ASTM F2506-13 Compliance Summary

DURANDAL & EXCALIBUR PROPELLERS

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Issue	Date	Detail of changes	Approval
1	2021-04-20	Original issue	J. BUIATTI

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1 GENERAL

1.1 Scope

This document is issued to demonstrate that :
E-PROPS ground adjustable pitch propellers DURANDAL & EXCALIBUR models, designed for gear-drive engines, can be implemented on LSA aircraft and fulfills ASTM F2506-13 requirements.

1.2 Description of the propellers range

Ground adjustable pitch propellers models
For gear-drive engines, 4 or more cylinders in 4 strokes, reduction ratio > 2

DURANDAL models : Clockwise CW rotation sense, tractor and pusher
EXCALIBUR models : Counterclockwise CCW rotation sense, tractor and pusher

Exist in 2, 3, 4 and 5 blades configurations
Exist in 13 different diameters (from 145 to 205 cm)
Different blades geometries, depending on number of blades, chord and diameter

Material : 100% Carbon + epoxy resin + Titanium leading edge protection

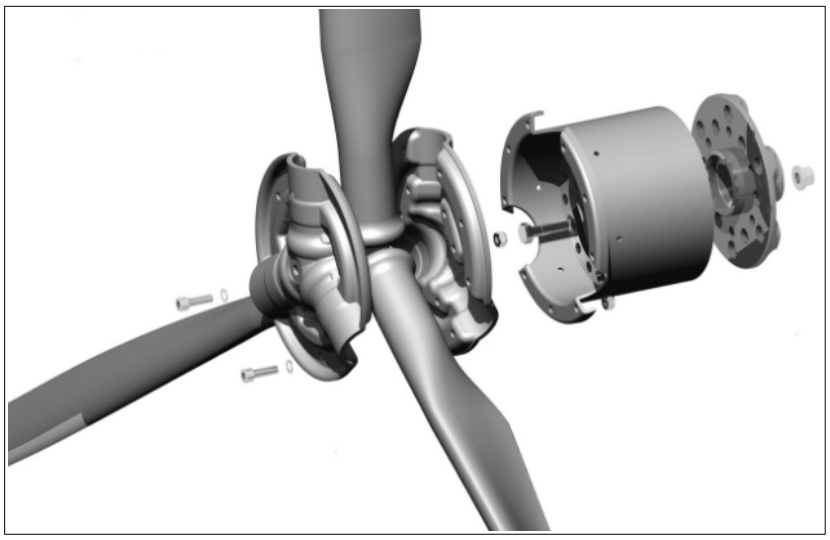
Weight : very light, depending on the model (ex : 2 kg for a 3-blade dia 170 cm)
Moment of inertia : depending on the model (ex : 2.300 kg.cm² for a 3-blade dia 170 cm)
Max torque = 155 N.m per blade
Max Peripheral Mach = 0,75 Mach
Max RPM at propeller = depending on the model
Max pitch tolerance = Max 0,3° between blades
Accessories :
- Carbon spinners: 15 different models
- Carbon spacers: 38 differents lengths

Potential : no limitation
MTBO : 2.000 hours
Check screws tightening :
- Every 100 h and/or every 6 months with Steel screws
- Every 200 h and/or every 12 months with Titanium screws

Manufacturing : Made in France (Sisteron) since 2008

1.3 Design

The DURANDAL and EXCALIBUR models are composed of :
- ✗ Blades in Carbon with Titanium leading edge protection
- ✗ Hub composed of 2 carbon parts (HHU)
- ✗ Spacer to mount the propeller on the gearbox flange (ESU), in carbon
- ✗ Screws & Bolts
- ✗ Spinner + its plate, in carbon



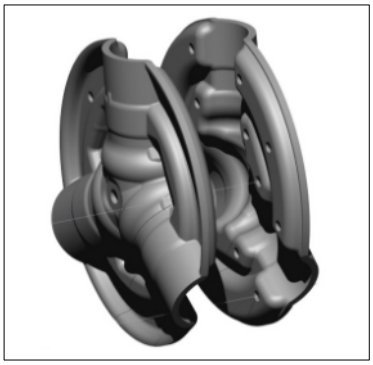
1.3.1. Blades

- Full carbon braid, with continue fibers between upper and lower surfaces of the blade
The HCF process (Helical Continuous Fibers), specifically designed by E-PROPS, ensures an exceptional strength of the 100% carbon + epoxy resin blade, from leading edge to trailing edge, from blade's foot to tip. The carbon fibers are continuous between the top and bottom surfaces. The braid is made like a sock. The mechanical strength is increased and becomes very high : no risk of rupture by delamination of the leading edge, no craks on the blades.

- Epoxy resin
The epoxy resin is the resin preferred in aeronautics because it has :
  * a very good mechanical and thermal properties
  * a very big resistance to fatigue
  * a good dimensional stability
  * a chemical good performance
  * and above all, an excellent adhesion on carbon fibers
The epoxy resin used by E-PROPS is including a high resistance to UVA & UVB additive
- Foam core with internal spar (D-Box)
- Blade's foot with ring inside

- Carbon stays visible : no paint, no varnish
- Leading edge protection in Titanium : Titanium of 5/10th thickness and length 40 cm (on propellers diameter 170 cm)
- RFID chip inside each blade for traceability
- Unique ref number on each blade

1.3.2. Hub



- 2 parts : 1 upper part (HHU-1), 1 lower part (HHU-2) mounted together with screws
- Full carbon parts
- Epoxy resin
- Unique ref number on each half hub for traceability
- Nylstop nuts to secure the tightening

1.3.3. Spacer

- Spacer to mount the propeller on the gearbox flange (ESU)
- In carbon (remplaces the usual aluminium spacers)
- Exists in 38 different lengths, from -20 to +170 mm (each 5 mm)

1.3.4. Spinner

- 15 different diameters, from 210 to 380 mm
- Made in carbon fabric + epoxy resin
- Spinners + flanges are balanced together
- Unique ref number on each spinner and plate

1.3.5. Manufacturing Process

All E-PROPS parts, blades, hubs and spinners, are made with manufacturing process called RTM (Resin Transfer Molding). This process is used by major companies as AIRBUS and BOEING for some critical ultra-light carbon parts on liner aircraft.

RTM is one of the best methods for mass production of composite parts.
It is primarily used to mold components with large surface areas, complex shapes and smooth finishes.

There are several benefits to using the Resin Transfer Molding process over the alternative processes available. Some key benefits include :
- Very good surface quality
- Very high fibers ratio
- Wide range of reinforcements
- Large or long and complex shapes
- Low environmental impact
- Labor savings
- No direct contact with the materials, far better for the operators' health

RTM process is realized by following a strict cycle of temperatures. The cooking of carbon parts allows to improve certain properties, in particular mechanical and of resistance under very hot conditions.

To assure a strict quality control and the reproducibility of the production, the components are exactly weighed very throughout the manufacturing. For example, 7 weighings are necessary for a propeller range Aircraft - Ultralights.

E-PROPS ensures the production monitoring by RFID and KANBAN method. These methods and tools optimize the manufacturing quality, reassure and fluidify the supplies, allow the real-time follow-up of the production process, the traceability of all the manufacturing steps, and offer a set of successful and reliable indicators.

Carbon parts are finished with a precise CNC centre.

Parts made by E-PROPS have a very high carbon fiber ratio (63%).

1.4 Traceability

Traceability refers to the situation where the necessary and sufficient information is available to know (possibly retrospectively) the exact and detailed composition of a material or product throughout its production and distribution chain. Since the beginning, E-PROPS carefully respects the traceability of all its products.
Each E-PROPS part (blade, hub, spacer, spinner, plate...) of the V20 range is identified with a unique serial number.
This unique number follows each part, from raw material batches (carbon, epoxy resin...), through all phases of manufacturing and finishing, and then throughout the life of the products after sale.
This number is written on the part inside or on a sticker, and also in the RFID chip which is inside every blade (readable with a special RFID reader).

1.5 Applicability

DURANDAL & EXCALIBUR ground adjustable pitch propellers models for :
- Gear-drive engines
- 4 strokes
- 4 or more cylinders
- Reduction ratio > 2

1.6 Reference documents

Ref	Document ID	format	version	date	Description
					TESTS REPORTS
RD- 003	200403_traction_HHU-2	ods / mp4	200403	2020-04-03	Durandal / Excalibur blade & hub tensile test 2-blade
RD- 004	200304_traction_HHU-3	ods / mp4	200302	2020-03-02	Durandal / Excalibur blade & hub tensile test 3-blade
RD- 005	200429_traction_HHU-4	ods / mp4	200429	2020-04-29	Durandal / Excalibur blade & hub tensile test 4-blade
RD- 006	200430_traction_HHU-5	ods / mp4	200430	2020-04-30	Durandal / Excalibur blade & hub tensile test 5-blade
RD- 007	fatigue_moyeu_pale	xls / mp4	130507	2013-05-07	Durandal / Excalibur endurance test
RD- 008	200326_torsion_ESU	ods / mp4	200326	2020-03-26	ESU / HHU / BLADE statique torque
RD- 009	200116_flexion_ESU	ods / mp4	200116	2020-01-16	ESU / HHU / BLADE bending HE40 / HE120 / HE170
					DEFINITION FILES
RD- 010	U310 / pied_ULC-v4	Imptr	210121	2021-01-21	blades U310 / U311
RD- 011	U312 / pied_ULC-v4	Imptr	200924	2020-09-24	blades U312 / U313
RD- 012	U314 / pied_ULC-v4	Imptr	210115	2021-01-15	blades U314 / U315
RD- 013	U316 / pied_ULC-v4	Imptr	210310	2021-03-10	blades U316 / U317
RD- 014	U332 / pied_ULC-v4	Imptr	201207	2020-12-07	blades U332 / U333
RD- 015	HHU-2-200316	step	200316	2020-03-16	HHU-2
RD- 016	HHU-3_v2_200511	step	200511	2020-05-11	HHU-3
RD- 017	HHU-4-200618	step	200618	2020-06-18	HHU-4
RD- 018	HHU-5-200406	step	200406	2020-04-06	HHU-5
RD- 019	ESU_201216	step	201216	2020-12-16	ESU-2-3-4-5
RD- 020	platine_geo_200204	step	200204	2020-02-04	PCU-2-3-4-5 210/380
RD- 021	plaque_avant_340	step	200710	2020-07-10	PA_CCU 340
RD- 022	plaque_avant_360	step	200710	2020-07-10	PA_CCU 360
RD- 023	plaque_avant_380	step	200710	2020-07-10	PA_CCU 360
RD- 024	Cone_18-1_210-230	step	200519	2020-05-19	CCU-2-3-4-5 210/230
RD- 025	Cone_18-1_240-260	step	201002	2020-10-02	CCU-2-3-4-5 240/260
RD- 026	Cone_18-1_270-310	step	200605	2020-06-05	CCU-2-3-4-5 270/310
RD- 027	Cone_18-1_320-380	step	200710	2020-07-10	CCU-2-3-4-5 320/380
RD- 028	BA_UL_200924	step	200924	2020-09-24	titanium leading edge protection

... / ...

Ref	Document ID	format	version	date	Description
					MANUFACTURING
RD- 029	plan strat 310 / 311	sql + paper	210121	2021-01-21	draping plan blade
RD- 030	plan strat 312 / 311	sql + paper	200924	2020-09-24	draping plan blade
RD- 031	plan strat 314 / 315	sql + paper	210115	2021-01-15	draping plan blade
RD- 032	plan strat 316 / 317	sql + paper	210310	2021-03-10	draping plan blade
RD- 033	plan strat 332 / 333	sql + paper	201207	2020-12-07	draping plan blade
RD- 034	plan strat ESU	sql + paper	210226	2021-02-26	draping plan ESU
RD- 035	plan strat HHU-2 / 3 / 4 / 5	ngc + paper	200618	2020-06-18	draping plan HHU-2-3-4-5
RD- 036	plan strat PCU	ngc + paper	200204	2020-02-04	draping plan PCU-2-3-4-5 210/380
RD- 037	sql.para_inj	sql	210310	2021-03-10	injection setting
RD- 038	terminator.U3xx	xml	210310	2021-03-10	cnc inspection scan and rectification
RD- 039	procedure_collage_blindage	pdf	201210	2020-12-10	titanium bonding
RD- 040	h_geomoule	sql	200924	2020-09-24	balancing tolerance
					INSPECTION FILES
RD- 041	BCF-H-V20-2B	ods	210415	2021-04-15	quality control form : 2-blade propeller
RD- 042	BCF-H-V20-3B	ods	210415	2021-04-15	quality control form : 3-blade propeller
RD- 043	BCF-H-V20-4B	ods	210415	2021-04-15	quality control form : 4-blade propeller
RD- 044	BCF-H-V20-5B	ods	210415	2021-04-15	quality control form : 5-blade propeller
RD- 045	BCF-C-V20	ods	210415	2021-04-15	quality control form : spinner
RD- 046	BCF-A-V20	ods	210415	2021-04-15	quality control form : adapters
					MANUALS
RD- 047	HEP-GDE-V20-2021-04-15-EN	pdf + paper	210415	2021-04-15	DURANDAL & EXCALIBUR Propellers Instruction Manual
RD- 048	HEP-EXPERT-V20-2021-EN	pdf + paper	210415	2021-04-15	Propeller expertise and overhaul manual
					OTHER DOCUMENTS
RD- 001	sql.m_ulm_polaire / sql.m_moteur	sql	200219	2020-02-19	List of engine/propeller combinations
RD- 002	sql._geoproduit	sql	210415	2021-04-15	List of propeller mass and moment of inertia
RD- 052	quality charter 2020-09-21	pdf + paper	200921	2020-09-21	Quality Charter
RD- 053	HEP-SB-LIST	ods	200301	2020-03-01	List of Service Bulletins
RD- 054	FIH	pdf + paper	210318	2021-03-18	Propeller Identification Sheet
RD- 055	online store	html	210420	2021-04-20	Dedicated website : https://aircraft.e-props.fr/

2 ASTM F2506-13 Compliance Summary

Compliance status :
C : compliant
NC : non compliant
PC : partially compliant
N/A : non applicable

Compliance method :
A : by analysis
T : by test
I : by inspection
S : by similarity

ASTM requirements	Compliance Status	Compliance Method	Compliance Description
1. Scope 1.1 This specification covers the establishment of the mini- mum requirements for the design, testing, and quality assurance of fixed-pitch or ground adjustable propellers for light sport aircraft. These propellers are used on light aircraft, and could be used with engines conforming to Practice F2339	**C**	N/A	-
1.1.1 When applying the additions provided in Appendix X1, this specification also covers the establishment of the minimum requirements for the design, testing and quality assurance of in-flight adjustable propellers for light-sport aircraft.	**N/A**	N/A	DURANDAL & EXCALIBUR models are ground adjustable propellers, not in-flight adjustable propellers
1.2 This specification is intended for use by manufacturers of propellers for light sport aircraft.	**C**	N/A	-
1.3 This specification does not address the airframe installation requirements for propellers.	**C**	N/A	-
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 and health practices and to determine the applicability of regulatory limitations prior to use	**C**	N/A	-

2. Referenced Documents 2.1 ASTM Standards : F2339 Practice for Design and Manufacture of Reciprocating Spark Ignition Engines for Light Sport Aircraft	**C**	N/A	-

3. Terminology 3.1 Definitions 3.1.1 blade : the aerodynamic portion of a propeller which is rotated through and acts on the air. 3.1.2 blade root : the portion of the blade that interfaces with the hub and provides retention. *3.1.3 conventional fixed pitch propeller :* 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 fixed pitch propeller :* a propeller with no capacity for pitch setting adjustment. *3.1.5 ground adjustable propeller :* a propeller whose pitch setting is adjustable only when the aircraft is on the ground and the propeller is not rotating. 3.1.6 hub : any device that retains the blades of a propeller assembly. 3.1.7 pitch setting : the propeller blade setting as deter- mined by the blade angle measured in a manner, and at a radius, specified by the instruction manual for the propeller. 3.1.8 propeller : 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	**C**	N/A	-

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.	**C**	A T I S	E-PROPS propellers compliance to ASTM F2506-13 : by analysis, by test, by inspection and by similarity. Several thousand DURANDAL & EXCALIBUR propellers in service without issue for more than 10 years
4.2 Manufacturers must prepare and make available a list of acceptable engine-propeller combinations.	**C**	A	List of engine-propeller combinations : document RD-001 (list) and RD-055 (online store on the E-Props website)
4.3 Manufacturers must prepare and make available an operating manual or manuals containing, at minimum, the following information:	**C**	A	Instruction Manuals, document : RD-047
4.3.1 An overall description of the propeller and its features.	**C**	A	Document RD-047
4.3.2 The mass moment of inertia of the propeller about its rotational axis.	**C**	A	Document RD-002 : list of propellers mass and moment of inertia
4.3.3 Instructions for installation of the propeller.	**C**	A	Document RD-047
4.3.4 Instructions for operation of the propeller.	**C**	A	Document RD-047
4.3.5 The maximum allowable engine power and rotational speed and any other propeller operating limitations found necessary by the manufacturer for the safe operation of the propeller.	**C**	A	Document RD-047
4.3.6 For ground adjustable propellers, instructions for pitch adjustment and the minimum and maximum pitch settings allowed during operation.	**C**	A	Document RD-047
4.3.7 Instructions for removal of the propeller.	**C**	A	Document RD-047

4.4 Each manufacturer must prepare and make available a maintenance manual. The maintenance manual is intended to provide for continued safe and proper operation of the propeller throughout its life cycle and contains, at minimum, the following content:	**C**	A	Document RD-047
4.4.1 A maintenance schedule that provides the recommended periods at which the propeller should be cleaned, adjusted, inspected, and tested.	**C**	I	Document RD-047
4.4.2 The applicable damage and wear allowances.	**C**	I	Document RD-047
4.4.3 Any applicable maintenance and overhaul instructions, which include the following:	**C**	A	Document RD-047
4.4.3.1 A list of tools needed.	**C**	A	Document RD-047
4.4.3.2 Skills or training required for personnel performing the work.	**C**	I	No specific skill is needed. Only use a calibrated torque wrench and the E-Props digital protractor
4.4.3.3 Inspections required.	**C**	I	Documents RD-047, RD-048
4.4.3.4 Details of repair and overhaul sequence and methods	**C**	I	Documents RD-047, RD-048
4.4.3.5 Applicable testing requirements.	**C**	I	Document RD-047 Max pitch tolerance between blades < 0.3°
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 entitled Life Limitations.	**C**	A	Document RD-048 Carbon – Epoxy = anisotropic material (like wood). No propeller component has life limitation. Only a global overhaul is recommended at 2000 h.

5. Design and Construction *5.1 Design Features*—The propeller may not have design features that have been shown to be hazardous or unreliable unless the suitability of each questionable design detail or part can be established by tests.	**C**	A T S	Design & Construction : documents RD-010, RD-011, RD-012, RD-013, RD-014, RD-015, RD-016, RD-017, RD-018, RD-019, RD-020, RD-021, RD-022, RD-023, RD-024, RD-025, RD-026, RD-027, RD-028, RD-029, RD-030, RD-031, RD-032, RD-033, RD-034, RD-035, RD-036, RD-037, RD-038, RD-039, RD-040 Safety margins in design files : 5 Several thousand DURANDAL & EXCALIBUR propellers in service without issue for more than 10 years
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.	**C**	A T	Main materials are well known : carbon braid, epoxy resin, titanium Tests reports : documents RD-003, RD-004, RD-005, RD-006, RD-007, RD-008, RD-009 Tensile test safety margin > 5
5.3 Durability—Each part of the propeller must be designed and constructed with consideration of likely in-service damage and wear. The propeller must be able to operate normally between inspection and overhaul periods at the maximum damage and wear limits published in the maintenance manual.	**C**	A I S	Documents RD-047, RD-048 DURANDAL & EXCALIBUR propellers have no potential. Recommended expertise and overhaul at 2000 h. Several thousand DURANDAL & EXCALIBUR propellers in service without issue for more than 10 years
5.4 Ground-Adjustable Propellers—The adjustment system of a ground-adjustable propeller must be designed such that no single failure or malfunction in that system during normal or emergency operation will result in unacceptable changes in propeller blade pitch setting. Failure of structural elements need not be considered if the occurrence of such a failure is expected to be extremely remote.	**C**	A S	The only cause of pitch change in flight is an incorrect application of torque on screws. Document RD-047 Several thousand DURANDAL & EXCALIBUR propellers in service without issue for more than 10 years

5.5 Propeller Strength and Endurance— Propellers must be shown to have satisfactory endurance as well as stresses that do not exceed values shown to be safe for continuous operation in accordance with the applicable requirements of Section 6, Tests and Inspections.	**C**	T	Tests reports : documents RD-003, RD-004, RD-005, RD-006, RD-007, RD-008, RD-009

6. Tests and Inspections 6.1 General 6.1.1 Each manufacturer must be able to show that the propeller concerned can complete the applicable tests and inspections of this section without evidence of failure or malfunction.	**C**	T I	Tests reports : documents RD-003, RD-004, RD-005, RD-006, RD-007, RD-008, RD-009
6.1.2 The minimum applicable testing and inspection requirements are outlined in Table 1 according to propeller material type.	**C**	A	*For composite propellers : only §6.2, §6.4, §6.5 and §6.6 are applicable*
6.2 Strength Testing: 6.2.1 Proof of strength must be shown for all propellers except conventional fixed pitch propellers. 6.2.2 On all other propellers, the blade root and blade retention system must be tested for 1 h at a load level equal to two times the centrifugal load that would be generated by the blade weight at maximum rated rotational speed. This may be done by either a whirl test or a static pull test. The required pull load for each blade must be carried by at least the inner 20 % of its span	**C**	T	Tests reports : documents RD-003, RD-004, RD-005, RD-006, RD-007, RD-008, RD-009 Blade tensile tests : rupture occurs at 5 times the max centrifugal load. 4 times the max load has been hold for 1 h without any damage. Application of load has been introduced at 20% of the blade span from root
6.3 Stress Measurement, Fatigue Strength, and Fatigue Analysis— Vibration testing may be performed to allow reduced endurance test hours. This section does not apply to conventional fixed pitch wooden propellers. 6.3.1 The magnitude of the propeller vibration stresses, including any stress peaks and resonant conditions, throughout the operational envelope of the propeller shall be determined: 6.3.1.1 By direct measurement of stresses on a vibrationally	**N/A**	N/A	N/A

representative engine, or 6.3.1.2 Comparison of the propeller to similar propellers installed on similar airplane installations for which these measurements have been made. 6.3.2 Through testing or analysis, the fatigue allowable for root, mid-blade and tip regions of the propeller blade shall be determined. This testing shall also account for normal in- service damage and wear. 6.3.3 Using the measured stresses and root, mid-blade, and tip fatigue allowables, a fatigue assessment shall be conducted to show that failure of the propeller will not occur between the declared propeller inspection intervals when using the declared inspection techniques.			
6.4 Endurance Testing—The propeller shall undergo an endurance test on the intended engine or a vibrationally representative engine that is capable of providing the maxi- mum rated power at the maximum rated propeller rotational speed and diameter. The propeller pitch may be adjusted as necessary to achieve maximum rated takeoff power at maximum rated takeoff RPM. Propeller pitch need not be readjusted for the remainder of the test unless necessary to avoid declared operational speed placards. During the test, it is acceptable to stop the test as needed, but the test should be restarted and continued from the point in the test schedule where it was stopped. The entire endurance test shall be completed by a single propeller and hardware. All propellers must be subjected to one of the following tests:	**C**	T S	Document RD-007 Several thousand DURANDAL & EXCALIBUR propellers in service without issue for more than 10 years
6.4.1 Conventional fixed pitch wooden propellers or propellers with a vibration stress survey must be subjected to one of the following tests: 6.4.1.1 A 50-h flight test in level flight or in climb. At least 5 h of this flight must be with the propeller operated at the rated rotational speed, and the remainder of the 50 h must be with the propeller operated at not less than 90 % of the rated rotational speed.	**N/A**	N/A	-

6.4.4.2 A 50-h ground test on an engine at the power and propeller rotational speed for which a rating is sought.			
6.4.2 Propellers without a vibration stress survey must be subjected to one of the following tests: 6.4.2.1 The endurance test shall be conducted according to the schedule, and in the order, shown in Fig. 1. 6.4.2.2 Compliance with 6.4.2.1 may be accomplished by providing documented service experience for the duration, power and speeds for the conditions shown in Fig. 1. The 10-h segment at maximum declared takeoff power and rpm shall be the final segment of testing after all other power and speed segments are completed.	**C**	T	Several thousand DURANDAL & EXCALIBUR propellers in service without issue for more than 10 years
6.4.3 An analysis based on tests of propellers of similar design may be used in place of the tests 6.4.1 and 6.4.2	**C**	T	Several thousand DURANDAL & EXCALIBUR propellers in service without issue for more than 10 years
6.5 Teardown Inspection: 6.5.1 After completion of each test prescribed in Section 6 of this specification, the propeller must be completely disassembled and a detailed inspection must be made of the propeller parts for cracks, wear, distortion, and any other unusual conditions.	**C**	T	Documents RD-003, RD-004, RD-005, RD-006, RD-007, RD-008, RD-009
6.5.2 Any unsatisfactory findings during the teardown inspection must be resolved through design changes and additional testing as necessary to establish the compliance of the propeller to this specification.	**C**	I	Documents RD-003, RD-004, RD-005, RD-006, RD-007, RD-008, RD-009 No issue during tests
6.6 Propeller Adjustments and Parts Replacements—The manufacturer may service and make repairs to the propeller during the tests. Any service or repairs completed must be allowed by the maintenance manual. If repairs or replacement of parts that are beyond the scope of the maintenance manual are found necessary during the tests or in the teardown inspection, the parts in question must be subjected to additional testing or design changes, or both, as necessary to establish the compliance of the propeller to this specification.	**C**	I	Documents RD-003, RD-004, RD-005, RD-006, RD-007, RD-008, RD-009 No issue during tests

7. Identification Marking 7.1 Each manufacturer of a propeller, propeller blade, or propeller hub shall identify each by means of a plate, stamping, engraving, etching, or other method of permanent identification.	**C**	A I	Documents RD-010, RD-011, RD-012, RD-013, RD-014, RD-015, RD-016, RD-017, RD-018, RD-019, RD-020, RD-021, RD-022, RD-023, RD-024, RD-025, RD-026, RD-027, RD-028, RD-029, RD-030, RD-031, RD-032, RD-033, RD-034, RD-035, RD-036, RD-037, RD-038, RD-039, RD-040 One label (serial number) and a RFID chip are integrated to blade and hub during manufacturing process
7.2 The identification shall be placed on a non-critical surface that will not likely be defaced or removed during normal service or lost or destroyed in an accident.	**C**	A I	Documents RD-010, RD-011, RD-012, RD-013, RD-014, RD-015, RD-016, RD-017, RD-018, RD-019, RD-020, RD-021, RD-022, RD-023, RD-024, RD-025, RD-026, RD-027, RD-028, RD-029, RD-030, RD-031, RD-032, RD-033, RD-034, RD-035, RD-036, RD-037, RD-038, RD-039, RD-040 One label (serial number) and a RFID chip are integrated to blade and hub during manufacturing process
7.3 The identification marking(s) shall contain the following information. Propeller diameter, pitch (for fixed-pitch propellers), and manufacturer's identification must be obvious from the marking(s). The other required information can be encoded or abbreviated as necessary to limit the space required for the marking(s): 7.3.1 Manufacturer's identification. 7.3.2 Propeller model designation. 7.3.3 Propeller serial number. 7.3.4 Part number (or equivalent). 7.3.5 Propeller diameter. 7.3.6 Propeller pitch (for fixed-pitch propellers).	**C**	A I	Documents RD-010, RD-011, RD-012, RD-013, RD-014, RD-015, RD-016, RD-017, RD-018, RD-019, RD-020, RD-021, RD-022, RD-023, RD-024, RD-025, RD-026, RD-027, RD-028, RD-029, RD-030, RD-031, RD-032, RD-033, RD-034, RD-035, RD-036, RD-037, RD-038, RD-039, RD-040 One label (serial number) and a RFID chip are integrated to blade and hub during manufacturing process

8. Design Control 8.1 The design of a propeller consists of at least the following: 8.1.1 The drawings and specifications, and a listing of those drawings and specifications necessary to define the configuration and the design features of the propeller shown to comply with this specification. 8.1.2 Information on dimensions, materials, and processes necessary to define the structural strength of the propeller. 8.1.3 Any other data necessary to allow, by comparison, the determination that later propellers of the same or similar design meet the requirements of this specification.	**C**	A	Documents RD-010, RD-011, RD-012, RD-013, RD-014, RD-015, RD-016, RD-017, RD-018, RD-019, RD-020, RD-021, RD-022, RD-023, RD-024, RD-025, RD-026, RD-027, RD-028, RD-029, RD-030, RD-031, RD-032, RD-033, RD-034, RD-035, RD-036, RD-037, RD-038, RD-039, RD-040

9. Quality Assurance The propeller manufacturer shall have a quality assurance system that ensures manufactured propellers maintain conformity to the established design.	**C**	A	E-Props quality charter : RD-052

10. Keywords light sport aircraft; propeller	**C**	N/A	Terminology definition

APPENDIX X1 Additional requirements for in-flight adjustable propellers	**N/A**	N/A	The DURANDAL & EXCALIBUR models are not in-flight adjustable propellers

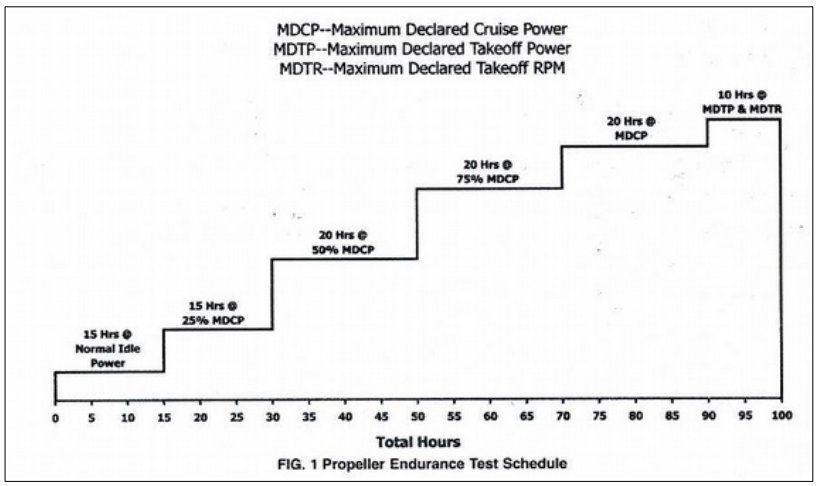


FIG. 1 Propeller Endurance Test Schedule