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THE USE EFFICIENCY OF TEXTILE MACHINES AND EQUIPMENT

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1.Introduction

Efficiency is a very important factor in the production process for the good functioning of the company. Each manufacturing company tries to efficiency was top notch, making it possible to compete with other companies. High impact on the effectiveness of the company have machines which by proper maintaining helping to improve the quality of the product [1]. Equipment quality is one of the basic conditions for the functioning of the production lines and directly affects the production capacity of the company. Machines, instruments, devices should have a repeatability and reproducibility cycle of operation. The right approach is important to the operation of machinery, and their running maintenance . Repair and maintenance service system of machinery and equipment is a component of the operating system of a company [4]. In order to improve the system it is necessary to analyze the current status and the conditions in which they are exploited in the machine during production. Analysis by having relevant data allows you to focus on strategies for optimization and process improvement in the operation of the maintenance and repair of machines and conclude further proposals in this regard [2].

The article assesses the functioning of the textile machines through the use of TPM factors. This work was largely devoted to the study of machines and devices for effectiveness, because they have a large impact on the quality of the product.

2. Subject of research

The subject of the study is to evaluate the effectiveness of textile machines in the company involved in the production of polypropylene fabrics. Study has been subjected to one of the basic machines working in the relevant section of the weaving mill. Rapier loom has been analyzed (rys. 1).



Fig. 1. Rapier Loom.

Rapier loom is a mechanical device for the production of fabrics which are made by joining together two perpendicular threads (weft). This thread is carried by two rapiers introduced into the inlet from the two sides of the fabric. One rapier is used for feeding the beginning of the weft threads to half the width of the fabric, and the other intercepts it and pass to the end of the width of the fabric.

The basic parameters of the analyzed machine are shown in Table 1.

Tab. 1. Technical parameters of the tested rapier loom.

Nominal width looms [mm]	1900
max. width threading [mm]	1810
min. width threading [mm]	1030
max. speed [obr./min.]	500
engine power [kW]	1,5

3.The evaluation of the operation of machines on the basis of factors TPM

The Total Productivity Management TPM is a program of preventive maintenance of machines in the factory. The main goal of TPM is minimized to zero any failures, defects, and other factors affecting the decrease in productivity of the manufacturing process and increasing the reliability of the machines. Implementation of the TPM enables you to: improve the degree of efficiency of machines, reduce downtime, increase awareness of employees and their commitment to work, extend the competences of employees, the share of operators in routines for handling machines, etc. Implementation of TPM allows effective use of existing resources [5].

The measure allows assessment of the efficient use of machinery in the machine park *OEE* (Overall Equipment Effectiveness), which is calculated from the formula:

$$OEE = WE \cdot WW \cdot WJ \cdot 100\% \quad (1)$$

where: *WE* – availability factor, *WW* – performance factor, *WJ* – quality factor.

The expected value of *OEE* is a min. 60%. *OEE* factor enables the assessment of the efficiency and functioning of the machines.

As part of the analysis the effectiveness of Rapier Loom were assessed. Tests were carried out for 31days of working. In Fig. 2 was presented a breakdown of plant availability time losses. The presented data show that the greatest loss of time generates the start-up of machinery – 58.3%, then there are other time loss – 19.9% and 19.2% retooling. The smallest percentage participation represent failures 11,2%.

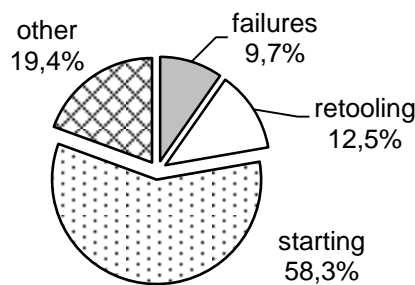


Fig. 2. The structure of machines availability.

In determining the *OEE* should consider three important components of the effectiveness of processes: machine availability, performance and quality. Accessibility is an indicator of the outages, which lead to the stopping of the production process for a given period of time. Productivity takes into account the losses due to the pace of work, where production takes place with less than the maximum rate. Quality calculates losses for the manufacture produce not satisfying expectations and quality standards [3]. Fig. 3

shows the distribution of values for the various factors determining the OEE for the analyzed machine.

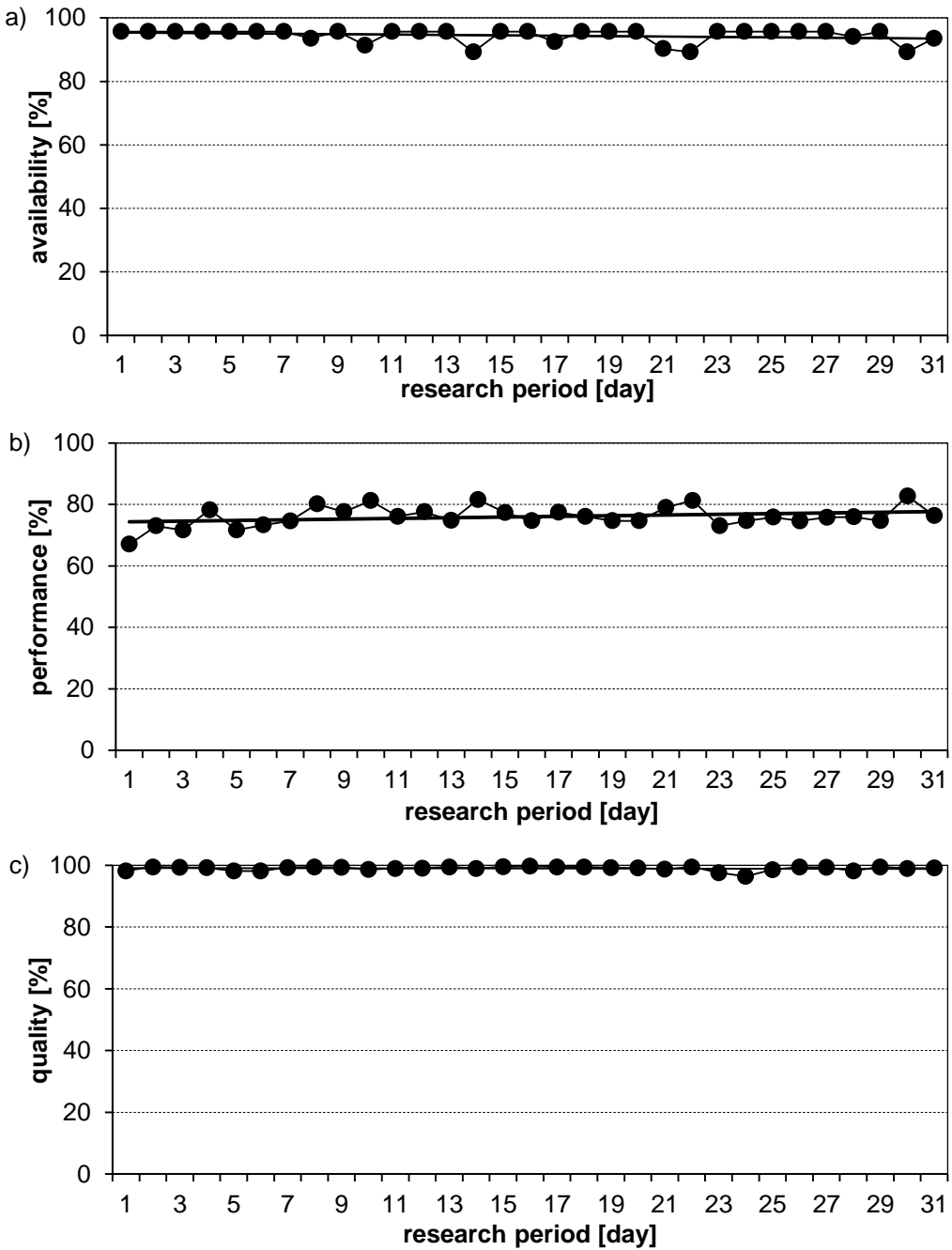


Fig. 3. Distribution of values of the indicator: a) the availability, b) performance, c) quality.

Fig. 4 presents a graph showing the value of OEE for individual days in the period of 1 month. The graph also indicates the trend line, which indicates the direction of growth OEE production on consecutive days.

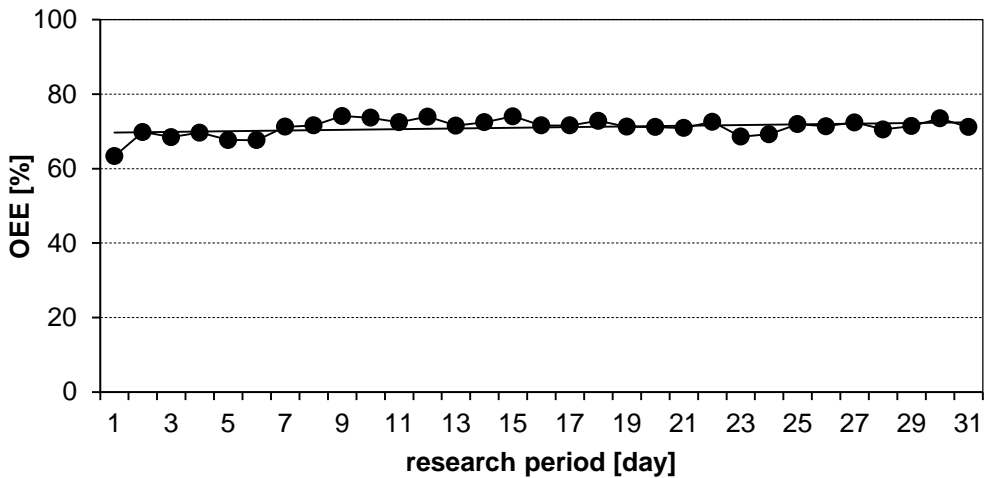


Fig. 4. OEE structure for each day of the study.

Fig. 5 presents the summary of the average values of each indicator of analyzed process with the values of the global level (World Class OEE). The graph shows that, the rate of availability (EC) and quality (WJ) reached a global standard, and performance indicators (WW) and OEE despite slightly lower values indicate that the test process is at a satisfactory level of efficiency.

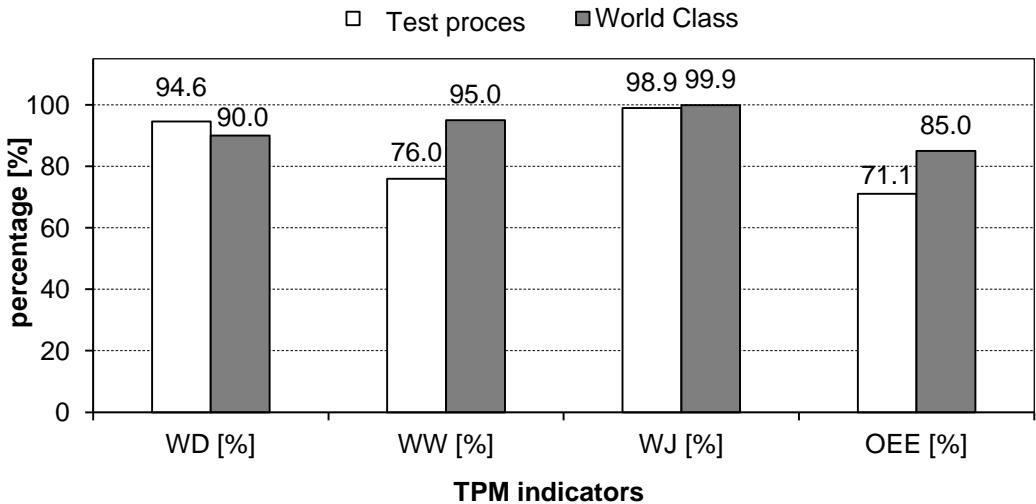


Fig. 5. Comparison of values of TPM for the test process with the values of the global level (World Class OEE).

4. Conclusion

The study has been subject to a company operating in the textile industry. Due to the implementation of mass production enterprise the main factor is the used machines.

Times obtained from observing the work of rapier loom were also analysed. The overall efficiency OEE of the rapier loom in the period was 71.1%. Global research indicates that the average rate of OEE in manufacturing plants is around 60%. However, OEE should be treated as an internal indicator - a number that allows to estimate the improvement or deterioration of the situation compared to another period on the same machine or production line.

In order to improve the overall efficiency of the tested machines of the analysed company should focus primarily on improving the efficiency factor, which is a combination of factors: speed of operation and the useful operating time.

The main advantage of OEE is that we see not only a major accident or major organizational problems, but also, in fact, above all, small losses, which can accumulate in the tens of minutes, sometimes even hours. The use of indicators is at the same time makes sense only when continuously monitor and analyze all the components in order to seek sources of losses and appropriate methods of their elimination.

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Literature

1. BORKOWSKI, S. SELEJDAK, J. SALAMON, S. *Efektywność eksploatacji maszyn i urządzeń*. Wyd.WZPCzęst. Częstochowma, (2006).
2. MIELCZAREK, K. BORKOWSKI, S. *Practice of Calculation TPM Coefficients*. Chapter 20. In: Quality Improvement and Machines Exploitation. S. Borkowski, J. Kliber (ed.). Publishing and Press Association of Universities Russia. Saint-Petersburg. (2008).
3. SELEJDAK, J. BORKOWSKI, S. *TPM coefficients as efficiency measures of machine in car tyre production*. Journal of Machine Manufacturing, s. 134-137, Vol. 49, Special Triple Edition., (2009)
4. SELEJDAK, J. KNOP, K. *Analysis of advantages resulted from improvement of an OEE factor*. Quality. Technological Improvement. Monography. Editing and Scientific Elaboration Stanisław Borkowski, Tomasz Lipiński. Publish.TRIPSOFT. Trnava, s.85-98, (2011).
5. ULEWICZ, R. KACZOROWSKI, Ł. *Efektywność eksploatacji maszyn do produkcji wyrobów z drewna. efektywność eksploatacji maszyn i zdolność jakościowa procesu*. Oprac. i red. nauk. Jozef Hrubec, Stanisław Borkowski. Wyd.Inst.Org. i Zarz. w Przem."ORGMAZ" Warszawa s.175-180, (2006).

Summary

The use efficiency of textile machines and equipment

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In this paper, an analysis of the efficiency of machines used in the textile industry. The test results are based on the selected coefficients TPM, enabling comprehensive assessment the degree of working time use of these machines.