Instruction manual

FLASH propeller range

Chemin de la Madone - 69210 LENTILLY - FRANCE
Phone: + 33 (0)4 74 72 12 69 - Fax: +33 (0)4 74 72 10 01
E-mail: contact@duc-helices.com - www.duc-helices.com

ISO 9001:2008 Certified Company
for its Quality System Management

LRQA
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CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

DUC HELICES
Chemin de la Madone
69210 LENTILLY, France

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standards:

ISO 9001:2008

The Quality Management System is applicable to:

Design, manufacturing of propellers and accessories in composite materials.

Approval
Certificate No: FQA 4001463

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Macro Revision 13

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.

Identification

Date		**Delivery note n°**	
Owner		**Engine/Gearbox ratio**	
Aircraft		**1st recommended pitch blade angle**	

Notes: .....

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Performances

PITCH (°) at 25cm from the tip of the blade	**TAKE-OFF DISTANCE** (m)	**CLIMB RATE** (ft/min or m/s)	**SLOW CRUISE** (km/h & rpm)	**VARIOUS CRUISE** (km/h & rpm)	**FAST CRUISE** (km/h & rpm)	**FULL THROTTLE VARIO 0** (km/h & rpm)

Notes (Date, Number of people, Weight, Weather, …): .....

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Summary

1. Presentation of the FLASH propeller

1.1. Description

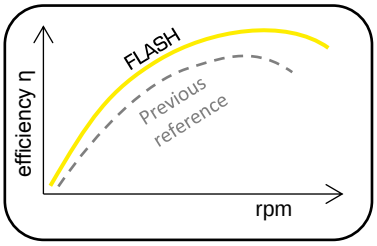
The **FLASH** propeller range is has a new innovative design, specific about its twisting axis and center of pressure.

Its aerodynamic design allows a **"constant speed" effect**, limiting variations in engine speed between on ground and in flight.

These propellers allow for **high efficiency** throughout the flight envelope i.e.:

- **Improved takeoff and climb rate due to higher engine speed, then higher engine efficiency**
- **Many cruise extension**
- **A high user comfort**

The blades and the hub of the FLASH propeller range are manufactured according the DUC Hélices company technologies, from unidirectional layers of carbon fibers prepreg epoxy resin.



Their composite structures are defined to obtain the **maximum stresses in torsion and bending**. Therefore "constant speed" effect is not related to deformation of the blade but its geometry and specific profile.

Due to its **specific geometric definition**, **excellent performance** is obtained in **both aerodynamic and acoustic, but also in consumption**.

1.2. Characteristics

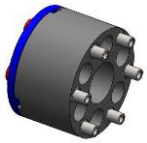
The FLASH propeller range is available:

- Tractor or pusher configuration (available in right & left rotation)
- Diameters Ø1520, Ø1620, Ø1660, Ø1730, Ø1850mm and others tailor made
  Ø59.8 Ø63.8 Ø65.4 Ø68.1 Ø72.8"
- Two-blade & Three-blade – FLASH 3.35 & 4.40 kg (7.39 & 9.70 lb.)
  FLASH-2 3.45 & 4.53 kg (7. 61 & 9.99 lb.)
- Shielded leading edge in Inconel®
- Carbon composite hub with metallic inserts
- Direct assembly on the propeller-shaft Ø101.6mm
- Excellence version "**FLASH-R**":
  - → Longitudinal reinforced carbon structure
  - → Higher bending strength
  - → Titanium color finishing
  - → Advanced controls

1.1. Shielding leading edge in Inconel

The leading edge of the FLASH blades is equipped with a metallic shielding in Inconel®. This material is refractory stainless with a very high hardness of surface.

1.2. Accessories



- **Aluminum mounting spacer (Direct mounting on P.C.D Ø101.6mm/Ø4")**

Moves the plane of the propeller to adjust the position according the engine hood

- **Aluminum adaptor spacer (Other mounting as SAE1, SAE2, …)**
- Move the propeller plane and adaptor the P.C.D fixation of the propeller
- **Spinner available in diameter Ø250mm (Ø9.8") & Ø340mm (Ø14.4")**
- **Adjusting tool for the setting of the pitch angle of the blades**
- **Neoprene cover protection of the blade**

- **Cleaning treatment for composite propellers**

Save money! A clean propeller is more efficient and decreases the fuel consumption.

1.1. Sales reference

Designation	Reference	Part number
Two-blade Inconel FLASH propeller, Right	01-19-001	H-FSH_2-D-I
Two-blade Inconel FLASH propeller, Left	01-19-002	H-FSH_2-G-I
Two-blade Inconel FLASH-R propeller, Right	01-20-001	H-FSH_2-D-R_I
Two-blade Inconel FLASH-R propeller, Left	01-20-002	H-FSH_2-G-R_I
Three-blade Inconel FLASH propeller, Right	01-21-001	H-FSH_3-D-I
Three-blade Inconel FLASH propeller, Left	01-21-002	H-FSH_3-G-I
Three-blade Inconel FLASH-R propeller, Right	01-22-001	H-FSH_3-D-R_I
Three-blade Inconel FLASH-R propeller, Left	01-22-002	H-FSH_3-G-R_I
Three-blade Inconel FLASH-2 propeller, Left	01-23-002	H-FSH2_3-G-I

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 **11.5**.

2. Applications

The DUC propellers have an **unlimited** flight potential in normal operation. To keep the unlimited potential, DUC Hélices defined a TBO (Time Between Overhaul) for a propeller depending on its engine. Refer to section **9. Potential use & Propeller maintenance** for more information.

Engine	Type	Gear box	Recommended propeller	Propeller diameter (inch)	Blade angle (°)	Blade angle allowed range(°)	TBO (hour)
3 AXIS – TRACTOR							
ROTAX 912	4 strokes	2.273 2.43	Two-blade Inconel FLASH, Tractor Right	Ø1730	22°	20° → 28°	2000
ROTAX 912S/912iS/914	4 strokes	2.43	Three-blade Inconel FLASH, Tractor Right	Ø1730 Ø1750	24°	22° → 32°	
JABIRU 2200	4 strokes	-	Two-blade Inconel FLASH, Tractor Right	Ø1520	18°	15° → 23°	
JABIRU 3300	4 strokes	-	Two-blade Inconel FLASH, Tractor Right	Ø1620	19°	16° → 24°	
UL Power 260i	4 strokes	-	Two-blade Inconel FLASH, Tractor Right	Ø1520	18°	15° → 23°	
UL Power 350iS	4 strokes	-	Two-blade Inconel FLASH, Tractor Right	Ø1620	20°	17° → 25°	
Continental O-200 **Lycoming O-235**	4 strokes	-	Three-blade Inconel FLASH, Tractor Right	Ø1660	19°	17° → 25°	
Lycoming O-320	4 strokes	-	Three-blade Inconel FLASH-R, Tractor Right	Ø1850	20°	18° → 26°	
Lycoming O-360	4 strokes	-	Three-blade Inconel FLASH-R, Tractor Right	Ø1900	20°	18° → 26°	
3 AXIS – PUSHER							
ROTAX 912	4 strokes	2.273 2.43	Three-blade Inconel FLASH, Pusher Left	Ø1730	22°	20° → 28°	2000
			Three-blade Inconel FLASH-2, Pusher Left	Ø1730	21°	19° → 27°	
ROTAX 912S/912iS/914	4 strokes	2.43	Three-blade Inconel FLASH, Pusher Left	Ø1700 Ø1730 Ø1750	22°	20° → 28°	
			Three-blade Inconel FLASH-2, Pusher Left		21°	19° → 29°	
AUTOGYRO & TRIKES							
ROTAX 912S/912iS/914	4 strokes	2.43	Three-blade Inconel FLASH, Pusher Left	Ø1700 Ø1730 Ø1750	22°	20° → 28°	2000
			Three-blade Inconel FLASH-2, Pusher Left		21°	19° → 29°	
BMW R12000 GF de SECOP	4 strokes	2.7	Three-blade Inconel FLASH, Pusher Right	Ø1750	22°	20° → 28°	
OTHER APPLICATIONS							
For all other applications, thank you to contact the DUC Hélices company to study the possibility of adapting the FLASH propeller.							

** Ø1850mm = 72.83"; Ø1730mm = Ø68.12»; Ø1660mm = Ø65.4»; Ø1620mm = Ø63.8»; Ø1520mm = Ø59.8"*

Remark

The values of the pitch angle are theoretical and associated with the engine. This setting should be adjusted according to the aircraft (see section **7. Indications for testing**).

For proper use of the propeller, refer to section **9. Potential use & Propeller maintenance**.

3. Installation precautions

WARNING Make sure the ignition is turned off before starting any type of operation on the propeller.
Do not run the engine without propeller, engine damage will result.

IMPORTANT **The blades of a propeller are part of a whole. DO NOT INTERCHANGE with other similar blades from propeller. The propeller 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 the manufacturers.**

WARRANTY CONDITIONS The user is still flying under its full responsibility (see **10. General terms of sale**).

4. Components of the FLASH propeller

The FLASH & FLASH-2 propellers are available in several versions and can be mounted on different model of engine.

4.1. Mounting configuration of the FLASH propeller

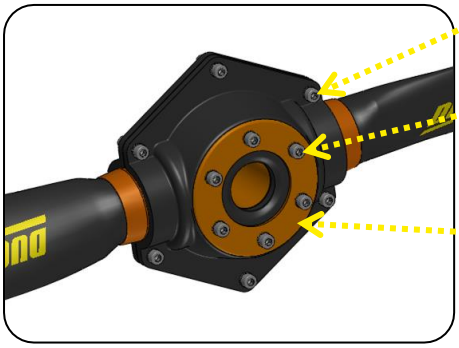
Here is a configuration table of the FLASH propeller mounting according the propeller-shaft of the engine.

If needed, see annex **11.1. Dimension of the engine propeller-shaft**.

MOUNTING	ENGINE PROPELLER-SHAFT			
	Ø4" / Ø101.6mm (Ex: Rotax, Jabiru)	**Type SAE 1 Ø4-3/8" / Ø111.125mm** (Ex: Continental O-200)	**Type SAE2 Ø4-3/4" / Ø120.65mm** (Ex: Lycoming O-360)	**Other ≠ Ø101.6mm**
direct on propeller-shaft (without spacer)	**X**			
with spacer	**X**			
with adaptor spacer		**X**	**X**	**X**

4.2. Mounting screws

4.2.1.Rotax/Jabiru mounting

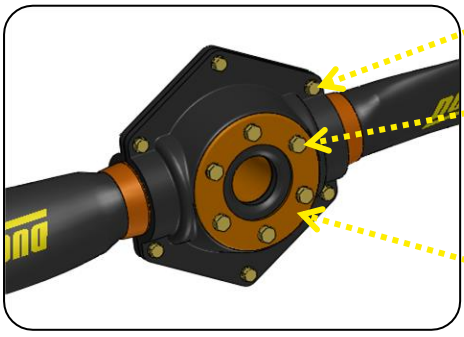


Hub assembly:
Screws CHC M8, Nylstop locking nuts & pin contact washers

Propeller fixation:
Screws CHC M8
(Screw length adapted according the mounting direct or with spacer)

Hub clamping washer:
Aluminum with holes Ø8mm on P.C.D. Ø101.6mm

4.2.2.SAE1/SAE2 mounting

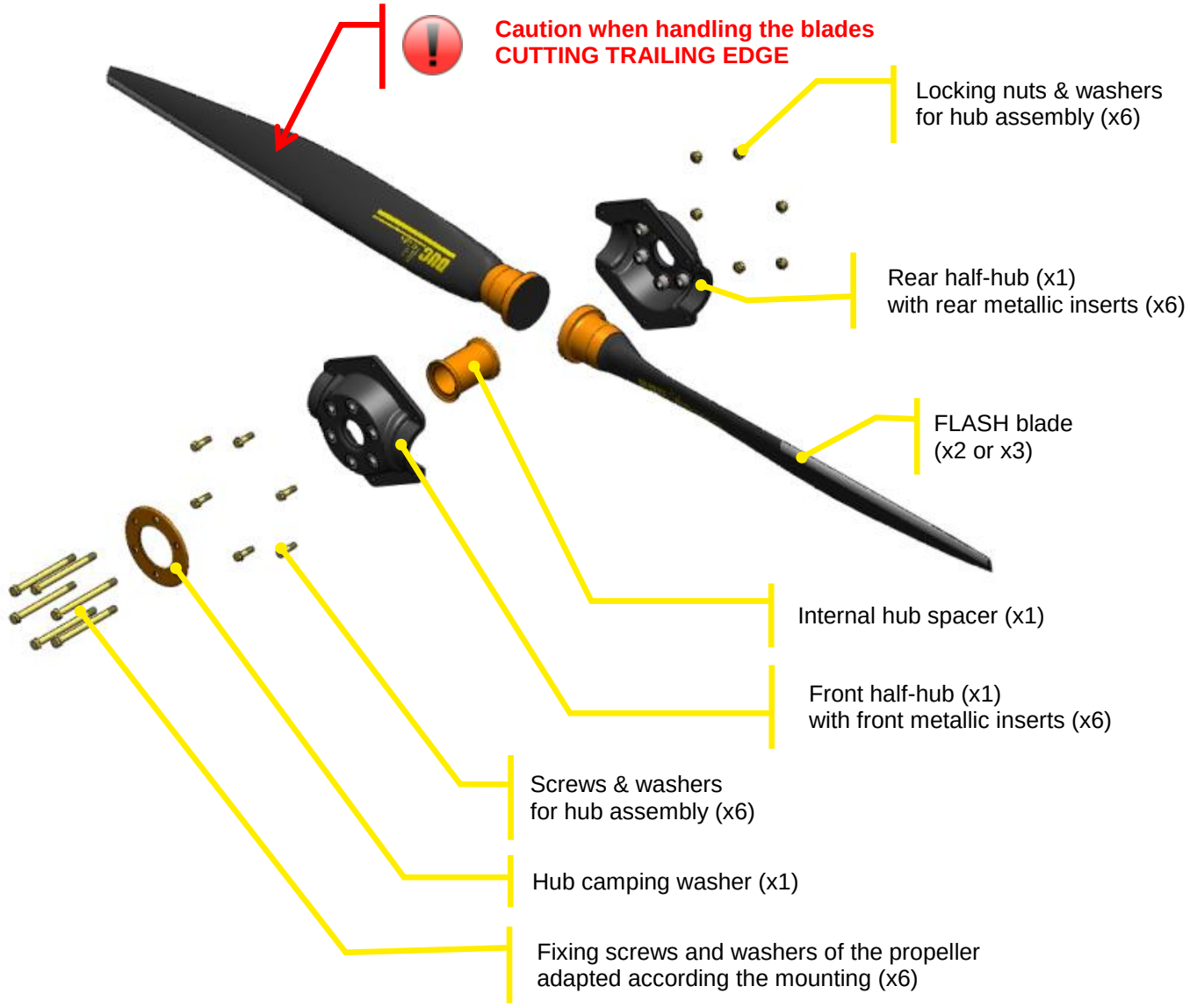


Hub assembly:
Screws AN5, locking nuts & standard washers

Propeller fixation:
SAE1: Screws AN6 (3/8")
SAE2: Screws AN8 (1/2")
(Screw length adapted according the length of the spacer)

Hub clamping washer: Aluminum
SAE1: Holes for screws AN6 (3/8") on P.C.D. Ø4-3/8" (Ø111.125mm)
SAE2: Holes for screws AN8 (1/2") on P.C.D. Ø4-3/4" (Ø120.65mm)

4.3. Exploded view for propeller



Remark
This exploded view shows the principle of the FLASH propeller assembly. The size of all of these components changes depending on the configuration of the propeller (diameter hole of the metallic inserts of the half-hub, length of the screws…).

4.4. List of required tools

Rotax/Jabiru mounting	SAE1/SAE2 mounting
M8 Torque Hex key (Tightening range: 22 to 30 Nm) M8 Torque Wrench (Tightening range: 22 to 30 Nm) Inclinometer (pitch adjusting tool) Plastic mallet Torque Screwdriver (Tightening: 4 Nm)	M8 Torque Hex key (Tightening range: 22 to 30 Nm) M8 Torque Wrench (Tightening range: 22 to 30 Nm) 3/8 or 1/2 Torque Wrench (Tightening range: 30 to 45 Nm) Inclinometer (pitch adjusting tool) Plastic mallet Torque Screwdriver (Tightening: 4 Nm)

5. Assembly instruction of the propeller

The assembly of the FLASH propellers is shown below. It is recommended to assemble the propeller on a worktable before installing it on the plane. The procedure is the same for two-blade and three-blade FLASH propellers.

For further information, contact the DUC Hélices Company.

5.1. Assembly of the propeller

STEP 1.

Place the **rear half-hub** on a worktable.

Be careful not to invert with the front hub half. Depending on your installation, the rear half-hub is one mounted on the propeller-shaft of the engine or on a spacer. The holes of the metal inserts of the rear half-hub are higher than the holes of the metal inserts of the front half-hub.

STEP 2.

Place the hub spacer in the center of the rear half-hub.

STEP 3.

Positioning the blades in their hub slots by placing them outwards.

Orient the DUC Hélices logo facing you.

Note that the metal inserts of the half-hub allow a locking of the blades in their axis within the hub.

STEP 4.

Place the **front half-hub** (metal insert with small hole) on the set to fit with the blade foots.

STEP 5.

From the front hub, set up the 6 screws and washers for hub assembly. At the rear, place washers and lock nuts.

Perform initial moderate tightening.

STEP 6.

Place the hub clamping washer on the front of the propeller hub (side logo).
Be sure the direction of the clamping washer (rounded edge outwards).

Place the 6 fixing screws and their washer.

In the case of pin contact washers (Rotax/Jabiru mounting), the pins are oriented towards the screw head.

5.2. Installation on the aircraft

As presented in section **4.1. Mounting configuration of the FLASH propeller**, several mounting are possible:

1. Installing **directly on propeller-shaft** of the engine
2. Use a **spacer** for spacing propeller from the propeller-shaft
3. Use an **adaptor spacer** to adjust the diameter fixing of the propeller and for spacing the propeller from the propeller-shaft

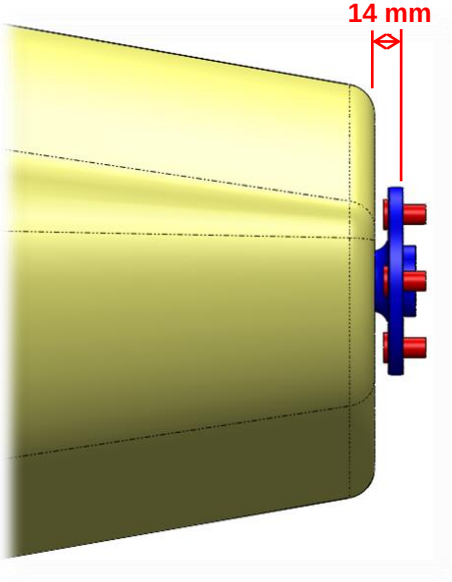
5.2.1. Direct installation on the aircraft

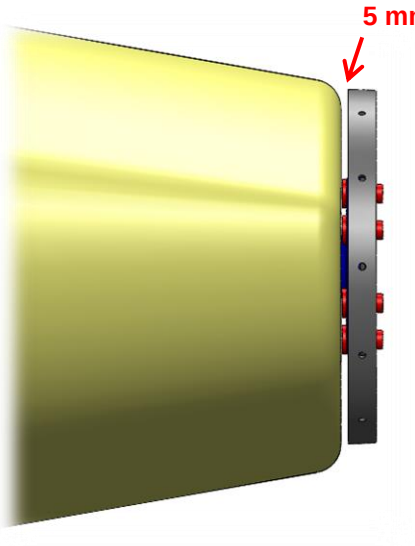
The direct installation of the FLASH propeller is possible only with the following conditions:

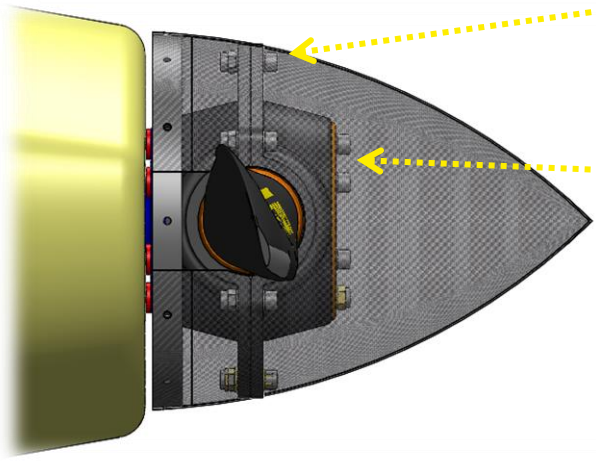
- ✓ Engine propeller-shaft type Rotax or Jabiru (6 indexing paws Ø13 or Ø14mm on P.C.D. Ø101.6mm/Ø4")
- ✓ Engine propeller-shaft out of the engine hood of 14mm for the mounting of the DUC spinner

If needed, see in annex **11.1. Dimension of the engine propeller-shaft.**

Remark: All engines having a propeller-shaft with a P.C.D. Ø101.6mm/Ø4" can install the FLASH propeller directly. **The holes of the metal inserts of the rear half-hub must be adapted to suit with the indexing paws of the propeller-shaft.** For further information, contact the DUC Propellers.





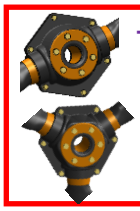


Assembly of the two-blade or three-blade hub

TIGHTENING TORQUE
3.0 Kg/m 30 N.m

Propeller fixing:
Screws CHC M8 & pin contact washer (length adapted according the indexing paws of the propeller-shaft)

Threaded paws (Ex: ROTAX): **Screw CHC M8x130mm**
Ø8 hole paws (Ex: JABIRU): **Screw CHC M8x140mm**



TIGHTENING TORQUE TWO-BLADE HUB
2.2 Kg/m 22 N.m

TIGHTENING TORQUE THREE-BLADE
2.5 Kg/m 25 N.m

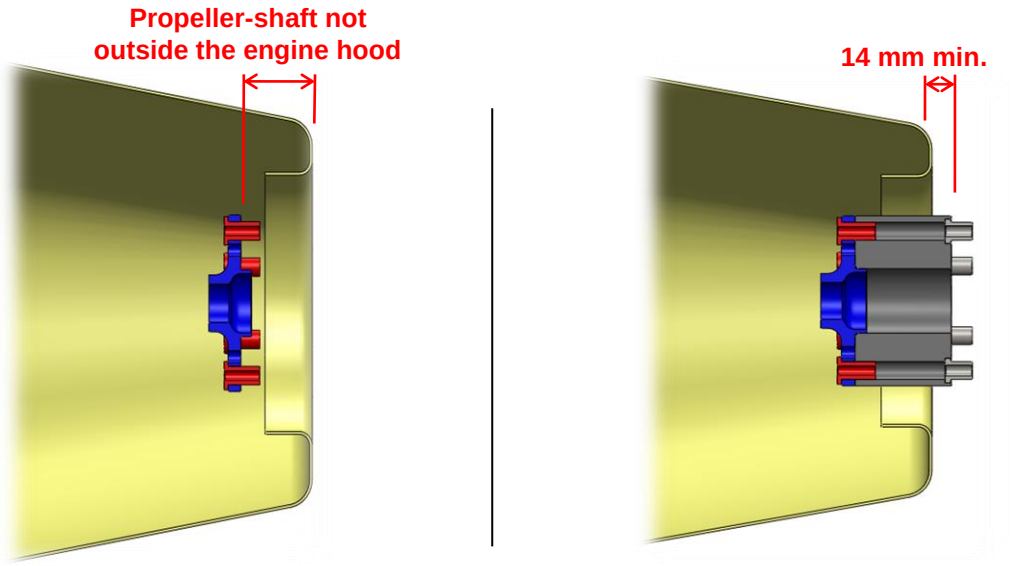
5.2.2.Use of an spacer

A spacer is necessary in the following case:

- ✓ Engine propeller-shaft type Rotax or Jabiru (6 indexing paws Ø13 or Ø14mm on P.C.D. Ø101.6mm/Ø4")
- ✓ Engine propeller-shaft placed inside the engine hood or not place at more than 14mm

Determination of the spacer length:

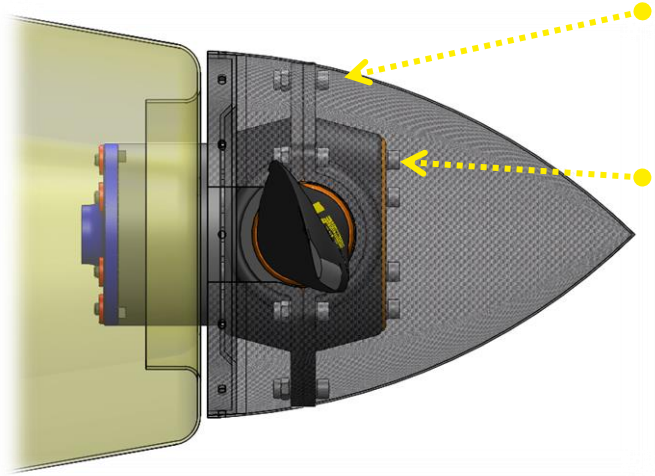
Measure the **distance X** between the propeller-shaft and the engine hood limit, then add **14mm**.



Available spacer:

Engine	Model	Length
ROTAX	912H spacer	6, 20, 30, 50, 60, 70, 80, 120mm
JABIRU	JABIRU spacer	6, 20, 30, 50, 60, 70, 80, 120mm

Presentation of the installation

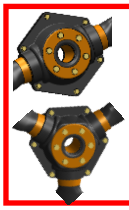


Assembly of the two-blade or three-blade hub

TIGHTENING TORQUE
3.0 Kg/m 30 N.m

Propeller fixing:
Screw CHC M8 & pin contact washer (screw length adapted according the length of the spacer)

Consult the installation instructions of the spacer for more information.



TIGHTENING TORQUE TWO-BLADE HUB
2.2 Kg/m 22 N.m

TIGHTENING TORQUE THREE-BLADE
2.5 Kg/m 25 N.m

5.2.3.Use of adaptor spacer

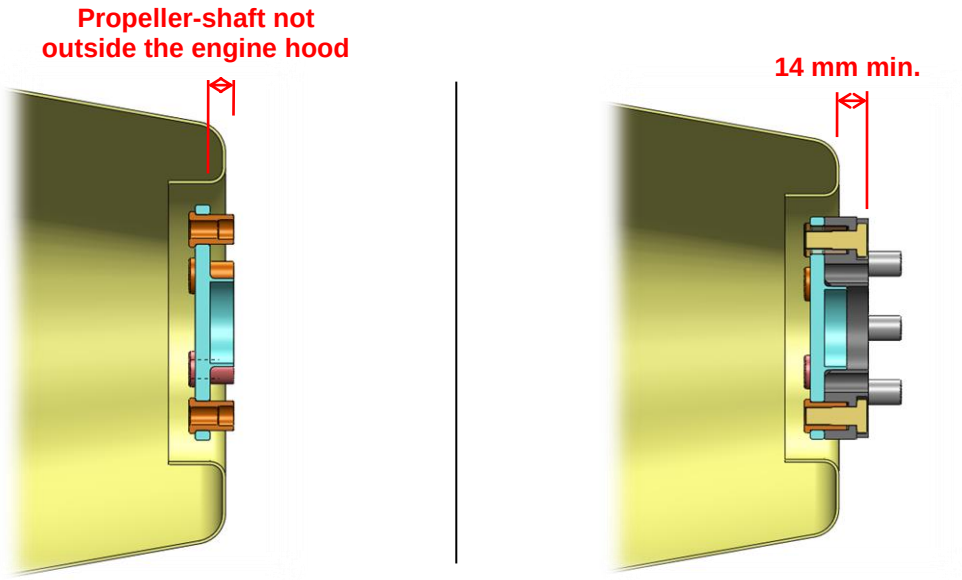
An adaptor spacer is necessary in the following case:

- ✓ Engine propeller-shaft different than the type Rotax or Jabiru (other than P.C.D. Ø101.6mm/Ø4")

If needed, see in annex **11.1 Dimension of the engine propeller-shaft**.

Determination of the adaptor spacer length:

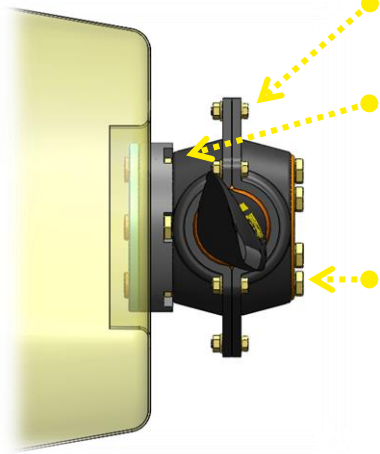
Measure the **distance X** between the propeller-shaft and the limit of the engine hood, then add **14mm**.



Available adpator spacer:

Engine	Model	Length
Continental O-200 / Lycoming O-233	SAE1 adaptor spacer	30, 70, 100mm
Lycoming O-360	SAE2 adaptor spacer	30, 70, 100mm

Presentation of the installation



Assembly of the two-blade or three-blade hub

TIGHTENING TORQUE 3.0 Kg/m 30 N.m

Fixation of the adaptor spacer
SAE1: Screw AN6 / SAE2: Screw AN8
(screw length adapted according the adaptor spacer length and the starter flange on the propeller-shaft)

TIGHTENING TORQUE ADAPTOR SPACER
AN6 (3/8"): 3.0 Kg/m 30 N.m
AN8 (1/2"): 4.5 Kg/m 45 N.m

Propeller fixing:
SAE1: Screw AN6-51 / SAE2: Screw AN8-51

TIGHTENING TORQUE PROPELLER FIXING
AN6 (3/8"): 3.0 Kg/m 30 N.m
AN8 (1/2"): 4.5 Kg/m 45 N.m

Consult the installation instructions of the adaptor spacer for more information.

Remark: It is imperative to use a spinner when using propeller FLASH. The mounting plate of the spinner can be placed before or after the spacer adaptation. It is necessary to adapt the mounting in function of its position.

5.3. Setting of the propeller & Finalization of the installation

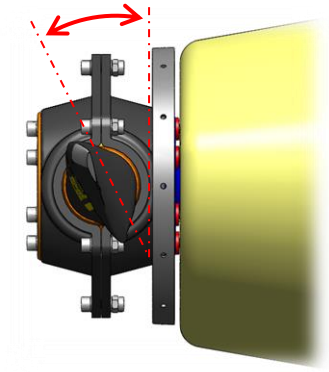
At this point, the propeller is installed on your aircraft with the spinner mounting plate.

If the propeller is already **assembled and the blades angle set**, pass directly **STEP 7**.

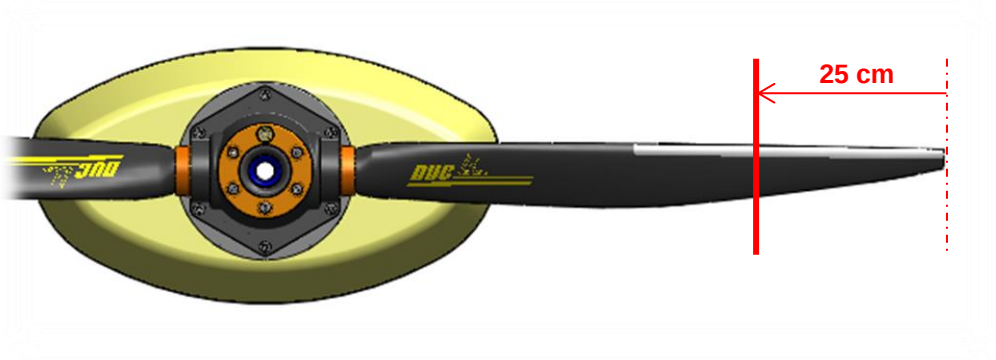
Otherwise, follow all the steps below to **adjust the pitch angle** before the final tightening of the screw.

A reminder of the definition of the airfoil and its vocabulary is presented in annex **11.2. Airfoil**.

STEP 1.



Side view



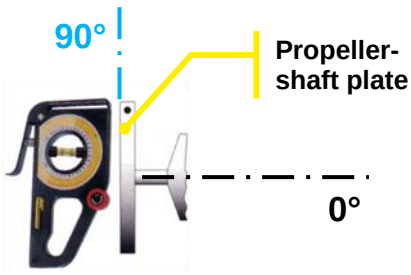
Front view

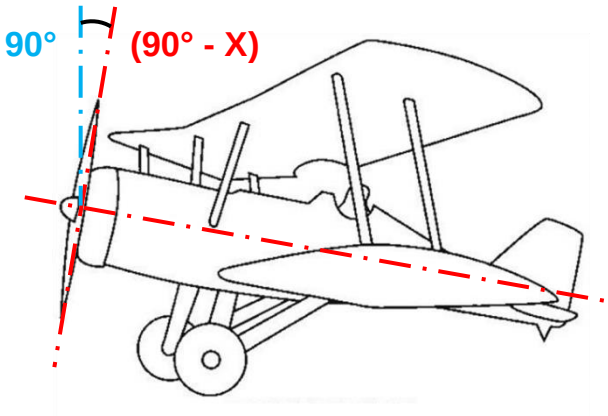
For the setting, the concerned blade must be **place in horizontal position.**

The setting is done with the adjusting tool flatten against the intrados (leading edge up) at **25 cm from the blade tip**. The attack angle is formed by the **vertical and the intrados of the blade**.

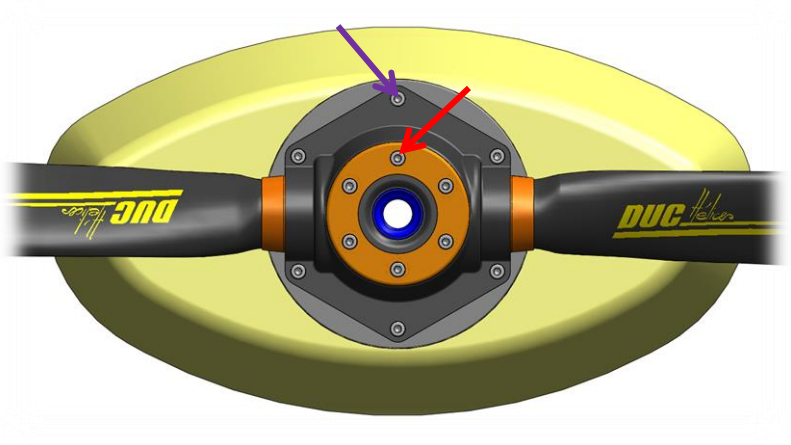
To do this, place your aircraft horizontally, so that the propeller shaft is perfectly vertical.

Check with the level of the adjustment tool (measured value = 90°). **If unable to change the longitudinal axis of the aircraft, raising the value of the X angle propeller shaft plate to subtract the value of the blade angle to be resolved.**



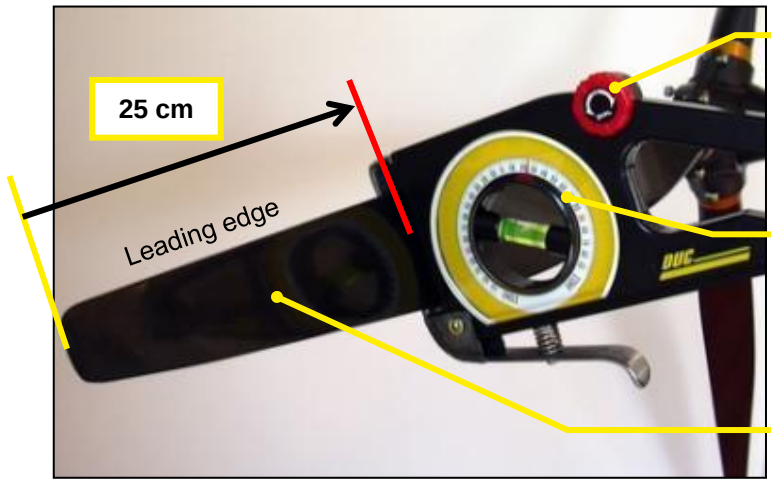


STEP 2.



Slightly untighten the **propeller fixing screws** and the **hub assembly screw**.

STEP 3.



Adjustment roller of the leading edge

Reading blade angle

Intrados of the blade with the leading edge upwards
Horizontal blade

Horizontal blade, leading edge upward, place the adjustment tool at 25 cm from the tip of the blade, intrados side (flat), handle down.

STEP 4.

Set the desired value of the adjustment tool.

Caution to apply the value X if a correction of the aircraft plan was needed.

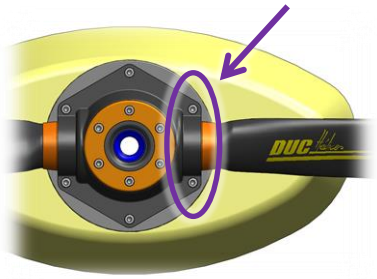
STEP 5.

Correct the position of the bubble on the adjustment tool by rotating the blade in the hub. To do this, using a mallet, lightly tap on the foot of the blade in the desired direction.

Do not apply pressure near the trailing edge, thinner area.

The accuracy of the adjustment tool is 0.2°. This is defined by the tolerance of the visual position of the bubble between the two lines.

STEP 6.



Once the desired pitch angle obtained, slightly tighten the **assembly screws of the hub**, those around the foot blade and then perform the same operation on each of the other blades.

STEP 7.

Remove the adjusting tool from the propeller then perform a **first tightening of the bolts manually**.

Then, carry out a **progressive tightening** of all the screws by **applying the correct torque** with a torque wrench:

TIGHTENING TORQUE

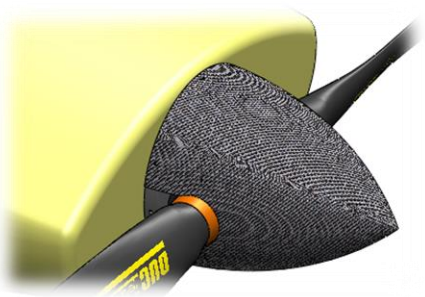
Screw assembly of the two and three-blade hubs = 30 Nm (3.0 kg/m)

Propeller fixing screws	
Direct mounting/Spacer	**Adaptor spacer mounting**
Two-blade screw CHC M8 = 22 Nm (2,2 kg/m) **Three-blade screw CHC M8 = 25 Nm (2.5 kg/m)**	**Screw AN6 (3/8") = 30 Nm (3 kg/m)** **Screw AN8 (1/2") = 45 Nm (4.5 kg/m)**

IMPORTANT

After a 1 hour operation following the installation or modification of the assembly, recheck the assembly of your propeller according the instructions manual using appropriate tools (tightening torque, pitch angle…).

STEP 8.



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

In the presence of a marking, please respect the indexing of the spinner from its plate.

At this point, the FLASH propeller is ready for first tests.

6. Precautions

PRECAUTIONS

If you notice any abnormal installation or operation, do not undertake the flight and immediately contact the DUC Hélices company.

Being aware of potential risks during assembly and initial testing of the propeller. Stay focused, attentive and vigilant to your environment. Recheck several times points to be observed. Maintaining high safety clearance during the set operation.

The products of the DUC Hélices company must be installed and used according to the instruction manuals provided. No modification can be made without the agreement of DUC Hélices company. The non-compliance of these data assumes no responsibility for the DUC Hélices company and makes out the warranty of the considered products (See section **10. General terms of sale**).

7. Indications for testing

INDICATIONS FOR TESTING

The tests are important. It is normal to make several adjustments successive alternating ground and flight tests.

PRELIMINARY TEST to secure the 1st flight (Ground Test)

- Immobilized your aircraft, brakes locked. Apply the manufacturer's recommendations for safety.
- Turn the engine on, warm it up.
- **Full throttle**, the engine must be at least 85% of maximum engine speed recommended by the manufacturer in flight. **If this is not the case, adjust the blade pitch angle**.

Increase pitch angle to reduce engine speed (and vice versa). 1° of pitch angle affects approximately 200 rpm engine speed.

VALIDATION TEST of the pitch angle setting (Flight Test)

- Check all tightening. Take off and place the aircraft in stabilized flight, vario zero.

- To take off, it is not recommended to throttle, brake applied and then releases the brakes. You must put the throttle gradually, brake released. The propeller has a constant speed effect, so this second way avoids cavitation takeoff. Furthermore, this method allows shorter takeoffs.

- **Full throttle**, the maximum engine speed recommended by the manufacturer must be reached **but not exceeded. If this is not the case, adjust the blade pitch angle.**

Increase pitch angle to reduce engine speed (and vice versa). 1° of pitch angle affects approximately 200 rpm engine speed.

IMPORTANT

After a 1 hour operation following the installation or modification of the assembly, recheck the assembly of your propeller according the instructions manual using appropriate tools (tightening torque, pitch angle…).

8. 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 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 **10. General terms of sale**).

9. Potential use & Propeller maintenance

9.1. Potential use of the propeller: Unlimited

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

To keep the unlimited potential, DUC Hélices has defined a TBO (Time Between Overhaul) for a propeller depending on its engine. This TBO according the engine is indicated in this manual (see **2. Applications**). In all cases, it may not exceed 5 years.

When more intensive use (flight school...), the value of the TBO can be doubled maintaining control at least every 2 years.

To achieve this, we propose to return the propeller to make a full control and ensure its proper use.
If no critical anomaly is detected, it is again credited with the same TBO and is returned to you.

As a reminder, there is no imperative logbook. But know that this control is offered as a service to our customers for continuing airworthiness and there is no obligation. In fact, security will not be affected.
The deliveries costs of sending and returning will be payable by the customer.

9.2. Propeller maintenance schedule

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

9.1. Regular maintenance (by the user)

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

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, 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 wrench
4. Replace(s) damage component(s)
5. Contact DUC Hélices to define a solution

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

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

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, 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 wrench
4. Replace(s) damage component(s)
5. Contact DUC Hélices to define a solution

9.3. Complete maintenance (by DUC Hélices)

Upon reaching the TBO (potential flight time between overhaul) defined by DUC Hélices, 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.

10. General terms of sale

10.1. Ordering procedure

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

10.2. Delivery

DUC Hélices 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 Hélices 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 price by the customer and without affecting the transfer of risk.

10.3. Price

The DUC Hélices 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 Hélices Company purchase order.

10.4. 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 Hélices 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.

10.5. Warranties

The DUC Hélices 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 Hélices Company. The failure of these data releases any liability of the DUC Hélices 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 Hélices 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 Hélices and features of one months after its purchase to return to society 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 society with DUC Hélices delivery order attached to the product. In return, the DUC Hélices Company takes no responsibility for damage or loss during transit due to improper or inadequate packaging. The company DUC Propellers 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 Hélices provides no other warranties.

10.6. 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 Hélices right to access, review, correct, correct and delete data you have provided.

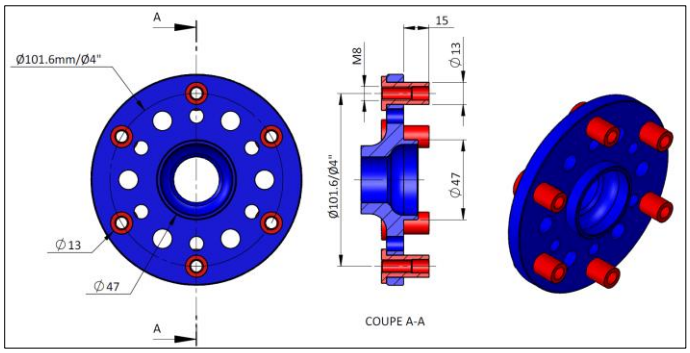
10.7. Litigation

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

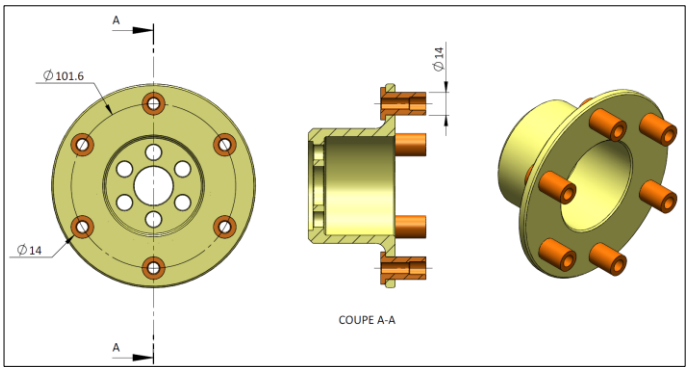
11. Annexes

11.1. Dimension of the engine propeller-shaft

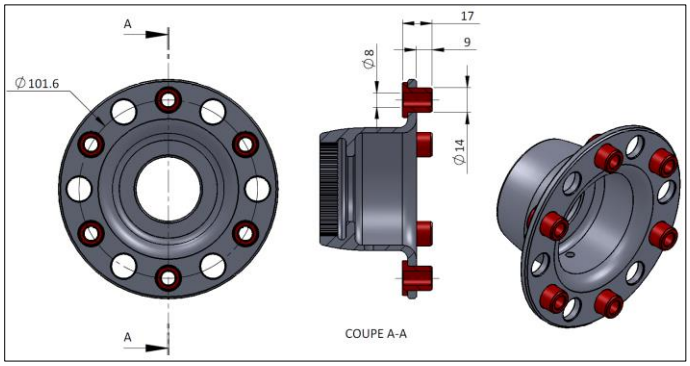
ROTAX 912S engine propeller-shaft



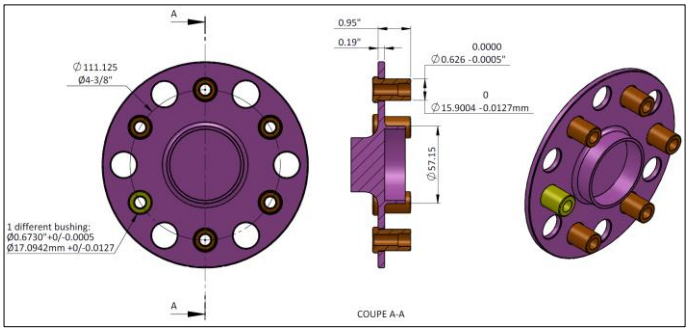
JABIRU 2200 engine propeller-shaft



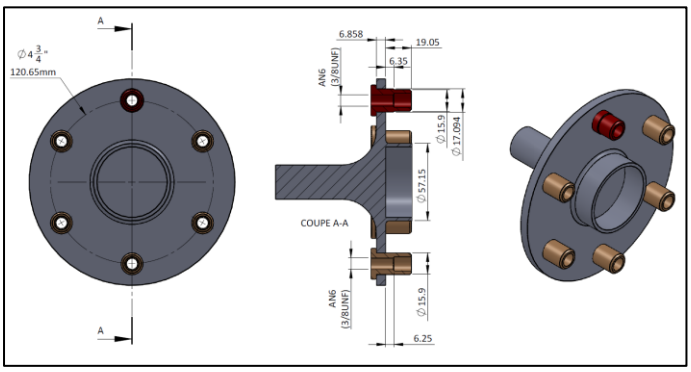
UL Power engine propeller-shaft



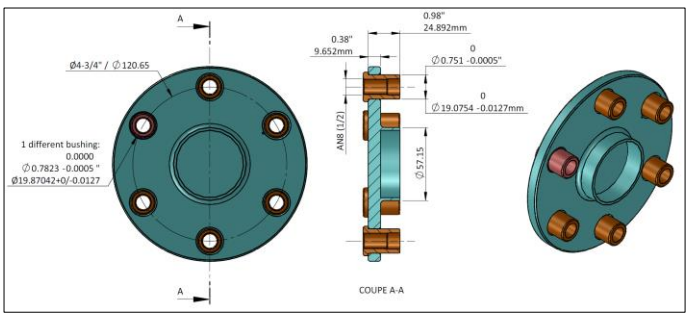
Lycoming O-235-H2C engine prop-shaft, type SAE 1



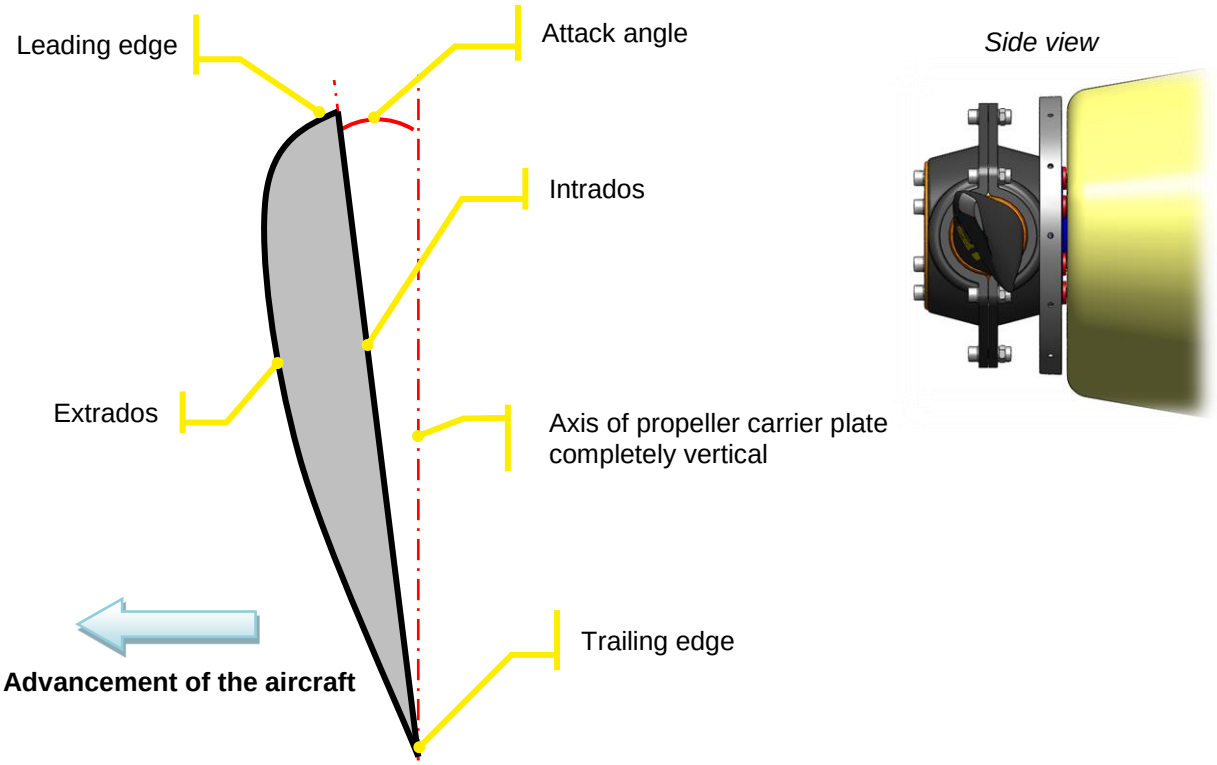
Lycoming O-320-A2A engine prop-shaft, type SAE 2



Lycoming O-360-A3A engine prop-shaft, type SAE 2



11.2. Airfoil



11.3. Moment of inertia of the FLASH propeller

Type of propeller	Diameter (mm)	Inertia (kg.cm²)
Three-blade Inconel FLASH Left & Right	1620	3457
	1660	3586
	1700	3722
	1730	3817
	1750	3882
	1850	4211
	1900	4375

11.4. Operating limitation of the FLASH propeller

Designation	Maximum engine power	Maximum rotational speed
Two-blade Inconel FLASH propeller, Right & Left	140 hp	3400 rpm
Two-blade Inconel FLASH-R propeller, Right & Left	160 hp	3000 rpm
Three-blade Inconel FLASH propeller, Right & Left	160 hp	3400 rpm
Three-blade Inconel FLASH-R propeller, Right & Left	215 hp	3000 rpm
Three-blade Inconel FLASH-2 propeller, Left	160 hp	3400 rpm

11.5. Identification marking of the propeller

11.5.1. 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 Left blade (All version)	FLASH Right blade (All version)	Half-hub (2 and 3-blade)
		

11.5.2. Propeller label (for LSA certified version)

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

1st line: Part number of the propeller model

- Two-blade (2) or Three-blade (3)
- 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

Here is an example for each versions of the FLASH propeller possible:

Propeller version	Label
Two-blade Inconel FLASH propeller, Right	
Two-blade Inconel FLASH propeller, Left	
Two-blade Inconel FLASH-R propeller, Right	
Two-blade Inconel FLASH-R propeller, Left	
Three-blade Inconel FLASH-2 propeller, Left	

Propeller version	Label
Three-blade Inconel FLASH propeller, Right	
Three-blade Inconel FLASH propeller, Left	
Three-blade Inconel FLASH-R propeller, Right	
Three-blade Inconel FLASH-R propeller, Left	

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

The centrifugal force undergoes by the FLASH blade was calculated for the most soliciting configuration, i.e. engine Rotax 912 (80hp).

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

ENGINE				PROPELLER					CENTRIFUGAL FORCE	
Type	RPM_{max} (rpm)	Red.	RPM_{Red} (rpm)	$Ø_{hélice}$ (mm)	G_{pale} (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**

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 tip blade of the propeller (m/s)

M : Weight of the blade (kg)

11.7. Centrifugal force test under EASA CS-P350 specification

Standard reference:
EASA Certification Specifications for Propeller CS-P

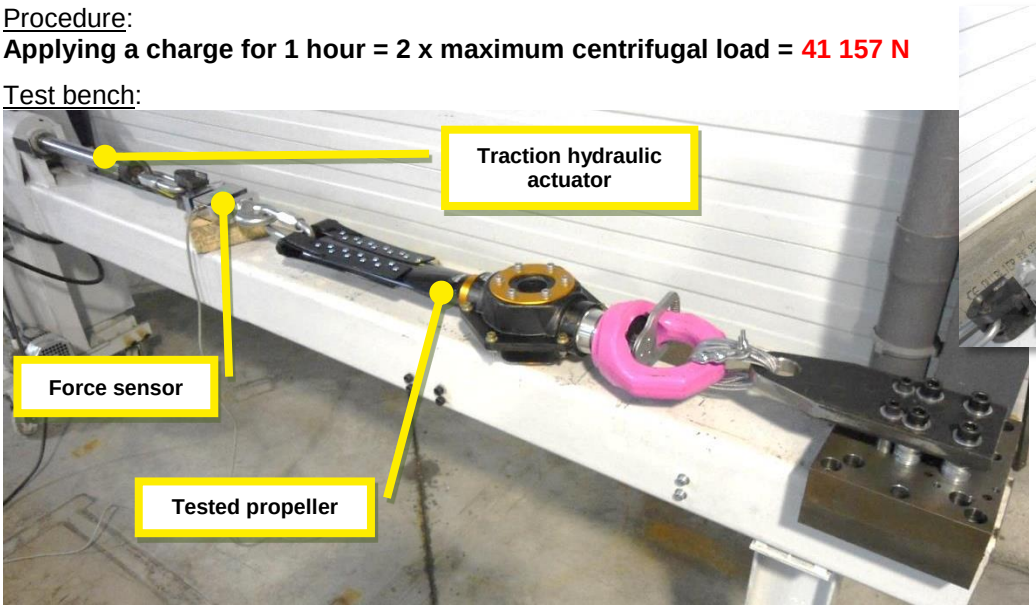
Test method:
The test of centrifugal force propeller is defined by the certification specification of propeller CS-P 350. Its objective is to demonstrate its compliance with the certification specification of propeller (CS-P) defined by the European Aviation Safety Agency (EASA). After the test, the 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.

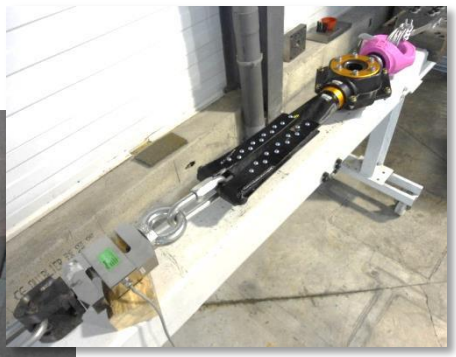
Objective:
This test is conducted with the Inconel FLASH propeller, Ø1730mm which is representative of its mounting on the engine Rotax 912 (80hp). This engine is the most penalizing for the propeller due to its rotation speed.
Thus, the test is used to validate all configurations below that selected. 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:
Two-blade Inconel FLASH propeller Ref. 01-19-001 P/N: H-FSH_2-D-I S/N: 003

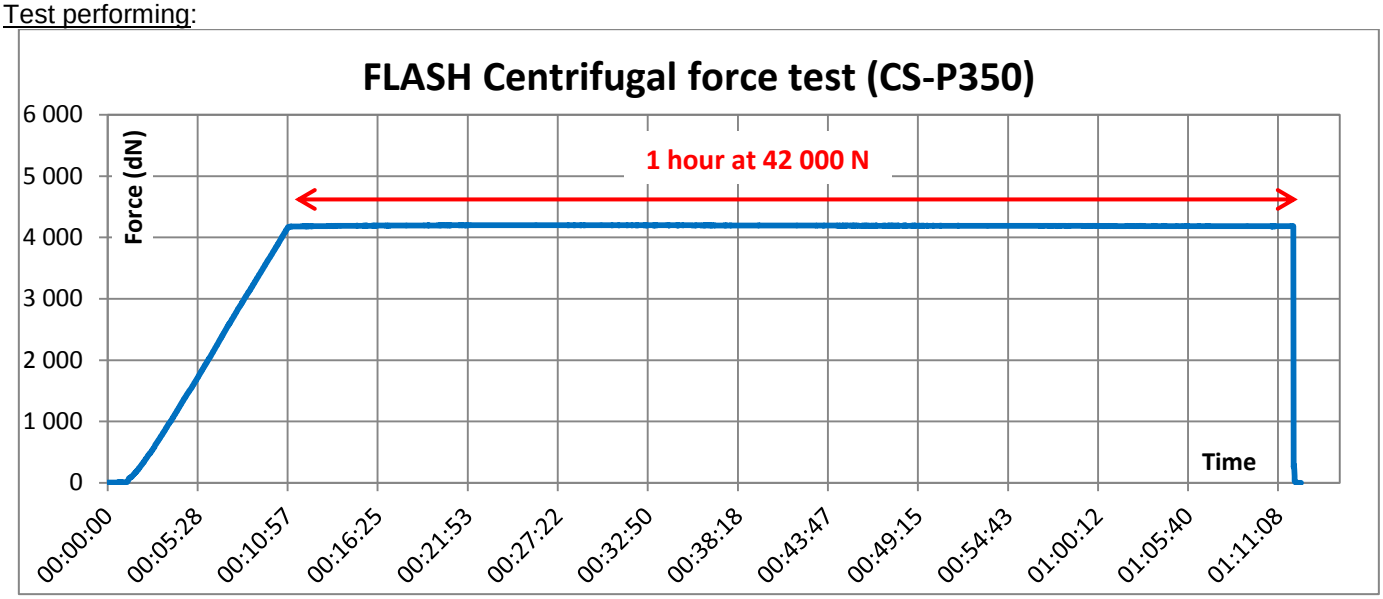
Procedure:
Applying a charge for 1 hour = 2 x maximum centrifugal load = 41 157 N

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 soliciting) of ROTAX 912 engine, soliciting the blade in a centrifugal force of 20 578 N.

11.8. Breaking test of the two-blade Inconel FLASH propeller

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

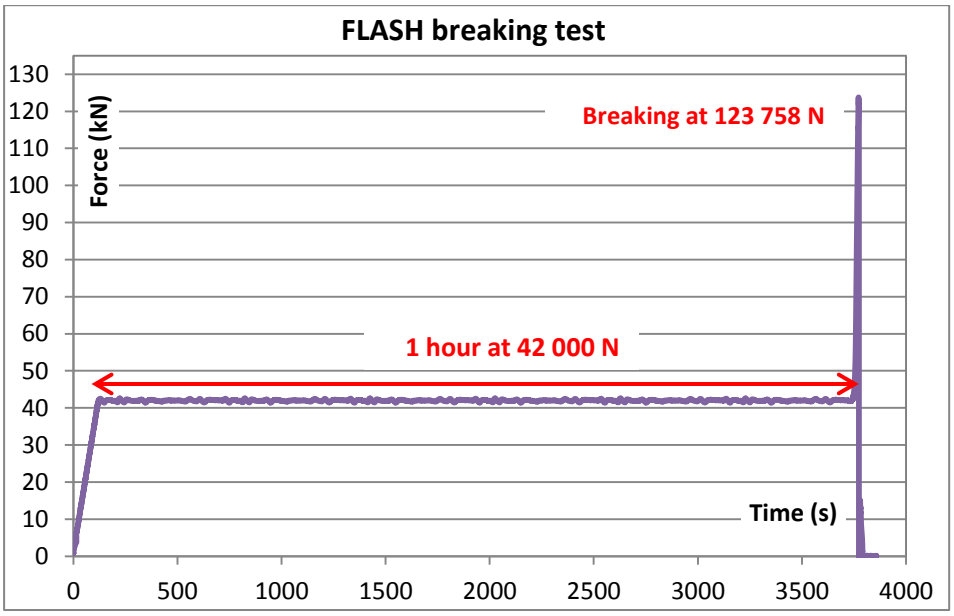
Purpose of the test:
Tensile test to rupture

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

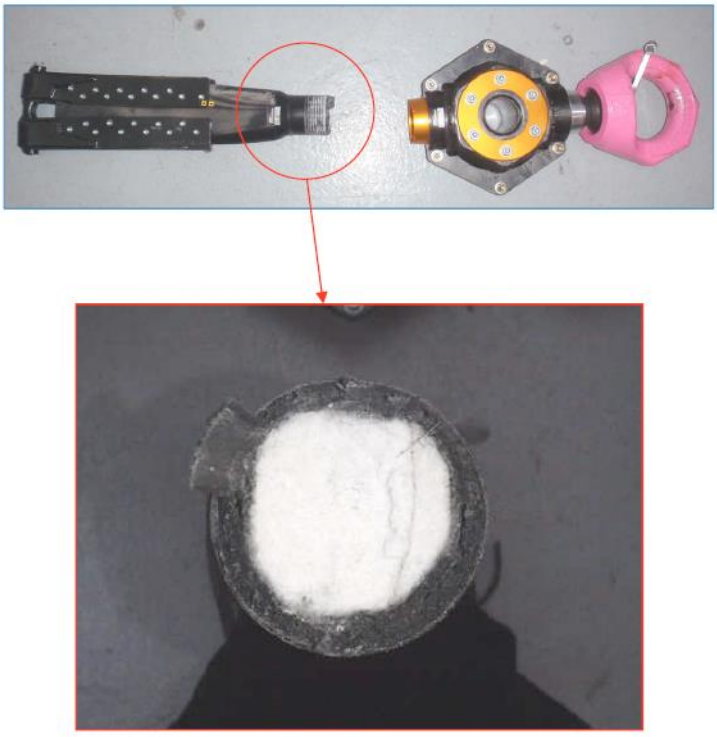
Testing method:
The tested propeller is placed between the fixed part and the movable part of the lab bench traction. Applying of the following sequence:

- Progressive increase of the load of 42 000 N in 120s (350N/s)
- Hold 42 000 N during 60 minutes
- Progressive increase of load to reach the break

Results:
At the end of the level at 42 000 N, no defect was found. The test was continued until failure.
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 **11.6 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 6.

11.9. Declaration of conformance of the FLASH propellers

11.9.1. Design and Construction

The propellers FLASH were designed to be adapted to the applications described in section 0. Every design 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 FLASH propeller conforms to withstand the stresses of operation on all its lifetime. Refer to the centrifugal force test (section 11.6 & 11.7), breaking test (section 11.8) and next section **11.9.2. Tests and Inspections**.

11.9.2. 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 **11.7. 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 two 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 FLASH propeller conforms to endurance test of each application exposed in section 0.

Teardown Inspection:
After completion of each test described above, the tested FLASH 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.

11.9.3. Design Control

The FLASH propeller 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 FLASH 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.

11.9.4. Quality Assurance

DUC Hélices Company is ISO 9001:2008 certified for its management of the quality system, which ensures manufactured propellers maintain conformity to the established design. Refer to page 2.

11.9.5. Certification of Conformity for ASTM F2506-10

"ASTM F2506-10 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 F2506-10 standard and after verification, it responds every requirement."

Mr. Vincent Duqueine
Manager
5/03/2013

DUC Hélices
Chemin de la Viaccne 69210 LENTILLY
Tél. 04 74 72 12 69
Fax 04 74 72 10 01
SIRET 413 269 887 00027

Chemin de la Madone - 69210 LENTILLY - FRANCE
Tél. : + 33 (0)4 74 72 12 69 - Fax : +33 (0)4 74 72 10 01
E-mail : contact@duc-helices.com - www.duc-helices.com
S.A.V. : service.technique@duc-helices.com

Entreprise certifiée
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