

SERVICE BULLETIN N° 20-001

Date :	11 January 2020
Propellers affected :	E-Props ground adjustable pitch : model EXCALIBUR-6 6-blade pusher model for ROTAX engines (reduced) Mounted on gyrocopters
SB subject :	Reminder of assembly, tightening and verification instructions of hub screws on EXCALIBUR-6 propellers Presentation of a method for checking possible ploughing effect.
Required actions :	Check of assembly, tightening and verification of hub screws on EXCALIBUR-6 propellers. Check possible ploughing effect
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This Service Bulletin follows some incidents, which occurred on gyrocopters with engine hoods, regarding 6-blade pusher propellers model EXCALIBUR-6 designed for Rotax engines (reduced).

After long flights at high engine RPM, pilots started to feel vibrations coming from the propeller. After expertise on ground, the hubs of the EXCALIBUR-6 propellers have suffered damages due to fretting between hub and blades' feet, which led to the creep of the resin and the destruction of the hub. The blades did not become completely uncoupled from the hub. Fortunately, no damages to the pilots and to the gyrocopters have been deplored.

Technical analysis are under way, but it is already likely that this phenomenon has arisen because the tightening of the screws holding the propeller on the gearbox flange was not sufficient.

For one or more reasons (still to be validated), the screws holding the propeller to the gearbox no longer performed their function, causing fretting in the hub at the feet of the blades.

=> In one case, it has been shown that the screws of the propellers have not been properly tightened neither during the first assembly, nor during the mandatory checks which have to be done according to the Instruction and Service Manual and according to the stickers on the hubs.

Please note that the "Instruction and Service Manual of the E-PROPS propellers" is given with all new propellers; last updated version is published on the E-Props website (www.e-props.fr, AIRCRAFT, menu Manuals / Documentations).

=> In an other case, the screws which have been used were not the screws provided with the propeller and were not compliant with the E-Props recommendations.

=> In another case, it is possible that the improper tightening could be due to a ploughing effect, preventing a correct tightening.

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On the gyrocopters, the propellers are not directly mounted on the gearbox flange but on a pre-launch pulley. Each installation is therefore different according to the manufacturer of the gyro or even according to each gyro.

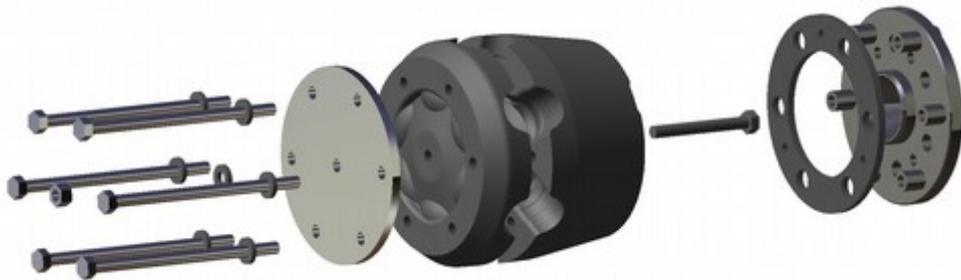
This Service Bulletin reminds assembly, tightening and verification instructions of hub screws on EXCALIBUR-6 propellers, and provides a simple method of verifying a possible ploughing effect.

USERS REQUIRED ACTIONS

1 – Reminder of assembly, tightening and verification instructions of hub screws on EXCALIBUR-6 propellers

These Instructions are detailed in the "Instruction and Service Manual of the E-PROPS propellers" which is given with all new propellers; last updated version is published on the E-Props website (www.e-props.fr, AIRCRAFT, menu Manuals / Documentations).

1-1 ASSEMBLY



drawing, from left to right :

- Screws, quality 10.9, lengths depending on gyros, supplied by E-PROPS (never cut, never thread again the screws, and do not use thread lock)
- Nord-Lock washers, aero quality, supplied by E-PROPS
- Flange in anodized aluminium, thickness 6 mm, supplied by E-PROPS
- Upper Half Hub : carbon fiber + epoxy resin
- Lower Half Hub (with a central screw) : carbon fiber + epoxy resin
- Thermic spacer in fiberglass thickness 5 mm, supplied by E-PROPS (*)
- Reducer with 6 Rotax drive lugs (supplied by E-PROPS)

(*) The EXCALIBUR-6 includes a thermic spacer in fiberglass with special treatment. Indeed, some assemblies on gyros can heat (for example: pre-launch 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 mandatory.

1-2 TIGHTENING

Torque screws EXCALIBUR-6 : **28 N.m**

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

Please note : the torque is not the only guarantee of a good tightening.

See below: PLOUGHING EFFECT

1-3 TIGHTENING CHECK

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

- **10 minutes after first assembly**
- then after the **first flight hour**

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

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

A M8 screw tightened at for example 24 N.m extends 0,12%. For a temperature variation of +65°C, the steel expansion is 0,08%.

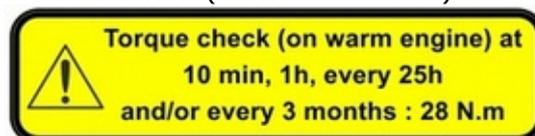
If you imagine a screw tightening in winter at 5°C, then a use in summer, when the screw easily reaches 70°C (on a warm engine), the residual elongation of the crews is : $0.12\% - 0.08\% = 0.04\%$

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.

The following sticker is glued on each hub (no not remove it) :



A summary sheet is given with each EXCALIBUR-6, in addition to the Manual :



HEP-2018-06-17



EXCALIBUR-6 PROPELLER INSTALLATION

summary



Position of the blades in the hub defined by the colored stickers to assure a perfect balancing.
Do not use thread lock : use NORD-LOCK washers.
Do not grease the blade's feet. Never modify the supplied screws (no cut and no thread adjustment)

Pitch measurement is done on the blade at **400 mm** of the hub. Tolerance is **0,3° max.**
Use the E-Props digital protractor. Put it at the intrados on leading edge.
Pitch increase decreases the engine RPM / Pitch decrease increases the engine RPM.

Screw tightening is essential.

Nominal torque of screws tightening: **28 N.m** (screws quality 10.9) 

Torque with a calibrated dynamometric key.
To keep the pitch adjustment apply the tightening torque **very gradually** : 2 N.m then 4, 8, 16, 24, 28 N.m

Torque has to be checked **always on warm engine** :

- **10 minutes after first assembly => important**
- then after the 1st flight hour
- then every **25 hours** and/or **every 3 months**

The propeller is NOT an accessory :
read & follow the E-PROPS Manual

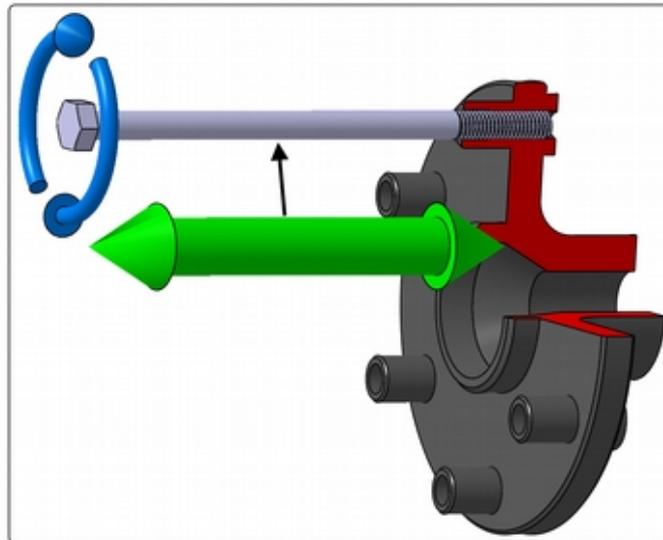
updated version on : www.e-props.fr

In the event that the recommendations of the E-Props Instruction and Service Manual are not respected by users, this type of incident could occur again.

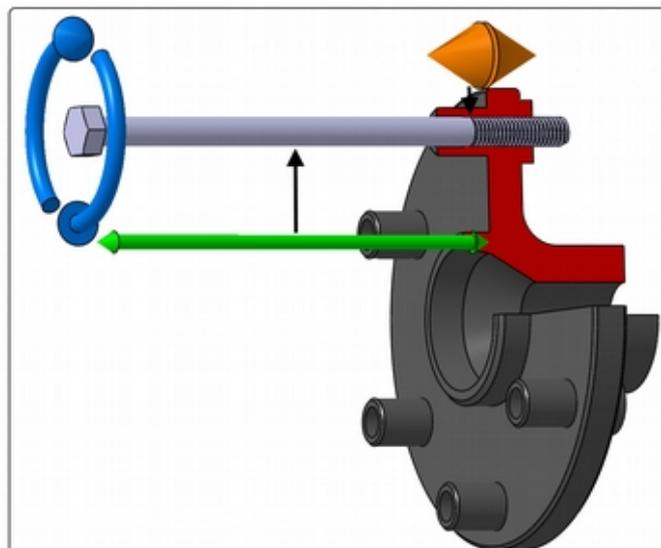
2 – Method of verifying a possible ploughing effect

2-1 PLOUGHING EFFECT

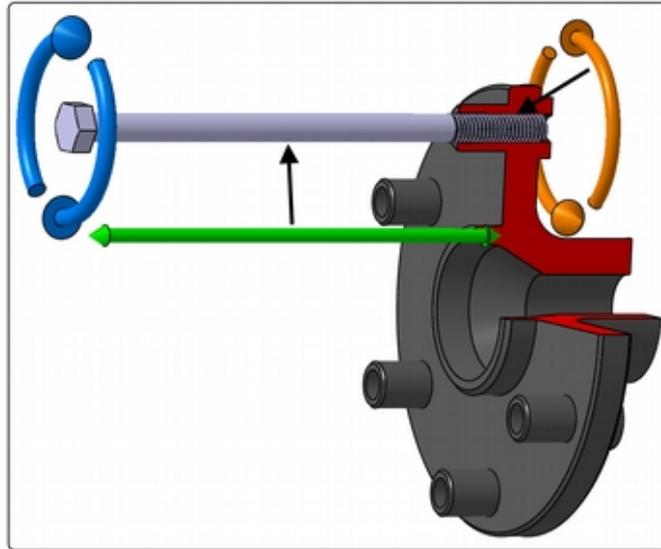
Ploughing effect is the contact between the smooth part of the screw and the end of the threading. This well-known phenomenon of mechanics prevents a complete tightening of the screw. When you do not know it, it can be a rather vicious problem because you do not detect it by tightening to the torque: you feel to have tightened well to the torque while the smooth part of the screw is stuck against the end of the threading.



NORMAL CASE: Tightening torque tightens the screw and compresses the hub.



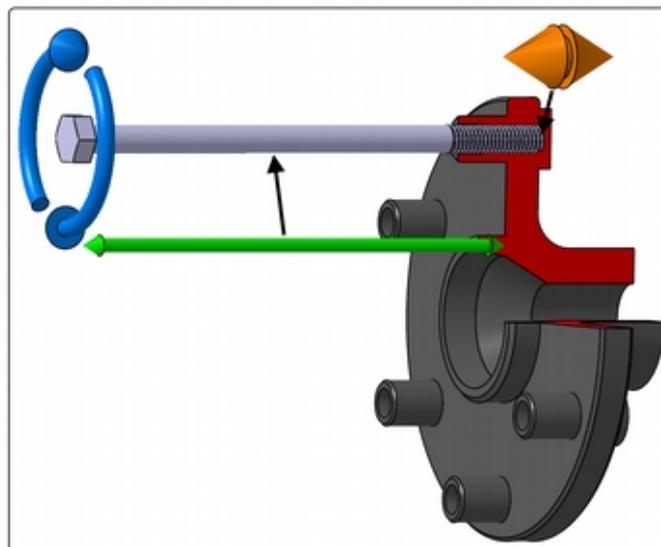
PLOUGHING EFFECT CASE : the tightening torque gives rise to an effort between the end of the thread and the start of tapping. The screw is little or no tightened, the hub is not compressed enough.



DAMAGED THREADING or THREAD LOCK CASE :

The tightening torque gives a torque between the threading and the tapping. The screw is little or no tightened, the hub is not compressed enough.

On the E-Props Instruction and Service Manual, E-PROPS strictly forbids the use of thread lock (Loctite) on the hub screws of all its propellers.



BLIND THREADING CASE : the tightening torque results in an effort between the end of the screw and the bottom of the tapping. The screw is little or no tightened, the hub is not compressed enough.

2-2 SCREWS EXCALIBUR-6 : PLOUGHING EFFECT

In the case of the EXCALIBUR-6 propeller mounting screws, a non-standard assembly revealed a ploughing effect.

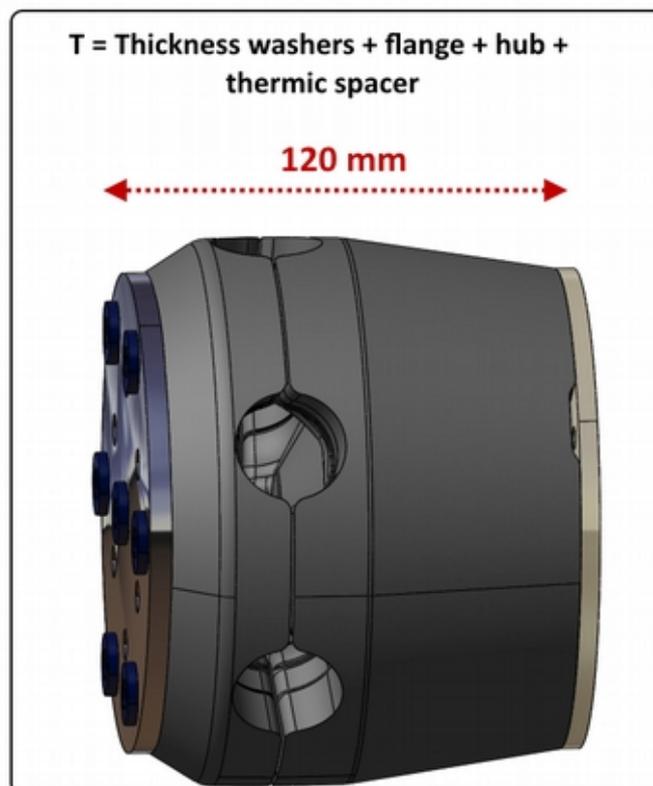
To check it, it is sufficient to take two measurements using a ruler.

PROCEDURE

1- Remove the propeller hub from the reducer flange equipped with Rotax drive lugs. Leave the Rotax drive lugs in place.

Loosen all screws gradually, including the center screw. Do not keep the center screw tightened while the other screws are loose; this would cause excessive strain.

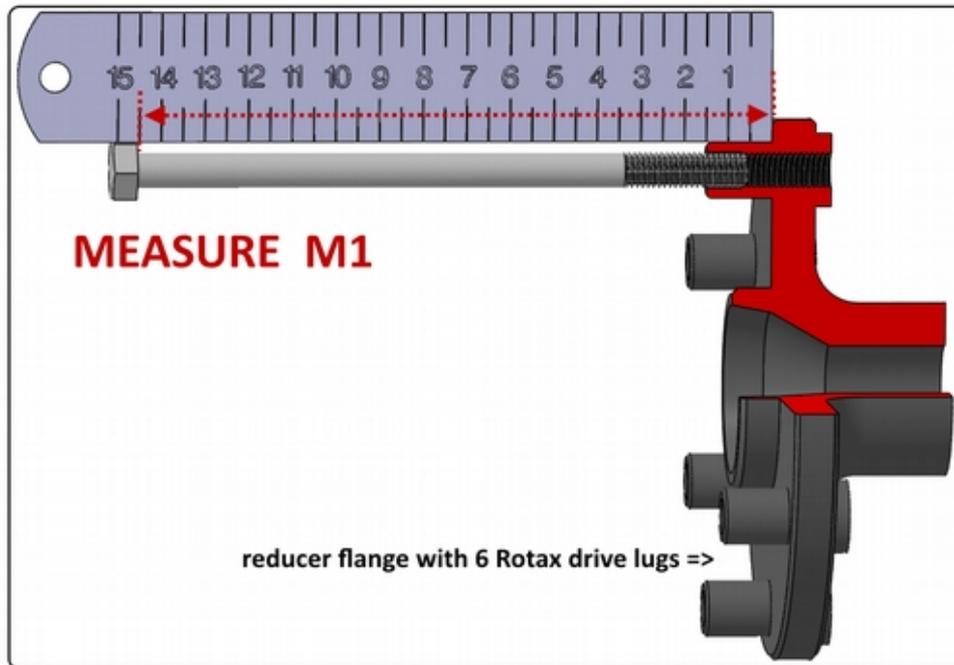
Remove the hub from the flange for both measurements.



2- The hub with the Nord-Lock washers, its aluminium flange and its thermic spacer has a thickness **T = 120 mm**.

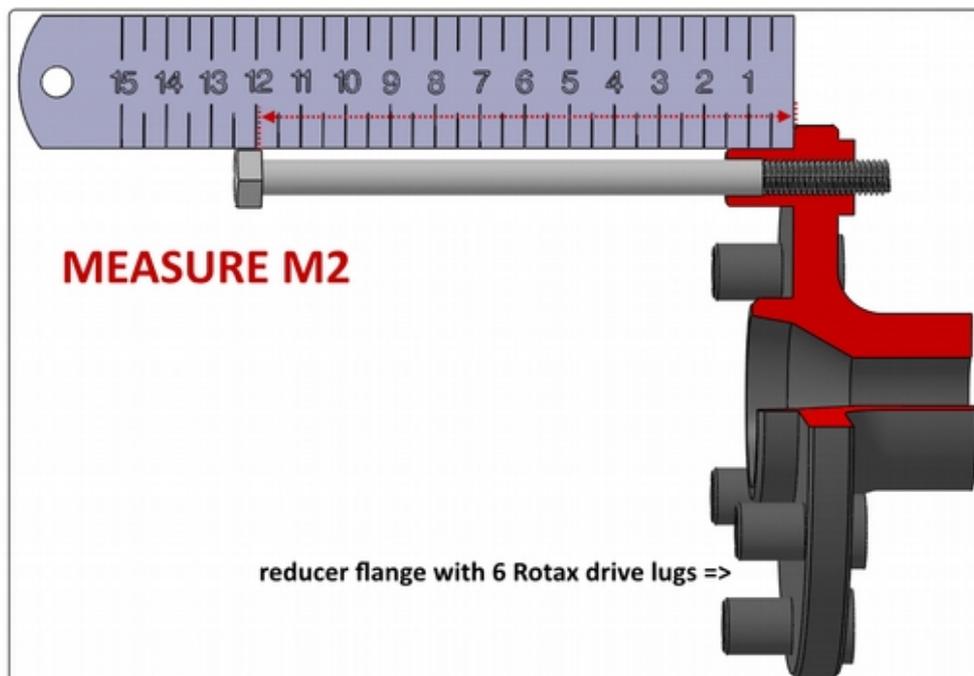
Check with a sliding foot that this is the case for your set [washers + aluminium flange + hub + thermic spacer]

- 3- Engage a screw in the drive lug, by hand, and bite the thread one turn
- 4- Measure the length M1 in mm: between the support face of the reducer and under the head of the screw



*bite the thread one turn and take the measure **M1***

- 5- Screw the same screw by hand, without forcing, completely in the drive lug, to the maximum possible
- 6- Measure M2 length in mm: between the bearing face of the reducer and under the screw head



*Screw the same screw by hand, without forcing, and take the measure **M2***

The measure M1 must be higher than 10 mm to the thickness T of the hub.

The measure M2 must be lower than 4 mm to the thickness T of the hub.

$$\mathbf{M1 > T + 10 \text{ mm}}$$

$$\mathbf{M2 < T - 4 \text{ mm}}$$

If it is NOT the case, your assembly is not correct.

DO NOT FLY with this assembly.

Contact E-PROPS to change your screws.

7- Try the 5 other screws and verify the measures M1 and M2 are the same as the first screws.

REMINDER : to take these measurements, the screws must be able to screw by hand. Do not use a key or force.

PLEASE NOTE :

- if the assembly is not correct, and if you have to change the screws, E-PROPS will provide them for free.
- if the threading is damaged, an assembly with stud bolts will be the best solution. Contact our team.

E-PROPS supplies the following screws, with each propeller :

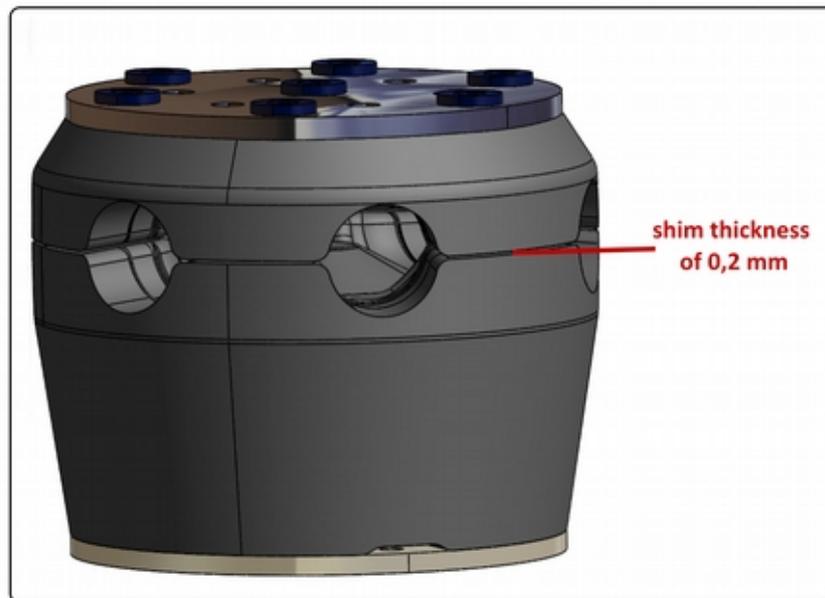
- screws M8, quality M8
- in the standard case of a Rotax reducer with Rotax drive lugs, the screws which are supplied by E-PROPS have a **length 140 mm with a threading of 28 mm**. The ploughing effect safety is 5 mm and the length in the drive lug is 16,5 mm.

If the assembly is different, E-PROPS may supply the adapted screws. Please contact our team.

2-3 ADDITIONAL TIGHTENING CONTROL

Once the EXCALIBUR-6 propeller is mounted and tightened (torque 28 N.m), check that the gap between the two parts of the hub passes a 0.2 mm thick shim.

A 0.2 mm shim thickness, for example, is the thickness of the last carded cover page of the E-Props Instruction and Service Manual (provided in the documents of the propeller). Cut a tab from this cover, pass it in the joint surface : you must be able to reach each screw with this tab.



MANUFACTURER REQUIRED ACTIONS

- 1- Issue of this Service Bulletin (French and English versions)
- 2- The E-PROPS company has contact the users of 6-blades EXCALIBUR-6 model mounted on gyrocopters in order to inform them
- 3- Information on the E-Props website
- 4- Supply of compliant screws to users who request it (free of charge)

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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.

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 E-Props company are available on the website **www.e-props.fr***