

RESISTANCE – INCONEL SWIRL' S BLADE

CALCULATIONS AND RESULTS OF TRIALS

CHARACTERISTICS OF THE INCONEL SWIRL'S BLADE : (see appendix 1)

INCONEL SWIRL'S BLADE FOR ROTAX ENGINE	
Length of the INCONEL SWIRL's blade (mm)	835 mm
Weight of the INCONEL SWIRL's blade (kg)	0.822 kg
Position of the center of gravity – cote AB (mm)	238 mm
Radius of the center of gravity (mm)	275 mm (238 + 37)
INCONEL SWIRL'S BLADE FOR JABIRU ENGINE	
Length of the INCONEL SWIRL's blade (mm)	772 mm
Weight of the INCONEL SWIRL's blade (kg)	0.821 kg
Position of the center of gravity – cote AB (mm)	224 mm
Radius of the center of gravity (mm)	261 mm (224+37)

TYPE OF ENGINE :

The studies were carried out on 3 types of 4 times engines and on one type of 2 times engine.

4 times engines :

- § ROTAX 912 with rotation / reducer 2.27,
- § ROTAX 912S with rotation / reducer 2.48,
- § JABIRU without reducer.

2 times engines :

- § ROTAX 582 with rotation / reducer B 2.58,
- § ROTAX 582 with rotation / reducer C 2.62,
- § ROTAX 582 with rotation / reducer C 3,
- § ROTAX 582 with rotation / reducer C 3.47,
- § ROTAX 582 with rotation / reducer C 4.

CALCULATION OF THE CENTRIFUGAL FORCE :

We applied the following formula :

$$F \text{ (N)} = \frac{M \text{ (kg)} \times V^2 \text{ (m/s)}}{R \text{ (m)}}$$

- F : centrifugal force (N),
- M : blade 's weight (Kg),
- V : linear speed (m/s),
- R : Radius of the center of gravity (m).

STATIC PULLING :

The static pulling with the blade in the axis uses the same device as the offset tests with 32° (picture 1-2).

§ Static pulling with the blade in the axis :	Delamination at 52000 N
§ Estimate of the static pulling with the blade in the axis :	Calculated break point at 90000 N

It was impossible to obtain a complete rupture of the blade because of the tears around the attaching bolts of the system of traction.

To estimate a value of rupture in the axis, we exerted an excentric static traction of 32°. The rupture occurred on the level of the shoulder of blade's foot. We can consider that the rupture of the blade in the axis represents approximately the double of the rupture's value with 32° because with this position, only half of the blade's foot is in contact with the assembly.

The two tests with 32° were also carried out to observe the behavior of the blade subjected to combined pulling. These statements do not show to in no case reality being given that the centrifugal force is inevitably in the axis.

§ Static pulling with the blade with 32° of the axis :	Break point at 45000 N
§ Static pulling with the blade assembled in the hub with 32° of the axis : :	Break point at 45000 N

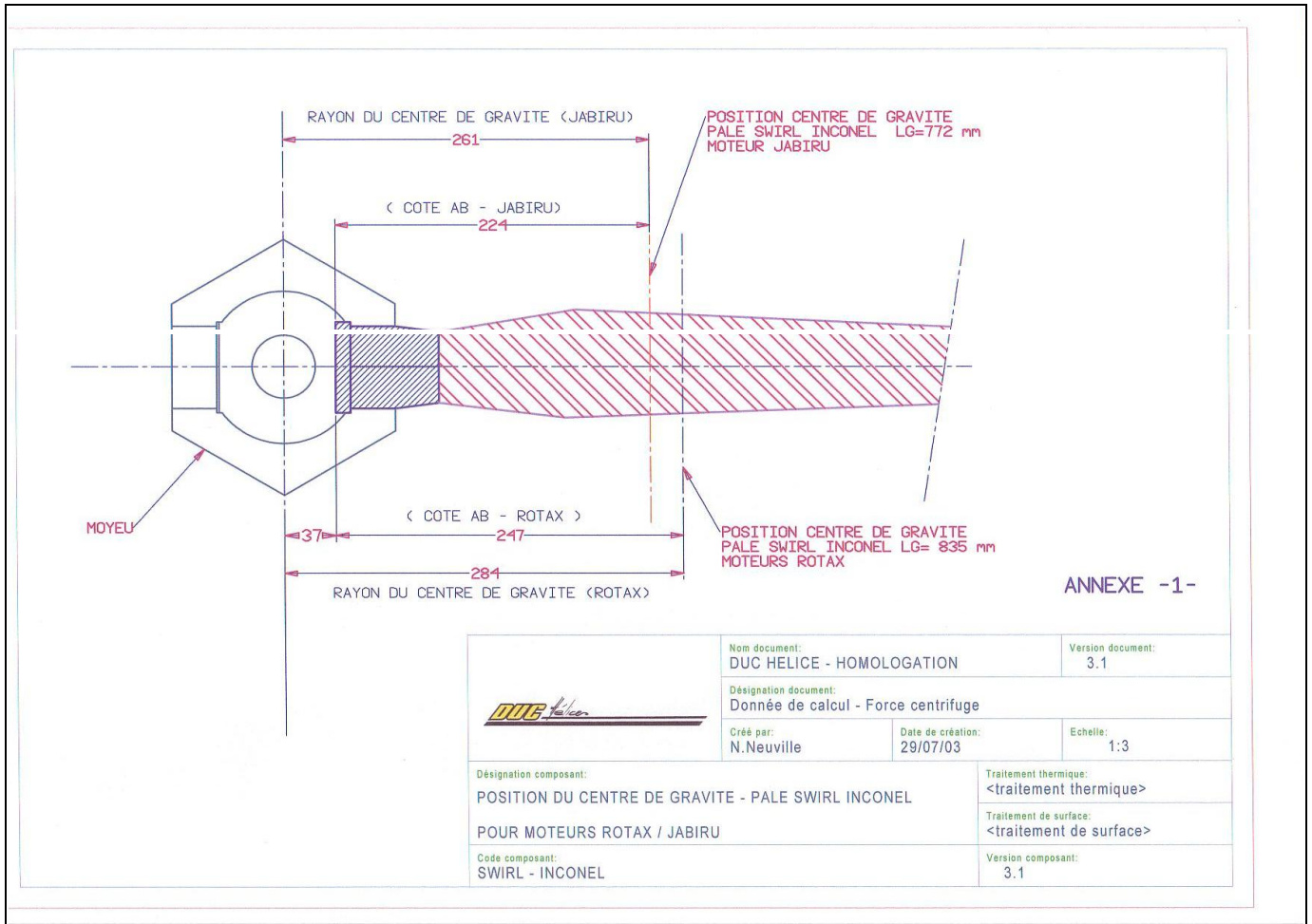


Picture -1.



Picture - 2

- blade with 32° of the axis -



STD SWIRL'S BLADE - CALCULATION OF THE CENTRIFUGAL FORCE ACCORDING TO THE ENGINE'S TYPE

Type Engine	Max. speed (Tr/min)	Speed with factor of increase 1,5 (Tr/min)	Reducer	Speed after Reducer (Tr/min)	Radius of the Gravity center	Linear speed (m/s)	Blade weight (kg)	Centrifugal force (N)
4 TIMES ENGINES								
ROTAX 912	6000	9000	2,27	3965	284	117,9	0,825	40348
ROTAX 912S	6000	9000	2,48	3629	284	107,9	0,825	33804
JABIRU	3300	4950	1	4950	261	135,2	0,821	57519
2 TIMES ENGINES								
ROTAX 582	6800	10200	2,58	3953	284	117,5	0,825	40119
ROTAX 582	6800	10200	2,62	3893	284	115,7	0,825	38903
ROTAX 582	6800	10200	3	3400	284	101,1	0,825	29672
ROTAX 582	6800	10200	3,47	2939	284	87,4	0,825	22178
ROTAX 582	6800	10200	4	2550	284	75,8	0,825	16691