

A UNIVERSAL STAND FOR AIR GEAR TEST MADE IN RAPID PROTOTYPING PROCESS

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Summary

This paper presents a universal stand to diagnose air gear models made in the process of Rapid Prototyping (RP) at the production stage.

The stand is designed in an open system, powered by a three-phase electric motor with a power of 0.75 kW, whose speed is controlled by a single-phase inverter. The stand is equipped with two measuring shafts, connected directly to a recorder RMC that allow you to read values torque and rpm in real time. Between this measuring shafts installed a gear reducer to allow the exchange of tested pair of gears. Powder brake with variable speed control is installed on the output as a load. Responsible for data acquisition software is copyright RMC-M - Monitor, which allows you to preview the results of measurements and print them in a report.

Trials conducted on the universal test stand for air gears demonstrators give reproducible, stable work parameters and thus enable to obtain uninterrupted, accurate measurements.

Keywords: a diagnostic at the stage production, a universal stand, Rapid Prototyping (RP), air gears

UNIWERSALNE STANOWISKO DO BADAŃ PRZEKŁADNI LOTNICZYCH WYKONANYCH W PROCESIE RAPID PROTOTYPING

Streszczenie

W niniejszym artykule przedstawiono uniwersalne stanowisko do diagnostyki na etapie wytwarzania modeli przekładni lotniczych wykonanych w procesie Rapid Prototyping (RP).

Stanowisko zaprojektowane w układzie otwartym napędza trójfazowy silnik elektryczny o mocy 0,75kW, którego obroty regulowane są za pomocą jednofazowego falownika. Stanowisko wyposażono w dwa momentomierze, podłączone bezpośrednio do rejestratora RMC, które umożliwiają odczyt wartości momentu i obrotów w czasie rzeczywistym. Między momentomierzami zainstalowano przekładnię reduktora umożliwiającą wymianę badanej pary kół zębatach. Jako obciążenie zamontowano na wyjściu hamulec proszkowy z płynną regulacją obrotów. Za akwizycję danych odpowiedzialne jest autorskie oprogramowanie RMC-M – Monitor, które umożliwia podgląd wyników pomiarów i ich wydruk w formie raportu.

Próby prowadzone na uniwersalnym stanowisku do badań demonstratorów przekładni lotniczych pozwalają na uzyskanie powtarzalnych, stabilnych parametrów pracy i tym samym na otrzymanie niezakłóconych, dokładnych wyników pomiarów.

Słowa kluczowe: diagnostyka na etapie wytwarzania, uniwersalne stanowisko, Rapid Prototyping (RP), przekładnie lotnicze

1. INTRODUCTION

This paper presents a universal stand for testing gear air models made in the process of rapid prototyping (Rapid Prototyping). Used gears can be made on various types of 3D printing devices. We used for tests INSPIRE D290 printer [1]. A complete stand for testing aeronautical gears was designed and made for this purpose.

2. TEST STAND CONSTRUCTION

Figure 1 shows stand for testing air gear demonstrators made in the process of RP (Rapid Prototyping).

Figure 2 shows a schematic diagram of the test stand.

The stand is designed in an open system, powered by a three-phase motor with a power of 0.75 kW with variable speed inverter using single-phase 230VAC.



Figure 1 The test stand for testing air gears [1]

The inverter is mounted in the control box (Fig. 3.) located on the stand front panel.

Variable speed control is possible in full range. Software settings have "soft" engine start leveling false readings on the gearbox. Most elements are mounted on a T-shape table to allow adjustment of the stand to the gear. The load is transmitted by powder brake. Increasing the supply current results in increased load on the gearing.

MT type measuring shafts (Fig. 4) are mounted on both sides and the measurement data (time, speed) are recorded on RMC recorder (Fig. 5) in real time.

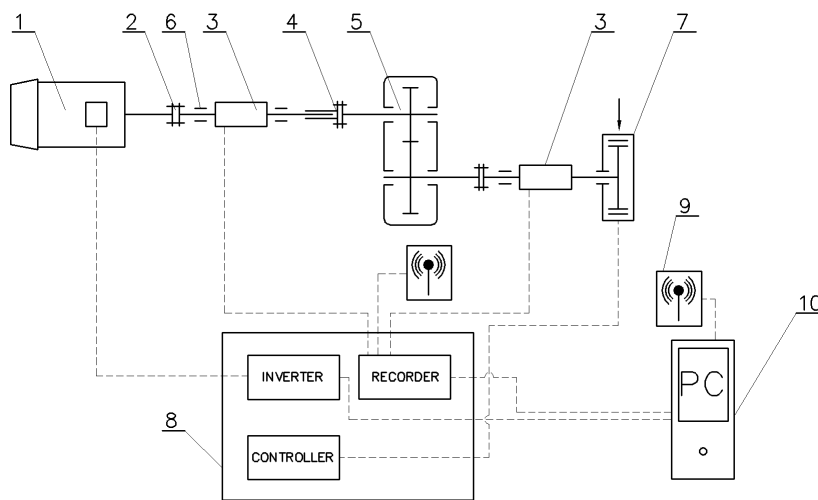


Figure 2. Schematic diagram of test stand: 1 - motor, 2-clutch, 3-measuring shaft, 4- releasable clutch, 5-tested gear unit, 6- bearing support, 7- powder brake, 8 - control box, 9 - Wi-Fi communication with the recorder, 10 – PC

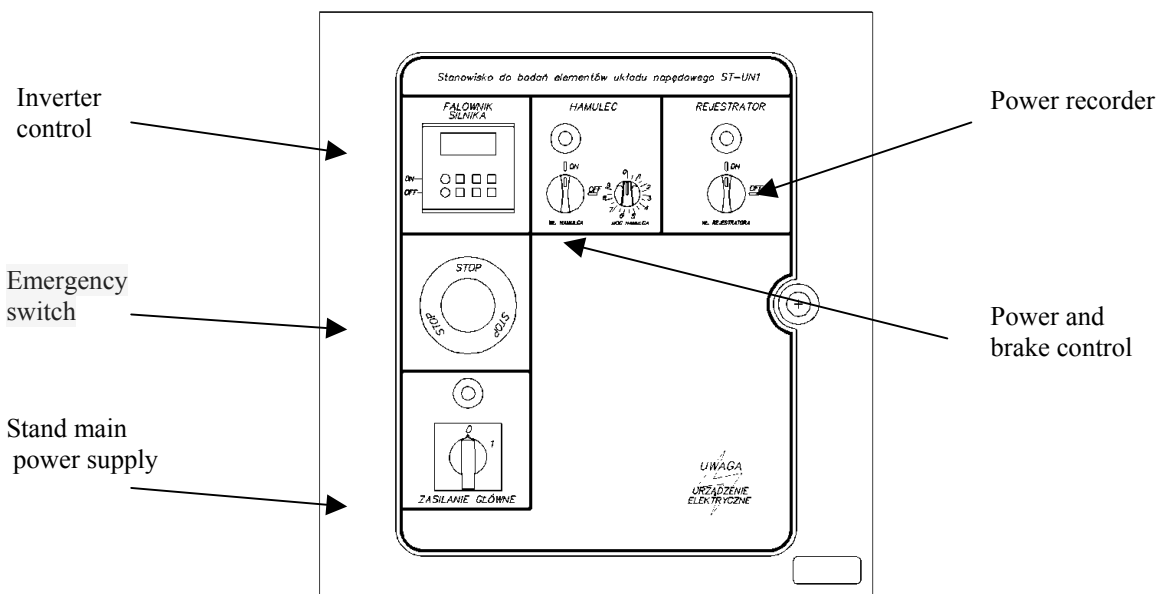


Figure 3. Distribution box ST-UN1



Figure 4. Measuring shaft- MT type

- The following functions are available here:
- viewing and drawing graphs of measured values in real time,
 - saving history of registration - a possibility of data processing in a spreadsheet,
 - playback of pre-recorded registration,
 - printing reports of registration in graphic and text format,
 - changing units and accuracy of displayed parameters,
 - digital filtering of measured quantities,
 - setting alarms for input.

Sample printouts in various modes are shown in Figure 7 and 8.



Figure 5. RMC recorder

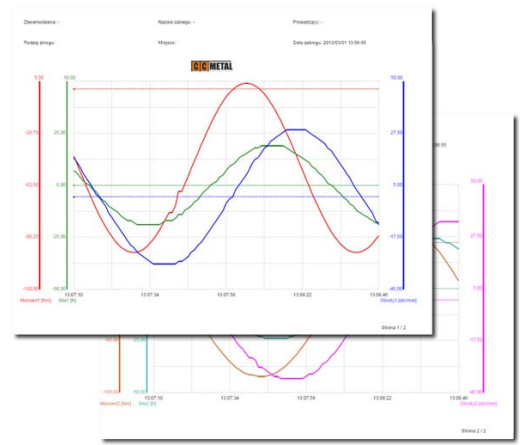


Figure 7. Printout of graphic report from RMC-M program

3. SOFTWARE AND DATA LOGGING

The data from the recorder can be stored on your PC and in the permanent memory of the recorder, giving the ability to work independently or under supervision of a PC. The recorder can fully cooperate with PC wirelessly via Wi-Fi protocol. Data is displayed on a color graphics display. A Copyright software RMC-M -Monitor (Figure 6) is responsible for data acquisition and allows you to preview the results of measurements and print them as a report.

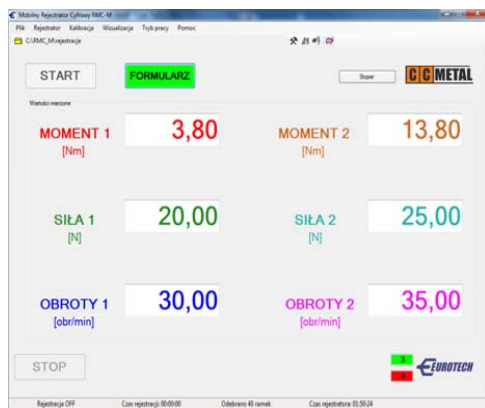


Figure 6. RMC-M main window

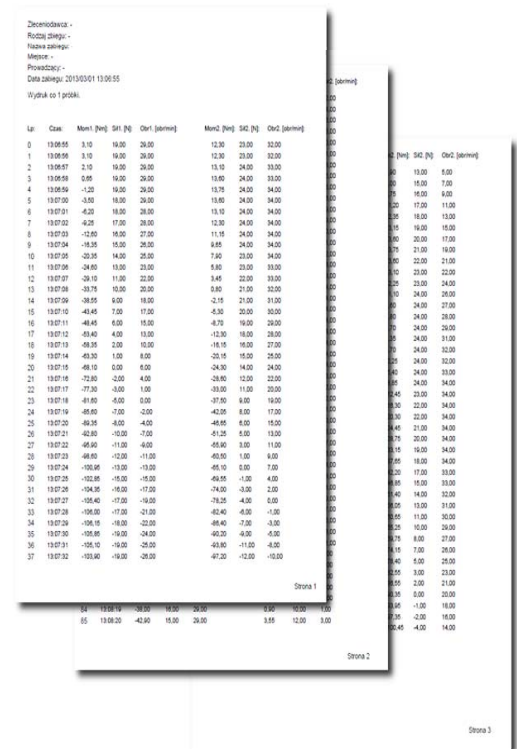


Figure 8. A text file printout in RMC-M

4. SUMMARY

Tests on the laboratory stand allow precise selection of parameters for aeronautical gear transmissions made in the process of rapid prototyping (RP). In the tested models, we can define the strength of designed gearing made of various types of composite materials and thus determine properties of the material. Research topics aeronautical gear and rapid prototyping methods is presented in a number of scientific studies [2 - 7]. Work in this area are intensively developed and the results implemented into specific technical solutions. The positive results of these diagnostic tests authorize the transition to the next phase of the production gear.

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Mariusz CIEPLAK, MSc, the owner of CC Metal company, cooperates with Department of Mechanical Engineering at Rzeszów University of Technology for rapid design and manufacture of machine parts. Engaged in constructing and building teaching posts for engineering applications. In the research work engaged in similarity model fabricated parts in Rapid Prototyping processes.