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RESISTANCE – DUC FC Windspoon blade

CALCULATIONS AND RESULTS OF TRIALS

DUC FC BLADE CHARACTERISTICS: (See ANNEXE-1)

PALE FC blade	
Length of the DUC FC blade	835 mm
Weight of the DUC FC blade (kg)	0.735 kg
Position of the gravity center – cote AB (mm)	254 mm
Radius of the gravity center (mm)	291 mm (254 + 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,

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.

CACULATION OF THE CENTRIFUGAL FORCE :

We applied the following formula :

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

- 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

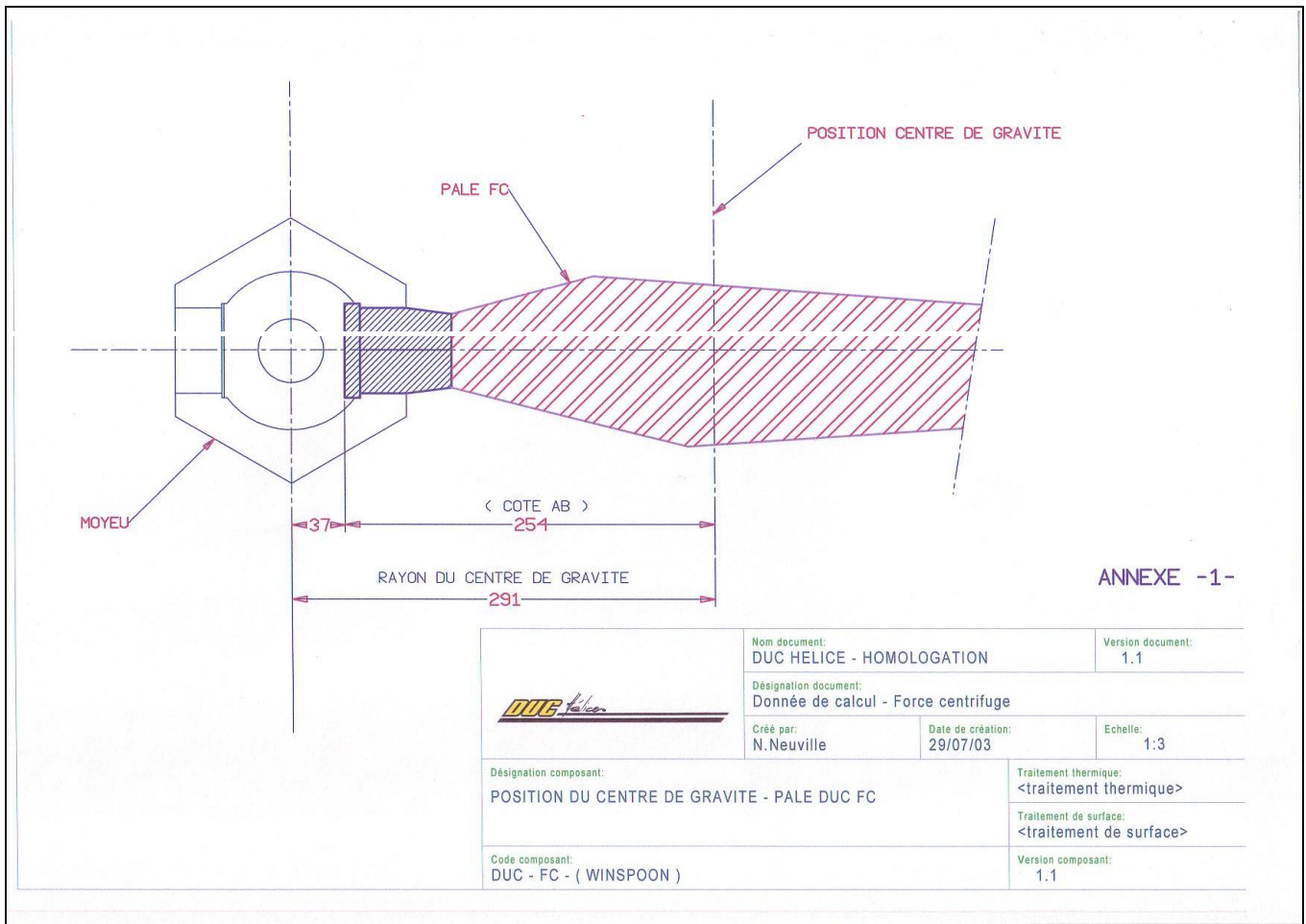


Picture -1.



Picture -2

- blade with 32° of the axis -



DUC FC BLADE- CALCULATION OF THE CENTRIFUGAL FORCE ACCORDING TO THE ENGINE TYPE

Type of engine	Max. speed (Tr/min)	Speed with factor of increase 1,5 (Tr/min)	Reducer	speed after the reducer (Tr/min)	Radius of the gravity's center	linear speed (m/s)	Blade's weight (kg)	Centrifugal force (N)
4 TIMES ENGINE								
ROTAX 912	6000	9000	2,27	3965	291	120,8	0,735	36832
ROTAX 912S	6000	9000	2,48	3629	291	110,5	0,735	30859
2 TIMES ENGINE								
ROTAX 582	6800	10200	2,58	3953	291	120,4	0,735	36623
ROTAX 582	6800	10200	2,62	3893	291	118,6	0,735	35514
ROTAX 582	6800	10200	3	3400	291	103,6	0,735	27087
ROTAX 582	6800	10200	3,47	2939	291	89,5	0,735	20246
ROTAX 582	6800	10200	4	2550	291	77,7	0,735	15236