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Standard Specification for Design and Testing of Light Sport Aircraft Propellers¹

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1. Scope

1.1 This specification covers the establishment of the minimum requirements for the design, testing, and quality assurance of propellers or propeller control systems (for example, governors), or both, for light sport aircraft. These propellers or control systems, or both, are used on light aircraft, and could be used with engines conforming to Practices F2339, F2538, or F2840.

1.2 This specification is intended for use by manufacturers of propellers for light sport aircraft.

1.3 This specification does not address the airframe installation requirements for propellers.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and to determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

F2339 Practice for Design and Manufacture of Reciprocating Spark Ignition Engines for Light Sport Aircraft

F2538 Practice for Design and Manufacture of Reciprocating Compression Ignition Engines for Light Sport Aircraft

F2840 Practice for Design and Manufacture of Electric Propulsion Units for Light Sport Aircraft

F3153 Specification for Verification of Aircraft Systems and Equipment

F3768 Specification for IFR Operations in IMC for a Light-Sport Aircraft

2.2 Code of Federal Regulations:³

14 CFR Part 35 Airworthiness Standards: Propellers

2.3 EASA Standards:⁴

CS-P Propellers

3. Terminology

3.1 Definitions:

3.1.1 *blade, n*—the aerodynamic portion of a propeller which is rotated through and acts on the air.

3.1.2 *blade root, n*—the portion of the blade that interfaces with the hub and provides retention.

3.1.3 *conventional fixed pitch propeller, n*—a one-piece fixed pitch propeller that is constructed of material such as wood or metal that has no abrupt changes in material properties as the blades transition through the hub area.

3.1.3.1 *Discussion*—A propeller with wooden blades bonded to a metallic hub would not be conventional.

3.1.4 *feather, n*—a pitch setting designed to minimize drag with the engine not operating.

3.1.5 *fixed pitch propeller, n*—a propeller with no capability for pitch setting adjustment.

3.1.6 *ground adjustable propeller, n*—a propeller whose pitch setting is adjustable only when the aircraft is on the ground and the propeller is not rotating.

3.1.7 *high pitch, n*—the maximum attainable (coarsest) pitch setting in flight during normal operation.

3.1.8 *hub, n*—any device that retains the blades of a propeller assembly.

3.1.9 *in-flight adjustable propeller, n*—any propeller that allows for adjustment of propeller blade pitch during operation, including manually controlled variable pitch propellers and automatic controlled (constant speed) propellers, regardless if

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from U.S. Government Publishing Office (GPO), 732 N. Capitol St., NW, Washington, DC 20401, <http://www.gpo.gov>.

⁴ Available from European Union Aviation Safety Agency (EASA), Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany, <https://www.easa.europa.eu>.

adjusted by direct pilot interaction, (constant speed) controller (governor), or combination of both.

3.1.10 *low pitch, n*—the minimum attainable (finest) pitch setting in flight during normal operation.

3.1.11 *manually adjustable propeller, n*—an in-flight adjustable propeller that only changes propeller blade pitch in response to direct pilot input specific to changing propeller pitch (for example, through a lever or switch that adjusts the pitch).

3.1.12 *pitch setting, n*—the propeller blade setting as determined by the blade angle measured in a manner, and at a radius, specified by the instruction manual for the propeller; a typical positive angle is with the section lead edge up with respect to the plane of rotation.

3.1.13 *propeller, n*—a device for propelling an aircraft that has blades on an engine-driven shaft and that, when rotated, produces by its action on the air, a thrust approximately perpendicular to its plane of rotation.

3.1.13.1 *Discussion*—For the purposes of the application of this specification, devices incorporating features such as flapping hinges or cyclic control are not considered propellers.

3.1.14 *reverse pitch, n*—a pitch setting less than low pitch, used to generate drag or reverse (negative) thrust.

3.2 Abbreviations:

3.2.1 *MDCP*—maximum declared cruise power

3.2.2 *MDTP*—maximum declared takeoff power

3.2.3 *MDTR*—maximum declared takeoff RPM

4. General

4.1 Each manufacturer who claims compliance to this specification must be able to show compliance with the applicable requirements of this specification, except:

4.1.1 Provided they show compliance to the requirements of 6.3 and 4.2.2, with no further showing to this specification, manufacturers may claim compliance to this specification for:

4.1.1.1 Propellers or control system components, or both, compliant with FAA 14 CFR Part 35 or EASA CS-P, or both.

4.1.1.2 Propellers or control system components, or both, that are variants of those specified in 4.1.1.1 from the same manufacturer, provided that:

(1) The general configuration and principles of design and construction of the original are unchanged for the variant.

(2) The assumptions, analyses, and testing of the original remain valid for the variant.

4.2 Manufacturers shall prepare and make available limitation information, which shall include:

4.2.1 The maximum allowable engine power and rotational speed for the propeller model and, if different, the maximum continuous allowable engine power and rotational speed.

4.2.2 Acceptable engine/propeller combinations, including:

4.2.2.1 Operating limitations found necessary by the manufacturer for the safe operation of the propeller for the engine/propeller combination.

4.2.2.2 Minimum and maximum diameter permitted for the engine/propeller combination.

4.2.2.3 Aircraft types or models, or both, to which the combination is applicable or limited (for example, Single Engine Tractor).

4.3 Manufacturers must prepare and make available an operating manual or manuals containing, at minimum, the following information:

4.3.1 An overall description of the propeller and its features.

4.3.2 The mass moment of inertia of the propeller about its rotational axis.

4.3.3 Instructions for installation of the propeller.

4.3.4 Instructions for operation of the propeller.

4.3.5 The limitation information, or a reference to it, specified by 4.2.

4.3.6 For ground adjustable propellers, instructions for pitch adjustment and the minimum and maximum pitch settings allowed during operation.

4.3.7 Instructions for removal of the propeller.

4.4 Each manufacturer must prepare and make available maintenance information and service instructions necessary to provide for continued safe and proper operation of the propeller or pitch control system component, or both, throughout its life cycle. These shall contain, at minimum, the following content:

4.4.1 A maintenance schedule that provides the recommended periods at which the propeller should be cleaned, adjusted, inspected, and tested.

4.4.2 The applicable damage and wear allowances.

4.4.3 Any applicable maintenance and overhaul instructions, which include the following:

4.4.3.1 A list of tools needed.

4.4.3.2 Skills or training required for personnel performing the work.

4.4.3.3 Inspections required.

4.4.3.4 Details of repair and overhaul sequence and methods.

4.4.3.5 Applicable testing requirements.

4.4.4 If a manufacturer deems it necessary to set mandatory replacement intervals of propellers or propeller components, the details of this requirement shall be stated in a separate, clearly distinguishable section.

5. Design and Construction

5.1 *Design Features*—The propeller may not have design features that have been shown, or are anticipated, to be hazardous or unreliable unless the suitability of each questionable design detail or part can be established by tests.

5.1.1 Propellers may not incorporate functions allowing for reverse pitch operations.

5.2 *Materials*—The suitability and durability of materials used in the propeller must:

5.2.1 be established on the basis of in-service experience or tests; and

5.2.2 conform to documented specifications that ensure that strength and other material properties consistently meet or exceed those used in the initial design and qualification testing.

5.3 *Durability*—Each part of the propeller must be designed and constructed with consideration of likely in-service damage