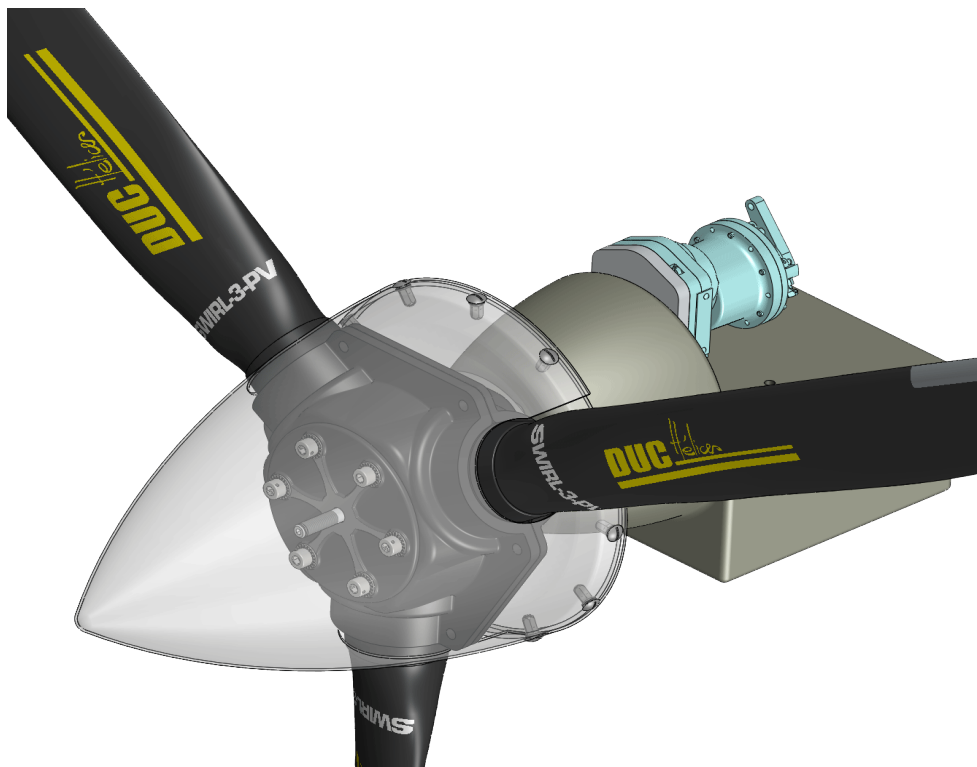




Instruction Manual
Inflight Variable Pitch Propellers
BLACK VP
Hydraulic



Aérodrome Du Beaujolais (LFHV)
289 Avenue Odette & Edouard DURAND
69620 FRONTENAS - FRANCE
Phone : + 33 (0)4 74 72 12 69
E-mail : contact@duc-helices.com - www.duc-helices.com

ISO 9001
BUREAU VERITAS
Certification



ISO 9001:2015 Certified Company
for its Quality System Management

Revision update

Date	Revision	Index	Object of modification
05/09/2023	A	-	Creation

Identification

Date		Delivery note n°	
Owner		Engine/Gearbox ratio	
Aircraft		Pitch range	Min : Max :
Notes :			
.....			
.....			
.....			

Performances

	STATIC	TAKE OFF	CLIMB RATE	CRUISE	CRUISE	CRUISE	FULL TH.
ENGINE rpm							
VARIO ft/min or m/s		Distance (m) :		0	0	0	0
SPEED km/h or kt							
MAP in.Hg							

	STATIC	TAKE OFF	CLIMB RATE	CRUISE	CRUISE	CRUISE	FULL TH.
ENGINE rpm							
VARIO ft/min or m/s		Distance (m) :		0	0	0	0
SPEED km/h or kt							
MAP in.Hg							

	STATIC	TAKE OFF	CLIMB RATE	CRUISE	CRUISE	CRUISE	FULL TH.
ENGINE rpm							
VARIO ft/min or m/s		Distance (m) :		0	0	0	0
SPEED km/h or kt							
MAP in.Hg							

This instruction manual is to be maintained throughout the life of the propeller.
He may have to evolve. The owner must check with the DUC Hélices Company
the latest version being valid applicable to the propeller.

Summary

1.	Hydraulic BLACK VP propeller	4
1.1.	Description	4
1.2.	Characteristics	4
1.3.	Shielding leading edge in Inconel or Nickel-Cobalt	5
1.4.	Accessories.....	5
1.5.	Sales reference.....	5
2.	Applications.....	6
3.	Installation and using precautions	7
4.	Technical data of Hydraulic BLACK VP propeller.....	7
4.1.	Mounting	7
4.2.	Hardware	8
4.3.	Vue éclatée de l'hélice	9
4.4.	Propeller governor	10
5.	Mounting instruction of the Hydraulic BLACK VP propeller	11
5.1.	Package contents	11
5.2.	Operator & List of necessary tools	12
5.3.	Assembly of the propeller on table.....	13
5.4.	Installation on the aircraft.....	15
5.5.	Installation of the propeller governor and its command.....	17
5.6.	Installation of the Hydraulic BLACK VP propeller.....	18
6.	Setting the small pitch stop and and static tests on ground of the propeller	20
7.	First taxi tests and then fly tests of the propeller	21
8.	Management of the failure of the variable pitch system	22
9.	Installation without spinner or with spinner other than DUC.....	22
10.	Potential use & Propeller maintenance.....	23
10.1.	Potential use of the propeller: Unlimited	23
10.2.	Propeller maintenance schedule.....	23
10.3.	Regular maintenance (by the user).....	23
10.4.	General maintenance (by the user or an aeronautics workshop).....	24
10.5.	Complete maintenance (by DUC Propellers Company).....	24
11.	General terms sale.....	25
11.1.	Ordering procedure.....	25
11.2.	Delivery.....	25
11.3.	Price.....	25
11.4.	Right of withdrawal.....	25
11.5.	Warranties	25
11.6.	Privacy Policy.....	25
11.7.	Litigation	25
12.	Annexes	26
12.1.	Dimension of the ROTAX 912/912S/914 propeller-shaft.....	26
12.2.	Airfoil.....	26
12.3.	Moment of inertia	26
12.4.	Engine performance data's	27
12.5.	Operating limitation of the Hydraulic BLACK PV propeller	28
12.6.	Identification marking of the propeller	28
12.7.	Calculation of the centrifugal force of the FLASH Inconel blade	29
12.8.	Centrifugal force test under EASA CS-P350 specification	29
12.9.	Breaking test of the 2-blade Inconel FLASH propeller	30
12.10.	Declaration of conformance of the Hydraulic BLACK PV propellers	32

1. Hydraulic BLACK VP propeller

1.1. Description

The **Hydraulic BLACK VP** propellers are innovative hydraulic variable pitch propellers of the latest generation achieving optimized performance for all phases of flight. They benefit from carbon / titanium blades and a carbon / aluminum hub manufactured using DUC Propeller technology, allowing them to be the lightest hydraulic variable pitch propeller ever designed.

The aerodynamic shape of the blades takes over the innovative design of the **TIGER**, **SWIRL** and **FLASH** range propellers.

These propellers make it possible to have **high yields** over the entire flight domain, namely:

- **Maximum takeoff and climb rate efficiency**
- **Maximum efficiency when cruising and maximum speed**
- **Great comfort of use**

Equipped with grade 5 titanium hardware, their technological level and their level of manufacturing requirements have never been more advanced.

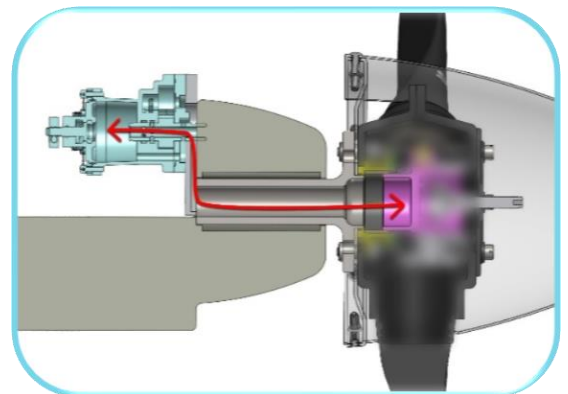
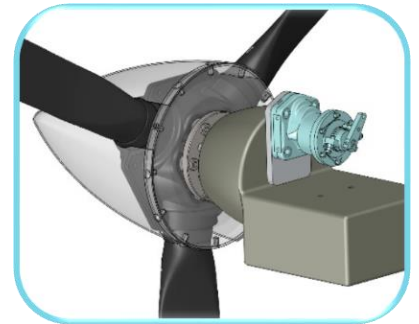
Their variable pitch carbon hub system allows a wide range of angle variation, while being secured by a small pitch safety stop.

The setting of the pitch angle of the blades is "Constant Speed", in other words managed automatically by a hydraulic governor which regulates the propeller pitch according to its engine speed setting.

The pitch variation is done by the hydraulic power and the governor adjustment control is simply mechanical (pusher or lever). **No electric current is consumed for this type of hydraulic variable pitch propeller.**

1.2. Characteristics

- 2, 3, 4 or 5 blades
- Tractor or Pusher
- Ø1520 à Ø1900mm Ø60 à Ø75pouce
- For Rotax 912UL/S/iS, 914UL, 915iS or 916is
- Range of adjustable angle: 23° max
- Shielded leading edge in Inconel or Nickel-Cobalt
- Carbon / titanium / aluminum composite hub for variable pitch propeller
(Mounting propeller shaft spacing Ø101.6mm)



1.3. Shielding leading edge in Inconel or Nickel-Cobalt

The leading edge of the **Hydraulic BLACK VP** blades is composed of a metallic shielding in Inconel or Nickel-Cobalt. This material is a superalloy including mainly nickel, with a very high hardness of the surface.



1.4. Accessories

- **Aluminum mounting spacer (Direct mounting on P.C.D Ø101.6mm/Ø4")**
Moves the plane of the propeller to adjust the position in accordance with the engine hood
CAUTION: Special version for hydraulic sealing of the hydraulic propeller
- **Spinner available: Ø230mm (Ø9.8") to Ø340 (Ø13.4")**
- **Neoprene cover protection of the blade**
- **Cleaning treatment for composite propellers**
Save money! A clean propeller is more efficient and decreases the fuel consumption.



1.5. Sales reference

Designation	Reference	Part number	Weight (kg)
3-blade Inconel SWIRLBLACK-3-R Hydraulic Right prop.	01-44-002	H-SW3_3-D-PVH_I	6.20
4-blade Inconel SWIRLBLACK-3-R Hydraulic Right prop.	01-44-003	H-SW3_4-D-PVH_I	7.50
2-blade Inconel FLASHBLACK-R Hydraulic Right prop.	01-26-002	H-FSH_2-D-PVH_I	4.90
3-blade Inconel FLASHBLACK-R Hydraulic Right prop.	01-27-002	H-FSH_3-D-PVH_I	6.50
3-blade Inconel FLASHBLACK-3-R Hydraulic Right prop.	01-81-133	H-FSH3_3-D-PVH_R_I	8.50
3-blade Inconel FLASHBLACK-2-R Hydraulic Left prop.	01-35-004	H-FSH2_3-G-PVH_I	6.80
4-blade Inconel FLASHBLACK-2-R Hydraulic Left prop.	01-35-010	H-FSH2_4-G-PVH_I	7.90
3-blade Inconel TIGERBLACK-R Hydraulic Right prop.	01-86-009	H-TIG_3-D-PVH_R_I	-
4-blade Inconel TIGERBLACK-R Hydraulic Right prop.	01-86-005	H-TIG_4-D-PVH_R_I	-
4-blade Inconel TIGERBLACK-R Hydraulic Left prop.	01-86-011	H-TIG_4-G-PVH_R_I	-
JHHOSTROJ Governor P110-060/A (for Rotax 915iS, 916iS) (2.54 gearbox) P110-030/A for Rotax 912ULS/iS/914UL (2.43 gearbox) P110-029/A for Rotax 912UL (2.273 gearbox)	01-69-023 01-69-020 01-69-021	-	+1.00

Note:

Specify the flight regulation aircraft (E.g.: **Ultra-light, LSA...**) and diameter when ordering (E.g.: ref. 01-21-001/**1730**).
For more information about the propeller marking, see section **12.6**.

2. Applications

The DUC Propellers Company has an **unlimited** flight potential in normal operation. To keep the unlimited potential, DUC Propellers Company defined a TBO (Time Between Overhaul) for a propeller depending on its engine. Refer to section **10. Potential use & Propeller maintenance** for more information.

Engine	Type	Gear box	Recommended propeller	Propeller diameter (mm)	Pitch angle amplitude (°)	TBO (hour)
3 AXES TRACTIF						
ROTAX 912UL/S/iS, 914UL	4 strokes	2.273 2.43	2-blade Inconel FLASHBLACK-R Hydraulic Right prop.	Ø1520 to Ø1900	23°	1500h or 5 years
			3-blade Inconel FLASHBLACK-R Hydraulic Right prop.			
			3-blade Inconel SWIRLBLACK-3-R Hydraulic Right prop.			
		3-blade Inconel TIGERBLACK-R Hydraulic Right prop.				
ROTAX 915iS	2.54	3-blade Inconel FLASHBLACK-3-R Hydraulic Right prop.	Ø1520 à Ø1900			
		4-blade Inconel SWIRLBLACK-3-R Hydraulic Right prop.				
		4-blade Inconel TIGERBLACK-R Hydraulic Right prop.	Ø1520 à Ø1750			
ROTAX 916iS		4-blade Inconel TIGERBLACK-R Hydraulic Right prop.	Ø1520 à Ø1750			
PROPULSIF						
ROTAX 912UL/S/iS, 914UL	4 strokes	2.273 2.43	3-blade Inconel FLASHBLACK-2-R Hydraulic Left prop.	Ø1520 to Ø1900	23°	1500h or 5 years
ROTAX 915iS		2.54	4-blade Inconel FLASHBLACK-2-R Hydraulic Left prop.	Ø1520 à Ø1900		
			4-blade Inconel TIGERBLACK-R Hydraulic Left prop.	Ø1520 à Ø1750		
ROTAX 916iS		4-blade Inconel TIGERBLACK-R Hydraulic Left prop.				
OTHERS APPLICATIONS						
For all other applications, thank you to contact the DUC Propellers Company to study the possibility of adapting the Hydraulic BLACK VP propeller.						

* Ø1900mm = 74.8" ; Ø1520mm = Ø59.8"

Remark

The pitch angle's value are theoretical and combined with the engine. This setting should be adjusted according to the aircraft. Thus, dependent on the type of aircraft, a pitch angle range is defined. The magnitude of this range must not exceed the specified above (see section **7. First taxi tests and then fly tests of the propeller**).

For proper use of the propeller, refer to section **10. Potential use & Propeller maintenance**.

3. Installation and using precautions



RECOMMANDATION

As recommended by the BRP manufacturer of Rotax engine, it's strongly recommended to use variable pitch **Hydraulic BLACK VP** propeller with an aircraft equipped with a vacuum indicator on engine intake manifold (**Pressure of the engine intake - PA**) to know the engine load. Refer to your engine manual or the section **12.3 Moment of inertia**

Type d'hélice	Diamètre	Inertie (kg.cm ²)
3-blade FLASHBLACK/-2 & SWIRLBLACK-3 prop.	1620	3975
	1660	4124
	1700	4280
	1730	4390
	1750	4465
	1850	4842
	1900	5031

Engine performance data's.

WARNING

Make sure the ignition circuit is turned off before starting any type of operation. Do not work the engine without a propeller, engine damage will (due to)?

IMPORTANT

- The propeller's blades are part of a package. **DO NOT EXCHANGE IT** with other similar blades from the propeller. The propeller's blades are manufactured to their application. Their structure, weight, and balance are different from a propeller to another.

- The spinner is an important element for cooling the engine. The aircraft must not fly without a spinner. Fitting a different spinner will be an addendum to this manual approved by the DUC to confirm its compatibility with the mounting of the propeller.

- The propeller is delivered with the appropriate screws. **The change of the screws is contrary to our recommendations unless validated by manufacturers.**

WARRANTY CONDITIONS

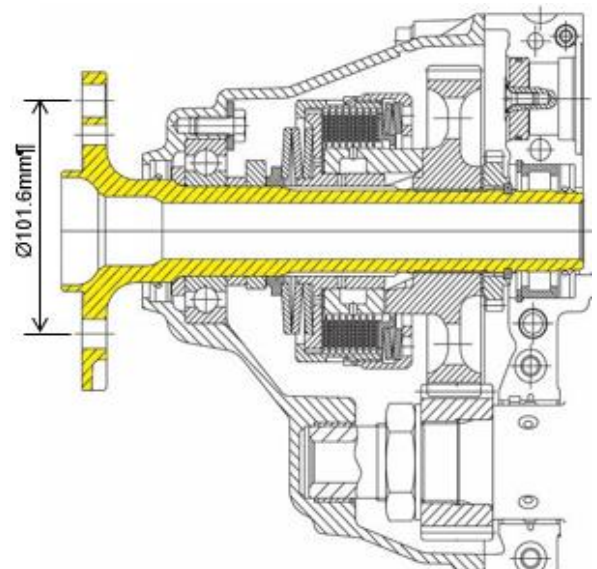
The user is still flying under his full responsibility (see. **6. General terms of sale**).

4. Technical data of **Hydraulic BLACK VP** propeller

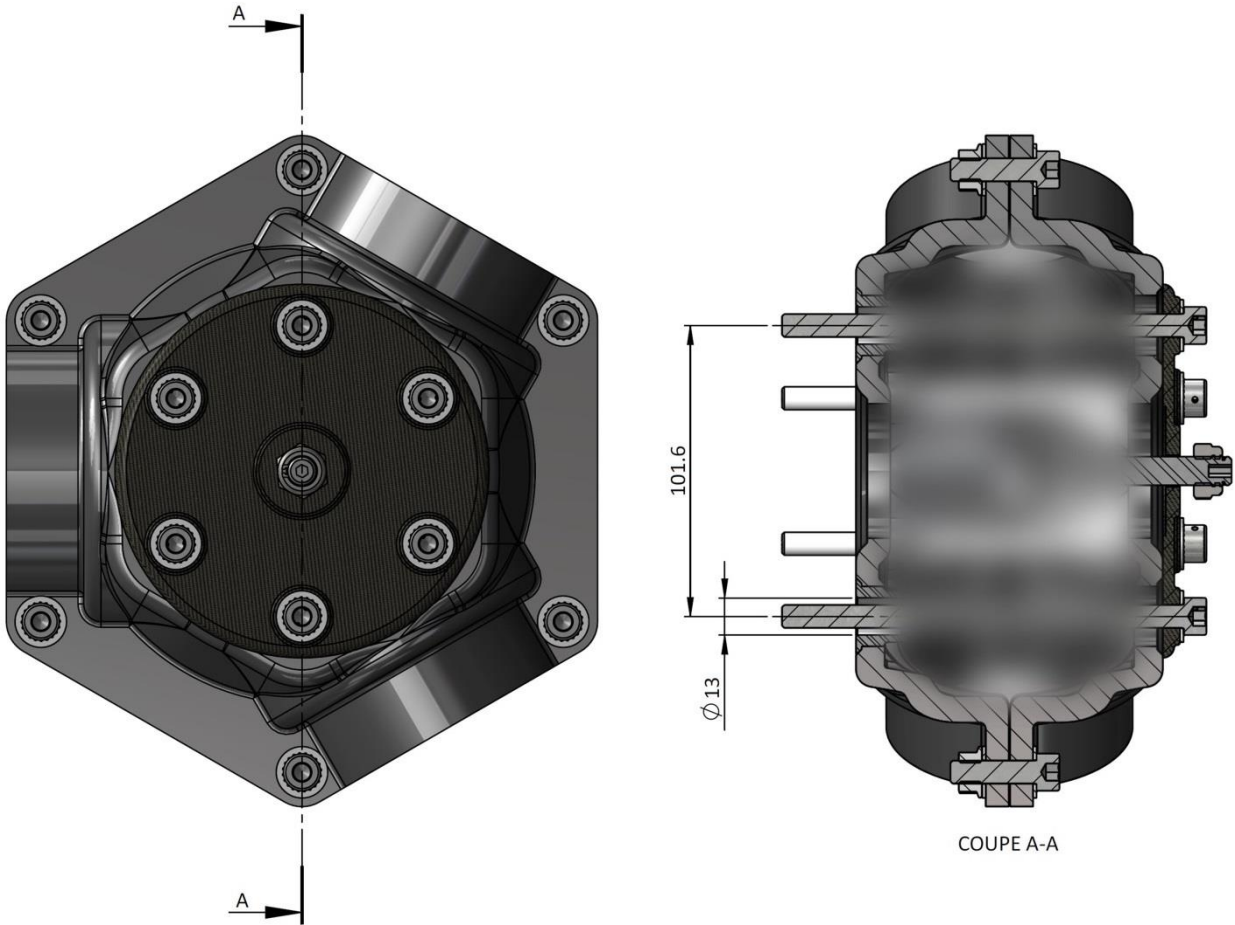
4.1. Mounting

The **Hydraulic BLACK VP** propellers are designed to be installed on **ROTAX 912UL/S/iS, 914UL, 915iS, 916iS engines**, prepared to receive a hydraulic variable pitch propeller governor. Refer to appendix 12.1 for the dimensions of the ROTAX propeller flange.

In the case of a different hollow shaft motor, a specific adaptation can be made. Please contact DUC Hélices.



Here the carbon/aluminum hub dimensions of the propeller:



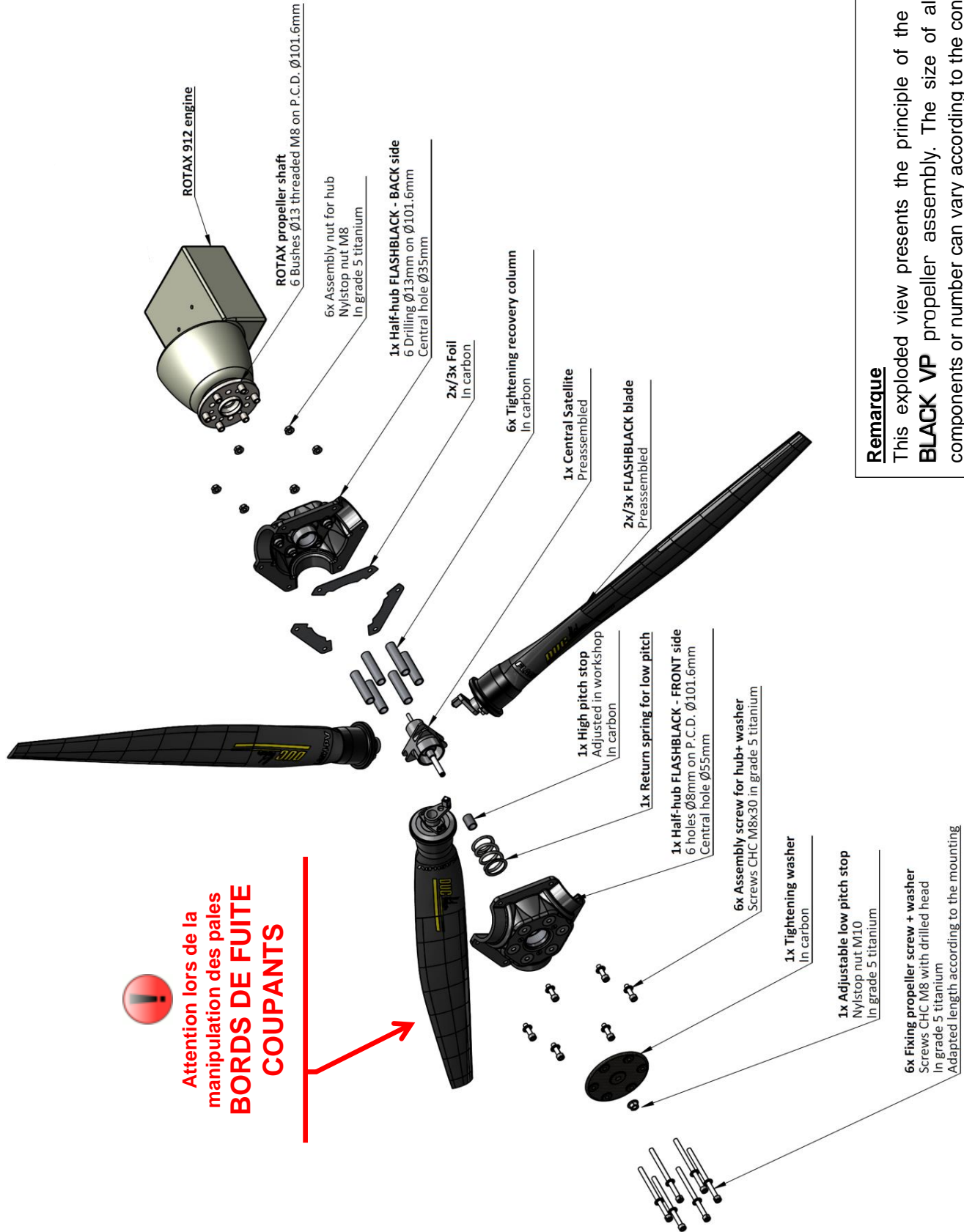
4.2. Hardware

For mounting of the propeller on Rotax engine:



- **Hub assembly:**
Screws/washer CHC M8x30 in grade 5 titanium
Nylstop nut in grade 5 titanium
- **Propeller fixation:**
Screws CHC M8 in grade 5 titanium with a drilled head for a stop with safety wire (adapted screw length according to the direct mounting of the propeller shaft or spacer) / pin contact washer.
- **Adjustable low pitch stop:**
Nylstop nut in grade 5 titanium
- **Tightening washer:**
Perforated carbon Ø8mm on Ø101.6mm

4.3. Vue éclatée de l'hélice



Remarque

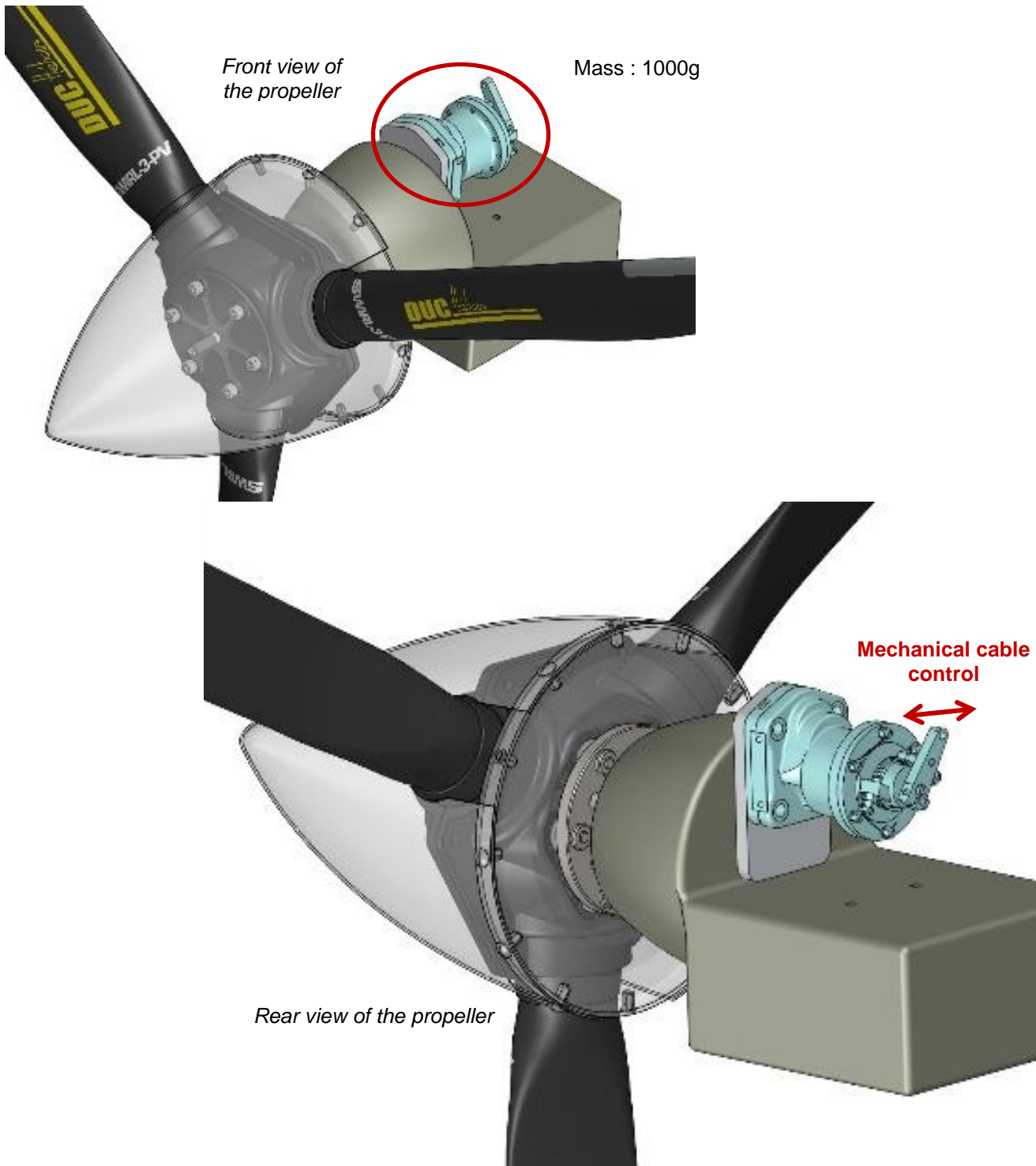
This exploded view presents the principle of the **Hydraulic BLACK VP** propeller assembly. The size of all of these components or number can vary according to the configurations (blade Number, length of the screw ...).

4.4. Propeller governor

The propeller governor allows "Constant Speed" management of the propeller pitch in flight. An adjustment is made by the pilot on this governor to choose an engine rotation speed. This adjustment is made using a mechanical cable control that can be either a push-pull or lever.

In flight, depending on the position of the throttle and the evolution of the aircraft, the governor varies his pressure to vary the propeller pitch and then keep the engine and propeller speed constant.

This governor is 100% mechanical, acting as a valve subjected to centrifugal force. For example, during an excess of centrifugal force due to an overspeed relative to the setting, the valve opens to increase the pressure and thus increase the pitch of the propeller. The opposite principle applies.











5. Mounting instruction of the Hydraulic BLACK VP propeller



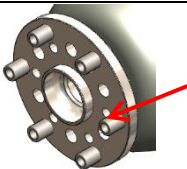
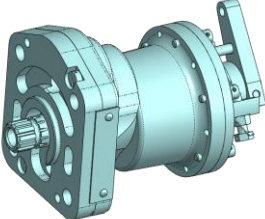
The mounting of the **Hydraulic BLACK VP** propeller is showed hereafter. It's recommended to assembly the propeller on a table before to install it on the aircraft. The process is the same for the 2-blade or 3-blade propeller.

for further help, please contact DUC Propellers Company.

5.1. Package contents

The **Hydraulic BLACK VP** propeller is sent in kit, composed of subsets. Thanks to perform the verification by checking the good package content:

View	Article	Quantity	Customer Verification
	Fixation screws of the propeller + Washer Screws CHC M8 with drilled head Adapted length according to the mounting	6	
	Adjustable low pitch stop Nylstop nut M10	1	
	Tightening washer In carbon	1	
	Assembly screw for hub + Washer Screws CHC M8x30	6	
	Front half-hub 6 Drilling Ø8mm on Ø101.6mm Central bore Ø55mm	1	
	Safety return spring for low pitch	1	
	Preassembled blade	2, 3, 4 or 5	
	Central satellite Preassembled	1	

View	Article	Quantity	Customer Verification
	Back half-hub + 6x Tightening recovery column 6 Drilling Ø13mm on Ø101.6mm Central bore Ø35mm	1	
	Assembly nut for hub Nylstop nut M8	6	
	Additional content but necessary for the installation: ROTAX bushes Ø13mm threaded M8 or DUC bushes Ø13mm drilled Ø8mm + Nylstop nut M8 + Washer	6	
	Optional JHSTROJ Governor + Flat seal P110-060 for Rotax 915iS, 916iS (Reducer 2.54) P110-030 for Rotax 912ULS/iS, 914UL (Reducer 2.43) P110-029 for Rotax 912UL (Reducer 2.273)	1	

5.2. Operator & List of necessary tools

In the context of mounting the propeller, 1 operator is sufficient.

Here is the list of necessary tools:

- Torque Allen key 6 (Torque: 20 and 25 Nm)
- Wrench 13
- Lubricating oil
- Torque flat screwdriver (Torque: 4 Nm)

5.3. Assembly of the propeller on table

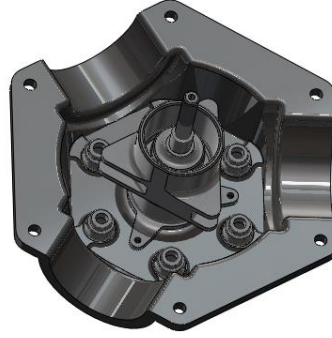
↓ Check the steps gradually

STEP 1.



Place the “**engine back half-hub**” (Central hole Ø55mm) on a table.
Be careful not reverse with the “**propeller front**” half-hub.

STEP 2.



Laid the **satellite** in the back half-hub without fitted into the carbon hole Ø35.
Check if you respect the right direction of the satellite’s mounting.

STEP 3.

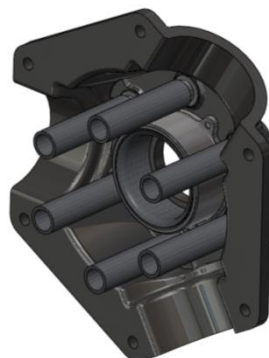


While keeping the satellite laid on the back half-hub, slot the **BLACK VP** blades one after the others into the satellite groove and into the back half-hub.

Place the **DUC** sticker in front of you.

STEP 4.

Ensure the good introduction of the blades in their place.
Place the **front half-hub**. This one must include 6 carbon tightening recovery columns.
Watch if the parts are aligned for the assembly.



Front half-hub



STEP 5.



STEP 5.

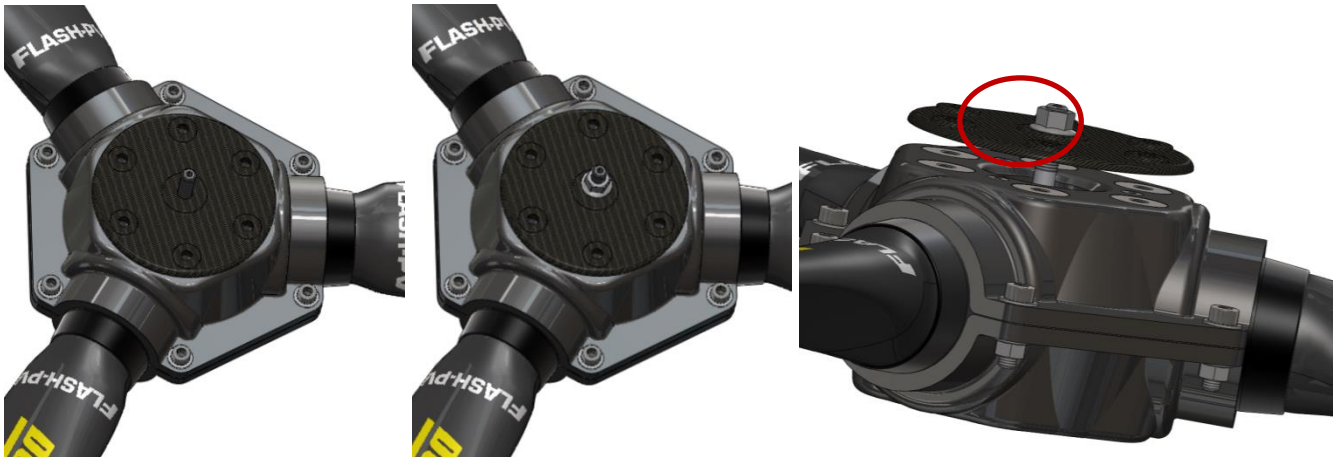


Add the safety return spring in low pitch.

Place the **Screws CHC M8x30 + Washer** over the top and the **Nylstop nut** behind for the assembly of the 2 half-hubs.
Make a first tightening to approach the screws.

Check if the blades are well placed in their place.
Pull slightly the blades outwards for a good placement of the blades.

STEP 6.



Place the **tightening washer in carbon**.
Put the safety return spring in compression by pushing the carbon washer and screw the **Nylstop nut M10** **at the beginning of this one and keep this position for the M10 nut until the setting of the propeller.**

STEP 7.

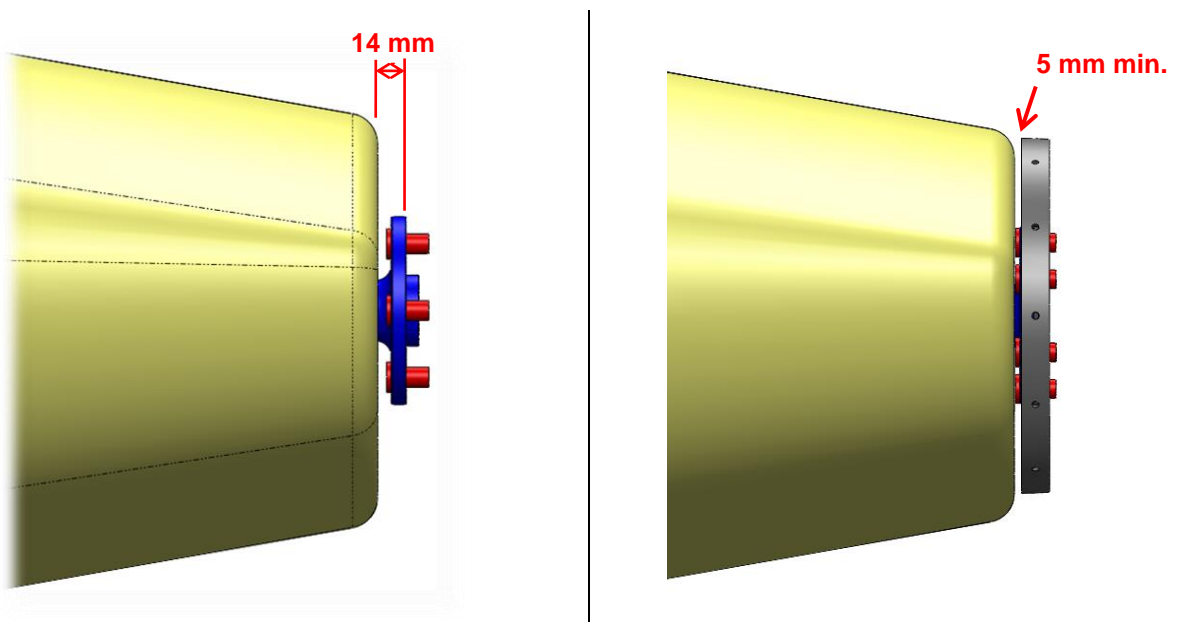


Put the **6 Fixation screws CHC M8 + Washer** in the fixations drillings of the propeller.

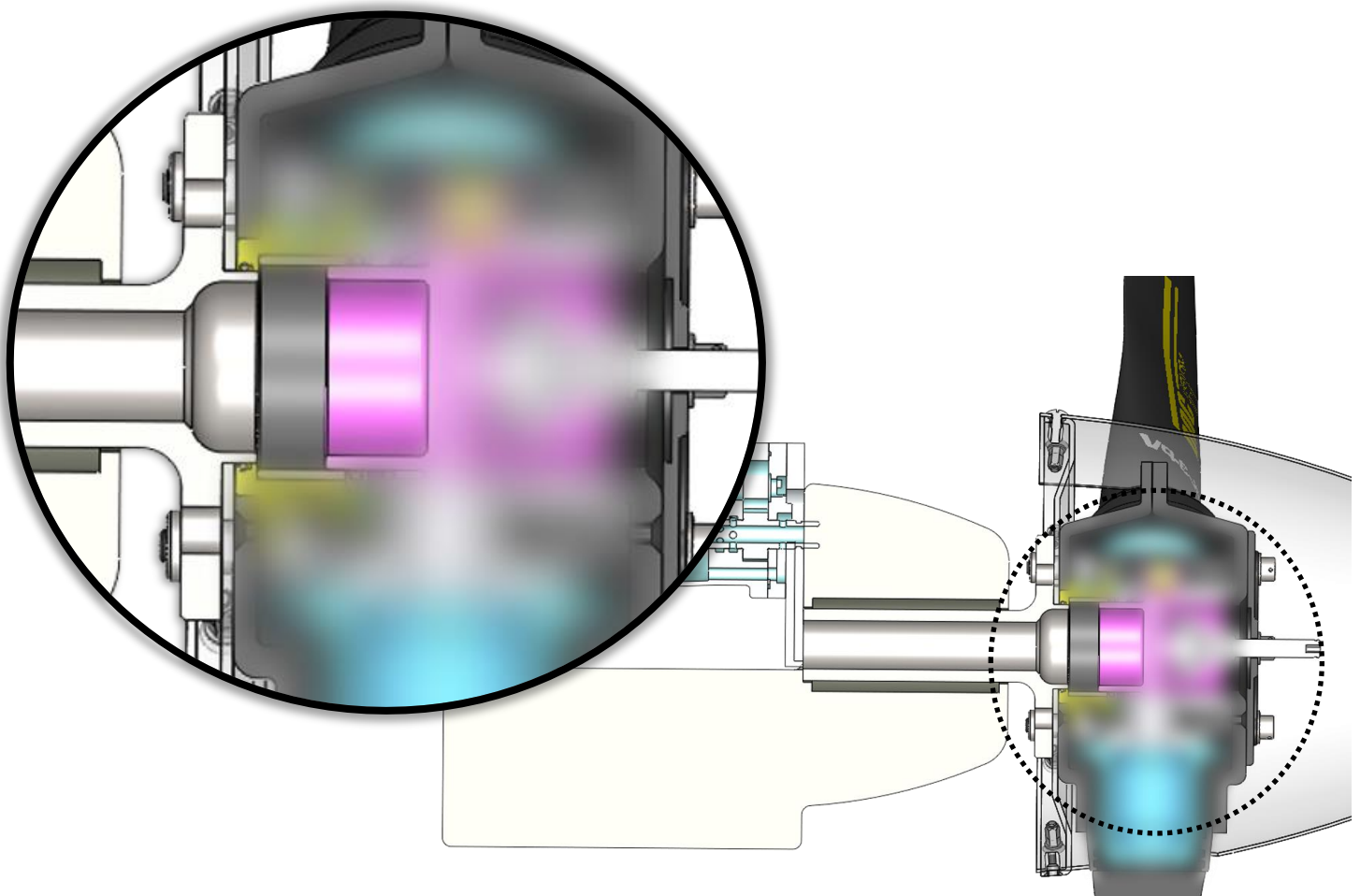
At this point, the propeller is pre-assembled on the table but not tight.

5.4. Installation on the aircraft

5.4.1. Direct installation on the aircraft



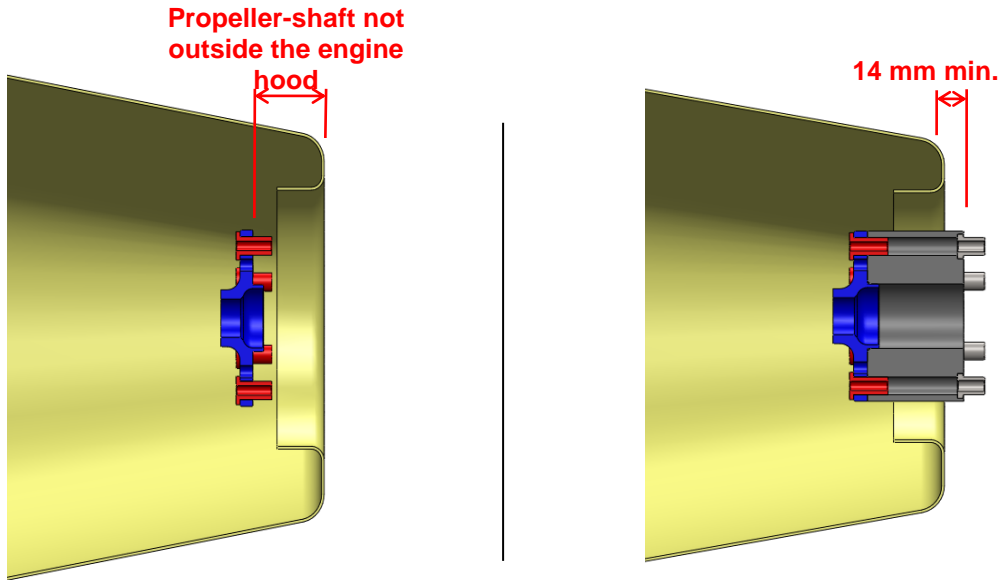
In this case, the hydraulic variable pitch propeller hub is suitable for this type of mounting:



5.4.2. Use of a spacer

Determination of the spacer length:

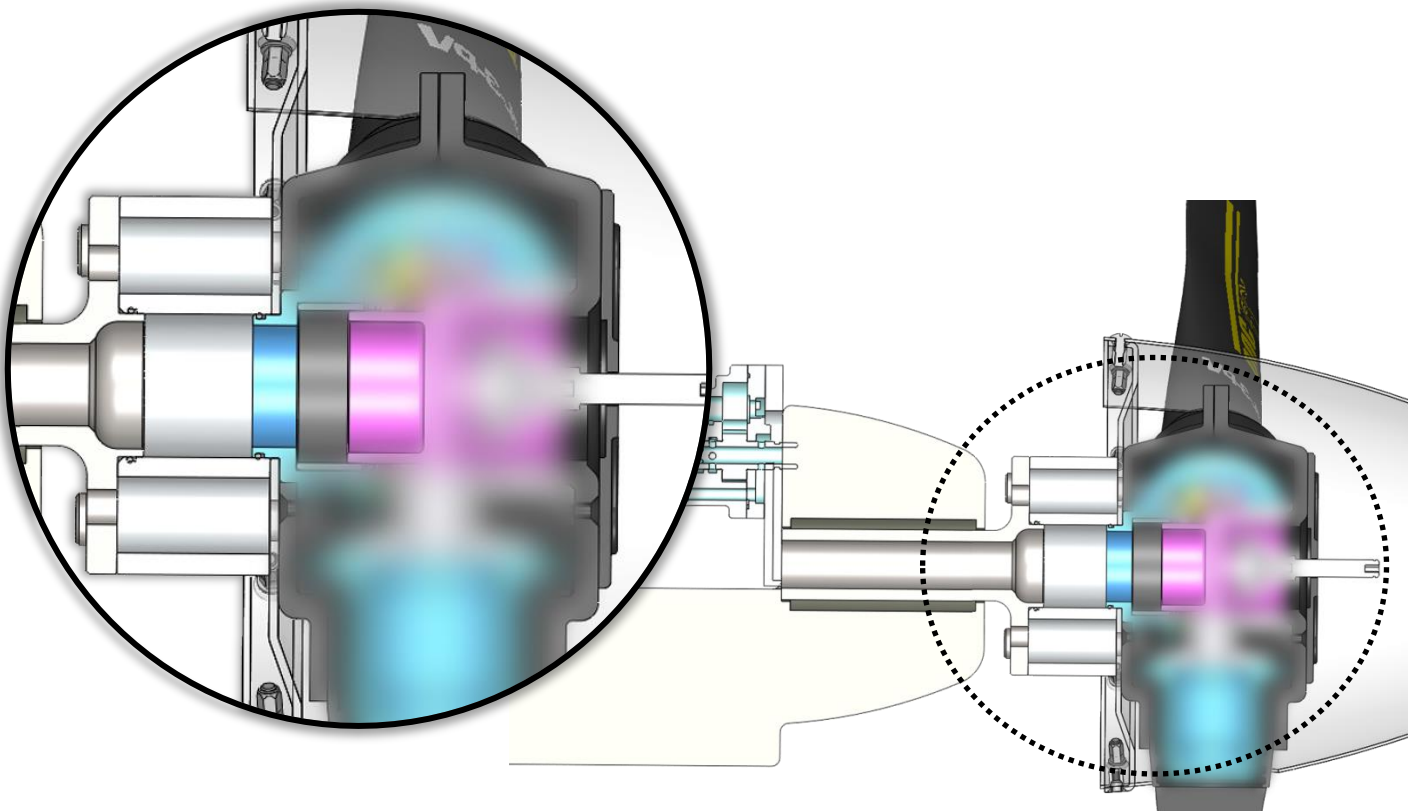
Measure the **distance X** between the propeller-shaft and the engine hood limit, then add **14mm**.



Available spacer:

Engine	Model	Length
ROTAX	912H spacer	3, 6, 10, 15, 20, 25, 30, 40, 45, 50, 60, 70, 75, 80, 90, 100, 120mm

In this case, the hydraulic variable pitch propeller hub is suitable for this type of mounting:



5.5. Installation of the propeller governor and its command

Refer to the Governor JIHOSTROJ manufacturer's manual.

Be careful to install the correct governor model according to the propeller rotation regime:

- P110-060 / A for Rotax 915iS, 916iS (Reducer 2.54)
- P110-030 / A for Rotax 912S/iS, 914UL (Reducer 2.43)
- P110-029 / A for Rotax 912UL engine (Reducer 2.273)

For mechanical control, this can be a Rickshaw or Lever control.

Make sure that this control remains in the "retracted / pushed" position during adjustment.

Refer to the Governor JIHOSTROJ manufacturer's manual.

Be careful to install the correct governor model according to the propeller rotation regime:

For mechanical control, this can be a Rickshaw or Lever control.

Make sure that this control remains in the "retracted / pushed" position during adjustment.

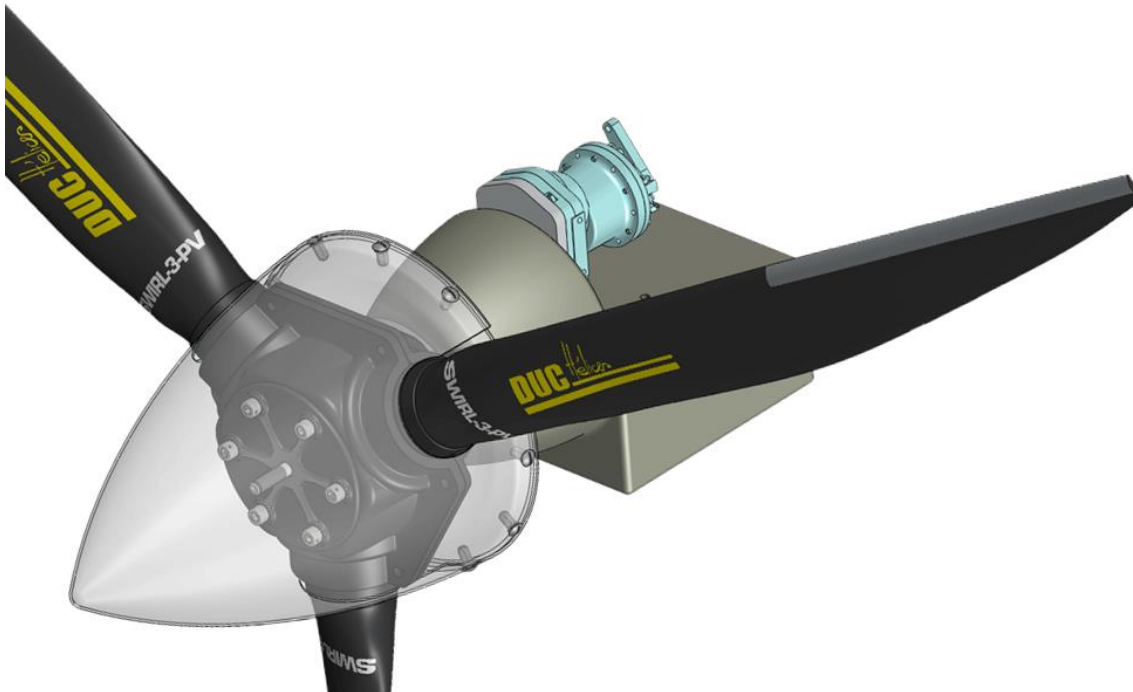
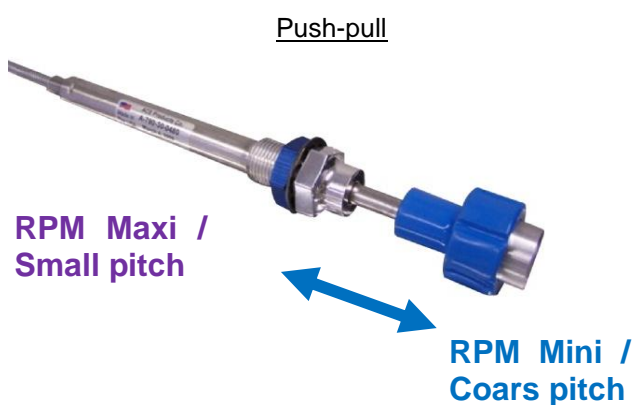
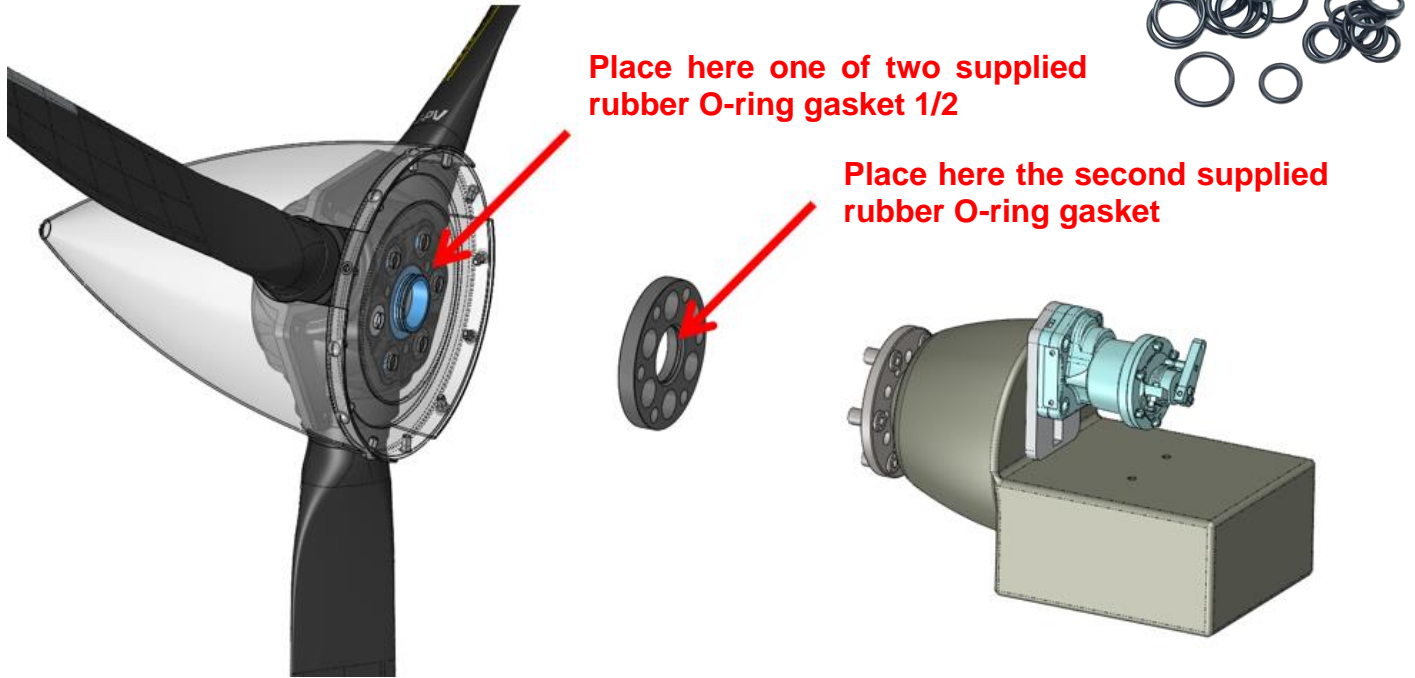


Illustration for example:



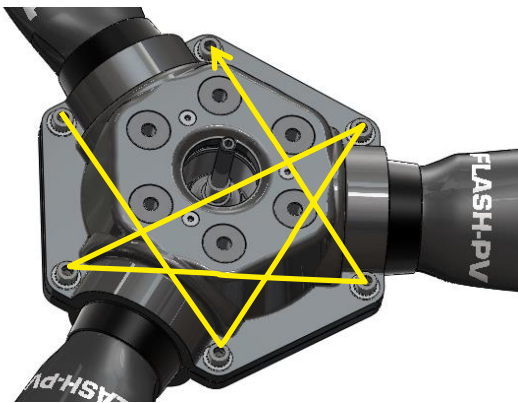
5.6. Installation of the Hydraulic BLACK VP propeller

STEP 8.



It is imperative to lubricate the seals before mounting.

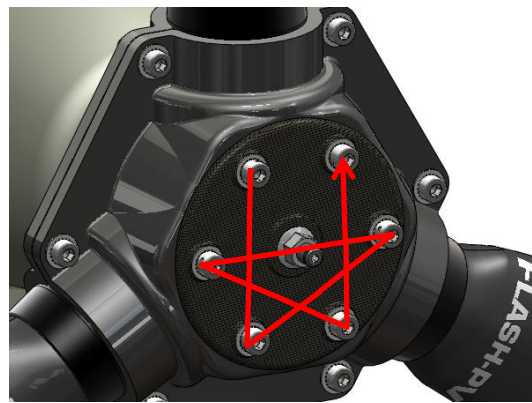
STEP 9.



Now, make a **progressive tightening** in cross in 2 or 3 times to reach the **tightening torque 25 N.m.**

TIGHTENING TORQUE
2,5 Kg/m 25 N.m

STEP 10.



Gradually tighten in 2 or 3 times the 6 CHC M8 propeller fixing screws at 20 Nm.

TIGHTENING TORQUE
2,5 Kg/m 25 N.m

At this point, the propeller is preinstalled on the ROTAX engine.

5.6.1. Bleeding the hydraulic system

When the governor, its cable control and the hydraulic propeller are completely installed, it is then necessary to perform the hydraulic purge of the system to expel the air and make the propeller pitch control 100% functional.

PROCEDURE

- 1) Heat the engine and oil to operating temperature
- 2) Then set the propeller pitch control to the "RPM Mini / Coars pitch" instruction, in other words the coars pitch position, or even the "Pulled" position of the command on the governor
- 3) Then gradually increase the engine power up to full power
- 4) Then vary the propeller pitch control 2 to 3 times in the position "RPM MAXI" to "RPM Mini".
- 5) Reduce everything to finish: Engine idle & Step control in "RPM Maxi" position, return / thrust

Important:

If the engine speed or the variation speed of the blade angle of the fluctuating propeller, this means that there may be air in the system and the system must be purged again. Repeat the entire procedure again.

If all these operations have been correctly applied, the hydraulic system is purged.

PRECAUTIONS

If you notice any faulty installation or operation, do not start a flight and immediately contact the company DUC Propellers.



- Be aware of potential risks during assembly and first tests of the propeller.**
- Be focused, attentive and vigilant to your surroundings. Check the points to be observed several times.**
- Maintain large safety distances when operating.**

DUC Propellers products must be assembled and used in accordance with the instruction manuals provided. No modification can be made without the prior agreement of DUC Hélices. Failure to comply with these data releases DUC Hélices from all liability and renders the products concerned out of warranty (See section 11. General Conditions of Sale).

6. Setting the small pitch stop and and static tests on ground of the propeller



RECOMMENDATION

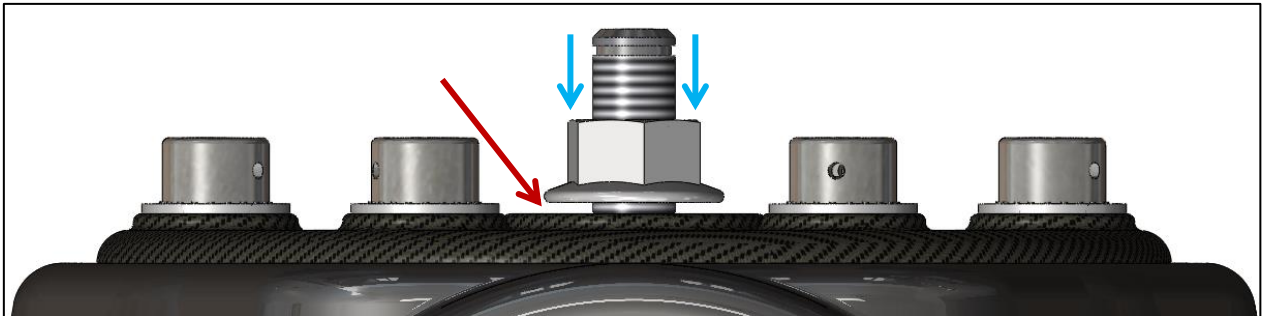
As recommended by the BRP manufacturer of Rotax engine, it's strongly recommended to use variable pitch **Hydraulic BLACK VP** propeller with an aircraft equipped with a vacuum indicator on engine intake manifold (**Pressure of the engine intake - MAP**) to know the engine load. Refer to your engine manual or the section **12.3 Moment of inertia**

Type d'hélice	Diamètre	Inertie (kg.cm ²)
3-blade FLASHBLACK/-2 & SWIRLBLACK-3 prop.	1620	3975
	1660	4124
	1700	4280
	1730	4390
	1750	4465
	1850	4842
	1900	5031

Engine performance data's.

The preliminary tests are important

- 1) Tight the small-pitch stop (**M10 nut**) to let **a clearance of 1mm** with the carbon washer.

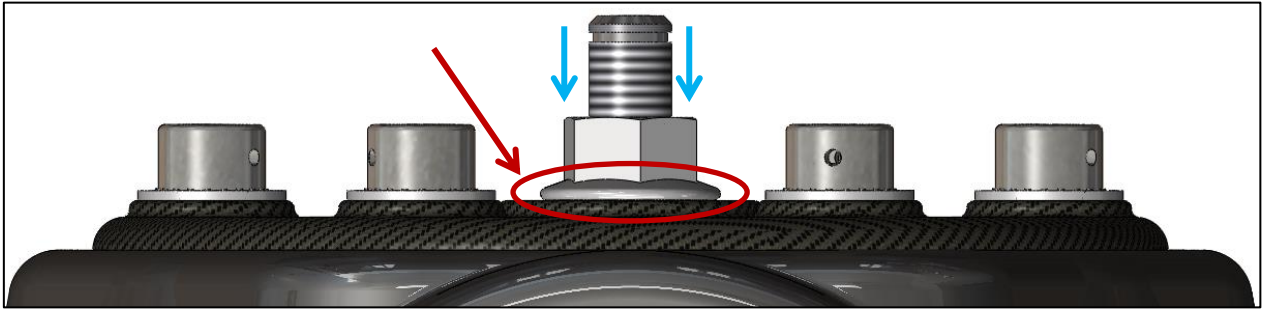


- 2) Placed the pitch control of the propeller in position "RPM Max / Small step"
- 3) Brake applied, start the engine and warm it as recommended by the manufacturer. The aim of this ground test is to set the propeller, at full throttle, at 5700-5800 rpm.
- 4) When the motor is in operational condition, do the following operation:
 - A. Increase the throttle smoothly to reach 5500±200 rpm.
 - B. Acting on the pitch command to increase the pitch and adjust in parallel the position of the throttle to keep a stable engine speed at 5500±200 rpm.

Make this operation to reach the fully depressed position of the throttle.

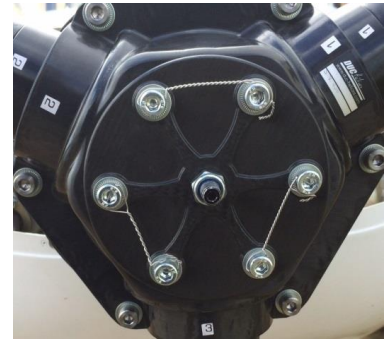
 - C. At full throttle, gently reduce the pitch to reach the engine speed of 5800±20 rpm.
- 5) When this setting is achieved, **DO NOT TOUCHE ANYMORE THE PITCH COMMANDE.**
- 6) Reduce throttle, shut down the engine and secure environment to perform an action on the propeller.
- 7) Set the small-pitch stop as the **M10 nut press slightly a contact on the carbon washer.**





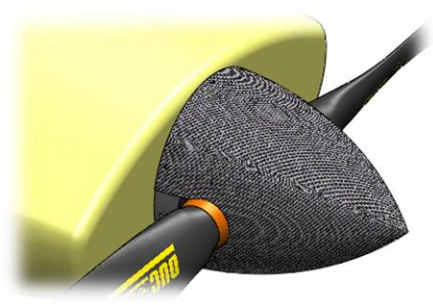
8) Replace the pitch controller in small-pitch position to reduce the pitch to the maximum.

9) When everything is set, set up the **safety wire** $\varnothing 0.8\text{mm}$ ($\varnothing 0.03\text{''}$) over the screw heads for safe installation.



10) After a final check (position and orientation of parts, tightening, ...), install the spinner on the spinner mounting plate by **tightening the screws to a torque of 4 Nm (0.4kg / m)** with the appropriate tools.

When the presence of a mark, be sure to follow the indexing of the spinner from the plate.



**At this point, the small-pitch stop of your
 Hydraulic BLACK VP propeller
 is set for the first taxi tests and then fly tests).**
**The user must perform the appropriate regulations procedures
 to change the propeller in accordance with applicable regulations of the aircraft.**

7. First taxi tests and then fly tests of the propeller

During the Vital Action (A-C-H-E-V-E-R) before each flight, it is recommended to check the proper functioning of the pitch variation of the propeller.

Before the first flights, do a run-up to get 5600-5700 rpm. If not, change the setting of the small-pitch stop.

During take-off or landing, it is imperative to return the propeller to small-pitch.

In flight, changing the pitch angle by continuously monitoring the Manifold Pressure (MAP).



RECOMMENDATION

As recommended by the BRP manufacturer of Rotax engine, it's strongly recommended to use variable pitch **Hydraulic BLACK VP** propeller with an aircraft equipped with a vacuum indicator on engine intake manifold (**Pressure of the engine intake - MAP**) to know the engine load. Refer to your engine manual or the section **12.3 Moment of inertia**

Type d'hélice	Diamètre	Inertie (kg.cm ²)
3-blade FLASHBLACK/-2 & SWIRLBLACK-3 prop.	1620	3975
	1660	4124
	1700	4280
	1730	4390
	1750	4465
	1850	4842
	1900	5031

Engine performance data's.

8. Management of the failure of the variable pitch system



In the unlikely event of hydraulic failure, the propeller comes naturally in small-pitch stop thanks to the return spring.

9. Installation without spinner or with spinner other than DUC



In the case of installation of the propeller **without spinner mounting plate** or **other spinner mounting plate**, be careful to check the following points:

- ✓ **Length of the fixing screws of the propeller:** Must be adapted according to the thickness of the spinner mounting plate.
- ✓ **Mechanical resistance of the plate when tightening:** For a similar assembly of the DUC spinner, the plate takes the tightening of the propeller fixing screws. It is, therefore, necessary to ensure that the used plate can withstand the clamping and resist of the propeller operate efforts (crushing of the plate).

IMPORTANT

The spinner is an important element for engine cooling.

The aircraft must not fly without propeller spinner. Mounting a different cone will be an amendment to this instruction manual approved by the DUC in order to confirm its compatibility mounting the propeller.

WARRANTY CONDITIONS

The user is still flying under its full responsibility (see section **6. General terms of sale**).

10. Potential use & Propeller maintenance

10.1. Potential use of the propeller: **Unlimited**

The propellers DUC have an unlimited flight potential in normal operation conditions.

To keep the unlimited potential, DUC Propellers Company has defined a TBO (Time Between Overhaul) for a propeller depending on its engine.

This TBO according to the engine is indicated in this manual (see **2.Applications**). **For ROTAX engine TBO is set at 1500 flight hours.** In all cases, it may not exceed 5 years.

To achieve this, the propeller must be returned to the DUC Propellers Company to perform a full control, verify its proper use and change the wearing parts if necessary.

Following this inspection and maintenance of the propeller, the propeller is credited again with the same TBO and is returned to you.

The cost of maintenance when you reach 1500 hours of flight on Rotax is 800 € excl. tax, in other words, 0.54€ per hour of flight. The deliveries costs of sending and returning will be payable by the customer.

Remember, there is no imperative of logbook in light aviation. But know that this control is highly recommended for the continuing airworthiness and safety.

10.2. Propeller maintenance schedule

Type	Actor	Frequency
Regular	User	Each pre-flight
General	the user or an aeronautics workshop	Every 100 hours or annually
Complete	DUC Propellers Company	Each TBO

10.3. Regular maintenance (by the user)

For a safety use of the propellers, it is necessary that the user performs regular maintenance to detect any abnormalities. This maintenance is usually just a simple check.

The frequency of checking: Each pre-flight

Control methods: Visual inspection & Manual handling

Checkpoints:

- Fixation of the propeller: Manually maintaining the tip of a blade of the propeller, shake it firmly to feel if a too much clearance appears in the setting of the propeller.
- Degradation of material: Check visually the entire propeller without dismantling (blade root, Inconel leading edge, the surface of the blade, spinner, hub, etc.)
- Fixation of the spinner: Check visually the fixation screws of the spinner. A marking paint can be made between each screw and spinner to have a means of visual inspection of proper tightening the screws.

Possible problems:

- Too much clearance in the propeller fixation
- Surface degradation due to dirt or impact / Crack apparent

Corrective actions (depending on the importance):

1. Clean the propeller with the DUC cleaning treatment DUC (ref. 01-80-003)
2. Perform a repair with the DUC repair kit (ref. 01-80-004)
3. Tighten the screws to proper torque with a wrench
4. Replace(s) damage component(s)
5. Contact DUC Propellers Company to define a solution

10.4. General maintenance (by the user or an aeronautics workshop)

A general maintenance by the user or an aeronautics workshop must be made at a lower frequency.

The frequency of checking: Every 100 hours or annually

Control methods: Visual inspection & Torque wrench

Checkpoints:

Fixation of the propeller: By removing the spinner of the propeller, check the proper tightening of the screws to the wrench. These screws of the hub should be tightened to proper torque, defined in the installation instructions attached.

A marking paint of all the screw/washer/hub after tightening can be done to help make a visual check outside of the general maintenance.

- Degradation of material: Check visually the entire propeller (blade root, Inconel leading edge, the surface of the blade, spinner, hub, etc.)

Possible problems:

- Too much clearance in the propeller fixation
- Surface degradation due to dirt or impact / Crack apparent

Corrective actions (depending on the importance):

1. Clean the propeller with the DUC cleaning treatment DUC (ref. 01-80-003)
2. Perform a repair with the DUC repair kit (ref. 01-80-004)
3. Tighten the screws to proper torque with a wrench
4. Replace(s) damage component(s)
5. Contact DUC Propellers Company to define a solution

10.5. Complete maintenance (by DUC Propellers Company)

Upon reaching the TBO (potential flight time between overhaul) defined by DUC Propellers Company, the propeller must be returned to the corporation for a full inspection of all components of the propeller.

See section **2.Applications** for the potential value of an hour's flight engine.

The possible degradation of the propeller components may vary depending on the location of use.

11. General terms sale

11.1. Ordering procedure

Orders placed by fax, by phone or mail server engage the customer upon receipt by our Customer Service Order and the Regulations.

11.2. Delivery

DUC Propellers Company agrees to make every effort to deliver the order within the shortest time, and the receipt of the order together with the Regulation. The delivery times indicated on the order are only indicative and the possible delays do not entitle the buyer to cancel the sale, to refuse the goods or claim damages. Any claim for non-compliance or failure will be sent within one week following the date of receipt of order.

The DUC Propellers Company is released from its obligation to deliver for all fortuitous events or force majeure. As an indication, the total or partial strikes, floods, fires are cases of force majeure. The transfer of ownership of goods supplied or delivered is suspended until full payment of the price by the customer and without affecting the transfer of risk.

11.3. Price

The DUC Propellers Company may change its prices at any time.

The customer agrees to pay the purchase price in effect at the time of order entry. Regulation Order is payable in advance in one payment when sending the DUC Propellers Company purchase order.

11.4. Right of withdrawal

Under Article L121-16 of the Consumer Code, the customer shall have seven clear days after the delivery of his order to return the products to the DUC Propellers Company for exchange or refund, without penalties except for the return costs. Returned products must not have suffered modification, damage consequence of shock or improper use and be packaged in original packaging. Goods shipped with postage due will not be accepted.

11.5. Warranties

The DUC Propellers Company's products must be installed and used in accordance with instruction manuals provided. No changes can be made without the prior approval of the DUC Propellers Company. The failure of these data releases any liability of the DUC Propellers Company and makes non-warranty the considered products.

The user is still flying under its sole responsibility.

The legal guarantee of industrial products is six months or for the potential duration of the helix (depends on which engine it is installed) against defects and hidden defects. See the section **2.Applications** to determine the potential value of an hour's flight engine.

DUC Propellers Company guarantees its product defect under normal use in the manner described below: If the customer finds a defect, he must report it immediately to the DUC Propellers Company and features of one month after its purchase to return to Company DUC Helices, all structural defects will snuff into account (except for damage result of incorrect operation, shock, injury, impairment or neglect, water or generally inappropriate use by the engine type, power, speed, and gear). To qualify for this warranty, the customer must send at its expense within one month after its purchase to be returned to Company with DUC Propellers Company delivery order attached to the product. In return, the DUC Propellers Company takes no responsibility for damage or loss during transit due to improper or inadequate packaging. The Company DUC Propellers Company then returned at his expense to the customer at the address on the delivery note, an identical or equivalent.

In addition to these guarantees, the Company DUC Propellers Company provides no other warranties.

11.6. Privacy Policy

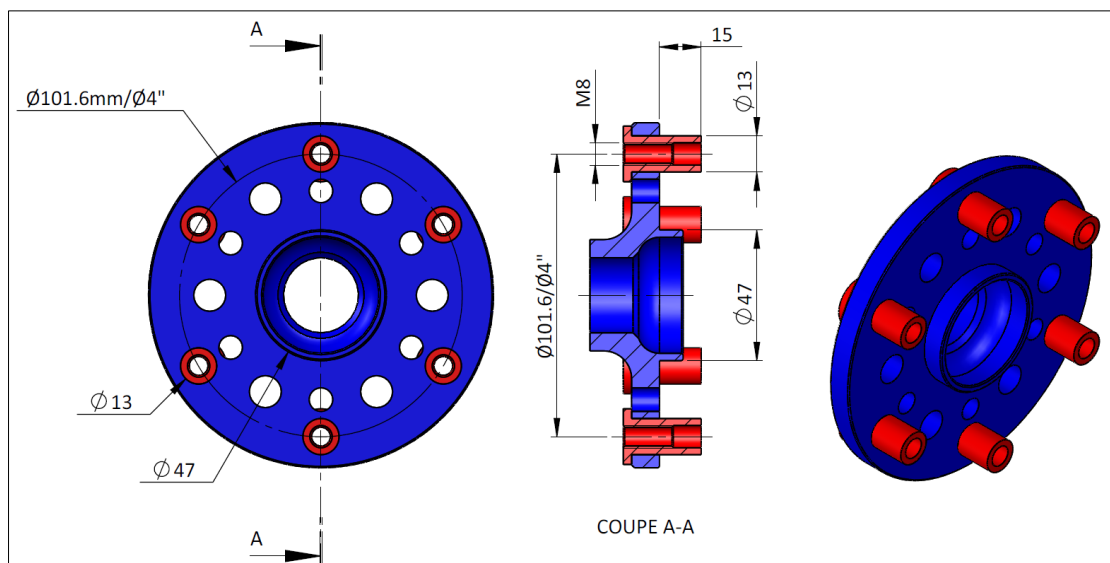
All the data you entrust to us are able to process your orders. Under Law No. 78-17 of January 6, 1978, relating to data, files and freedoms you have with the customer service Company DUC Propellers Company right to access, review, correct, correct and delete data you have provided.

11.7. Litigation

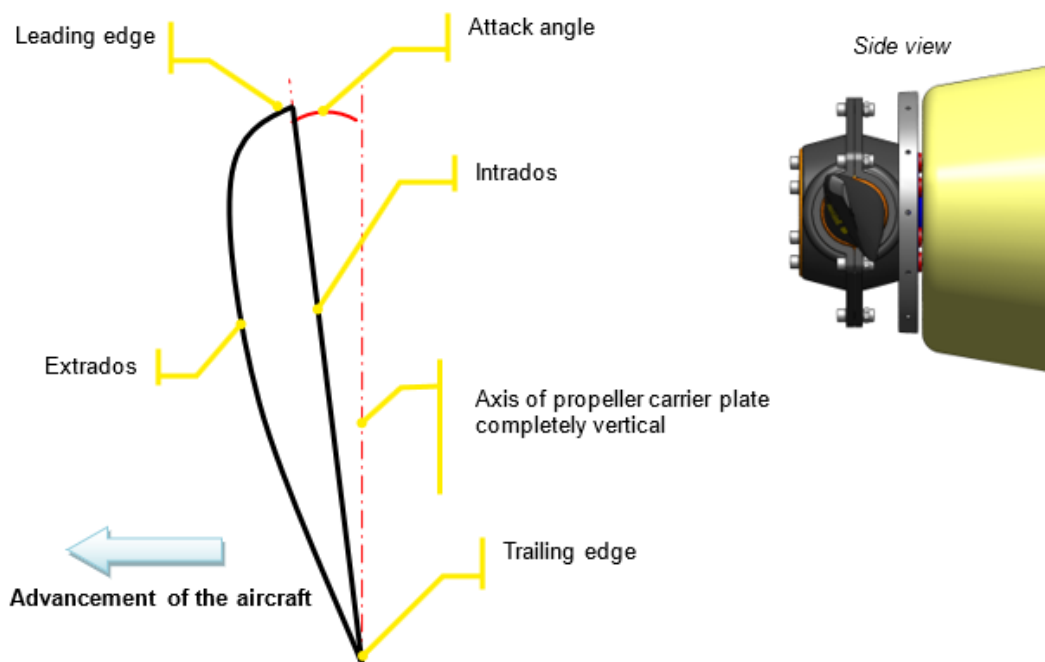
Any order placed convincing the customer, without any restriction, the General Conditions of the sale of the DUC Propellers Company. Any dispute concerning the sale (price, GTS, product ...) will be subject to French law before the Tribunal de Commerce de Lyon.

12. Annexes

12.1. Dimension of the ROTAX 912/912S/914 propeller-shaft



12.2. Airfoil



12.3. Moment of inertia

Type d'hélice	Diamètre	Inertie (kg.cm ²)
3-blade FLASHBLACK/-2 & SWIRLBLACK-3 prop.	1620	3975
	1660	4124
	1700	4280
	1730	4390
	1750	4465
	1850	4842
	1900	5031

12.4. Engine performance data's



PERFORMANCE DATA – ROTAX 912UL (80hp)				
Step	Engine rpm	Power HP	Torque Nm	MAP in.HG
Take-off 5 min max	5800	80	98.1	Full power
Cruise	5500	78	100.7	Full power
75 %	5000	58	83.1	27.2
65 %	4800	50	75	26.5
55 %	4300	43	70.8	26.3



PERFORMANCE DATAS – ROTAX 912ULS/iS (100hp)				
Step	Engine rpm	Power HP	Torque Nm	MAP in.HG
Take-off 5 min max	5800	100	121.0	27.5
Cruise	5500	90	119.8	27
75 %	5000	68	97.4	26
65 %	4800	60	88.7	26
55 %	4300	50	84.3	24



PERFORMANCE DATAS – ROTAX 914UL (115hp)				
Step	Engine rpm	Power HP	Torque Nm	MAP in.HG
Take-off 5 min max	5800	115	139	39
Cruise	5500	100	128	35
75 %	5000	74	105	31
65 %	4800	64	95	29
55 %	4300	54	90	28



PERFORMANCE DATAS – ROTAX 915iS (141cv)				
Phase	Moteur tr/min	Puissance HP	Couple Nm	PA in.HG
Décollage 5 min max	5800	140	-	45
90 %	5240	125	-	42
80 %	4680	107	-	40
71 %	4120	87	-	38
61 %	3560	64	-	34





12.5. Operating limitation of the Hydraulic BLACK PV propeller

Designation	Maximum engine power	Maximum rotational speed
2-blade Inconel FLASHBLACK-R propeller, Right	120 hp	2800 rpm
3-blade Inconel FLASHBLACK-R propeller, Right	120 hp	2800 rpm
3-blade Inconel FLASHBLACK-3-R propeller, Right	141 hp	2800 rpm
3-blade Inconel SWIRLBLACK-3-R propeller, Right	120 hp	2800 rpm
4-blade Inconel SWIRLBLACK-3-R propeller, Right	141 hp	2800 rpm
3-blade Inconel FLASHBLACK-2-R propeller, Left	120 hp	2800 rpm
4-blade Inconel FLASHBLACK-2-R propeller, Left	141 hp	2800 rpm

12.6. Identification marking of the propeller

12.6.1. Manufacturing label

As the propeller is dismountable, each component (blade and half-hub) has a manufacturing traceability label which identifies the component and specifies its own serial number:

FLASH-PV Right Blade	FLASH-2-PV Left Balde	SWIRL-3-PV Right Blade	Half-hub FLASH (2-blade / 3-blade)
			

12.6.1. Propeller label (for LSA certified version)

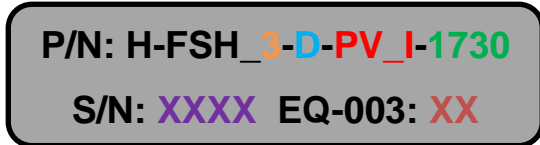
At the end of the manufacturing, a 2nd label - the propeller label - is placed on each component of the propeller (blade and half-hub) with the following information:

1st line: Part number of the propeller model



2-blade (2) or 3-blade (3) or 4-blade (4)
 Left (G) or Right (D)
 Reinforced structure (R) and/or Inconel leading edge (I)
 Diameter in mm



2nd line: Propeller data

Serial number of the propeller (not only the component)
 Value of the static balancing of each blade of the prop



Voici un exemple pour chacune des 4 versions d'hélices possible :

Propeller version	Label
2-blade Inconel FLASHBLACK-R Right propeller	
3-blade Inconel FLASHBLACK-R Right propeller	

3-blade Inconel SWIRLBLACK-3-R Right propeller	 <p>www.duc-helices.com P/N:H-SW3_3-D-PV_I-1730 S/N:1234 EQ-003:123</p>
3-blade Inconel FLASHBLACK-2-R Right propeller	 <p>www.duc-helices.com P/N:H-FSH2_3-G-PV_I-1730 S/N:1234 EQ-003:123</p>

12.7. Calculation of the centrifugal force of the FLASH Inconel blade

The centrifugal force undergoes by the blade was calculated for the most solliciting configuration.

Calculation of the centrifugal force:
$$F = \frac{M \times V^2}{R_G}$$

ENGINE				PROPELLER					CENTRIFUGAL FORCE	
Type	RPM _{max} (tr/min)	Red.	RPM _{Red} (tr/min)	Ø _{prop} (mm)	G _{blade} (mm)	R _G (mm)	V (m/s)	M (kg)	F (N)	F _{FoS(2)} (N)
ROTAX 912	6000	2.273	2643	2-Ø1730	209	263.6	72.93	1.020	20 578	41 157
ROTAX 912S/914	6000	2.43	2469	3-Ø1730	209	263.6	68.12	1.020	17 958	35 916
ROTAX 915	6000	2.54	2362	4-Ø1730	209	263.6	65.2	1.020	16 449	32 898

RPM_{max} : Maximum engine speed (RPM)

RPM_{Red} : Propeller rotation speed (RPM)

Red. : Gear box ratio

F : Centrifugal force (N)

F_{FoS(2)} : Centrifugal force with factor of safety 2 (RPM)

Ø_{hélice} : Propeller diameter (mm)

G_{pale} : Gravity center position on the blade (mm)

R_G : Radius of the gravity center of the blade (mm)

V : Linear speed in the gravity center (m/s)

M : Weight of the blade (kg)

12.8. Centrifugal force test under EASA CS-P350 specification

Standard reference:

EASA Certification Specifications for Propeller CS-P

Test method:

The test of centrifugal force propeller is defined by the certification specification of propeller CS-P 350. Its objective is to demonstrate its compliance with the certification specification of propeller (CS-P) defined by the European Aviation Safety Agency (EASA). After the test, the propeller must show no evidence of fatigue, failure or permanent deformation that would result in a major or hazardous effect on the propeller. It is considered that this test is used to validate the mechanical strength of the propeller, i.e. to confirm the manufacturing process thereof.

Objective:

This test is conducted with the Inconel FLASH propeller, Ø1730mm which is representative of its mounting on the engine Rotax 912 (80hp). This engine is the most penalizing for the propeller due to its rotation speed.

Thus, the test is used to validate all configurations below that selected. In addition, all using the same propeller design and the same manufacturing technology will be considered consistent with values similar or lower than those of the test.

Tested sample:

2-blade Inconel FLASH propeller Ref. 01-19-001 P/N: H-FSH_2-D-I S/N: 003

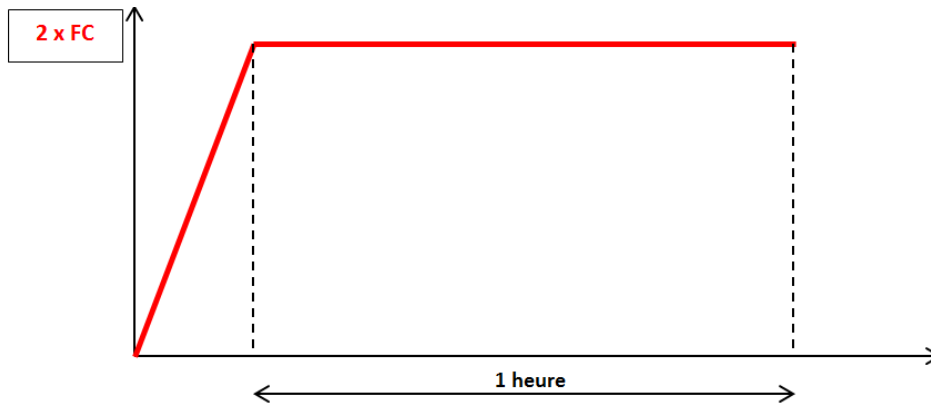
Procedure:

Applying a charge for 1 hour = 2 x maximum centrifugal load = 53 502 N

Test bench:



Test performing:



Results:

Obtained by visual analysis, no damage or failure was observed during and after the centrifugal load test.

Declaration of conformance:

The centrifugal load test according to specification EASA CS-P 350 leads to the conclusion that the propeller is properly sized and is designed to operate on a similar installation (or less solliciting) of ROTAX 912 engine, solliciting the blade in a centrifugal force of 20 578 N.

12.9. Breaking test of the 2-blade Inconel FLASH propeller

Reference:

Extract from the SOPAVIB test report n° R6375973-002-1

Purpose of the test:

Tensile test to rupture

Tested sample:

2-blade FLASHBLACK-2 Left prop Réf. 01-35-021
 2-blade SWIRLBLACK-2 Right prop

P/N: H-FSH2_2-G-PV_I
 P/N: H-SW2-2-D-PV-I

S/N: 001
 S/N: 001



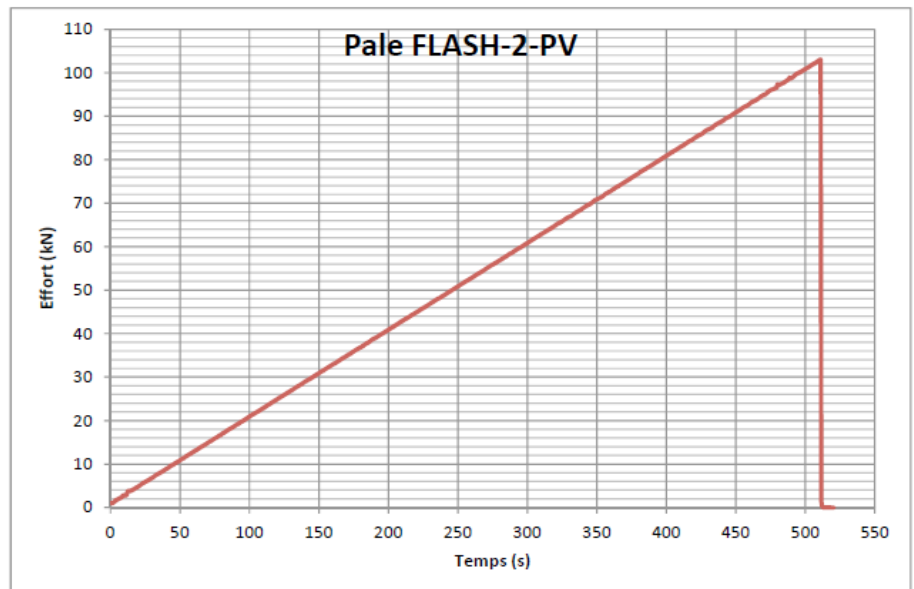
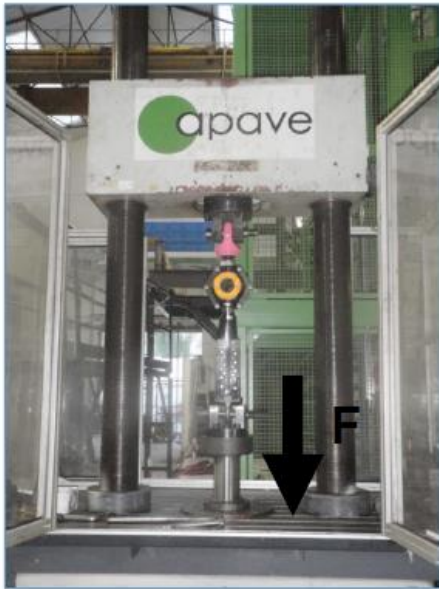
Testing method:

The tested propeller is placed between the fixed part and the movable part of the lab bench traction. Applying of the following sequence:

- Preload 1kN
- Rise in load at the speed of 0.2 kN / s until rupture

Results:

The curve below shows the traction load applied to the propeller according the time.



Analysis of the specimen :



Conclusion

The failure of the blade occurred at the foot, like expected, to an effort of 123.7 kN, i.e. more than 12 tons of load.

However, it was found in annex 12.7 **Calculation of the centrifugal force of the FLASH Inconel blade** that the maximum effort in centrifugal, with safety factor of 2 (the standard required under EASA CS-P350), does not exceed 41 157 N.

Therefore, we can confirm the correct size of the FLASH propeller for all applications with a safety factor of 5.

12.10. Declaration of conformance of the Hydraulic BLACK PV propellers

12.10.1. Design and Construction

The Hydraulic BLACK PV propellers were designed to be adapted to the applications described in section 0. Every designs features are reliable and mastered by DUC Hélices company.

The materials used in the propeller were selected for their technical properties to be conforms to the definition of the propeller and durable during the propeller life.

About the ground adjustable system, the design allows a fine and careful setting of the propeller blade pitch. Also, the system is robust to not change during normal and emergency operation of the propeller and also after many settings.

Definition Hydraulic BLACK PV propeller conforms to withstand the stresses of operation on all its lifetime. Refer to the centrifugal force test (section 12.7 & **Error! Reference source not found.**), breaking test (section 12.9) and next section.

12.10.2. Tests and Inspections

The FLASH propeller completes the tests and inspections described below, without failure or malfunction.

Strength Testing:

Proof of strength is presented in section 12.8. **Centrifugal force test under EASA CS-P350 specification.**

The blade root and blade retention system were tested for 1 hour at a load level equal to 2 times the centrifugal load that would be generated by the blade weight at maximum rated rotational speed. This test was done in a static pull test.

Endurance Testing:

The propeller conforms to endurance test of each application exposed in section 0.

Teardown Inspection:

After completion of each test described above, the tested propeller was completely disassembled and each propeller parts were inspected. No failure or crack was found.

Propeller Adjustments and Parts Replacements:

During the tests and inspections carried out, no parts have to be repaired or replaced. All propeller parts resisted the tests and were conform after inspections.

12.10.3. Design Control

The Hydraulic BLACK PV propellers was design on CAD software. All the CAD files and 2D drawings are stored in the Design Office of DUC Hélices Company, as the definition of the Hydraulic BLACK PV configurations. All the technical data (dimensions, materials and processes) are saved in manufacturing procedure. Also, a copy all these data are archived out of the company.

12.10.4. Quality Assurance

DUC Hélices Company is ISO 9001:2015 certified for its management of the quality system, which ensures manufactured propellers maintain conformity to the established design. Refer to page 2.

12.10.5. Certification of Conformity for ASTM F2506-13

"ASTM F2506-13 is the standard specification for design and testing of fixed-pitch or ground adjustable for Light Sport Aircraft propellers.

DUC Hélices Company declares that the FLASH propeller complies with the ASTM F2506-13 standard and after verification, it responds every requirement."

M. Vincent Duqueine
Manager
05/09/2023

DUC Hélices Propellers
contact@duo-helices.com - www.duc-helices.com
Aérodrome de Villefranche-Tarare
69620 FRONTENAS - FRANCE
Tél. : +33 (0)4 74 72 12 69
SIRET : 413 269 887 00035

DUC Hélices Propellers

Aérodrome de Villefranche-Tarare (LFHV)

289 Avenue Odette & Edouard DURAND

69620 FRONTENAS - FRANCE

Tél. : + 33 (0)4 74 72 12 69

E-mail : contact@duc-helices.com - www.duc-helices.com

S.A.V. : service.technique@duc-helices.com



Entreprise certifiée
ISO 9001:2015

INFO
PILOTE



Protect your propeller!

Neoprene cover – Commercial reference: O1-80-002

INFO
PILOTE



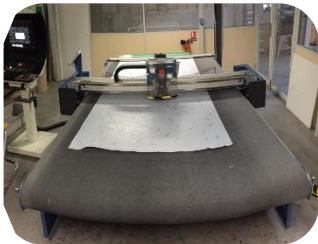
Save money!

Degrease your propeller

REDUCE CONSUMPTION

by improving performance

Commercial reference: O1-80-003



Data and pictures included in this instruction manual are exclusively property of DUC Hélices Company. Any part of this manual can be reproduced or transmitted in any form with any means, electronic or manual, for any reason, without written approval of DUC Hélices Company.