

Technical document

Starter/Generator bearings examination

Final report

Accident on **17/01/2016**
in **Hanalei (Hawaii)**
to the **Rotorcraft EUROCOPTER - EC130**
registered **N11VQ**
operated by **Blue Hawaiian Helicopters**

Foreword

This document and the photographs and technical information contained herein are subject to the laws relating to communication and confidentiality embodied in European Regulation 996 of 20 October 2010.

The conclusions of this document are based on the work undertaken by the BEA (Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile). They should not be used to prejudge the final conclusions of the safety investigation.

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1 - EQUIPEMENT EXAMINED

	Starter/Generator 
Manufacturer	Thalès
Part number	524-031
Serial number	5493

The objective of the examination is to perform dimensional controls of bearing and front support bearing

Date of examination : September 22, 2016
Attendees: David BECOUR (BEA)

[REDACTED]

EQUIPMENT Description



Fig. 1 - Front support bearing



Fig. 2 - Bearing

Below are the blueprints of the two pieces:

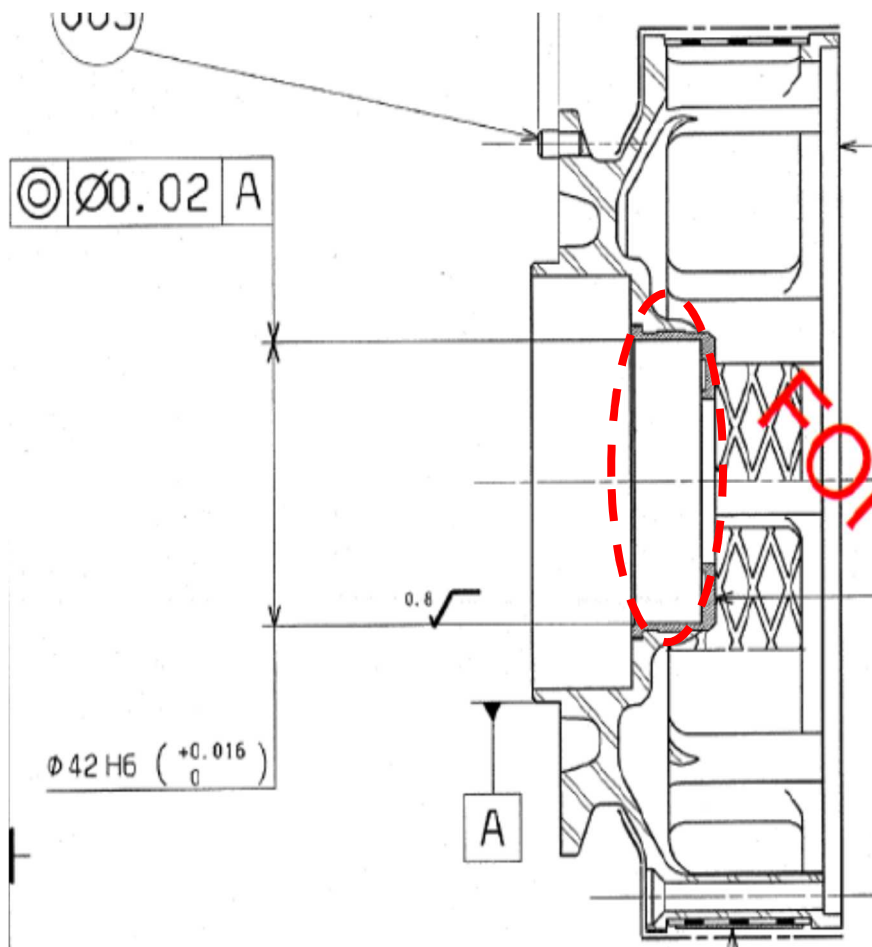


Fig. 3 – Diagram of the front support bearing

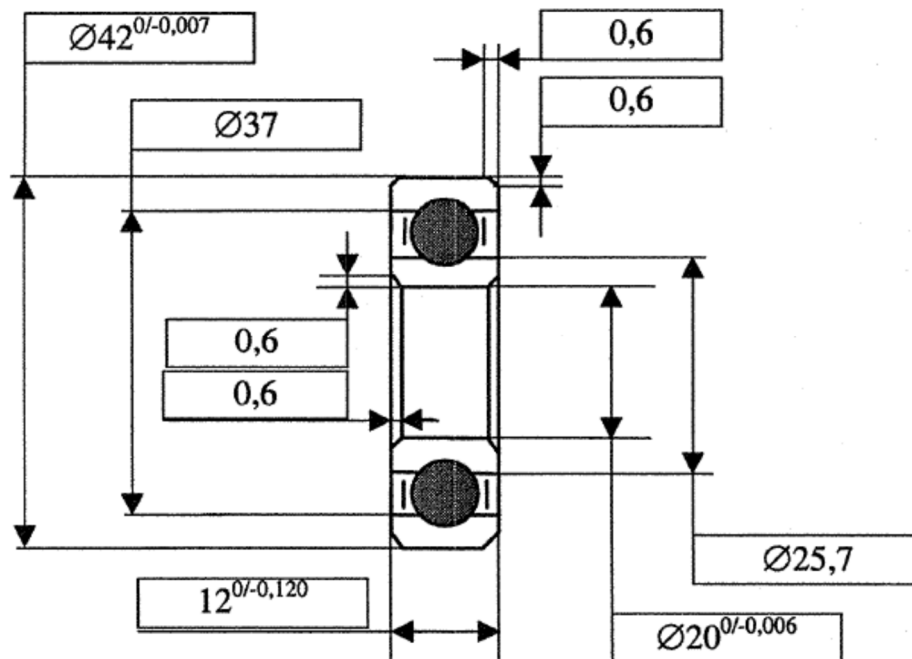


Fig. 4 – Diagram of the bearing

2 - MEANS

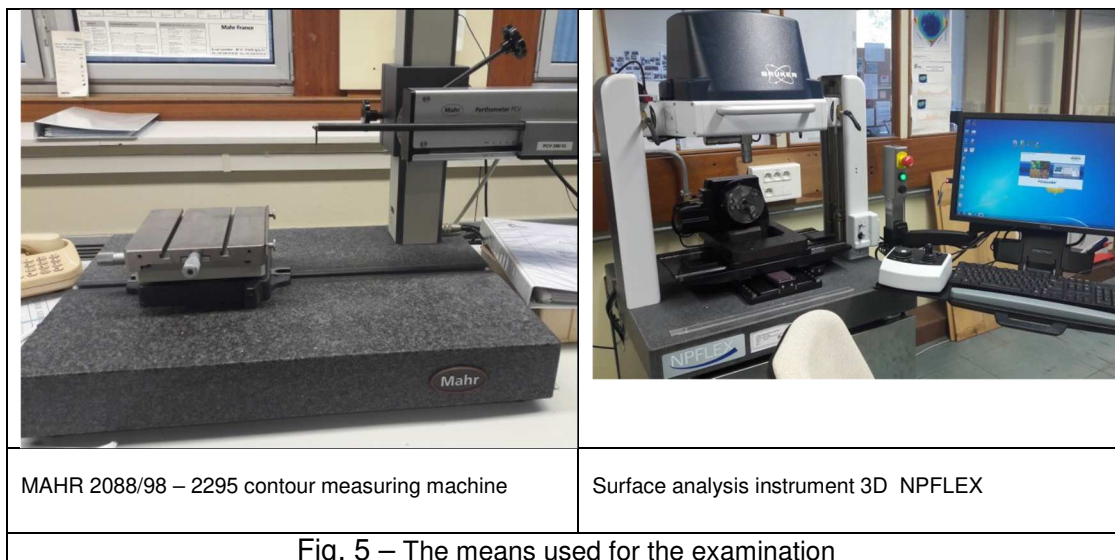
To perform the different measurements, the following tools were used:



Coordinate measuring machine Leitz PMM



Roundness measuring instrument TAYLOR HOBSON

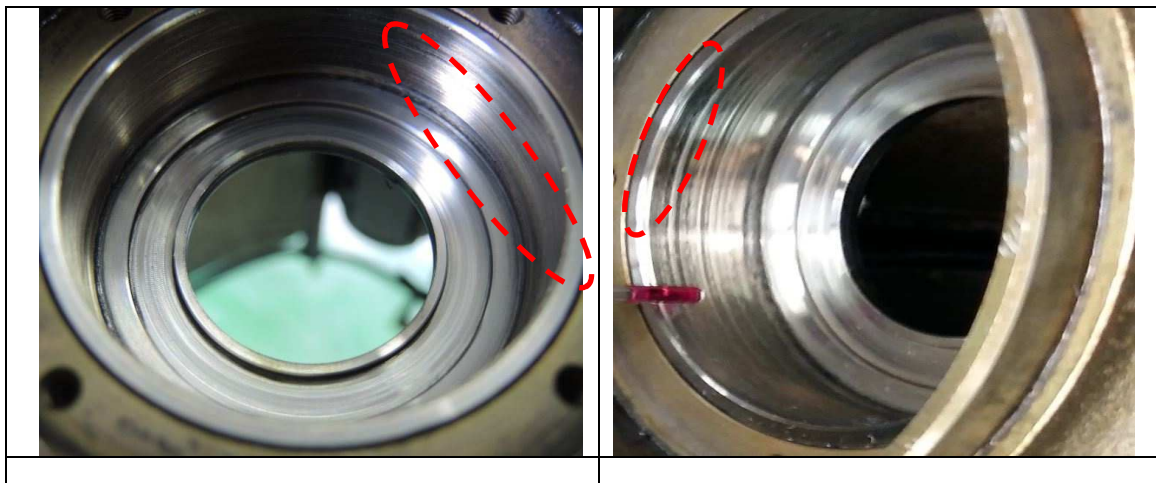


For correctly perform dimensional controls of bearing and front support bearing, the use of these 4 machines was mandatory.

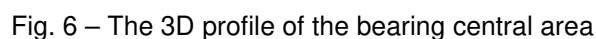
4 - WORKS PERFORMED

4.1 Front bearing support

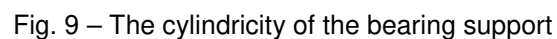
Visually, we observed a lack of material on the central area of the bearing support and on the two rounded ends (of the bearing support. Deposits of dust and metal were also visible.



The first action was to measure the profile of the bearing support.
The 3D profile of the support on central area (length 8mm) is available below.



The total cylindricity of the bearing support can be seen below



The important cylindricity on the full length of the support confirms the heavy wear.

The vertical 2D profile of the support can be seen below:

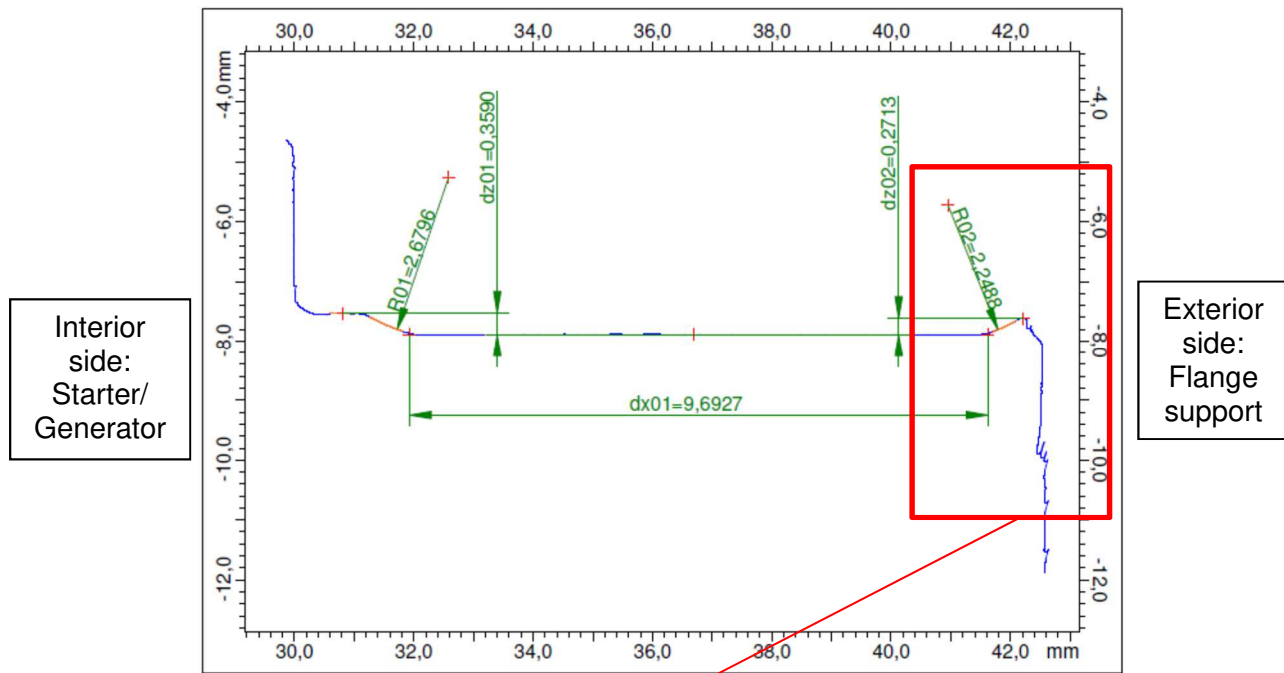


Fig. 10 – Vertical 2D profile of the support

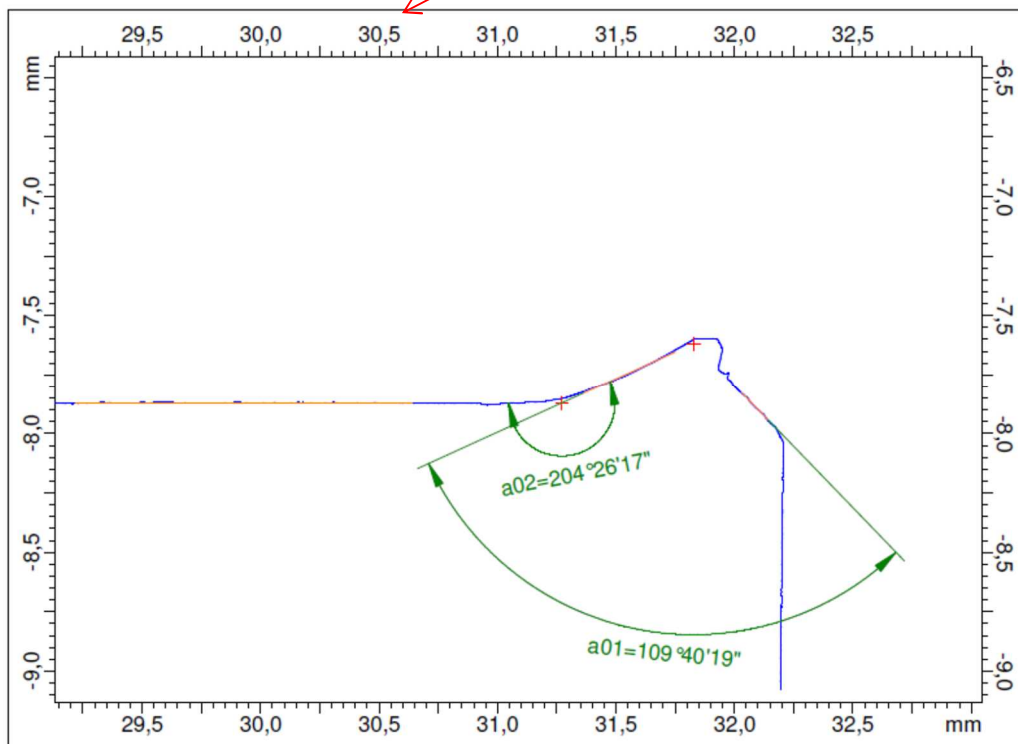


Fig. 11 - Zoom on the vertical 2D profile of the support

Finally we measured several sections compare the diameters.

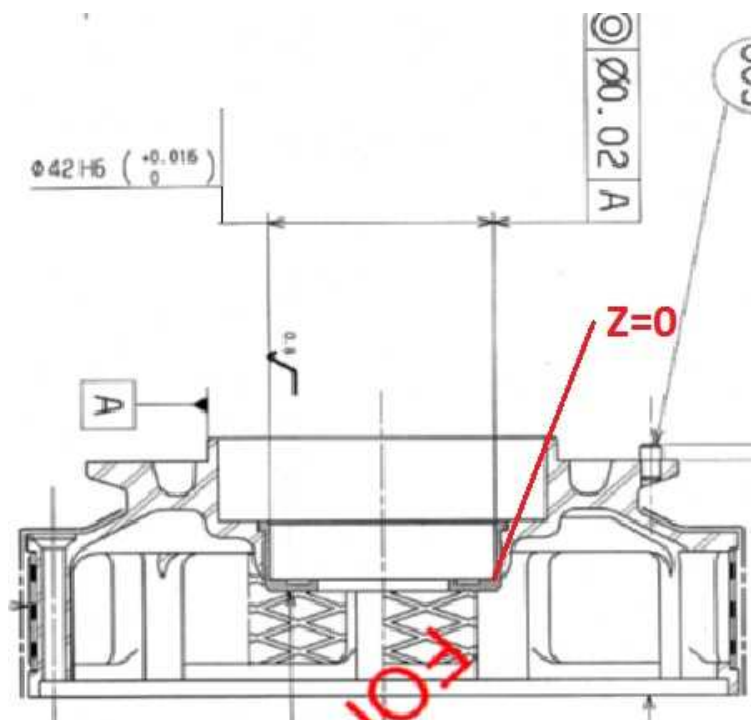


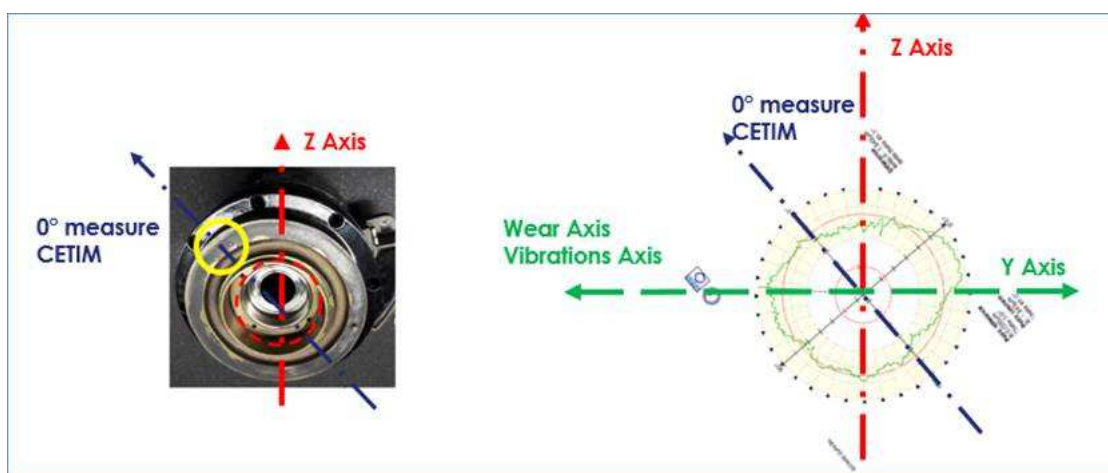
Fig. 12 – Diagram of the bearing support

The origin ($Z=0$) of these measurements is spot facing the bottom of the support.

Section (mm)	$\varnothing 42H6 (+0.016,-0)$
$Z=1.36$	42.008
$Z=1.41$	42.029
$Z=2.30$	42.636
$Z=3.30$	42.644
$Z=4.30$	42.652
$Z=5.30$	42.657
$Z=6.30$	42.675
$Z=7.30$	42.680
$Z=16.41$	42.211

Fig. 13 – Several measurements of the bearing support

Representation of the bearing support in the Y-Z helicopter reference.



4.2 Bearing

Dimensional measurements were performed to check the diameter in several positions.

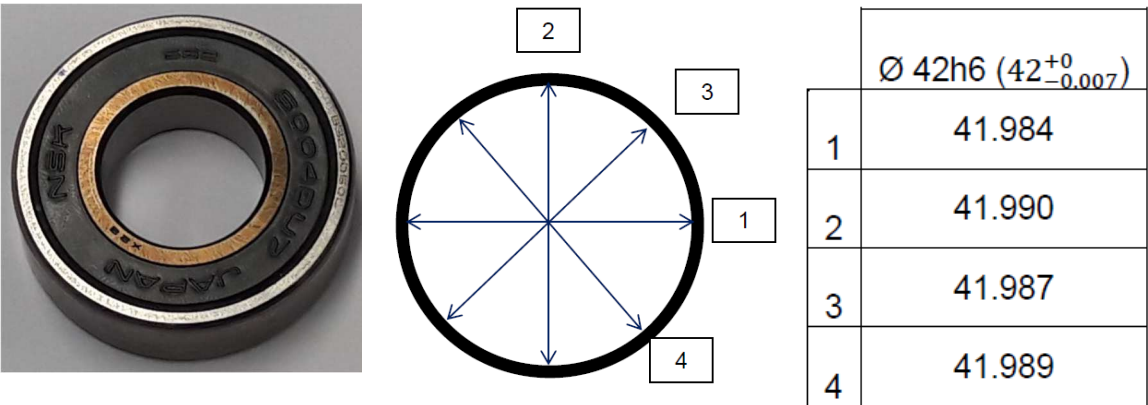


Fig. 14 – Dimensional measurements (in mm) of bearing support

Note: the contact points of the micrometer gauge are on the centrum of bearing track.

The 2D profile measurement of the bearing exterior ring is available below:

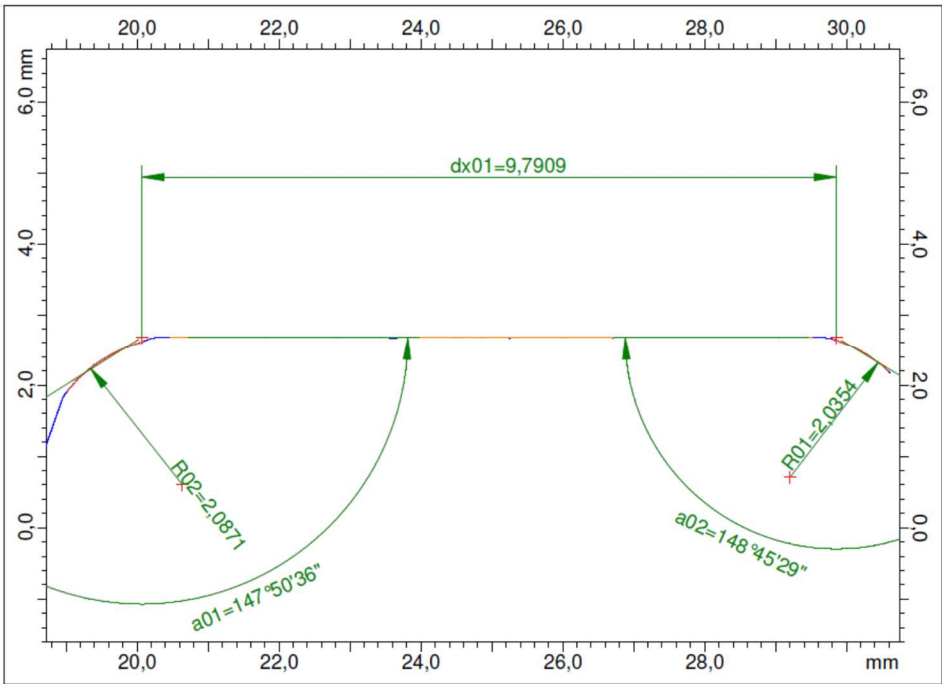


Fig. 14 – 2D profile of the bearing exterior ring

The 2D profile of the bearing external ring and the bearing support have a similarity. The specified chamfers, on the diagram, are physically the soft curve transition with an equal radius on the bearing and the bearing support.

5- MEASUREMENTS UNCERTAINTY

- U = 15% for surface state measurements
- U = 0.01 mm for diameter and 2D profiles measurements
- U = 0.05 mm for cylindricity

6- CONCLUSION

We observed a pronounced wear of the bearing support, with a difference around 0.650 with a maximum of 0.680 mm between a local diameter and the nominal diameter.

Despite a relatively correct visual aspect of the bearing, this one presents an external diameter much less altered than the bearing support.

The profiles of the bearing and the bearing support have similar dimensions.



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