HI-TECH
CARBON PROPELLERS

# INSTRUCTION and SERVICE MANUAL

## Ground Adjustable Pitch Propellers
## for ROTAX engines serie 9

E-Props

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# You have just acquired an E-PROPS propeller : congratulations !

Since 2008, the full carbon E-PROPS propellers are designed and manufactured by our aeronautical technicians in Sisteron, Provence, France.

**The propeller is not an accessory : read and follow the instructions of this Manual**

If certain points of this Manual do not seem to you clear, do not hesitate to consult an approved dealer or directly the E-PROPS company. **Strictly follow the instructions of this manual, otherwise the E-PROPS guarantee could not be applied.**

This document must be kept during all propeller's life. The owner of the propeller must have the latest version of this document; he can ask the E-PROPS company on this subject, or consult the updated version on the E-PROPS website : **www.e-props.fr / aircraft.e-props.fr**, on the MANUALS page.

The general terms and conditions of sales are available on our website.

*We thank you for your confidence and we wish you very nice flights with your aircraft equipped with an E-PROPS propeller !*

## ATTENTION

**The propeller and its accessories have been designed, tested and validated for a specific set of "engine + reduction drive + diameter". This Manual is given instructions for REDUCTION DRIVE ENGINES. It is STRONGLY FORBIDDEN to mount this propeller on DIRECT DRIVE ENGINES.**
**NEVER mount this propeller on an other set of engine + reduction drive without the written agreement of the E-PROPS team.**

Before to start the engine and the propeller, carefully read the Instruction and Service Manual. The non compliance with this instruction could cause physical injury, even the death. Please also read the aircraft Manual and the engine Manual for other instructions.

The E-PROPS propellers are not "certified" propellers : they are not compliant with aeronautical standard as AESA or FAA. However, they are **compliant with the ASTM F2506-13** (LSA).

Their use is the sole responsibility of the owner / pilot of the aircraft. The user admits knowing and accepting the risks of using such propellers, and admits knowing that his engine could stop abruptly.

The E-PROPS propellers shall be used respecting the VFR flight conditions.

Any rotating propeller can be a serious danger for the pilot, passengers and/or spectators. Never let the children touch propellers, even when the engine is stopped. Be always extremely careful as soon as an engine equipped with a propeller may turn. Before turning the propeller with the hand, always attentively check that the engine driving ignition is off.

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# 1. GENERAL POINTS

The **E-PROPS** propellers equip all engines on all aircraft types : airplanes, ultralights, delta trikes, gyroplanes, UAV, VTOL, airships and paramotors.

**Since 2008**, those innovative propellers are manufactured **in France**, on industrial aera of Sisteron's airfield, in the Alpes de Haute Provence. E-PROPS propellers are designed and manufactured to be very light and strong. The blades and the hubs are 100% carbon, with an integrated leading edge protection. The propellers are very-precisely balanced and have a **MTBO of 2000 hours**.

The specific and innovative design, the perfect compliance of profiles, the high quality materials and the special manufacturing process allow to obtain **the world's lightest ground adjustable pitch propellers.**

The performances of the ground adjustable pitch propellers are exceptional because of a very high **ESR effect** (Extended Speed Range). Those results are validated by flight tests campaigns.

**=> More information on the website : www.e-props.fr / aircraft.e-props.fr**

## 2. PROPELLERS' DESCRIPTION

| | |
|---|---|
| **Blades** | **100% carbon** + epoxy resin<br>Optimum use of carbon fibers to obtain light and strong blades<br>Foam core with D-Box<br>RTM manufacturing process |
| **Blade's foot** | Carbon fiber rolled up on a titanium ring<br>Exceptional strength (calculated and verified)<br>No metallic part = **no galvanic corrosion** |
| **Hub** | 100% carbon + epoxy resin high T° (120°C)<br>Ground adjustable pitch<br>Compact hub for minimum drag and to optimize engine's cooling<br>Optimum tightening anti vibrations Nord-Lock screws |
| **Leading edge protection** | **Strong internal leading edge protection** in Nanostrength® resin<br>Special polyurethane tape (as on helicopter blades) |
| **E-PROPS geometry** | Propellers of 3rd generation : efficient, light and strong<br>High CL profiles by HELICES E-PROPS (software LmPTR)<br>Adapted diameter and blades' numbers<br>Adapted chord for maximum ESR effect<br>Specific models to reduce noise, as on EXCALIBUR-6 |
| **Moment of Inertia** | Moment of Inertia calculated then verified<br>Strict respect of the engines limitations |

| | |
|---|---|
| **Balancing** | Blades, hubs and accessories are balanced at each manufacturing step.<br>Propellers balanced on an electronic bench |
| **Quality control** | Each component is equipped with a RFID chip. More than 15 weighing are necessary during manufacturing of a propeller for ultralights / aircraft |
| **Pitch adjustment** | Ground adjustable pitch / Simple adjustment with a precise digital protractor |
| **Life limitation – MTBO** | None / recommended major periodic inspection : **2.000 hrs** |
| **Periodic checks** | Check of the screws tightening and the blades' pitch :<br>=> 50 h and/or 3 months for all models excepted EXCALIBUR-6<br>=> 25 h and/or 3 months for EXCALIBUR-6 |
| **Mechanical Strength Tests** | Centrifugal load : break at **11.000 tonnes**, safety coefficient : **7,2**<br>Carbon propeller can hold **6 times** the maximal load during 1 hour without any damages<br>Stress the blade with alternating bending during **2.000 hours** at 10 times the worse case of functioning |
| **Certification** | Propellers designed, made and tested to meet the requirements aeronautical standards. Compliant with the **ASTM F2506-13** standard (LSA) |
| **Accessories** | Delivered with the propeller : flange (black anodized) and complete screw kit with Nord-Lock washers, digital protractor, Rotax drive lugs, and, if necessary, extended hubs (which replace spacers).<br>In option : carbon spinners : different models and diameters |
| **Garantee** | Garantee "TEST YOUR PROPELLER DURING 6 MONTHS"<br>**6 months satisfied or your money back** |

# 3. PROPELLER ASSEMBLY

## 3.1. Propellers components

An E-PROPS propeller for airplanes / ultralights (ground adjustable pitch) shall be composed of :

- the blades
- the hub, in two parts (upper part and lower part)
- the aluminium flange (black anodized)
- the screws for the assembly : screws, NORD-LOCK washers, potentially nuts / drive lugs
- sometimes a small flange to push aside the propeller from the engine fairing (option)

## 3.2. Serial numbers

Each E-PROPS part has a serial number. Those numbers are integrated in resin or on a sticker, and are also in the RFID chip inside the blade.


*example : serial number on blade's foot*

Those references are important to determine the modifications or replacements of components with E-PROPS team. They are indicated on the invoice, delivery note and Propeller Identification Sheet. E-PROPS keeps all technical data of each propeller.

### 3.3. Preliminary checks

First verify in "engine" and "aircraft" manuals the appropriate instructions for propeller's implementation.

Then check the good state and the cleanliness of the threading receiving screws in flange's engine. Screws should be screwed completely by hand.

Please verify that the hub and the engine flange are both clean and even (no sand, no filings, no dirt).

The propeller must be mounted directly against the flange (or against the spacer). NEVER insert a rubber ring between the propeller and the flange : the screws could break.

If you are using a composite spinner (not made by E-PROPS), please verify that the resin is able to withstand 120°C. In case of doubt, increase the frequency of screws tightening.

### 3.4. Propeller assembly

Put together the blades, the two parts of the hub, the aluminium flange and the screws.


*Example : hub and blades of a 3-blades E-PROPS propeller*

Put the blades' feet in the half hub on the engine's side. The blades are going on the grooves of the hub. The position of the blades in the hub are defined by the colored stickers, and also the position of the aluminium flange. Colors have to correspond to assure a perfect balancing.

*stickers*

*Nord-Lock washers*

The aluminium flange and accessories (spinner, mounting plate) also have a sticker. The colors must be aligned to have the best balancing.

The E-PROPS team is doing on each propeller a very precise balancing, with digital balancing benches. Each set of blades is balanced with its hub, and, if any, with its spinner and spacer.

The "***E-PROPS***" stickers on the blades must be visible by the user, when he is in front of the propeller (tractor configuration) or behind the propeller (pusher configuration).


Except in specific case and initial agreement with the customer, a sticker "E-PROPS" is placed on each blade by the manufacturing team. Some hubs are also delivered with some technical stickers. Those stickers are placed before balancing and final check of the propeller.

Assemble the other part of the hub. Colored stickers must be aligned. Close the hub and moderately tighten the central nut.

E-PROPS is using NORD-LOCK® washers for its carbon hubs (propellers for ultralights / aircraft). These washers which assure the tightening must be positioned under the head of the screw. Any other assembly systems does not guarantee an optimal tightening.

NORD-LOCK® washers secure bolted joints with tension instead of friction. The system is comprised of a pair of washers that has cams on one side and radial teeth on the opposite side [*see NORD-LOCK washers in Annex*].

**Do not use thread lock** : it would give false torque indications. To avoid loosening of screws, please only use the NORD-LOCK washers. If you use thread lock (as LOCTITE, for example), this may void E-PROPS warranty.

During propeller assembly on the engine, check there is a sufficient gap between hub and engine fairing. For a standard assembly a gap of 2 cm is enough. In case of more flexible assembly, the gap will be of 5 cm or more, depending on the specific engine / aircraft. In any case : check the free motion of propeller before starting engine.

Check the gap between blade tips and any potential obstacle (wing, fuselage). A gap of 5 cm is usually enough.

Be careful : blades are a little flexible and blade tips can move of some cm along the thrust axis (1 to 2 cm only). This is important for pusher configuration.

**NEVER cut an E-PROPS blade, neither at foot, nor at tip.**

If a non E-PROPS spacer is used between engine flange and propeller hub, check that contact surface between hub and spacer is equivalent to the engine flange surface. If not, propeller will not be assembled without E-PROPS specific instructions.

### 3.5. Extended hubs

E-PROPS has developed a solution of extended hubs, very strong, very light, simply to assemble and economic, which can equip the E-PROPS propellers, tractor configuration, for reduction drive engines.

This system replaces the usual aluminium spacers, heavy, expensive and difficult to assemble. At this day, this system is available on 3-blades propellers, tractor configuration.

*extended hub on a ROTAX 912 or 912S engine, with an E-PROPS spinner*

**NEVER cut an E-PROPS extended hub**

The extended hubs are designed and manufactured for a defined length. Cut them is similar to destroy the mechanical strength of the hub. This would be very dangerous.

It is absolutely FORBIDDEN to fly with an E-PROPS extended hub which would have been cut.

Example :
- aluminium spacer on an ultralight Savannah, 120 mm length = 2,4 kg
- E-PROPS carbon extended hub, same length = 420 gr **=> *weight gain = 2 kg !***

### 3.6. Assembly on the engine

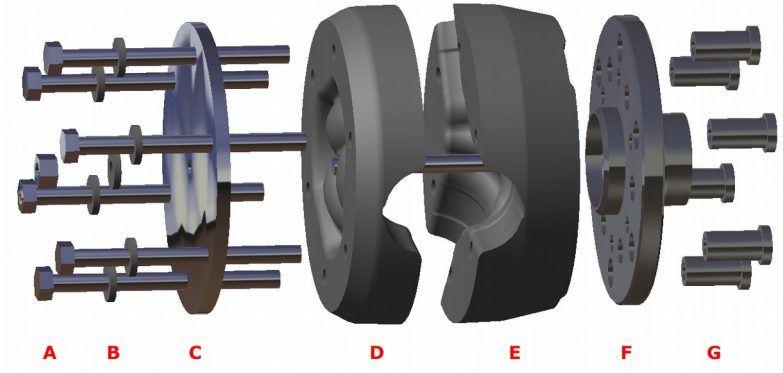
Put the hub against the engine's flange and slightly torque the screws with their washers, before beginning the pitch adjustment.

*The anodized flange is positioned in front of the hub*

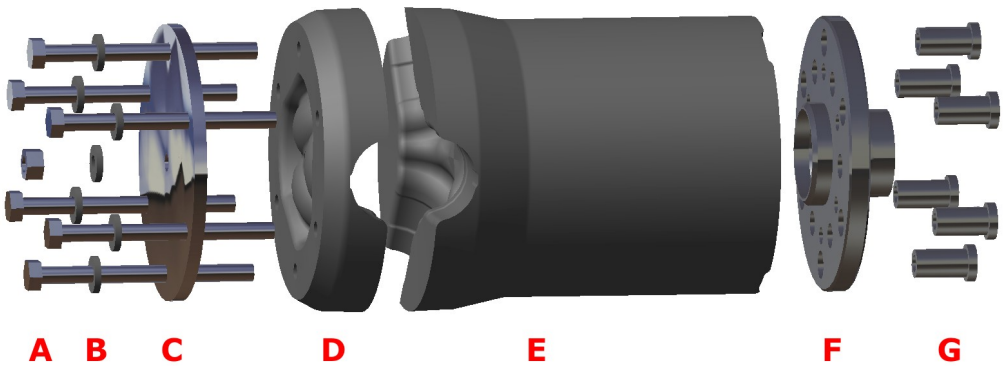
Please note : on certain models, after hub screw tightening, it could stay a small space (about 2 mm) between the two parts of the hub. That's normal to have a perfect tightening on the blades feet (and not only on the two flat sections of the hub).

### 3.7. Propeller assembly : 3-blade (DURANDAL, EXCALIBUR-3), 4-blade (EXCALIBUR-4)

**STANDARD HUB**



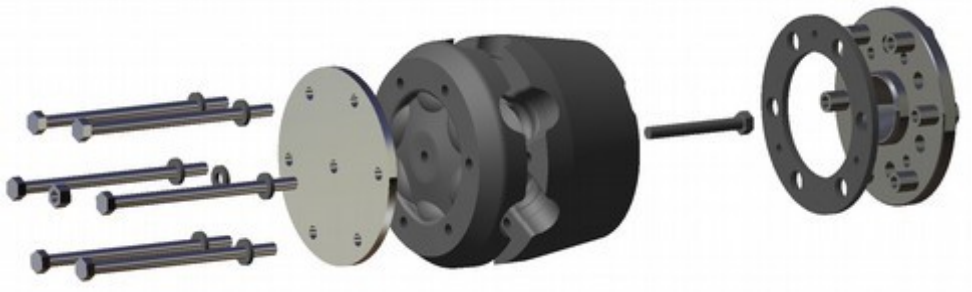

**EXTENDED HUB**




*see references next page*

| | |
|---|---|
| **A** | 6 screws + 1 central nut (for the central screw of the hub) |
| **B** | 7 Nord-Lock washers |
| **C** | 1 Flange in anodized aluminium |
| **D** | 1 upper Half Hub |
| **E** | 1 lower Half Hub (standard or extended) |
| **F** | 1 reducer flange (on the engine,not provided by E-PROPS) |
| **G** | 6 drive lugs : threaded or smooth / If they are smooth, it is necessary to assemble them with a lock nut |

### 3.8. Propeller assembly : 6-blade EXCALIBUR-6



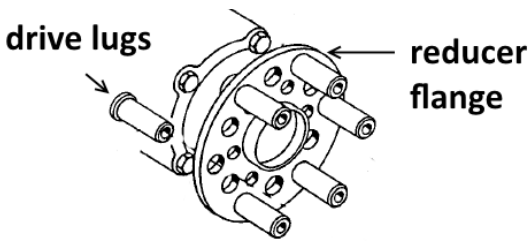
The EXCALIBUR-6 includes a thermic spacer in fiberglass with special treatment. Indeed, some assemblies on gyros can heat (for example: pre-launchers putted during take-off at max RPM). The thermic spacer avoids the consequences of a fast temperature increasing on the carbon hub.

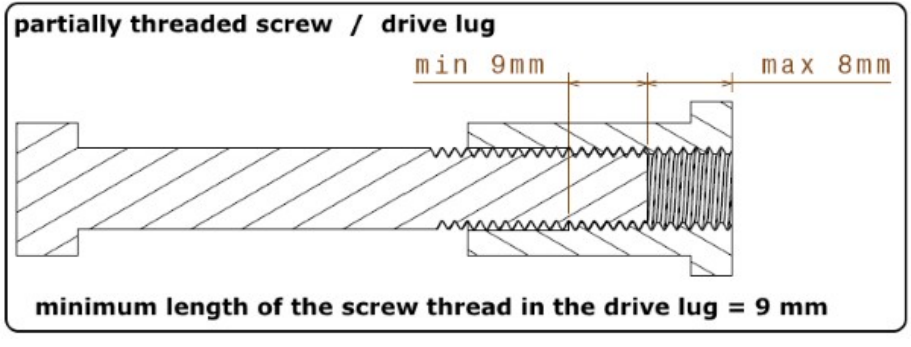
**=> On gyros, this spacer is absolutely mandatory.**

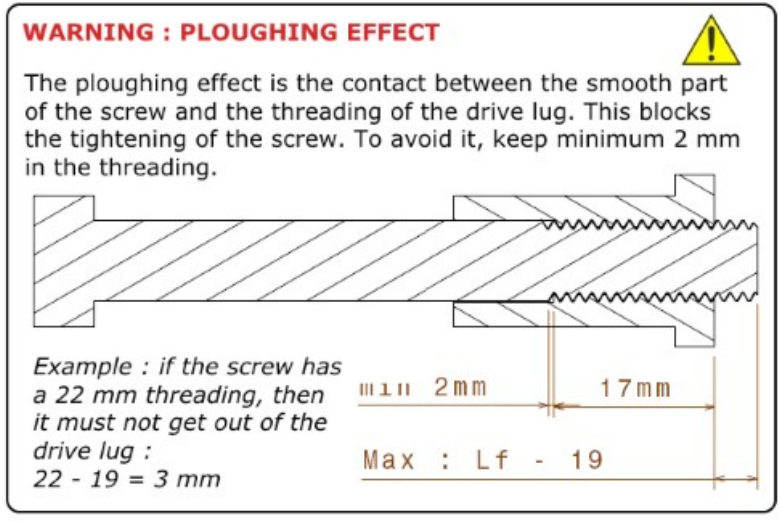
### 3.9. ROTAX drive lugs

On 4-stroke ROTAX engines (serie 9 : ROTAX 912UL, 912ULS, 912iS, 914 and 915iS), the propeller is assembled on the engine flange with some drive lugs. Those drive lugs are essential for the centering.

As explained by ROTAX, **the drive lugs must be inserted in the carbon hub of minimum 4 mm**.






The Drive Lugs provided by E-PROPS for ROTAX engines are bought from the ROTAX company only.

To put threaded drive lugs on the flange of a ROTAX engine : it's better to install them before the assembly of the propeller. For that purpose, use a socket of 15, some washers and a screw with the good threading. Very slightly lubricate the screw and the drive lugs (and only the screw, not the blade's foot).
If necessary, clean the flange's holes with a reamer for a good assembly of the drive lugs.

### 3.10. Screws

**Quality, length and threading of the screws are essential to make a good assembly**
**Only use screws provided by E-PROPS**
*⌦ If you have not the good screws length to make a good assembly of the propeller on the engine, please contact the E-PROPS team. The team will send the good screws to you (quality and length).*

**Screws totally threaded**: for some configurations, E-PROPS provides totally threaded screws. Those screws have the same mechanical strength as partially threaded screws. **DO NOT REPLACE THEM by partially threaded screws** : the Ploughing Effect could be important (*see previous page*).

**NEVER cut / NEVER thread again aeronautical screws** : this would destroy the surface treatment and significantly affect the screws performances. The tightening of the propeller could not be ensured.
The use of screws which are not provided by E-PROPS and/or which have been modified (cut or threaded) results in voiding the E-PROPS warranty.

**Do not use thread lock** (LOCTITE) : it would give false torque indications. To avoid loosening of screws, please only use the NORD-LOCK washers (*see Annex*).

It is imperative to use a **calibrated torque wrench** to apply the good torque on the screws, as a good practice in aviation.

# 4. PITCH ADJUSTMENT OF THE BLADES

## 4.1. General points

The E-PROPS propellers described in this Manual are "**ground adjustable pitch**", it means that the pitch is fixed when the propeller is assembled on the engine, and can be modify by the user on ground (not during the flight).

The pitch adjustment must be carefully done by the user, and of course must be the same for all blades. If the pitch is not the same on each blade, the performances can be degraded, and this could be generate some vibrations *(see § Balancing / Vibrations).*

**a gap of pitch of 1° may cause some important problems**

A first recommended pitch blade angle is given by E-PROPS on the **Propeller Identification Sheet** (included in the documents of the propeller). This **indicative value** depends on the propeller's model, the engine, the reducer, the aircraft and the use of the aircraft. Depending on the use of his aircraft and on his wishes, the owner / pilot has to adapt the pitch of the blades.

Setting procedure, or how to reach the maximum RPM as wanted :

| |
|---|
| **the increase of the pitch decreases the engine RPM** |
| **the decrease of the pitch increases the engine RPM** |

### 4.2. E-PROPS propellers : ESR effect

E-PROPS is using the term **ESR effect** (Extended Speed Range effect) to define a fixed pitch propeller (or ground adjustable pitch one) which behavior is near from the behavior of a variable pitch propeller.

This ESR effect has the following characteristics : it causes very small gap between the static RPM and the flight RPM, and this allows to keep a strong power at take-off.
It seems that **the max throttle RPM stays nearly constant**.

Example :
- take-off : engine full throttle 5400 RPM
- max speed 200 km/h : engine full throttle 5500 RPM

The gap between 0 km/h and 200 km/h is in this case only 100 RPM. For comparison purposes, a standard propeller (not ESR) can have a gap up to 1000 RPM between take-off and max cruise speed.

The ESR effect can improve the performances at take-off, because then the engine is running very near of its max RPM, and provide all its power during take-off.

Some E-PROPS models allow to have more RPM at take-off than in flight…

### 4.3. Pitch adjustment : examples

On the **Rotax engines 9 series** (912 to 915), the pitch adjustment for which the E-PROPS propeller would give the best performances on the whole speed range of the aircraft is obtained at **5.500 RPM, full throttle, horizontal flight**. So it is recommended to refine the pitch adjustment to obtain this value when you put full throttle in flight. This does not mean you must fly at 5.500 RPM in cruise : it is just the good value to obtain the best adjustment of the blades pitch (optimization point).
So on Rotax engines 9 series, the best way to obtain the best pitch of your E-PROPS propeller, which will give the best performances on the whole speed range of the aircraft, is to :

➔ First adjust the recommended pitch value (on the Propeller Identification Sheet).

➔ Then on ground put full throttle to verify the max RPM : if you have between 5.100 and 5.800 RPM, you can go flying. If not, then adjust to pitch to obtain between min 5.100 and max 5.800 RPM on ground.

➔ Then fly horizontally and measure how many RPM you have when you put full throttle : if you have about 5.500 RPM (+/- 50 RPM), it's perfect.

➔ If not, then adjust the pitch to obtain 5.500 max RPM in horizontal flight full throttle.
**On a Rotax 9 series, an increase of 0,6° of the pitch decreases the engine RPM of 100 RPM**.
A decrease of 0,6° of the pitch increases the engine RPM of 100 RPM. For example, in horizontal flight, full throttle, the engine is running at 5.700 RPM. The pilot wants 5.500 RPM. The difference is 2 x 100 RPM. It is necessary to increase the blade's pitch :
2 x 0,6° = 1,2°.

***0,6° = 100 RPM***

Examples :

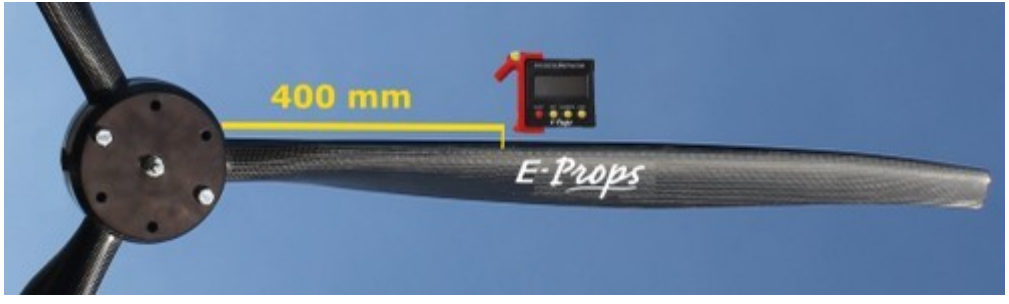
1- ICP SAVANNAH with ROTAX 912s engine (100hp) reducer 2,43
Propeller : Durandal 100 L diameter 180 cm
Use : flights in mountain, very short runways
Propeller adjustment : pitch = 5800 RPM, full throttle, horizontal flight
With this pitch, during take-off, the engine RPM is 5700 RPM, with allows a very short take-off.

2- JMB AIRCRAFT VL3 with ROTAX 912s engine (100hp) reducer 2,43
Propeller : Durandal 100 M diameter 170 cm
Use : long flights
Propeller adjustment : pitch = 5500 RPM, full throttle, horizontal flight
With this pitch, during take-off, the engine RPM is also 5500 RPM. The cruise flight is fast and comfortable. The performances at take-off are still very good (even as good as with a variable pitch propeller) due to the ESR effect of the E-PROPS propeller.

3- AUTOGYRO MTO Sport with ROTAX 914 engine (115hp) reducer 2,43
Propeller : Excalibur-6 diameter 172 cm
Use : local flights, long flights
Propeller adjustment : pitch = 5800 RPM, full throttle, horizontal flight
With this pitch, during take-off, the engine RPM is 5800 RPM, with allows a very short take-off and an excellent climb rate.

### 4.4. Blade Pitch adjustment

Place the blades at the same pitch by measuring it at **400 mm** (40 cm) of the side of the hub (the digital protractor must be outside the 400 mm). T
The measure has to be made on every blade in horizontal, **digital protractor installed against the intrados (bottom surface) of the blade, hook on the leading edge of the blade.**




Trick : put some tapes at 400 mm of the side of the hub (and remove them before to go flying !).

With each new propeller, E-PROPS provides a **digital protractor** with a precision of +/- 0,1°, easy to use, because the aircraft has not to be on a flat surface. The digital protractor is set to zero by supporting the opposite side of the hook against the flange of the propeller (vertically and between 2 screws).


*Digital protractor (precision : +/- 0,1°)*

***Unit = degree** for E-PROPS propellers*

*The red hook can be put left or right, to read the angle on pusher and on tractor configuration, as needed.*

**The tare on the hub does not allow an absolute precision.** The aircraft can have moved, the user can slightly do the tare and the measure differently...

It is common to measure a global gap between 2 adjustments.
=> It does not mean that blades moved themselves alone. **If the screws are good tightened, the blades cannot move themselves alone.** It is just that the tare is slightly different. This difference can be measured up to 1°, even more in certain cases.
What is important is that **the relative precision between blades remains good**.
Please note : do not tare between the measures of each blade, because the initial reference of the digital protractor would be lost.

*** TRACTOR PROPELLERS CASE**
Set the zero of the digital protractor by pressing the opposite side of the hook against the anodized flange (vertically and between 2 screws).
Please note : in case of pitch modification, first tare, then measure the pitch. Calculate the new pitch, then adjust it.

To measure the pitch, the digital protractor must be installed **against the intrados of the blade, hook on the leading edge of the blade.**

E-PROPS propeller blades have a quite curved leading edge and an important dihedral. These two data request that pitch measurement must be carried out with blades exactly in the same place.
In order to help to this measurement, a spirit level has been added to the protractor. So pitch check can be done with an "horizontal" blade.

*** PUSHER PROPELLERS CASE**
Attention, if protractor zero-setting is carried out with pressing the hook opposite side to the counter plate of the propeller between two screw heads, once this setting done, protractor is hanging on the blade leading edge. But this procedure needs to turn the protractor by 180°.
In this case, if counter plate is not vertical, an important measurement error occurs.

To fix this issue :
1/ add shims under ultralight wheels in order to get verticality of engine flange before propeller assembly.
2/ Remove the hook, set zero and put the hook again

**Pitch tolerance between the blades : maximum 0,3°**

*A gap of 0.3°, it means that "maximum pitch – minimum pitch" must no exceed 0.3°.*

The pitch adjustment can be modified :

- manually, by applying a torque on the blade
  Trick : apply a light torque on the blade with one hand, and a small bending with the other hand
- or with a small rubber hammer, in tapping slowly on the trailing edge, near the blade's foot. Remove the digital protractor from the blade before tapping, to avoid accidental failing.

Trick : always turn the propeller by the blade not yet adjust, in order to avoid to change the pitch already set. Do not let the digital protractor on the blade, to reduce the risk of failing (the red hook could break).

Warning : **never lubricate blade feet or hubs** to facilitate pitch adjustment
Don't use any grease, oil or silicone on blade feet.
Pitch keeping could not be warranted if blade feet are lubricated.

### 4.5. Tightening of the propellers screws

After a good positioning of the propeller on the engine, and according to engine / aircraft manuals, tighten the screws.

**Be careful : a bad tightness of the propellers' screws could be very dangerous**

It is imperative to use a **calibrated torque wrench** to apply the good torque.

The standard torques of the screws are as follow (indicated on a sticker on the hub) :

| E-PROPS range (reduction drive engines) | screws quality | torque | torque periodicity |
|---|---|---|---|
| **DURANDAL** | **8.8** | **24 N.m** | **50 h** |
| EXCALIBUR - 3 | 8.8 | 24 N.m | 50 h |
| EXCALIBUR - 4 | 8.8 | 24 N.m | 50 h |
| **EXCALIBUR - 6** | **10.9** | **28 N.m** | **25 h** |

The torque must be **gradually** applied, in order to avoid a change of the pitch : 2 N.m, then 4, 8, 16, 24 or 28 N.m.
The untightening has to be done in the same manner.


*tightening sense of the screws*

Please note : up to 4 N.m (and up to 8 N.m for EXCALIBUR-6), it is possible to slightly change the pitch, with a rubber hammer for example. The pitch adjustment must be checked before to continue the tightening.

If a spacer or a spinner is added (not provided by E-PROPS), be sure that there is no material thickness wastage (carbon temperature withstand) to keep a perfect tightness.

> The **central screw** must be tightened (or loosened) exactly as the other screws : same torque, and also gradually. Never keep the central screw tightened when the other screws are loosened : the mechanical stress on the central screw would be too important.

A SUMMARY SHEET is given with each propeller, in addition to the present Manual. This sheet is also available on the page MANUALS on the website www.e-props.fr. You can display this sheet for example on your hangar, in order to easily find the main technical data which allow to check your propeller.

**Torque and pitch adjustment of the E-PROPS propellers must be carefuly checked, always on engine warm :**

**- 10 minutes after first assembly** (*)

**- then after the first flight hour**

**- then as many as necessary,**
**and at minimum every 50 h (25 h for EXC-6) and/or every 3 months** (*)

(*) **A check on warm engine AND every 3 months, WHY ?**

A M8 screw tightened at 24 N.m extends 0,12%. For a temperature variation of +65°C, the steel expansion is 0,08%. If you imagine a screw tightening in winter at 5°C, then a use in summer, when the screw easily reaches 70°C (on a warm engine), the residual elongation of the crews is : 0.12% - 0.08% = 0.04%
The remaining screw tightening is : 0.04% / 0.12% = 33%
=> only remains **1/3 of the initial tightening** to maintain the blades
Then the blades can slightly move. Friction generate heat and make the phenomenon worse.

That's why the screws tightening must be verified **when the engine is warm** (so when the screws are warm), and must be checked at every change of season, it means **every 3 months**.
On **side-by-side two-seater gyrocopters with Rotax 912 turbo or 914**, with engine hoods, in warm weather, check the EXCALIBUR-6 propeller screws before each flight. The concentration of high heat on the screws may expand them, and the fixing screws may slightly loosen.

On the hubs, there are 2 stickers :

1/


2/


For all models, excepted EXCALIBUR-6

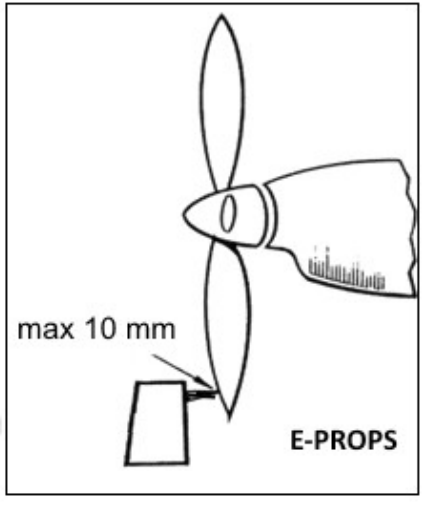
or


Only for EXCALIBUR-6

Those stickers must stay on the hub. **Remove those stickers may void E-PROPS warranty**.

### 4.6. Tracking

Propeller track is the path followed by a blade segment in one rotation.
The maximum tracking of the E-PROPS propellers is **10 mm max**, measured at extrados.




It is not impossible that a more important tracking may cause vibrations, but it is usually NOT the initial cause of vibrations *(see § Balancing / Vibrations in the present Manual).*

## 5. ASSEMBLY OF A STANDARD SPINNER

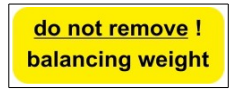
E-PROPS manufacture propellers' spinners in carbon, very strong, the lightest on the market. They are black (carbon finish, no paint), balanced and ready to be mounted. They can be adapted for propellers from 2-blades to 6-blades.

The spinner kit consists of a spinner, its mounting plate and all the screws. The mounting plate is assembled on the spinner with 6 screws M5.

For balancing, a screw can be putted on the mounting plate. Please **do not remove** this screw from the plate.

**DO NOT ADD BALANCING WEIGHTS ON THE SPINNER OR ON THE PLATE.**

A yellow sticker is glued near the balancing screw.
Please do not remove this sticker.

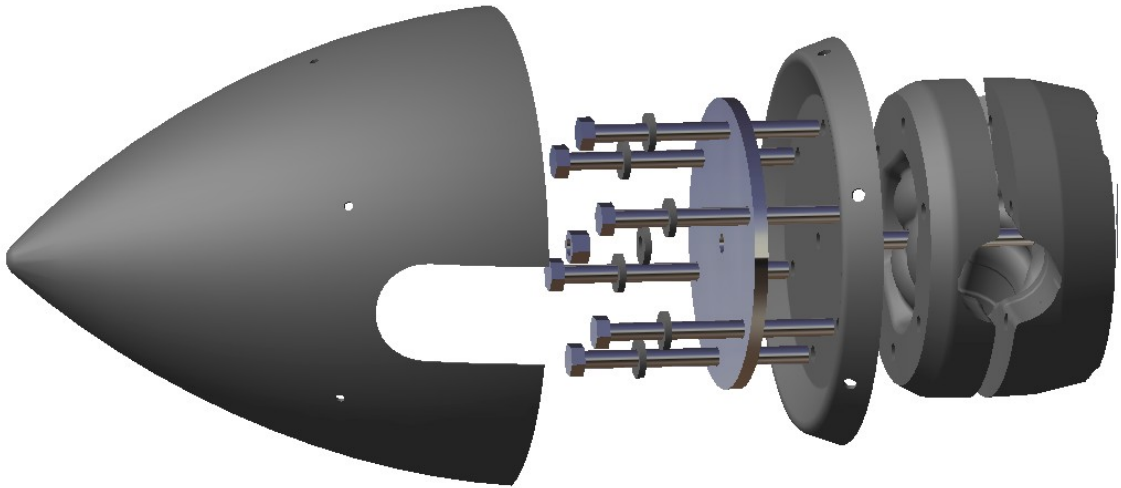



The E-PROPS spinners available in different diameters :
Ø 210 mm - Ø 230 mm - Ø 240 mm - Ø 250 mm
Ø 265 mm - Ø 275 mm - Ø 300 mm

**BE CAREFUL** : first mount the propeller then **SET THE GOOD PITCH OF THE BLADES BEFORE PLACING THE SPINNER**, otherwise, in certain cases, the blades could touch the edge of the spinner.

**E-PROPS STANDARD SPINNER ASSEMBLY**

The E-PROPS spinners are mounted on the flange of the propeller, so they are adapted to all hubs configurations (including extended hubs system).



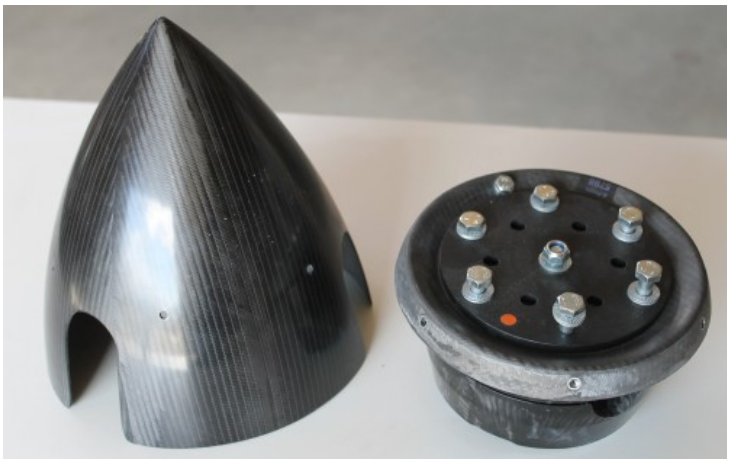

*see references next page*

| | |
|---|---|
| **A** | Carbon spinner |
| **B** | 6 screws + 1 central nut (for the central screw of the hub) |
| **C** | 7 Nord-Lock washers |
| **D** | 1 Flange in anodized aluminium |
| **E** | Carbon Mounting plate (of the spinner) |
| **F** | 1 upper Half Hub |
| **G** | 1 lower Half Hub (standard or extended) |

Be careful : the mounting plate of the spinner must be installed between the aluminium flange and the carbon

**Avoid any other assembly**

**The blades touch the spinner ?**
**Verify if you have the good pitch**

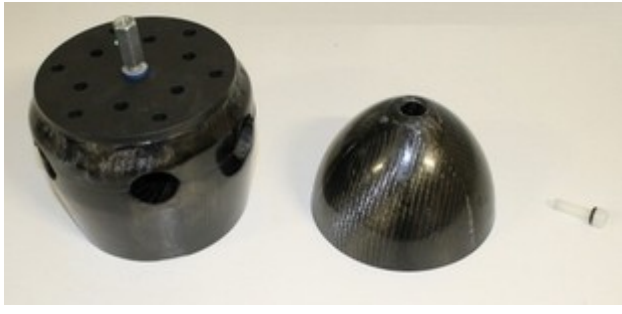


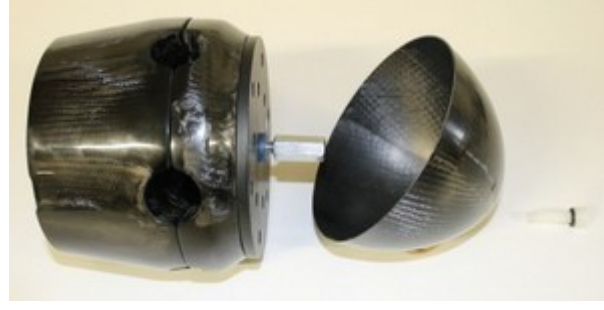
## 6. ASSEMBLY OF MINI-SPINNER SP-130

E-PROPS manufactures carbon mini-spinners diameter 130 mm length 85 mm.

Those spinners can be adapted to 2-, 3-, 4- and 6-blades propellers, tractor and pusher configurations.

The spinner kit consists of a spinner and the screws.
Weight spinner with all screws : 70 gr





*hub with long screw + Nord-Lock washer + Mini-Spinner + Nylon screw + seal*

Assembly :

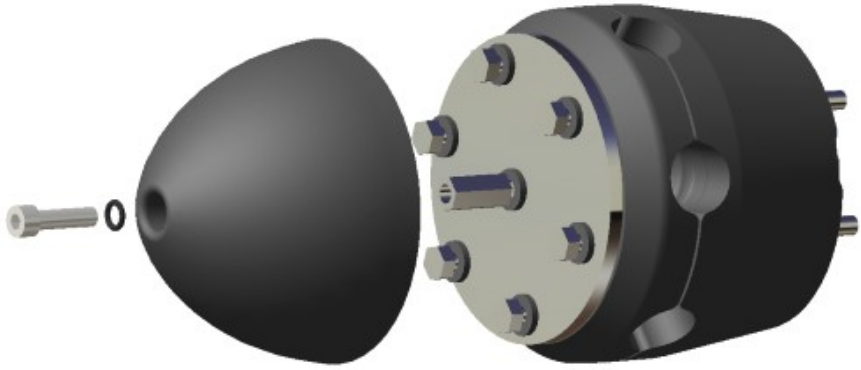
1– On the central screw of the hub : remove the standard central screw, put the hexagonal long screw with its NORD-LOCK washer

2- Tighten this long screw at the same torque as the screws : 24 N.m or 28 N.m (please verify the torque of your propeller, § 4.5)

3– Put the Mini-Spinner on the hub

4– Put the Nylon screw with its seal in the long screw through the Mini-Spinner

5– Tighten the Nylon screw at 1,5 to 2 N.m with a 6 mm Allen key



**Avoid any other assembly**

# 7. LEADING EDGE PROTECTION

## 7.1. Nanostrength Shock Additive

All carbon E-Props propellers have a leading edge protection with Nanostrength® additive shock in the epoxy resin. Made by ARKEMA, Nanostrength® are new innovative additive to reinforce epoxy resin, with high energy absorbing capability.

This special additive has been selected because :

- the reinforcement is integrated in the blade : no risk of detachment
- no metallic part : no risk of galvanic corrosion
- reinforcement all along the leading edge : not just 20 or 30 cm
- no extra weight on the tips : smaller Moment of Inertia
- possibility to easily repair the leading edge protection, even on a big impact (when a metallic leading edge must be changed - or the whole blade) : every pilot can make this repair himself, with the E-PROPS repair kit

## 7.2. Extra Protection : Polyurethane Tape

All E-PROPS blades for ROTAX serie 9 engines have also an extra protection in a strong polyurethane tape, used on certified helicopter rotor blades.

This polyurethane protection tape is made from very high performance elastomer, resistant to erosion, abrasion, punctures, minor impact damage and tears. Its formula is also resistant to ultraviolet light. Its thickness is 0,36 mm.

This protection tape does not impact the aerodynamic performances of the blades. The E-PROPS team has made many tests which all show that the performance gap between a blade with a polyurethane protection tape and a blade without this tape is not measurable.

# 8. TEST FLIGHTS

The tests have to be done very carefully, checking the engine RPM with a calibrated RPM sensor.

The RPM data is a key parameter of flight and adjustment of the engine – propeller. The speedometer has to be well calibrated on the whole range of application.

Please note : **speedometers with needles have to be calibrated**. Be careful, because a speedometer which is given false data can damage the propeller and the engine.

In case of test flights on short runway, be sure to have a maximum engine RPM near to the maximum power.
For the first test flights, avoid to fly at maximum load or with a passenger.

## ***Propeller Tests Sheet*** *(example)*

| | |
|---|---|
| Date : | QNH : |
| Aircraft : | Wind on ground : |
| Propeller : | T° : |
| Propeller's pitch : | Aircraft's weight : |

| | |
|---|---|
| Take-off distance (m) | |
| Rate of climb (ft/min) | |

LEVEL FLIGHT SPEED (Vi) ALTITUDE :

| RPM | km/h |
|---|---|
| | |
| | |
| | |

# 9. MAINTENANCE / REPAIR

The E-PROPS propellers have an unlimited lifetime under normal operating conditions.
A major inspection is recommended at about **2.000 hours**.
This inspection can be done by agreed dealers or by the E-PROPS team.

## 9.1. Maintenance

1 – At each pre-flight and/or post-flight check :

Visually inspect of the propeller, its fastenings and accessories (spinners, spacers...)
Shake the blades to detect a potential play between blades and hubs

2 – Periodic check : every **50 h (25 h for EXC-6)** **and/or** **every 3 months** :

Visually inspect of the propeller, its fastenings and accessories (spinners, spacers...)

Check of the screws tightening :
This check must be done using a calibrated torque wrench, on a warm engine
If the screws are not tightened at the indicated torque, please see the § of the present manual

Check of the blades' pitch :
This check must be done using the E-PROPS digital protractor
If the pitch adjustment has changed, please see the § of the present manual

### 9.2. Conditions of use / Repair

The E-PROPS propellers must be used by respecting the VFR (Visual Flight Rules) conditions.
This excludes flying in bad weather conditions with an aircraft equipped with an E-PROPS propeller.
In the case of an involuntary entry to bad weather conditions, the pilot has to take all the measures to land as quickly as possible.
Under a storm or heavy rain, it is recommended to reduce the engine (propeller) RPM (below 4.800 RPM for a ROTAX engine 912 family) and to land as soon as possible.

The propeller's efficiency is bound to its cleanliness : a dirty propeller would have a less good efficiency.
The cleaning of a carbon propeller is made with a sponge, with some water with soap, or with a product for windows cleaning (in France we are using "*Plizz Fée du Logis*", as gliders pilots on their canopies).

If an incident or a shock require an important repair, this one must be realized by E-PROPS in its workshops, or by a specialist after discussions with the team E-PROPS.

The final checks of the propeller, and in particular balancing, are made by E-PROPS before the delivery. Any technical intervention on the propeller may affect this balancing and generate vibrations which may damage the engine.

In case of incident, **please contact E-PROPS as soon as possible**.

### 9.3. Balancing / Vibrations

The E-PROPS propellers are precisely balanced, if possible with their accessories (spacers, spinners).
The team is using an electronic bench to balance the propellers. The maximum tolerance accepted is **0,3 gr/m**.

Be careful : the blades have not necessarily the same weight.
To balance a propeller, the weight of both blades is important, of course, but before all the **weight distribution all along the blade.**


The weights P1 et P2 of each blade apply respectively to center of gravity G1 and G2, which are not at an equal distance on the center of rotation O of the propeller.
The balancing must be realized to obtain : P1 x d1 = P2 x d2

It is strongly discouraged to add weight to one blade, in order to have the same weight for all blades. The propeller would be then unbalanced, and can cause some vibrations.

**Modification of the balancing of an E-PROPS propeller voids any warranty**.

E-PROPS propellers are well known to generate very few vibrations, due to their very light weight and to their very precise balancing. When propellers are light, a good balancing, with low tolerance, is enough to avoid the perception of vibrations, or the vibrations consequences. In this case, a dynamic balancing should not bring anything.

If you fell some vibrations, particularly at idling speed and at power reduction, verify the carburators synchronization. It is the main reason of the vibrations.
The carburators synchronization has to be made on the engine integrated on the aircraft.

If the carburators synchronization is OK, then verify the silent-blocks condition. Some are too soft, too rigid or in bad conditions, and this should generate vibrations.

Vibrations can also be generated by a difference of the pitch between the blades (tolerance for E-PROPS models = 0,3°), or by a bad balancing of the accessories (spacers, spinners…).

When it is possible, try another propeller to see if you still have vibrations.

If you don't find the cause of the vibrations, please contact us :

**helices@e-props.fr** or **+33 492 34 00 00**

# 10. SERVICE BULLETINS

The Service Bulletins are published by the manufacturers of aeronautical products. They are established to prevent the users of a technical problem, a novelty or an improvement of the aeronautical product, as well as to transmit a technical information concerning the use of the aeronautical product.

**Helices E-PROPS has chosen the complete transparency towards the users of its products**

The improvements, modifications and changes brought to its products further to tests, feedback and possible problems met by the users are detailed in Service Bulletins written by the company. It is not an obligation, but a security approach in the sector of the leisure aviation.

Incomplete review of all information in this document can cause errors. Please read the entire Service Bulletin to make sure you have a complete understanding of the requirements.

The Service Bulletins of the Helices E-PROPS company are available here : **www.e-props.fr**

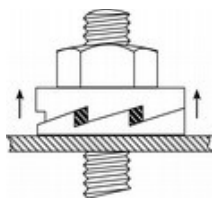
## 11. ANNEX : NORD-LOCK® WASHERS

Nord-Lock washers are easy and effective to use while ensuring structural security for applications exposed to vibration and dynamic loads. Installing the washers : the pre-assembled washers are installed in pairs (never disassemble them), cam face to cam face.

Tightening : Tighten Nord-Lock washers with standard tools.
Untightening : untightening Nord-Lock washers is as simple as tightening. Note that since the locking function is not based on increased friction, the untightening torque is generally lower than the tightening torque. Therefore it is not possible to measure offtorque as verification of locking function.

Reusing Nord-Lock : Nord-Lock washers can be reused **about 50 times.**
As with all fasteners, they should be inspected for wear before reassembly. Make sure that the washers are reinstalled correctly cam face to cam face.

E-PROPS is using NORD-LOCK® washers for its carbon hubs.
Any other assembly systems do not guarantee an optimal tightening.
The washers must be mounted under the screw's head.



# The propeller is NOT an accessory :

# read the Manual and follow the instructions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