

# **European Aviation Safety Agency**

## **The Executive Director**

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### **DECISION NO. 2003/7/RM**

#### **OF THE EXECUTIVE DIRECTOR OF THE AGENCY**

**of 24 October 2003**

**on certification specifications, including airworthiness codes and acceptable means of compliance, for propellers (« CS-P »)**

#### **THE EXECUTIVE DIRECTOR OF THE EUROPEAN AVIATION SAFETY AGENCY**

Having regard to Regulation (EC) No 1592/2002 of the European Parliament and of the Council of 15 July 2002 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency<sup>1</sup> (hereinafter referred to as the “Basic Regulation”), and in particular Articles 13 and 14 thereof,

Having regard to the Commission Regulation (EC) No 1702/2003 of 24 September 2003<sup>2</sup> laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations, in particular 21A.16A of Part 21 thereof;

Whereas :

- (1) The Agency shall issue certification specifications, including airworthiness codes and acceptable means of compliance, as well as guidance material to be used in the certification process.
- (2) The Agency has, pursuant to Article 43 of the Basic Regulation, consulted widely interested parties on the matters which are subject to this Decision and following that consultation provided a written response to the comments received,

**HAS DECIDED AS FOLLOWS:**

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<sup>1</sup> OJ L 240, 7.09.2002, p. 1.

<sup>2</sup> OJ L 243, 27.09.2003, p. 6.

## Article 1

Unless otherwise decided for propellers to be installed on powered sailplanes and very light aeroplanes, the certification specifications, including airworthiness codes and acceptable means of compliance, for propellers are those laid down in the Annex to this Decision.

## Article 2

This Decision shall enter into force on 24 October 2003. It shall be published in the *Official Publication of the Agency*.

Done at Brussels, 24 October 2003.

For the European Aviation Safety Agency,

Patrick GOUDOU

Executive Director

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# **Certification Specifications for Propellers**

**CS-P**



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Reserved

EASA Certification Specifications  
for  
Propellers

CS-P  
Book 1

Airworthiness code

## **SUBPART A – GENERAL**

### **CS-P 10      Applicability**

- (a) This CS-P contains airworthiness specifications for the issue of type-certificates, and changes to those certificates, for Propellers, in accordance with Part 21.
- (b) The applicant is eligible for a Propeller type-certificate when compliance with subparts A, B and C has been demonstrated. If the additional compliance with subpart D has not also been shown, this must be stated in the Propeller type-certificate data sheet.

### **CS-P 15      Terminology**

- (a) The terminology of this CS-P 15 must be used in conjunction with the issue of CS-Definitions current at the date of issue of this CS-P. Where used in CS-P, the terms defined in this paragraph and in CS-Definitions are identified by initial capital letters.
- (b) (reserved)

### **CS-P 20 Propeller Configuration and Identification**

- (a) The list of all the parts and equipment, including references to the relevant drawings and software design data, which defines the proposed type design of the Propeller, must be established.
- (b) The Propeller identification must comply with 21A.801(a) and (c), and 21A.805.

### **CS-P 30 Instructions for Propeller Installation and Operation**

- (a) Instructions for installing the Propeller must be established, which must:
  - (1) Include a description of the operational modes of the Propeller control system and its functional interface with the aircraft and engine systems.
  - (2) Specify the physical and functional interfaces with the aircraft, aircraft equipment and the engine.
  - (3) Define the limiting conditions on the interfaces specified in CS-P 30 (a)(2).
  - (4) List the limitations established under CS-P 50.
  - (5) Define the hydraulic fluids approved for use with the Propeller, including grade and specification, related operating pressure and filtration levels.
  - (6) State the assumptions made to comply with the specifications of this CS-P.
- (b) Instructions must be established, which must specify the procedures necessary for operating the Propeller within the limitations of the Propeller type design.

### **CS-P 40 Instructions for Continued Airworthiness**

- (a) In accordance with 21A.61 (a), manual(s) must be established containing instructions for continued airworthiness of the Propeller. They must be up-dated as necessary according to changes to existing instructions or changes in Propeller definition.



- (b) The instructions for continued airworthiness must contain a section titled airworthiness limitations that is segregated and clearly distinguishable from the rest of the document(s). This section must set forth each mandatory replacement time, inspection interval and related procedure required for type certification.
- (c) The following information must be considered, as appropriate, for inclusion into the manual(s) required by CS-P 40 (a).
  - (1) A description of the Propeller and its components, systems and installations.
  - (2) Installation instructions, including proper procedures for uncrating, de-inhibiting, acceptance checking, lifting and attaching accessories, with any necessary checks.
  - (3) Basic control and operating information describing how the Propeller components, systems and installations operate, including any special procedures and limitations that apply.
  - (4) Servicing information that covers details regarding servicing points, capacities of tanks, reservoirs, types of fluids to be used, pressures applicable to the various systems, locations of lubrication points, lubricants to be used and equipment required for servicing.
  - (5) Scheduling information for each part of the Propeller that provides the recommended periods at which it should be cleaned, inspected, adjusted, tested and lubricated, and the degree of inspection, the applicable wear tolerances and work recommended at these periods. Necessary cross-references to the airworthiness limitations section must also be included. In addition, if appropriate, an inspection programme must be included that states the frequency of the inspections necessary to provide for the continued airworthiness of the Propeller.
  - (6) Trouble shooting information describing probable malfunctions, how to recognise those malfunctions and the remedial action for those malfunctions.
  - (7) Information describing the order and method of removing the Propeller and its parts and replacing parts, the order and method of disassembly and assembly, with any necessary precautions to be taken. Instructions for proper ground handling, crating and shipping must also be included.
  - (8) Cleaning and inspection instructions that cover the material and apparatus to be used and methods and precautions to be taken. Methods of inspection must also be included.
  - (9) Details of repair methods for worn or otherwise non-serviceable parts and components along with the information necessary to determine when replacement is necessary. Details of all relevant fits and clearances.
  - (10) Instructions for testing including test equipment and instrumentation.
  - (11) Instructions for storage preparation, including any storage limits.
  - (12) A list of the tools and equipment necessary for maintenance and directions as to their method of use.

#### **CS-P 50 Propeller Ratings and Operating Limitations**

- (a) Propeller ratings and operating limitations must:
  - (1) Be established, appropriate to the installation and environmental conditions.
  - (2) Be included directly or by reference in the Propeller type-certificate data sheet.
  - (3) Be based on the operating conditions demonstrated during the tests required by this CS-P as well as any other information necessary for the safe operation of the Propeller.
- (b) The ratings and operating limitations must be established for the following, as applicable:
  - (1) Power and rotational speed for:
    - (i) Take off.
    - (ii) Maximum continuous.
    - (iii) If requested by the applicant, other ratings may also be established.

- (2) Over-speed and over-torque limits.

#### **CS-P 70 Tests - History**

- (a) In order to enable compliance with 21A.21 (c)(3), should a failure of a Propeller part occur during the certification tests, its cause must be determined and the effect on the airworthiness of the Propeller must be assessed. Any necessary corrective actions must be determined and substantiated.
- (b) The development history of the Propeller or component or equipment of the Propeller must be considered. Any significant event, relevant to airworthiness of the Propeller, occurring during development and not corrected before certification tests, must also be assessed under CS-P 70 (a).



## **SUBPART B - DESIGN AND CONSTRUCTION**

### **CS-P 150 Safety Analysis**

- (a) (1) An analysis of the Propeller must be carried out to assess the effects of each failure condition under stated aircraft operating and environmental conditions. This analysis will consider -
  - (i) The Propeller System in a typical installation. When the analysis depends on representative components, assumed interfaces, or assumed installed conditions, such assumptions will be stated in the analysis.
  - (ii) Consequential secondary failures and dormant failures.
  - (iii) Multiple failures referred to in CS-P 150 (d) or that result in the Hazardous Propeller Effects defined in CS-P 150 (g)(1).
- (2) A summary must be made of those failures, which could result in Major Propeller Effects or Hazardous Propeller Effects defined in CS-P 150 (g), together with an estimate of the probability of occurrence of those effects.
- (3) It must be shown that Hazardous Propeller Effects will not occur at a rate in excess of that defined as extremely remote (probability less than  $10^{-7}$  per Propeller flight hour). The estimated probability for individual failures may be insufficiently precise to enable the total rate for Hazardous Propeller Effects to be assessed. For Propeller certification, it is acceptable to consider that the intent of this paragraph is achieved if the probability of a Hazardous Propeller Effect arising from an individual failure can be predicted to be not greater than  $1 \times 10^{-8}$  per Propeller flight hour. It will also be accepted that, in dealing with probabilities of this low order of magnitude, absolute proof is not possible and reliance must be placed on engineering judgement and previous experience combined with sound design and test philosophies.
- (4) It must be shown that Major Propeller Effects will not occur at a rate in excess of that defined as remote (probability less than  $10^{-5}$  per Propeller flight hour).
- (b) If significant doubt exists as to the effects of failures or likely combination of failures, any assumption of the effect of the failure may be required to be verified by test.
- (c) It is recognised that the probability of primary failures of certain single elements (for example, blades) cannot be sensibly estimated in numerical terms. If the failure of such elements is likely to result in Hazardous Propeller Effects, they will be identified as Propeller Critical Parts and reliance must be placed on meeting the prescribed integrity specifications of CS-P 160. These instances must be stated in the safety analysis.
- (d) If reliance is placed on a safety system or device, such as beta lockout, reserved feathering oil, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures, to prevent a failure progressing to Hazardous Propeller Effects, the possibility of a safety system failure in combination with a basic Propeller failure must be covered. If items of a safety system are outside the control of the Propeller manufacturer, the assumptions of the safety analysis with respect to the reliability of these parts must be clearly stated in the analysis and identified in the instructions for installation and operation required under CS-P 30.
- (e) If the acceptability of the safety analysis is dependent on one or more of the following, it must be identified in the analysis and appropriately substantiated.
  - (1) Mandatory maintenance actions required for certification or other maintenance actions performed at stated intervals. This includes the verification of the serviceability of items which could fail in a latent manner. These maintenance intervals must be published in the appropriate manual(s).

Additionally, if errors in maintenance of the Propeller system could lead to Hazardous Propeller Effects, the appropriate procedures must be included in the relevant Propeller manual(s).

- (2) Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The method of demonstrating satisfactory functioning must be published in the appropriate manual(s).
  - (3) The provisions of specific instrumentation, not otherwise required. Such instrumentation must be published in the appropriate interface documentation.
  - (4) A fatigue assessment being made.
- (f) If applicable, the safety analysis must include assessment of indicating equipment, manual and automatic controls, governors and Propeller control systems, synchrophasers, synchronisers, and Propeller thrust reversal systems.
- (g) Unless otherwise approved and stated in the safety analysis, for compliance with CS-P, the following failure definitions apply to the Propeller:
- (1) The following are regarded as Hazardous Propeller Effects -
    - (i) The development of excessive drag.
    - (ii) A significant thrust in the opposite direction to that commanded by the pilot.
    - (iii) A release of the Propeller or any major portion of the Propeller.
    - (iv) A failure that results in excessive unbalance.
  - (2) The following are regarded as Major Propeller Effects -
    - (i) An inability to feather the Propeller (for feathering Propellers).
    - (ii) An inability to change Propeller pitch when commanded.
    - (iii) An uncommanded change in pitch.
    - (iv) An uncontrollable torque or speed fluctuation.

#### **CS-P 160 Propeller Critical Parts Integrity**

The Propeller Critical Parts must be identified under CS-P 150 (c) and their integrity must be established by the following disciplines:

- (a) An engineering plan, the execution of which demonstrates that the combination of loads, material properties, environmental influences and conditions are sufficiently well-known or predictable by analysis, or test experience to allow the parts to be withdrawn from service at a life before hazardous failure can occur.
- (b) A manufacturing and inspection plan which defines the method of manufacture -
  - (1) For producing all parts with the attributes assumed by the engineering plan of CS-P 160 (a).
  - (2) To enable the relevant manufacturing history to be traceable.
  - (3) To ensure that manufacturing changes will be controlled to prevent the assumed attributes being degraded.
- (c) The manufacturer must demonstrate that adequate procedures are adopted to ensure the necessary control of the engineering and manufacturing functions associated with the production of Propeller Critical Parts.
- (d) The manufacturing processes, maintenance in service and overhaul of Propeller Critical Parts must be such as to ensure that they have characteristics essentially similar to those on which the certification of the design was based, and must be associated with specified acceptance standards and non-destructive inspection.

### **CS-P 170 Materials and Manufacturing Methods**

- (a) The suitability and durability of materials used in the Propeller must :
  - (1) Be established on the basis of experience, tests, or both.
  - (2) Account for environmental conditions expected in service.
- (b) All materials used in the Propeller, together with associated specifications and processes, and all manufacturing methods which will be part of the type design, must be identified.
- (c) The design values of properties of materials must be suitably related to the most adverse properties stated in the material specification.

### **CS-P 210 Variable and Reversible Pitch Propellers**

- (a) No single failure or malfunction in the Propeller will result in unwanted travel of the Propeller blades to a position below the in-flight low-pitch position. The extent of any intended travel below the normal in-flight low-pitch must be documented in the appropriate manuals. Failure of structural elements need not be considered if the occurrence of such a failure is shown to be extremely remote under CS-P 150.
- (b) In Propellers incorporating a method to select blade pitch below the in-flight low-pitch position, provisions must be made to sense and indicate to the flight crew that the Propeller blades are below that position by an amount defined in the Propeller instructions for installation. The method for sensing and indicating the Propeller blade pitch position must be such that its failure does not affect the control of the Propeller.

### **CS-P 220 Feathering Propellers**

- (a) Feathering Propellers must be designed to feather from all conditions in flight, while taking into account likely wear and leakage. Feathering and unfeathering limitations must be documented in the appropriate manual(s).
- (b) Propeller pitch control systems that use engine oil to feather must incorporate a method to allow the Propeller to feather if the engine oil system fails.
- (c) Feathering Propellers must be designed to be capable of unfeathering after being feathered for the maximum expected diversion time at the minimum declared steady state outside air temperature.
- (d) Where there is a minimum Engine/Propeller rotational speed and/or associated aircraft speed below which Propeller feathering cannot be accomplished, the Propeller type-certificate data sheet must be endorsed accordingly.

### **CS-P 230 Propeller Control System**

The specifications of this paragraph are applicable to any system or component that controls, limits or monitors Propeller functions.

- (a) The Propeller control system must be designed, constructed and validated to show that:
  - (1) Operation in normal, alternative modes and transition between operating modes performs the intended functions throughout the declared operating conditions and flight envelope.
  - (2) Functionality is not adversely affected by the declared environmental conditions, including temperature, electromagnetic interference (EMI), high intensity radiated fields (HIRF) and lightning.

The environmental limits to which the system has been satisfactorily validated must be documented in the appropriate Propeller manual(s).

- (3) A method is provided to indicate that an operating mode change has occurred if flight crew action is required. In such an event, operating instructions must be provided in the appropriate Propeller manual(s).
- (b) The Propeller control system must be designed and constructed so that, in addition to compliance with CS-P 150:
  - (1) No single failure or malfunction of electrical or electronic components in the control system may result in a Hazardous Propeller Effect.
  - (2) The effects of failures or malfunctions in a typical installation directly affecting the Propeller control system, such as structural failures of attachments to the control, fire or overheat, must not lead to a Hazardous Propeller Effect due to a control system failure.
  - (3) No loss of normal Propeller pitch control may cause a Hazardous Propeller Effect under the intended operating conditions.
  - (4) The failure or corruption of data or signals shared across Propellers must not cause a Propeller effect greater than Major.
- (c) Electronic Propeller control system embedded software must be designed and implemented by an approved method, which is consistent with the criticality of the performed functions and minimises the existence of software errors.
- (d) The Propeller control system must be designed and constructed so that no failure or corruption of aircraft-supplied data will result in hazardous Propeller Effects.
- (e) The Propeller control system must be designed and constructed so that the loss, interruption or abnormal characteristics of aircraft-supplied electrical power will not result in Hazardous Propeller Effects. The power quality specifications must be described in the appropriate Propeller manual(s).

#### **CS-P 240     Strength**

The maximum stresses developed in the Propeller must not exceed acceptable values considering the particular form of construction and the most severe operating conditions. Due consideration must be given to the effects of any residual stresses.

## **SUBPART C - TYPE SUBSTANTIATION**

### **CS-P 330     General**

- (a) The configuration of the Propeller or components or parts to be tested must be sufficiently representative of the type design for the purpose of the test.
- (b) All automatic controls and protection must be in operation unless it is justified that this is not possible or that they are not required because of the nature of the test.

### **CS-P 340     Inspections, Adjustments and Repairs**

- (a) Before and after conducting the tests prescribed in this subpart, the test article must be subjected to an inspection, and a record must be made of all the relevant parameters, calibrations and settings.
- (b) During all tests, only servicing and minor repairs must be permitted except that Major repairs or replacement of parts may be allowed, provided that the parts in question are subjected to an agreed level of additional testing. Any unscheduled repair or action on the test article must be recorded.

### **CS-P 350     Centrifugal Load Tests**

It must be demonstrated that the Propeller complies with CS-P 350 (a), (b) and (c) without evidence of failure, malfunction, or permanent deformation that would result in a Major or Hazardous Propeller Effect. When the Propeller could be sensitive to environmental degradation this must be taken into account.

- (a) The hub, the blade retention system, and the counterweights must be tested for a period of one hour to a load equivalent to twice the maximum centrifugal load to which the Propeller would be subjected at the maximum rated rotational speed.
- (b) If appropriate, blade features associated with transitions to the retention system must be considered in showing compliance with CS-P 350 (a).
- (c) Components used with or attached to the Propeller such as spinners, de-icing equipment, and blade shields, must be capable of withstanding for a period of 30 minutes a load equivalent to 159 percent of the maximum centrifugal load to which the component would be subjected at the maximum rated rotational speed. This may be performed by either:
  - (1) Testing at the required load for a period of 30 minutes or
  - (2) An analysis based on test.

### **CS-P 360     Bird Impact**

It must be demonstrated, by tests or analysis based on tests or experience on similar designs, that the Propeller is capable of withstanding the impact of the birds which are specified in the aircraft specifications applicable to the intended installation of the Propeller, except that the mass of the bird must not exceed 1.8 kg, at the most critical location and the flight conditions which will cause the highest blade loads in a typical installation without



causing a Major or Hazardous Propeller Effect.

#### **CS-P 370     Fatigue Characteristics**

- (a) A fatigue evaluation of the Propeller must be conducted by tests, or analysis based either on tests or previous experience, to show that Hazardous Propeller Effects due to fatigue will be avoided throughout the intended operational life of the Propeller on either
  - (1) The intended aircraft. In such case compliance with CS-P 550 is required, or
  - (2) A typical aircraft.
- (b) (1) When necessary for complying with the safety objective of CS-P 370 (a), fatigue characteristics must be established for:
  - (i) Hubs,
  - (ii) Blades,
  - (iii) Blade retention components and
  - (iv) Other Propeller components, which are affected by fatigue loads and which are shown under CS-P 150 as having a fatigue failure mode leading to Hazardous Propeller Effects.
- (2) The fatigue characteristics must take into account
  - (i) All known and reasonably foreseeable vibration and cyclic load patterns that are expected in service, and
  - (ii) Expected service deterioration, variations in material properties, material fatigue scatter, manufacturing variations and environmental effects.

#### **CS-P 380     Lightning Strike**

It must be demonstrated, by tests or analysis based on tests or experience on similar designs, that the Propeller is capable of withstanding a lightning strike without causing a Major or Hazardous Propeller Effect. The limits to which the Propeller has been qualified must be documented in the appropriate manual(s).

#### **CS-P 390     Endurance Test**

Endurance tests on the Propeller System must be made on a representative engine in accordance with CS-P 390 (a) or (b), as applicable, without evidence of failure or malfunction.

- (a) Fixed-pitch or ground adjustable-pitch Propellers must be subjected to one of the following tests:
  - (1) A 50-hour flight-test in level flight or in climb. The Propeller must be operated at take-off power and rotational speed during at least five hours of this flight test, and at not less than 90 percent of the take-off power and rotational speed for the remainder of the 50 hours.
  - (2) A 50-hour ground test. The Propeller must be operated at take-off power and rotational speed.
- (b) Variable-pitch Propellers must be subjected to one of the following tests :
  - (1) A 110-hour endurance test which must include the following conditions :
    - (i) 5 hours at take-off power and rotational speed and thirty 10-minute cycles composed of
      - Acceleration from idle,
      - 5 minutes at take-off power and rotational speed,

- Deceleration, and
- 5 minutes at idle,
- (ii) 50 hours at maximum continuous power and rotational speed,
- (iii) 50 hours, consisting of ten 5-hour cycles composed of
  - 5 accelerations and decelerations between idle and take-off power and rotational speed,
  - 4.5 hours at approximately even incremental conditions from idle up to, but not including maximum continuous power and rotational speed, and
  - 30 minutes at idle.
- (2) Operation of the Propeller throughout the engine endurance tests prescribed in CS-E 440 or CS-E 740.
- (c) An analysis based on tests of Propellers of similar design may be used in place of the tests of CS-P 390 (a) and (b).

#### **CS-P 400 Functional Test**

- (a) For a Variable-Pitch Propeller, except as provided under CS-P 400 (c), the same Propeller System used for the test of CS-P 390 (b) must complete the functional tests of CS-P 400 (b) without evidence of failure or malfunction.
- (b) As applicable, the following functional tests will be performed on a representative engine in a test stand or on an aircraft:
  - (1) For a manually controllable Propeller, 500 representative cycles must be made across the full range of pitch and rotational speed.
  - (2) For a governing Propeller, 1500 complete cycles must be made across the range of pitch and rotational speed.
  - (3) For a feathering Propeller, 50 cycles of feathering and unfeathering operation.
  - (4) For a reversible-pitch Propeller, 200 cycles must be made from minimum flight idle pitch to maximum reverse pitch. For each cycle, while at maximum reverse pitch, the Propeller must be run for at least 30 seconds at the maximum power and rotational speed to be approved.
- (c) An analysis based on tests of Propellers of similar design may be used in place of the tests of CS-P 400 (b).

#### **CS-P 410 Over-speed and Over-torque**

- (a) When approval of a Maximum Propeller Over-speed is sought, it must be demonstrated, by test, service experience on similar designs, analysis or combination thereof, that the Propeller is capable of performing 20 runs, each of 30 seconds duration, at the Maximum Propeller Over-speed condition without evidence of failure or malfunction.
- (b) When approval of a Maximum Propeller Over-torque is sought, it must be demonstrated, by test, service experience, analysis or combination thereof, that the Propeller is capable of performing 20 runs, each of 30 seconds duration, at the Maximum Propeller Over-torque condition, without evidence of failure or malfunction.

#### **CS-P 420 Components of the Propeller Control System**

By tests or analysis based on tests or service experience on similar components, it must be demonstrated that each component of the Propeller blade pitch control system, including governors, pitch change assemblies, pitch

locks, mechanical stops and feathering system components, can withstand cyclic operation that simulates the normal load and pitch change travel to which the component would be subjected during not less than 1000 hours of typical operation in service.

#### **CS-P 430     Propeller Hydraulic Components**

It shall be established by test, validated analysis or combination thereof that Propeller components which are subject to significant gas or liquid pressure loads can withstand, for a stabilised period of one minute :

- (a) A Proof Pressure equal to 1.5 times the maximum operating pressure without permanent deformation or leakage that would prevent performance of the intended function.
- (b) A Burst Pressure equal to 2.0 times the maximum operating pressure without failure. Leakage is permitted and seals may be excluded from tests.

#### **CS-P 440     Propeller Systems and Components**

For those systems or components which cannot be adequately substantiated by the specifications of this subpart, additional tests or analysis must be made to demonstrate that the systems or components are able to perform their intended functions in all declared environmental and operating conditions.

## **SUBPART D - PROPELLER VIBRATION, FATIGUE EVALUATION AND FLIGHT FUNCTIONAL TESTS**

### **CS-P 510 Applicability**

This subpart prescribes the tests and evaluations to be performed on the Propeller with the engine and airframe combination for which approval is sought.

### **CS-P 530 Vibration and Aero-elastic Effects**

- (a) It must be demonstrated by tests, analysis based upon tests or previous experience on similar designs that the Propeller does not experience harmful aero-elastic effects (including flutter) or harmful effects of vibration throughout the operational envelope of the aircraft with suitable stress margins.
- (b) When necessary for complying with the safety objective of CS-P 530 (a), the magnitude of the Propeller vibration stresses or loads, including any stress peaks and resonant conditions, must be determined throughout the declared operational envelope of the intended aircraft by either:
  - (1) Measurement of stresses or loads through direct testing or analysis based on direct testing of the Propeller on the aircraft and engine installation for which approval is sought, or
  - (2) Comparison of this Propeller to similar Propellers installed on similar aircraft installations for which these measurements have been made.

### **CS-P 550 Fatigue Evaluation**

- (a) An evaluation of the Propeller must be conducted to show that failure due to fatigue will be avoided throughout the intended operational life of the Propeller, using the fatigue and structural data obtained in compliance with CS-P 370 and vibration data obtained in compliance with CS-P 530. This evaluation must include:
  - (1) A determination of operating limitations, service life, mandatory replacement times and inspection intervals for the Propeller and its Propeller Critical Parts.
  - (2) The intended loading spectra, including all reasonably foreseeable vibration and cyclic load patterns, considering identified emergency, over-speed or over-torque conditions.
  - (3) The effects of temperature, humidity and likely deterioration expected in service.
- (b) Each determined mandatory replacement period and inspection interval must be included in the airworthiness limitation section of the instructions for continued airworthiness required by CS-P 40.
- (c) Any operating conditions or speed ranges shown by the fatigue evaluation and vibration survey to require limitation must be clearly stated in the Propeller certification documentation.

### **CS-P 560 Flight Functional Tests**

A flight test of not less than 50 hours must be conducted on a Propeller, as detailed below, to demonstrate its

functional characteristics when installed on the intended engine and aircraft.

- (a) The Propeller must be fitted with all parts, such as spinner and de-icing equipment, which are normally used with it, and must be installed on a representative engine and aircraft.
- (b) Throughout the pitch range for which certification is sought fixed, adjustable or variable (non-governing) pitch Propellers must demonstrate that: -
  - (1) The declared maximum rotational speed or maximum torque are not exceeded under all normal and likely emergency operations.
  - (2) During ground run-up, take-off and climb at best-rate-of-climb aircraft speed, the Propeller must not cause exceedence of any approved engine limitations.
  - (3) During ground run-up and take-off, the Propeller must not limit the engine speed below its approved speeds.
  - (4) During a closed-throttle glide at speeds up to the aircraft VNE speed, the Propeller must not cause the engine to exceed its maximum continuous limitations.
- (c) Variable pitch (governing) Propellers. As applicable the test must demonstrate that, over the whole range of normal and likely emergency operations of the Propeller and in an environmental envelope appropriate to the intended aircraft, -
  - (1) No incompatibility with the engine or the aircraft is encountered.
  - (2) The Maximum Governed Propeller Rotational Speed is not exceeded.
  - (3) Governing is stable under all oil temperature conditions.
  - (4) The Propeller is appropriately responding to rapid throttle movements
  - (5) Governing and feathering is possible at all aircraft speeds up to VNE
  - (6) Unfeathering is possible, especially after being feathered for the maximum diversion time at the minimum declared steady state outside air temperature.
  - (7) Beta control response and sensitivity is adequate.
  - (8) All stops and warning lights adequately function.
- (d) Propellers designed for operation in reverse pitch. 50 landings must be made using the reverse pitch at the maximum Propeller rotational speed allowed for such operation.

EASA Certification specifications  
for  
Propellers

CS-P  
Book 2

Acceptable means of compliance

## **SUBPART A GENERAL**

**In addition to the acceptable means of compliance in Book 2 of these Certification Specifications, AMC-20 may also provide acceptable means of compliance to the specifications in Book 1 of this CS-P.**

Reserved





## **SUBPART B - DESIGN AND CONSTRUCTION**

Reserved



## **SUBPART C - TYPE SUBSTANTIATION**

Reserved



## **SUBPART D. PROPELLER VIBRATION, FATIGUE EVALUATION AND FLIGHT FUNCTIONAL TESTS**

Reserved

