airplanes; or

(ii) Any two engines on an airplane with three or more engines; or

(iii) Any power converter or energy storage device.

(3) Essential loads for which an alternate source of power is required, as applicable, by the operating rules of this chapter, after any failure or malfunction in any one power supply system, distribution system, or other utilization system.

(d) In determining compliance with paragraph (c)(2) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operations authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines.

(e) In showing compliance with this section with regard to the electrical power system and to equipment design and installation, critical environmental and atmospheric conditions, including radio frequency energy and the effects (both direct and indirect) of lightning strikes, must be considered. For electrical generation, distribution, and utilization equipment required by or used in complying with this chapter, the ability to provide continuous, safe service under foreseeable environmental conditions may be shown by environmental tests, design analysis, or reference to previous comparable service experience on other airplanes.

(f) As used in this section, "systems" refers to all pneumatic systems, fluid systems, electrical systems, mechanical systems, and powerplant systems included in the airplane design, except for the following:

(1) Powerplant systems provided as part of the certificated engine.

(2) The flight structure (such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments) whose requirements are specific in subparts C and D of this part.

§ 23.1311

Electronic display instrument systems.

(a) Electronic display indicators, including those with features that make isolation and independence between powerplant instrument systems impractical, must:

(1) Meet the arrangement and visibility requirements of §23.1321.

(2) Be easily legible under all lighting conditions encountered in the cockpit, including direct sunlight, considering the expected electronic display brightness level at the end of an electronic display indicator's useful life. Specific limitations on display system useful life must be contained in the Instructions for Continued Airworthiness required by §23.1529.

(3) Not inhibit the primary display of attitude, airspeed, altitude, or powerplant parameters needed by any pilot to set power within established limitations, in any normal mode of operation.

(4) Not inhibit the primary display of engine parameters needed by any pilot to properly set or monitor powerplant limitations during the engine starting mode of operation.

(5) Have an independent magnetic direction indicator and either an independent secondary mechanical altimeter, airspeed indicator, and attitude instrument or individual electronic display indicators for the altitude, airspeed, and attitude that are independent from the airplane's primary electrical power system. These secondary instruments may be installed in panel positions that are displaced from the primary positions specified by §23.1321(d), but must be located where they meet the pilot's visibility requirements of §23.1321(a).

(6) Incorporate sensory cues for the pilot that are equivalent to those in the instrument being replaced by the electronic display indicators.

(7) Incorporate visual displays of instrument markings, required by §§23.1541 through 23.1553, or visual displays that alert the pilot to abnormal operational values or approaches to established limitation values, for each parameter required to be displayed by this part.

(b) The electronic display indicators, including their systems and installations, and considering other airplane systems, must be designed so that one display of information essential for continued safe flight and landing will remain available to the crew, without need for immediate action by any pilot for continued safe operation, after any single failure or probable combination of failures.

(c) As used in this section, "instrument" includes devices that are physically contained in one unit, and devices that are composed of two or more physically separate units or components connected together (such as a remote indicating gyroscopic direction indicator that includes a magnetic sensing element, a gyroscopic unit, an amplifier, and an indicator connected together). As used in this section, "primary" display refers to the display of a parameter that is located in the instrument panel such that the pilot looks at it first when wanting to view that parameter.

§ 23.1321

Arrangement and visibility.

(a) Each flight, navigation, and powerplant instrument for use by any required pilot during takeoff, initial climb, final approach, and landing must be located so that any pilot seated at the controls can monitor the airplane's flight path and these instruments with minimum head and eye movement. The powerplant instruments for these flight conditions are those needed to set power within powerplant limitations.

(b) For each multiengine airplane, identical powerplant instruments must be located so as to prevent confusion as to which engine each instrument relates.

(c) Instrument panel vibration may not damage, or impair the accuracy of, any instrument.

(d) For each airplane, the flight instruments required by Sec. 23.1303, and, as applicable, by the operating rules of this chapter, must be grouped on the instrument panel and centered as nearly as practicable about the vertical plane of each required pilot's forward vision. In addition:

(1) The instrument that most effectively indicates the attitude must be on the panel in the top center position;

(2) The instrument that most effectively indicates airspeed must be adjacent to and directly to the left of the instrument in the top center position;

(3) The instrument that most effectively indicates altitude must be adjacent to and directly to the right of the instrument in the top center position; and

(4) The instrument that most effectively indicates direction of flight, other than the magnetic direction indicator required by Sec. 23.1303(c), must be adjacent to and directly below the instrument in the top center position; and

(5) Electronic display indicators may be used for compliance with paragraphs (d)(1) through (d)(4) of this section when such displays comply with requirements in Sec. 23.1311.

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

§ 23.1331

Instruments using a power source.

For each instrument that uses a power source, the following apply:

(a) Each instrument must have an integral visual power annunciator or separate power indicator to indicate when power is not adequate to sustain proper instrument performance. If a separate indicator is used, it must be located so that the pilot using the instruments can monitor the indicator with minimum head and eye movement. The power must be sensed at or near the point where it enters the instrument. For electric and vacuum/pressure instruments, the power is considered to be adequate when the voltage or the vacuum/pressure, respectively, is within approved limits.

(b) The installation and power supply systems must be designed so that—

(1) The failure of one instrument will not interfere with the proper supply of energy to the remaining instrument; and

(2) The failure of the energy supply from one source will not interfere with the proper supply of energy from any other source.

(c) There must be at least two independent sources of power (not driven by the same engine on multiengine airplanes), and a manual or an automatic means to select each power source.

§ 23.1351

General.

(a) Electrical system capacity. Each electrical system must be adequate for the intended use. In addition--

(1) Electric power sources, their transmission cables, and their associated control and protective devices, must be able to furnish the required power at the proper voltage to each load circuit essential for safe operation; and

(2) Compliance with paragraph (a)(1) of this section must be shown as follows--

(i) For normal, utility, and acrobatic category airplanes, by an electrical load analysis or by electrical measurements that account for the electrical loads applied to the electrical system in probable combinations and for probable durations; and

(ii) For commuter category airplanes, by an electrical load analysis that accounts for the electrical loads applied to the electrical system in probable combinations and for probable durations.

(b) Function. For each electrical system, the following apply:

(1) Each system, when installed, must be--

(i) Free from hazards in itself, in its method of operation, and in its effects on other parts of the airplane;

(ii) Protected from fuel, oil, water, other detrimental substances, and mechanical damage; and

(iii) So designed that the risk of electrical shock to crew, passengers, and ground personnel is reduced to a minimum.

[(2) Electric power sources must function properly when connected in combination or independently.

(3) No failure or malfunction of any electric power source may impair the ability of any remaining source to supply load circuits essential for safe operation.

(4) In addition, for commuter category airplanes, the following apply:]

(i) Each system must be designed so that essential load circuits can be supplied in the event of reasonably probable faults or open circuits including faults in heavy current carrying cables;

(ii) A means must be accessible in flight to the flight crewmembers for the individual and collective disconnection of the electrical power sources from the system;

(iii) The system must be designed so that voltage and frequency, if applicable, at the terminals of all essential load equipment can be maintained within the limits for which the equipment is designed during any probable operating conditions;

(iv) If two independent sources of electrical power for particular equipment or systems are required, their electrical energy supply must be ensured by means such as duplicate electrical equipment, throwover switching, or multichannel or loop circuits separately routed; and

(v) For the purpose of complying with paragraph (b)(5) of this section, the distribution

system includes the distribution busses, their associated feeders, and each control and protective device.

(c) *Generating system.* There must be at least one generator/alternator if the electrical system supplies power to load circuits essential for safe operation. In addition--

(1) Each generator/alternator must be able to deliver its continuous rated power, or such power as is limited by its regulation system.

(2) Generator/alternator voltage control equipment must be able to dependably regulate the generator/alternator output within rated limits;

[(3) Automatic means must be provided to prevent damage to any generator/alternator and adverse effects on the airplane electrical system due to reverse current. A means must also be provided to disconnect each generator/alternator from the battery and other generators/alternators.]

(4) There must be a means to give immediate warning to the flight crew of a failure of any generator/alternator.

(5) Each generator/alternator must have an overvoltage control designed and installed to prevent damage to the electrical system, or to equipment supplied by the electrical system that could result if that generator/alternator were to develop an overvoltage condition.

(d) *Instruments.* A means must exist to indicate to appropriate flight crewmembers the electric power system quantities essential for safe operation.

(1) For normal, utility, and acrobatic category airplanes with direct current systems, an ammeter that can be switched into each generator feeder may be used and, if only one generator exists, the ammeter may be in the battery feeder.

(2) For commuter category airplanes, the essential electric power system quantities include the voltage and current supplied by each generator.

(e) *Fire resistance.* Electrical equipment must be so designed and installed that in the event of a fire in the engine compartment, during which the surface of the firewall adjacent to the fire is heated to 2,000° F for 5 minutes or to a lesser temperature substantiated by the applicant, the equipment essential to continued safe operation and located behind the firewall will function satisfactorily and will not create an additional fire hazard.

(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.

(g) 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 and any other standby electrical sources) 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; and

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

§ 23.1357

Circuit protective devices.

(a) Protective devices, such as fuses or circuit breakers, must be installed in all electrical circuits other than--

[(1) Main circuits of starter motors used during starting only; and]

(2) Circuits in which no hazard is presented by their omission.

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

(c) Each resettable circuit protective device ("trip free" device in which the tripping mechanism cannot be overridden by the operating control) must be designed so that--

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(1) A manual operation is required to restore service after tripping; and

(2) If an overload or circuit fault exists, the device will open the circuit regardless of the position of the operating control.

(d) If the ability to reset a circuit breaker or replace a fuse is essential to safety in flight, that circuit breaker or fuse must be so located and identified that it can be readily reset or replaced in flight.

(e) For fuses identified as replaceable in flight--

(1) There must be one spare of each rating or 50 percent spare fuses of each rating, whichever is greater; and

(2) The spare fuse(s) must be readily accessible to any required pilot.

§ 23.1365

Electric cables and equipment.

(a) Each electric connecting cable must be of adequate capacity.

(b) Any equipment that is associated with any electrical cable installation and that would overheat in the event of circuit overload or fault must be flame resistant. That equipment and the electrical cables must not emit dangerous quantities of toxic fumes.

(c) Main power cables (including generator cables) in the fuselage must be designed to allow a reasonable degree of deformation and stretching without failure and must--

(1) Be separated from flammable fluid lines; or

(2) Be shrouded by means of electrically insulated flexible conduit, or equivalent, which is in addition to the normal cable insulation.

(d) Means of identification must be provided for electrical cables, terminals, and connectors.

(e) Electrical cables must be installed such that the risk of mechanical damage and/or damage caused by fluids vapors, or sources of heat, is minimized.

(f) Where a cable cannot be protected by a circuit protection device or other overload protection, it must not cause a fire hazard under fault conditions.

§ 23.1367

Switches.

Each switch must be--

- (a) Able to carry its rated current;**
- (b) Constructed with enough distance or insulating material between current carrying parts and the housing so that vibration in flight will not cause shorting;**
- (c) Accessible to appropriate flight crewmembers; and**
- (d) Labeled as to operation and the circuit controlled.**

Part 43; MAINTENANCE, PREVENTIVE MAINTENANCE, REBUILDING AND ALTERATION.

§ 43.1

Applicability.

[(a) Except as provided in paragraphs (b) and (d) of this section, this part prescribes rules governing the maintenance, preventive maintenance, rebuilding, and alteration of any-]

(1) Aircraft having a U.S. airworthiness certificate;

(2) Foreign-registered civil aircraft used in common carriage or carriage of mail under the provisions of Part 121, or 135 of this chapter; and

(3) Airframe, aircraft engines, propellers, appliances, and component parts of such aircraft.

[(b) This part does not apply to any aircraft for which the FAA has issued an experimental certificate, unless the FAA has previously issued a different kind of airworthiness certificate for that aircraft.]

(c) This part applies to all life-limited parts that are removed from a type certificated product, segregated, or controlled as provided in Sec. 43.10.

[(d) This part applies to any aircraft issued a special airworthiness certificate in the light-sport category except:

(1) The repair or alteration form specified in §§43.5 (b) and 43.9 (d) is not required to be completed for products not produced under an FAA approval;

(2) Major repairs and major alterations for products not produced under an FAA approval are not required to be recorded in accordance with appendix B of this part; and

(3) The listing of major alterations and major repairs specified in paragraphs (a) and (b) of appendix A of this part is not applicable to products not produced under an FAA approval.

§ 43.3

Persons authorized to perform maintenance, preventive maintenance, rebuilding, and alterations.

(a) Except as provided in this section and Sec. 43.17, no person may maintain, rebuild, alter, or perform preventive maintenance on an aircraft, airframe, aircraft engine, propeller, appliance, or component part to which this part applies. Those items, the performance of which is a major alteration, a major repair, or preventive maintenance, are listed in appendix A.

(b) The holder of a mechanic certificate may perform maintenance, preventive maintenance, and alterations as provided in Part 65 of this chapter.

(c) The holder of a repairman certificate may perform maintenance, preventive maintenance, and alterations as provided in part 65 of this chapter.

(d) A person working under the supervision of a holder of a mechanic or repairman certificate may perform the maintenance, preventive maintenance, and alterations that his supervisor is authorized to perform, if the supervisor personally observes the work being done to the extent necessary to ensure that it is being done properly and if the supervisor is readily available, in person, for consultation. However, this paragraph does not authorize the performance of any inspection required by Part 91 or Part 125 of this chapter or any inspection performed after a major repair or alteration.

(e) The holder of a repair station certificate may perform maintenance, preventive maintenance, and alterations as provided in Part 145 of this chapter.

(f) The holder of an air carrier operating certificate or an operating certificate issued under Part 121 or 135, may perform maintenance, preventive maintenance, and alterations as provided in Part 121 or 135.

[(g) Except for holders of a sport pilot certificate, the holder of a pilot certificate issued under part 61 may perform preventive maintenance on any aircraft owned or operated by that pilot which is not used under part 121, 129, or 135 of this chapter.

The holder of a sport pilot certificate may perform preventive maintenance on an aircraft owned or operated by that pilot and issued a special airworthiness certificate in the light-sport category.]

(h) Notwithstanding the provisions of paragraph (g) of this section, the Administrator may approve a certificate holder under Part 135 of this chapter, operating rotorcraft in a remote area, to allow a pilot to perform specific preventive maintenance items provided--

(1) The items of preventive maintenance are a result of a known or suspected mechanical difficulty or malfunction that occurred en route to or in a remote area;

(2) The pilot has satisfactorily completed an approved training program and is authorized in writing by the certificate holder for each item of preventive maintenance that the pilot is authorized to perform;

(3) There is no certificated mechanic available to perform preventive maintenance;

(4) The certificate holder has procedures to evaluate the accomplishment of a preventive maintenance item that requires a decision concerning the airworthiness of the rotorcraft; and

(5) The items of preventive maintenance authorized by this section are those listed in paragraph (c) of appendix A of this part.

(i) Notwithstanding the provisions of paragraph (g) of this section, in accordance with an approval issued to the holder of a certificate issued under part 135 of this chapter, a pilot of an aircraft type-certificated for 9 or fewer passenger seats, excluding any pilot seat, may perform the removal and reinstallation of approved aircraft cabin seats, approved cabin-mounted stretchers, and when no tools are required, approved cabin-mounted medical oxygen bottles, provided--

(1) The pilot has satisfactorily completed an approved training program and is authorized in writing by the certificate holder to perform each task; and

(2) The certificate holder has written procedures available to the pilot to evaluate the accomplishment of the task.

(j) A manufacturer may--

(1) Rebuild or alter any aircraft, aircraft engine, propeller, or appliance manufactured by him under a type or production certificate;

(2) Rebuild or alter any appliance or part of aircraft, aircraft engines, propellers, or appliances manufactured by him under a Technical Standard Order Authorization, an FAA-Parts Manufacturer Approval, or Product and Process Specification issued by the Administrator; and

(3) Perform any inspection required by Part 91 or Part 125 of this chapter on aircraft it manufactures, while currently operating under a production certificate or under a currently approved production inspection system for such aircraft.

§ 43.9

Content, form, and disposition of maintenance, preventive maintenance, rebuilding, and alteration records (except inspections performed in accordance with part 91, part 125, Sec. 135.411(a)(1), and Sec. 135.419 of this chapter).

(a) Maintenance record entries. **Except as provided in paragraphs (b) and (c) of this section, each person who maintains, performs preventive maintenance, rebuilds, or alters an aircraft, airframe, aircraft engine, propeller, appliance, or component part shall make an entry in the maintenance record of that equipment containing the following information:**

(1) A description (or reference to data acceptable to the Administrator) of work performed.

(2) The date of completion of the work performed.

(3) The name of the person performing the work if other than the person specified in paragraph (a)(4) of this section.

(4) If the work performed on the aircraft, airframe, aircraft engine, propeller, appliance, or component part has been performed satisfactorily, the signature, certificate number, and kind of certificate held by the person approving the work. The signature constitutes the approval for return to service only for the work performed.

(b) Each holder of an air carrier operating certificate or an operating certificate issued under Part 121 or 135 that is required by its approved operations specifications to provide for a continuous airworthiness maintenance program, shall make a record of the maintenance, preventive maintenance, rebuilding, and alteration, on aircraft, airframes, aircraft engines, propellers, appliances, or component parts which it operates in accordance with the applicable provisions of Part 121 or 135 of this chapter, as appropriate.

(c) This section does not apply to persons performing inspections in accordance with Part 91, 125, Sec. 135.411(a)(1), or Sec. 135.419 of this chapter.

[(d) In addition to the entry required by paragraph (a) of this section, major repairs and major alterations shall be entered on a form, and the form disposed of, in the manner prescribed in appendix B, by the person performing the work.

§ 43.13

Performance rules (general).

(a) Each person performing maintenance, alteration, or preventive maintenance on an aircraft, engine, propeller, or appliance shall use the methods, techniques, and practices prescribed in the current manufacturer's maintenance manual or Instructions for Continued Airworthiness prepared by its manufacturer, or other methods, techniques, and practices acceptable to the Administrator, except as noted in Sec. 43.16. He shall use the tools, equipment, and test apparatus necessary to assure completion of the work in accordance with accepted industry practices. If special equipment or test apparatus is recommended by the manufacturer involved, he must use that equipment or apparatus or its equivalent acceptable to the Administrator.

(b) Each person maintaining or altering, or performing preventive maintenance, shall do that work in such a manner and use materials of such a quality, that the condition of the aircraft, airframe, aircraft engine, propeller, or appliance worked on will be at least equal to its original or properly altered condition (with regard to aerodynamic

function, structural strength, resistance to vibration and deterioration, and other qualities affecting airworthiness).

(c) Special provisions for holders of air carrier operating certificates and operating certificates issued under the provisions of [Part 121 or 135 and Part 129] operators holding operations specifications. Unless otherwise notified by the administrator, the methods, techniques, and practices contained in the maintenance manual or the maintenance part of the manual of the holder of an air carrier operating certificate or an operating certificate under Part [121 or 135] and Part 129 operators holding operations specifications (that is required by its operating specifications to provide a continuous airworthiness maintenance and inspection program) constitute acceptable means of compliance with this section.

Appendix A

Sec. A43.1

(a) *Major alterations--*

(1) *Airframe major alterations.* Alterations of the following parts and alterations of the following types, when not listed in the aircraft specifications issued by the FAA, are airframe major alterations:

- (i) Wings.
- (ii) Tail surfaces.
- (iii) Fuselage.
- (iv) Engine mounts.
- (v) Control system.
- (vi) Landing gear.
- (vii) Hull or floats.
- (viii) Elements of an airframe including spars, ribs, fittings, shock absorbers, bracing, cowling, fairings, and balance weights.
- (ix) Hydraulic and electrical actuating system of components.
- (x) Rotor blades.
- (xi) Changes to the empty weight or empty balance which result in an increase in the maximum certificated weight or center of gravity limits of the aircraft.
- (xii) Changes to the basic design of the fuel, oil, cooling, heating, cabin pressurization, electrical, hydraulic, de-icing, or exhaust systems.
- (xiii) Changes to the wing or to fixed or movable control surfaces which affect flutter and vibration characteristics.

(2) *Powerplant major alterations.* The following alterations of a powerplant when not listed in the engine specifications issued by the FAA, are powerplant major alterations.

- (i) Conversion of an aircraft engine from one approved model to another, involving any changes in compression ratio, propeller reduction gear, impeller gear ratios or the substitution of major engine parts which requires extensive rework and testing of the engine.
- (ii) Changes to the engine by replacing aircraft engine structural parts with parts not supplied by the original manufacturer or parts not specifically approved by the Administrator.
- (iii) Installation of an accessory which is not approved for the engine.
- (iv) Removal of accessories that are listed as required equipment on the aircraft or engine specification.
- (v) Installation of structural parts other than the type of parts approved for the installation.
- (vi) Conversions of any sort for the purpose of using fuel of a rating or grade other than that listed in the engine specifications.

(3) *Propeller major alterations.* The following alterations of a propeller when not authorized in the propeller specifications issued by the FAA are propeller major alterations:

- (i) Changes in blade design.
- (ii) Changes in hub design.
- (iii) Changes in the governor or control design.
- (iv) Installation of a propeller governor or feathering system.
- (v) Installation of propeller de-icing system.
- (vi) Installation of parts not approved for the propeller.

(4) *Appliance major alterations.* Alterations of the basic design not made in accordance with recommendations of the appliance manufacturer or in accordance with an FAA Airworthiness Directive are appliance major alterations. In addition, changes in the basic design of radio communication and navigation equipment approved under type certification or a Technical Standard Order that have an effect on frequency stability, noise level, sensitivity, selectivity, distortion, spurious radiation, AVC characteristics, or ability to meet environmental test conditions and other changes that have an effect on the performance of the equipment are also major alterations.

(b) *Major repairs--*

(1) *Airframe major repairs.* Repairs to the following parts of an airframe and repairs of the following types, involving the strengthening, reinforcing, splicing, and manufacturing of primary structural members or their replacement, when replacement is by fabrication such as

riveting or welding, are airframe major repairs.

- (i) Box beams.
- (ii) Monocoque or semimonocoque wings or control surfaces.
- (iii) Wing stringers or chord members.
- (iv) Spars.
- (v) Spar flanges.
- (vi) Members of truss-type beams.
- (vii) Thin sheet webs of beams.
- (viii) Keel and chine members of boat hulls or floats.
- (ix) Corrugated sheet compression members which act as flange material of wings or tail surfaces.
- (x) Wing main ribs and compression members.
- (xi) Wing or tail surface brace struts.
- (xii) Engine mounts.
- (xiii) Fuselage longerons.
- (xiv) Members of the side truss, horizontal truss, or bulkheads.
- (xv) Main seat support braces and brackets.
- (xvi) Landing gear brace struts.
- (xvii) Axles.
- (xviii) Wheels.
- (xix) Skis, and ski pedestals.
- (xx) Parts of the control system such as control columns, pedals, shafts, brackets, or horns.
- (xxi) Repairs involving the substitution of material.
- (xxii) The repair of damaged areas in metal or plywood stressed covering exceeding six inches in any direction.
- (xxiii) The repair of portions of skin sheets by making additional seams.
- (xxiv) The splicing of skin sheets.
- (xxv) The repair of three or more adjacent wing or control surface ribs or the leading edge of wings and control surfaces, between such adjacent ribs.

- (xxvi) Repair of fabric covering involving an area greater than that required to repair two adjacent ribs.
- (xxvii) Replacement of fabric on fabric covered parts such as wings, fuselages, stabilizers, and control surfaces.
- (xxviii) Repairing, including rebottoming, of removable or integral fuel tanks and oil tanks.
- (2) *Powerplant major repairs.* Repairs of the following parts of an engine and repairs of the following types, are powerplant major repairs:
- (i) Separation or disassembly of a crankcase or crankshaft of a reciprocating engine equipped with an integral supercharger.
 - (ii) Separation or disassembly of a crankcase or crankshaft of a reciprocating engine equipped with other than spur-type propeller reduction gearing.
 - (iii) Special repairs to structural engine parts by welding, plating, metalizing, or other methods.
- (3) *Propeller major repairs.* Repairs of the following types to a propeller are propeller major repairs:
- (i) Any repairs to, or straightening of steel blades.
 - (ii) Repairing or machining of steel hubs.
 - (iii) Shortening of blades.
 - (iv) Retipping of wood propellers.
 - (v) Replacement of outer laminations on fixed pitch wood propellers.
 - (vi) Repairing elongated bolt holes in the hub of fixed pitch wood propellers.
 - (vii) Inlay work on wood blades.
 - (viii) Repairs to composition blades.
 - (ix) Replacement of tip fabric.
 - (x) Replacement of plastic covering.
 - (xi) Repair of propeller governors.
 - (xii) Overhaul of controllable pitch propellers.
 - (xiii) Repairs to deep dents, cuts, scars, nicks, etc., and straightening of aluminum blades.
 - (xiv) The repair or replacement of internal elements of blades.
- (4) *Appliance major repairs.* Repairs of the following types to appliances are appliance major repairs:
- (i) Calibration and repair of instruments.
 - (ii) Calibration of radio equipment.
 - (iii) Rewinding the field coil of an electrical accessory.
 - (iv) Complete disassembly of complex hydraulic power valves.
 - (v) Overhaul of pressure type carburetors, and pressure type fuel, oil and hydraulic pumps.
- (c) Preventive maintenance. Preventive maintenance is limited to the following work, provided it does not involve complex assembly operations:**
- (1) Removal, installation, and repair of landing gear tires.
 - (2) Replacing elastic shock absorber cords on landing gear.
 - (3) Servicing landing gear shock struts by adding oil, air, or both.
 - (4) Servicing landing gear wheel bearings, such as cleaning and greasing.
 - (5) Replacing defective safety wiring or cotter keys.
 - (6) Lubrication not requiring disassembly other than removal of nonstructural items such as cover plates, cowlings, and fairings.
 - (7) Making simple fabric patches not requiring rib stitching or the removal of structural parts or control surfaces. In the case of balloons, the making of small fabric repairs to envelopes (as defined in, and in accordance with, the balloon manufacturers' instructions) not requiring load tape repair or replacement.
 - (8) Replenishing hydraulic fluid in the hydraulic reservoir.

- (9) Refinishing decorative coating of fuselage, balloon baskets, wings tail group surfaces (excluding balanced control surfaces), fairings, cowlings, landing gear, cabin, or cockpit interior when removal or disassembly of any primary structure or operating system is not required.
- (10) Applying preservative or protective material to components where no disassembly of any primary structure or operating system is involved and where such coating is not prohibited or is not contrary to good practices.
- (11) Repairing upholstery and decorative furnishings of the cabin, cockpit, or balloon basket interior when the repairing does not require disassembly of any primary structure or operating system or interfere with an operating system or affect the primary structure of the aircraft.
- (12) Making small simple repairs to fairings, nonstructural cover plates, cowlings, and small patches and reinforcements not changing the contour so as to interfere with proper air flow.
- (13) Replacing side windows where that work does not interfere with the structure or any operating system such as controls, electrical equipment, etc.
- (14) Replacing safety belts.
- (15) Replacing seats or seat parts with replacement parts approved for the aircraft, not involving disassembly of any primary structure or operating system.
- (16) Trouble shooting and repairing broken circuits in landing light wiring circuits.
- (17) Replacing bulbs, reflectors, and lenses of position and landing lights.
- (18) Replacing wheels and skis where no weight and balance computation is involved.
- (19) Replacing any cowling not requiring removal of the propeller or disconnection of flight controls.
- (20) Replacing or cleaning spark plugs and setting of spark plug gap clearance.
- (21) Replacing any hose connection except hydraulic connections.
- (22) Replacing prefabricated fuel lines.
- (23) Cleaning or replacing fuel and oil strainers or filter elements.
- (24) Replacing and servicing batteries.
- (25) Cleaning of balloon burner pilot and main nozzles in accordance with the balloon manufacturer's instructions.
- (26) Replacement or adjustment of nonstructural standard fasteners incidental to operations.**
- (27) The interchange of balloon baskets and burners on envelopes when the basket or burner is designated as interchangeable in the balloon type certificate data and the baskets and burners are specifically designed for quick removal and installation.
- (28) The installations of anti-misfueling devices to reduce the diameter of fuel tank filler openings provided the specific device has been made a part of the aircraft type certificate data by the aircraft manufacturer, the aircraft manufacturer has provided FAA-approved instructions for installation of the specific device, and installation does not involve the disassembly of the existing tank filler opening.
- (29) Removing, checking, and replacing magnetic chip detectors.
- (30) The inspection and maintenance tasks prescribed and specifically identified as preventive maintenance in a primary category aircraft type certificate or supplemental type certificate holder's approved special inspection and preventive maintenance program when accomplished on a primary category aircraft provided:
 - (i) They are performed by the holder of at least a private pilot certificate issued under part 61 who is the registered owner (including co-owners) of the affected aircraft and who holds a certificate of competency for the affected aircraft (1) issued by a school approved under Sec. 147.21(e) of this chapter; (2) issued by the holder of the production certificate for that primary category aircraft that has a special training program approved under Sec. 21.24 of

this subchapter; or (3) issued by another entity that has a course approved by the Administrator; and

(ii) The inspections and maintenance tasks are performed in accordance with instructions contained by the special inspection and preventive maintenance program approved as part of the aircraft's type design or supplemental type design.

(31) Removing and replacing self-contained, front instrument panel-mounted navigation and communication devices that employ tray-mounted connectors that connect the unit when the unit is installed into the instrument panel, (excluding automatic flight control systems, transponders, and microwave frequency distance measuring equipment (DME)). The approved unit must be

designed to be readily and repeatedly removed and replaced, and pertinent instructions must be provided. Prior to the unit's intended use, and operational check must be performed in accordance with the applicable sections of part 91 of this chapter.

(32) Updating self-contained, front instrument panel-mounted Air Traffic Control (ATC) navigational software data bases (excluding those of automatic flight control systems, transponders, and microwave frequency distance measuring equipment (DME)) provided no disassembly of the unit is required and pertinent instructions are provided. Prior to the unit's intended use, an operational check must be performed in accordance with applicable sections of part 91 of this chapter.

Appendix B

Sec. B43.1

(a) Except as provided in paragraphs (b), (c), and (d) of this appendix, each person performing a major repair or major alteration shall--

(1) Execute FAA Form 337 at least in duplicate;

(2) Give a signed copy of that form to the aircraft owner; and

(3) Forward a copy of that form to the FAA Aircraft Registration Branch in Oklahoma City, Oklahoma, within 48 hours after the aircraft, airframe, aircraft engine, propeller, or appliance is approved for return to service.

(b) For major repairs made in accordance with a manual or specifications acceptable to the Administrator, a certificated repair station may, in place of the requirements of paragraph

(a)--

(1) Use the customer's work order upon which the repair is recorded;

(2) Give the aircraft owner a signed copy of the work order and retain a duplicate copy for at least two years from the date of approval for return to service of the aircraft, airframe, aircraft engine, propeller, or appliance;

(3) Give the aircraft owner a maintenance release signed by an authorized representative of the repair station and incorporating the following information:

(i) Identity of the aircraft, airframe, aircraft engine, propeller or appliance.

(ii) If an aircraft, the make, model, serial number, nationality and registration marks, and location of the repaired area.

(iii) If an airframe, aircraft engine, propeller, or appliance, give the manufacturer's name, name of the part, model, and serial numbers (if any); and

(4) Include the following or a similarly worded statement--

"The aircraft, airframe, aircraft engine, propeller, or appliance identified above was repaired and inspected in accordance with current Regulations of the Federal Aviation Agency and is

approved for return to service.

Pertinent details of the repair are on file at this repair station under Order No. -----,

Date-----

Signed-----

For signature of authorized representative)

Repair station name) (Certificate No.)

-----."

(Address)

[(c) Except as provided in paragraph (d) of this appendix, for a major repair or major alteration made by a person authorized in Sec. 43.17, the person who performs the major repair or major alteration and the person authorized by Sec. 43.17 to approve that work shall execute an FAA Form 337 at least in duplicate. A completed copy of that form shall be-

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(1) Given to the aircraft owner; and

(2) Forwarded to the Federal Aviation Administration, Aircraft Registration Branch, AFS-750, Post Office Box 25504, Oklahoma City, OK 73125, within 48 hours after the work is inspected.

(d) For extended-range fuel tanks installed within the passenger compartment or a baggage compartment, the person who performs the work and the person authorized to approve the work by Sec. 43.7 shall execute an FAA Form 337 in at least triplicate. A completed copy of that form shall be--

(1) Placed on board the aircraft as specified in Sec. 91.417 of this chapter;

(2) Given to the aircraft owner; and

(3) Forwarded to the Federal Aviation Administration, Aircraft Registration Branch, AFS-751, Post Office Box 25724, Oklahoma City, OK 73125, within 48 hours after the work is inspected.

Part 91; GENERAL OPERATING AND FLIGHT RULES.

§ 91.303

Aerobatic flight.

No person may operate an aircraft in aerobatic flight--

(a) Over any congested area of a city, town, or settlement;

(b) Over an open air assembly of persons;

(c) Within the lateral boundaries of the surface areas of Class B, Class C, Class D, or Class E airspace designated for an airport;

(d) Within 4 nautical miles of the center line of any Federal airway;

(e) Below an altitude of 1,500 feet above the surface; or

(f) When flight visibility is less than 3 statute miles.

For the purposes of this section, aerobatic flight means an intentional maneuver involving an abrupt change in an aircraft's attitude, an **abnormal attitude**, or abnormal acceleration, not necessary for normal flight.

§ 91.305

Flight test areas.

No person may flight test an aircraft except over open water, or sparsely populated areas, having light air traffic.

§ 91.407

Operation after maintenance, preventive maintenance, rebuilding, or alteration.

(a) No person may operate any aircraft that has undergone maintenance, preventive maintenance, rebuilding, or alteration unless--

(1) It has been approved for return to service by a person authorized under Sec. 43.7 of this chapter; and

(2) The maintenance record entry required by Sec. 43.9 or Sec. 43.11, as applicable, of this chapter has been made.

(b) No person may carry any person (other than crewmembers) in an aircraft that has been maintained, rebuilt, or altered in a manner that may have appreciably changed its flight characteristics or substantially affected its operation in flight until an appropriately rated pilot with at least a private pilot certificate flies the aircraft, makes an operational check of the maintenance performed or alteration made, and logs the flight in the aircraft records.

(c) The aircraft does not have to be flown as required by paragraph (b) of this section if, prior to flight, ground tests, inspection, or both show conclusively that the maintenance, preventive maintenance, rebuilding, or alteration has not appreciably changed the flight characteristics or substantially affected the flight operation of the aircraft.