# CIVIL AERONAUTICS BOARD

WASHINGTON, D. C.

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## CIVIL AIR REGULATIONS

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# PART 14--AIRCRAFT PROPELLER AIRWORTHINESS



As Amended to December 15, 1956

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# TITLE 14—CIVIL AVIATION

## Chapter I—Civil Aeronautics Board

Subchapter A—Civil Air Regulations

PART 14—AIRCRAFT PROPELLER AIRWORTHINESS

REVISION OF PART

Because of the number of changes resulting from current amendments to Part 14, there follows a revision of Part 14 incorporating all changes thereto which were in effect on December 15, 1956.

By the Civil Aeronautics Board.

(SEAL) M. C. MULLIGAN, *Secretary.*

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AUTHORITY: §§ 14.0 to 14.157 issued under sec. 205, 52 Stat. 984; 49 U. S. C. 425. Interpret or apply secs. 601, 603, 52 Stat. 1007, as amended, 1009, as amended; 49 U. S. C. 551, 553.

### SUBPART A—GENERAL

APPLICABILITY AND DEFINITIONS

§ 14.0 *Applicability of this part.* This part establishes standards with which compliance shall be demonstrated for the issuance of and changes to type certificates for propellers[1] used on aircraft. This part, until superseded or rescinded, shall apply to all propellers for which applications for type certification are made after the effective date of this part (August 20, 1938).

§ 14.1 *Definitions.* As used in this part, terms are defined as follows:

(a) *Administration*—(1) *Administrator.* The Administrator is the Administrator of Civil Aeronautics.

(2) *Applicant.* An applicant is a person or persons applying for approval of a propeller or any part thereof.

(3) *Approved.* Approved, when used alone or as modifying terms such as means, devices, specifications, etc., means approved by the Administrator. (See § 14.18.)

(b) *General design*—(1) *Propeller.* A propeller includes all parts, appurtenances, and accessories thereof.[2]

(2) *Propeller accessories.* Propeller accessories are those necessary for the control and operation of the propeller.

(3) *Pitch setting.* Pitch setting is the propeller blade setting determined by the blade angle measured in a manner, and at a radius, specified in the instruction manual for the propeller.

(4) *Fixed-pitch propeller.* A fixed-pitch propeller is a propeller the pitch setting of which cannot be changed except by processes constituting a workshop operation.

(5) *Adjustable-pitch propeller.* An adjustable-pitch propeller is a propeller the pitch setting of which can be conveniently changed in the course of ordinary field maintenance but which cannot be changed when the propeller is rotating.

(6) *Variable-pitch propeller.* A variable-pitch propeller is a propeller the pitch setting of which can be changed by the flight crew or by automatic means while the propeller is rotating.

(7) *Feathered pitch.* Feathered pitch is the propeller pitch setting which in flight, with the engines stopped, gives approximately the minimum drag and corresponds with a wind-milling torque of approximately zero.

(8) *Reverse pitch.* Reverse pitch is the propeller pitch setting for any blade angle used beyond zero pitch (e. g. the negative angle used for reverse thrust).

CERTIFICATION

§ 14.10 *Eligibility for type certificates.* A propeller shall be eligible for type certification under the provisions of this part if it complies with the airworthiness provisions hereinafter established or if the Administrator finds that the provision or provisions not complied with are compensated for by factors which provide an equivalent level of safety: *Provided,* That the Administrator finds no feature or characteristic of the propeller which renders it unsafe for use on aircraft.

§ 14.11 *Designation of applicable regulations.* The provisions of this section shall apply to all propeller types certificated under this part irrespective of the date of application for type certificate.

(a) Unless otherwise established by the Board, the propeller shall comply with the provisions of this part together with all amendments thereto effective on the date of application for type certificate, except that compliance with later effective amendments may be elected or required pursuant to paragraphs (c), (d), and (e) of this section.

(b) If the interval between the date of application for type certificate and the issuance of the corresponding type certificate exceeds three years, a new application for type certificate shall be required, except that for applications pending on May 1, 1954, such three-year period shall commence on that date. At the option of the applicant, a new application may be filed prior to the expiration of the three-year period. In either instance the applicable regulations shall be those effective on the date of the new application in accordance with paragraph (a) of this section.

(c) During the interval between filing the application and the issuance of a type certificate, the applicant may elect to show compliance with any amendment of this part which becomes effective during that interval, in which case all other amendments found by the Administrator to be directly related shall be complied with.

(d) Except as otherwise provided by the Board, or by the Administrator pursuant to § 1.24 of this subchapter, a change to the type certificate (see § 14.13 (b)) may be accomplished, at the option of the holder of the type certificate, either in accordance with the regulations incorporated by reference in the type certificate pursuant to § 14.13 (c), or in accordance with subsequent amendments to such regulations in effect on the date of application for approval of the change, subject to the following provisions:

(1) When the applicant elects to show compliance with an amendment to the regulations in effect on the date of application for approval of a change, he shall show compliance with all amendments which the Administrator finds are directly related to the particular amendment selected by the applicant.

(2) When the change consists of a new design or a substantially complete redesign of a major component of the propeller and the Administrator finds that the regulations incorporated by reference in the type certificate pursuant to § 14.13 (c) do not provide complete standards with respect to such change, he shall require compliance with such provisions of the regulations in effect on the date of application for approval of the change as he finds will provide a level of safety equal to that established by the regulations incorporated by reference at the time of issuance of the type certificate.

(e) If changes listed in subparagraphs (1) through (3) of this paragraph are made, the propeller shall be considered as a new type, in which case a new application for type certificate shall be required and the regulations together with all amendments thereto effective on the date of the new application shall be made applicable in accordance with paragraphs (a), (b), (c), and (d) of this section.

(1) A change in number of blades;

(2) A change in the principle of pitch change operation;

(3) A change in design which the Administrator finds is so extensive as to require a substantially complete investigation of compliance with the regulations.

[1] Applicable to both reciprocating and turbine engines, unless otherwise stated.

[2] As defined in Section 1 of the Civil Aeronautics Act of 1938, as amended.

§ 14.12 *Recording of applicable regulations.* The Administrator, upon the issuance of a type certificate, shall record the applicable regulations with which compliance was demonstrated. Thereafter, the Administrator shall record the applicable regulations for each change in the type certificate which is accomplished in accordance with regulations other than those recorded at the time of issuance of the type certificate. (See § 14.11.)

§ 14.13 *Type certificate.* (a) An applicant shall be issued a type certificate when he demonstrates the eligibility of the propeller by complying with the requirements of this part in addition to the applicable requirements in Part 1 of this subchapter.[3]

(b) The type certificate shall be deemed to include the type design (see § 14.14 (b), the operating limitations for the propeller (see § 14.16), and any other conditions or limitations prescribed by the regulations in this subchapter.

(c) The applicable provisions of this part recorded by the Administrator in accordance with § 14.12 shall be considered as incorporated in the type certificate as though set forth in full.

§ 14.14 *Data required.* (a) The applicant for a type certificate shall submit to the Administrator such descriptive data, test reports, and computations as are necessary to demonstrate that the propeller complies with the requirements of this part.

(b) The descriptive data required in paragraph (a) of this section shall be known as the type design and shall consist of such drawings and specifications as are necessary to disclose the configuration of the propeller and all the design features covered in the requirements of this part, such information on dimensions, materials, and processes as is necessary to define the structural strength of the propeller, and such other data as are necessary to permit by comparison the determination of the airworthiness of subsequent propellers of the same type.

§ 14.15 *Inspections and tests.* Inspections and tests shall include all those found necessary by the Administrator to insure that the propeller complies with the applicable airworthiness requirements and conforms to the following:

(a) All materials and products are in accordance with the specifications in the type design,

(b) All parts of the propeller are constructed in accordance with the drawings in the type design,

(c) All manufacturing processes, construction, and assembly are as specified in the type design.

§ 14.16 *Required tests.* The tests prescribed in this part shall be conducted to establish the propeller operating limitations, as chosen by the applicant, and the reliability of the propeller to operate within those limitations. The provisions of paragraphs (a) through (c) of this section shall be applicable.

(a) The applicant shall furnish all testing facilities, including equipment and competent personnel, to conduct the prescribed tests.

(b) An authorized representative of the Administrator shall witness such of the tests as are necessary to verify the test report.

(c) The Administrator shall establish propeller operating limitations determined on the basis of the propeller operating conditions demonstrated during the tests.

§ 14.17 *Production certificates.* (For requirements with regard to production certificates see Part 1 of this subchapter.)

§ 14.18 *Approval of materials, parts, processes, and appliances.* (a) Materials, parts, processes, and appliances shall be approved upon a basis and in a manner found necessary by the Administrator to implement the pertinent provisions of the regulations in this subchapter. The Administrator may adopt and publish such specifications as he finds necessary to administer this regulation, and shall incorporate therein such portions of the aviation industry, Federal, and military specifications respecting such materials, parts, processes, and appliances as he finds appropriate.

NOTE: The provisions of this paragraph are intended to allow approval of materials, parts, processes, and appliances under the system of Technical Standard Orders, or in conjunction with type certification procedures for a propeller, or by any other form of approval by the Administrator.

(b) Any material, part, process, or appliance shall be deemed to have met the requirements for approval when it meets the pertinent specifications adopted by the Administrator, and the manufacturer so certifies in a manner prescribed by the Administrator.

§ 14.19 *Changes in type design.* (For requirements with regard to changes in type design and the designation of applicable regulations therefor, see § 14.11 (d) and (e), and Part 1 of this subchapter.)

IDENTIFICATION AND INSTRUCTION MANUAL

§ 14.20 *Propeller identification data.* A certificated propeller, propeller blade, or propeller hub shall have displayed upon it conspicuously the identification data required by § 1.50 of this subchapter. The identification data shall be permanently attached upon a noncritical surface of the propeller, blade, or hub by means of a plate, stamping, engraving, etching, or other approved method. When such data are not visible when the propeller is assembled or installed on an aircraft, they shall also be painted or printed on the propeller, blade, or hub.

§ 14.21 *Instruction manual.* The applicant shall prepare and make available an approved manual containing instructions for the installation, operation, servicing, maintenance, repair, and overhaul of the propeller.

NOTE: It is not intended to limit the form of the manual to a single document.

## SUBPART B—AIRWORTHINESS

### DESIGN AND CONSTRUCTION

§ 14.100 *Scope.* (a) The propeller shall not incorporate design features or details which experience has shown to be hazardous or unreliable. The suitability of all questionable design details or parts shall be established by tests.

(b) The design and construction provisions of this part shall be applicable to the propeller when it is installed, operated, and maintained in accordance with the instruction manual prescribed in § 14.21.

§ 14.101 *Materials.* The suitability and durability of all materials used in the propeller shall be established on a basis of experience or tests. All materials used in the propeller shall conform to approved specifications which will insure their having the strength and other properties assumed in the design data.

§ 14.102 *Durability.* All parts of the propeller shall be designed and constructed to minimize the development of an unsafe condition of the propeller between overhaul periods.

§ 14.103 *Reversible propellers.* Reversible propellers shall be adaptable for use with a reversing system in an airplane so that no single failure or malfunctioning of the reversing system during normal or emergency operation will result in unwanted travel of the propeller blades to a position substantially below the normal flight low-pitch stop. Failure of structural elements need not be considered if the occurrence of such failure is expected to be extremely remote.

### TESTS

§ 14.150 *General.* The tests and inspections prescribed in §§ 14.151 through 14.157 shall be applicable to propellers, including all essential accessories. The propeller shall complete the prescribed tests without evidence of failure or malfunctioning.

§ 14.151 *Centrifugal load test.* The hub and blade retention arrangement of propellers with detachable blades shall be subjected to a centrifugal load equal to twice the centrifugal force to which the propeller is to be subjected in normal operation. Either one of the following two test methods shall be acceptable:

(a) A one-hour whirl test, or

(b) A static pull test.

§ 14.152 *Vibration test.* Propellers with metal blades and/or metal hubs shall be subjected to a vibration test under sufficient conditions to establish the level of vibratory stresses in the blade and/or hub when the propeller is operated under all conditions of rotational speed and engine power which are to be established for the propeller. The test shall be conducted on the same or equivalent engine and the test stand configuration on which the endurance tests are conducted.

§ 14.153 *Endurance test*—(a) *Fixed-pitch wood propellers.* Fixed-pitch wood

[3] Prior to approval for use of a type certificated propeller on a certificated aircraft, the propeller will be required to comply with pertinent provisions of the applicable aircraft airworthiness parts of the regulations in this subchapter.

propellers shall be subjected to one of the following endurance tests:

(1) A 10-hour endurance block test on an engine shall be conducted with a propeller of the greatest pitch and diameter for which certification is sought at the rated rotational speed.

(2) A 50-hour flight test shall be conducted in level flight or in climb. At least 5 hours of this flight test shall be conducted with the propeller operated at the rated rotational speed, and the remainder of the 50 hours shall be conducted with the propeller operated at not less than 90 percent of the rated rotational speed.

(3) A 50-hour endurance block test on an engine shall be conducted at the power and propeller rotational speed for which certification is sought.

(b) *Fixed-pitch metal propellers and adjustable-pitch propellers.* Fixed-pitch propellers with metal blades and adjustable-pitch propellers shall be subjected to one of the endurance tests prescribed in paragraphs (a) (2) and (3) of this section.

(c) *Variable-pitch propellers.* Variable-pitch propellers shall be subjected to one of the following endurance tests:

(1) A 100-hour endurance test shall be conducted on an engine of the same power and rotational speed characteristics as the engine or engines with which the propeller is intended to be used. The endurance test shall be conducted at the maximum continuous rotational speed and power rating of the propeller, except that, in the event a rotational speed(s) and power condition(s) is found to be critical on the basis of the vibration test prescribed in § 14.152, such portion of the 100 hours as the Administrator finds necessary, but not in excess of 50 hours, shall be conducted at the critical rotational speed(s) and power condition(s). If a take-off rating greater than the maximum continuous rating is to be established, a 10-hour block test in addition to the 100 hours shall be conducted at the maximum power and rotational speed for the take-off rating.

(2) The propeller shall be operated throughout the engine endurance tests prescribed in Part 13 of this subchapter.

§ 14.154 *Functional test.* Variable-pitch propellers shall be subjected to the following functional tests as applicable. The same propeller as used in the endurance test shall be used in the functional tests and shall be driven by an engine mounted on a test stand or on an aircraft.

(a) *Manually controllable propellers.* 500 complete cycles of control shall be applied throughout the pitch and rotational speed ranges.

(b) *Automatically controllable propellers.* 1,500 complete cycles of control by means of automatic control mechanism shall be applied throughout the pitch and rotational speed ranges.

(c) *Feathering propellers.* 50 cycles of feathering operation shall be applied.

(d) *Reversible-pitch propellers.* 200 complete cycles of control shall be applied from the lowest normal pitch to the maximum reverse pitch. At the end of each cycle the propeller shall be operated in reverse pitch for a period of one minute at the reverse pitch maximum rotational speed and power.

§ 14.155 *Special tests.* Such tests shall be conducted as the Administrator finds necessary to substantiate the use of any unconventional features of design, material, or construction.

§ 14.156 *Teardown inspection.* After completion of the tests, the propeller shall be completely disassembled and a detailed inspection shall be made of the propeller parts to check for fatigue, wear, and distortion.

§ 14.157 *Propeller adjustments and parts replacements.* During the tests servicing and minor repairs of the propeller shall be permissible. If major repairs or replacement of parts are found necessary during the tests or in the teardown inspection, the parts in question shall be subjected to such additional tests as are found by the Administrator to be necessary.

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NOTICE

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