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AB 792

CONSTRUCTION AND MATERIALS RESEARCH LABORATORY SECTION

CONSTRUCTION TESTING LABORATORY
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RESEARCH REPORT

Durability static test of a NACA 8H12 gyrocopter rotor blade part made of carbon composite

Report No: LM1/RPT/Gyrotech/04/18 **Number of pages:** 11

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Warsaw, July 2018

	Durability tests of a composite gyrocopter blade part type GT/CB/8H12/OR	*Report no* ***LM1/RPT/Gyrotech/04/18*** ISSUE: I

SUBJECT OF TESTING: static durability

RESEARCH FACILITY: a blade fragment made of composite carbon, Ident. GT/CB/8H12/OR

TYPE OF WORK: testing

PRINCIPAL: Ilot - CKTP / Gyro-Tech sp. z o.o.

REPORT CONTAINS: 11 pages

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SYMBOLS OF WORK RELATED: See page 11

KEYWORDS: gyrocopter, blade, composite, static tests, durability

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SUMMARY

The report contains description implementation, progress and results of tests of a gyrocopter blade fragment made of carbon composite.

Prepared by	Date	Verified by	Date	
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Distribution:

Copy 1 – Gyro-Tech sp. z o.o.

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1. Introduction

The tests were perform within the Intelligent Developmen Operational Programme. Project no. **POIR.01.01.01-00-0827/15-00** entitled 'INNOVATIVE COMPOSITE ROTORS FOR ULTRALIGHT HELICOPTERS'.

2. Object of research

The object of the research was part of a gyrocopter blade type **GT/CB/8H12/OR** made of composite carbon – pic. 1. Parts introducing loads were designed and manufactured by the Principal.

Pic. 1. Blade type GT/CB/8H12/OR

3. Purpose of research

The aim of the study was to determine the static durability of the blade fragment and to provide a set of measurement data for further durability analyses.

4. Basis of the study

- Testing procedure JPB.03 / LM1 [1]

5. Testing station

The tests were carried out on the AVIATA durability frame equipped with suitable facilities, allowing adding required loads to the tested element.

6. Measuring and testing facilities, uncertainty measurement

The load in the test was carried out by using electro-hydraulic cylinder which is part of the AVIATA durability frame along with a controller in the following completion:
- Hydraulic cylinder R-580-150
- MTS 407/01 Controller S / N M402246L

The force, displacement and deformation were recorded by using a measuring system "System 5000" from Vishay MicroMeasurement equipped with appropriate analog-digital cards.

Calibration of measuring channels contain protocols [2], [3], [4].

Force measurement

For measurement and control used was a force transducer 1232-450kN / 01 with amplifier MTS 407.12 DC Conditioner S / N 1467366F (part of the controler MTS 407).

Determination of measuring point	Converter	Range	Amplifier	System 5000 Card	Card Channel	Estimated measurement uncertainty *)
F	1232-450kN/01	450 kN	407.12 DC Conditioner 1467366F	HL5130/04	2	+/- 0.3 kN

**) Expanded uncertainty (with a confidence level of p = 95%)*

Displacement measurement

The resulting displacement of the cylinder piston loading of the AVIATA machine was measured by LVDT transducer integrally built in the cylinder.

Determination of measuring point	Converter	Range	Amplifier	System 5000 Card	Card Channel	Estimated measurement uncertainty *)
U	R-580-150	150 mm	407.14B AC Conditioner 0423852D	HL5130/04	1	+/- 0.4 mm

**) Expanded uncertainty (with a confidence level of p = 95%)*

7. Test course and results

Before carrying out the test, a representative of the Principal confirmed the compliance of the tested object with the documentation. The representative of the Principal was present during the tests. It was agreed with the Principal that the load will be proceeded with a fixed elongation speed: 2 mm / min. During execution of an attempt, measured were: the loading force and displacement of the cylinder piston.

The test was carried out on 20.07.2018 [5].

Pic. 2. Blade mounted on the testing station

The course of force against displacement is presented in the chart – Fig. 1, while the form of destruction is presented in Pic.3 and Pic.4.
The maximum recorded load (destructive power): **381.5 kN.**
Form of destruction: shear of bolts attaching the blade to the handle.

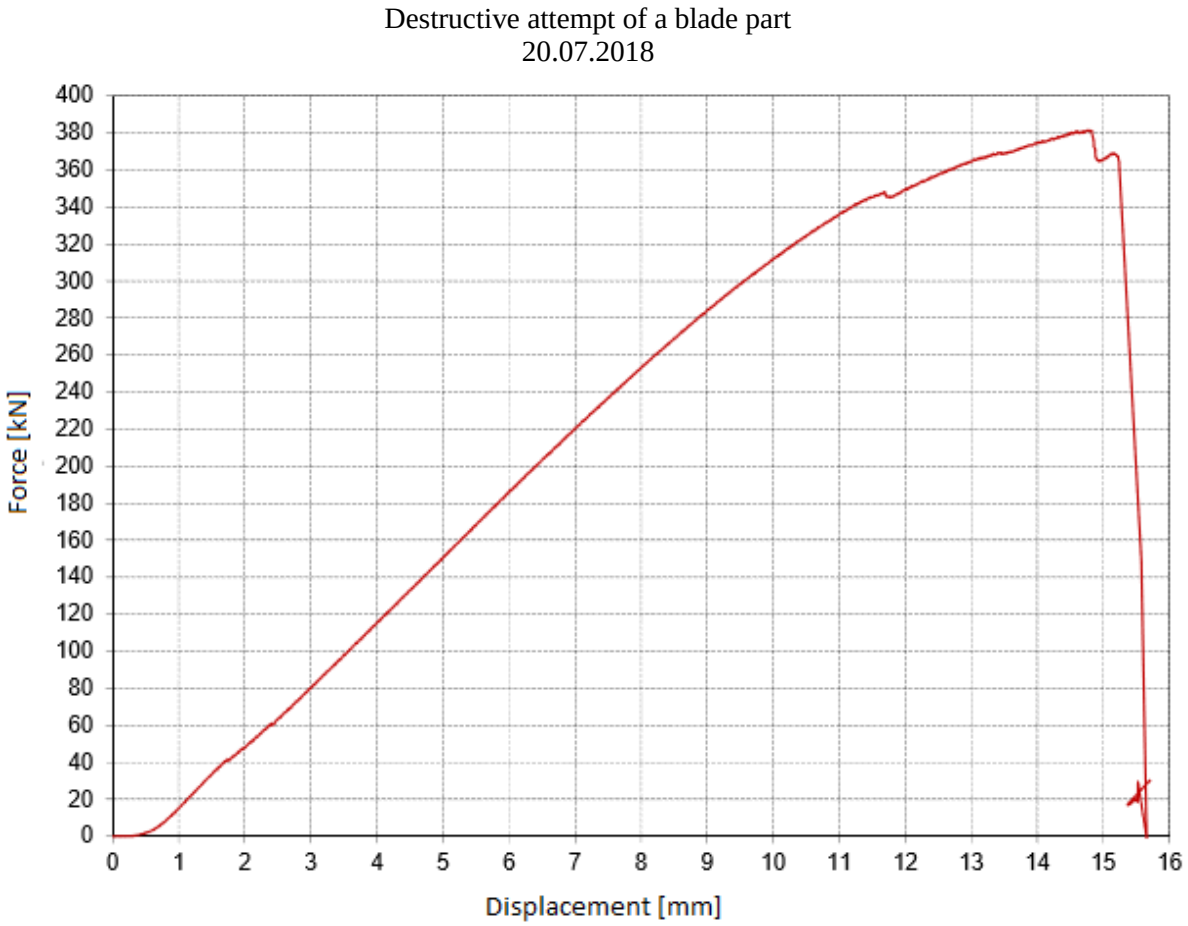

Fig. 1. The load course.

Pic. 3. Destroyed bolts connection of the blade with the handle

Pic. 4. Destroyed bolts connection of the blade with the handle (after disassembly)

8. References

[1] J. Wlazło, Static and quasi-static research on complete mechanical constructions, their assemblies or components or construction parts. Research Procedure No JPB.03 LM1issue 2; Ilot, Warsaw 18.10.2010

[2] Minutes of force measuring channel calibration: force transducer Interface, model 1232ACK-450kN-B amplifier 407.12 Conditioner DC controller MTS 407/01, GUM No. M3-M33.4180.246.2016.4700.1; Warsaw 06.12.2016

[3] Minutes of displacement track calibration of the AVIATA hydraulic machine cylinder, No. WPB / PRT / 03/19; Warsaw 10.05.2018

[4] Minutes of verification of measurement cards High Level Model 5130B System 5000 No WPB / PRT / 08/18; Warsaw 10.05.2018

[5] Research Work Card LM1/KPB/05/18

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