STUDY ON THE IMPLEMENTATION OF A PREVENTIVE MENTENANT PLAN FOR THE IMPROVAL OF THE PERFORMANTS OF A PRELUCRATION CENTRE WITH 6 AXES

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ABSTRACT (TNR 10 pt Bold): This paper examines how the performance of mechanical systems in the composition of a processing center can be improved, which gives a 6-axis movement by implementing a preventive maintenance plan. Theoretical concepts on maintenance types are presented and are detailed on a 6-axis processing center. A comparative analysis is presented between an initial maintenance plan and a final one to highlight the improvement of the performance of a 6-axis processing center.

KEY WORDS (TNR 10 pt Bold): performance, maintenance, plan, performance.

1. INTRODUCTION

The development of monitoring and diagnostic techniques and their implementation on industrial systems ensures their safe and efficient operation, with positive effects on reliability and productivity. Addressing problems related to the occurrence and management of a fault situation in an industrial system requires, in a first stage, the definition of common terms:

- maintenance
- concept that meets the notions of maintenance, repair;
- reliability – the extent to which a machine will operate without malfunction during the mission, under established conditions of use;
- technological reliability – the extent to which a machine can achieve technological performance (capability) during the mission;
- repairs – the totality of the activities by which a machine (equipment) is brought to normal operating parameters.

Maintenance can be considered as a set of technical-organisational activities aimed at maintaining operation as well as maintenance and repair of industrial systems [1]. Autonomous maintenance raises the level of skills and knowledge for operators, therefore has a dual role:

- transforming the work of driving and handling packages into a work of observation, reflection and authentic contribution to the company's performance more interesting and motivating thing. -maintaining equipment at an optimal level of operation and performance growth by preventing breakdowns, minor shutdowns, quality defects, safety hazards in terms of autonomous maintenance [2]

Reactive maintenance. This type of maintenance is characterized by two elements, namely low planning and incomplete repairs [3]. Repairs are often poorly planned due to time constraints imposed by production and system management. Typically, reactive maintenance costs three to four times more than if the same problem were solved in a planned way.

In the case of corrective maintenance, as opposed to reactive maintenance, the activity focuses on planned tasks at regular intervals to ensure that machines or systems are kept in working order at optimum parameters [1].

The concept of preventive maintenance has a multitude of meanings. A literal interpretation of this term defines a maintenance programme aimed at eliminating or preventing corrective and reactive maintenance [4].

Preventive maintenance is maintenance aimed at reducing the probabilities of failure or degradation of fixed assets [5].

Like preventive maintenance, predictive maintenance has a lot of definitions. For some human operators this is reduced to monitoring the vibrations of rotary machines in order to detect incipient defects and prevent disruption of officials [3].

Predictive maintenance is in fact a philosophy or attitude that, based on operating conditions, allows optimization of the entire industrial system [4]

Following the analysis of existing information on the practical maintenance activity and the requirements for a module to manage the maintenance activity it has been established that predictive maintenance is the type of concept indicated in particular to large economic agents. For the preparation of maintenance activities, the following steps will be performed

-Defining catalog types of interventions [6] – designates the technical class of the intervention, grouping is done on cycles of interventions that are associated with the equipment.

-Definition of equipment catalog – fixed assets for which maintenance activity is planned, recorded and tracked.

-Define meter catalogs – certain equipments have meters that allow measuring and recording the use of the equipment.

-Normative maintenance works – definition catalog repair cycles. -Technological repair sheets – the stringing of operations, raw materials and spare parts that are currently used in a type of repair.

2. PLANIFICATION AND FOLLOWING OF MENTENANCE ACTIVITIES

Repair work can be structured after several steps to be followed by the maintenance workshops: -Intervention plans – based on criteria for the selection of equipment or interventions, they are planned over a given period determined in advance according to the history of system defects. -Unplanned interventions-accidental interventions. - Repair programs. -Maintenance orders – unique codes to identify the execution of a maintenance activity, at the command level and based on the associated technology sheets. It is possible to determine the need for raw materials and materials, spare parts and actual labour costs.

-Launch documentation works repair.

-Record labor reports on orders.

Reports:

-Maintenance Response Reports.

- Repair plans.

-Third-party orders.

-Verbal teaching-receiving process.

Components of a system, such as pumps, electric or hydraulic motors, transmission systems, etc. as integral parts of it shall operate at optimum parameters to ensure that the projected performance of the system as a whole is achieved. Addressing maintenance problems, establishing procedures and maintenance strategy for a system must therefore take into account both monitoring and diagnosis at the level of each component, but also the influence of variables in the system. Most of the time the cause of a defect is found in variations in process parameters and an incorrect approach to system monitoring and diagnosis can lead to ineffective actions. Thus, in addition to the most well-known techniques of monitoring

-Vibration analysis is one of the most used methods of detection and diagnosis of defects in electromechanical systems [7]. This method measures the vibrations of the system, usually with an accelerometer, after which the spectrum generated is examined in order to identify the frequencies significant in terms of the state of the machine. Certain frequencies are system-specific in normal operation. Changing the amplitude of certain harmonics, for example, may signify the presence of a defect. Vibration detection is done with the help of TER resistive transducers that are glued to the opposite sides of a blade that picks up the vibration. TER sensors are bound in the next arms of a Wheatstone bridge, which balances in the blade's resting position and provides an imbalanceal tension when the slide vibrates. The imbalance voltage is picked up and amplified with an instrumental amplifier, then transformed into a digital size. On the panel of the tool.

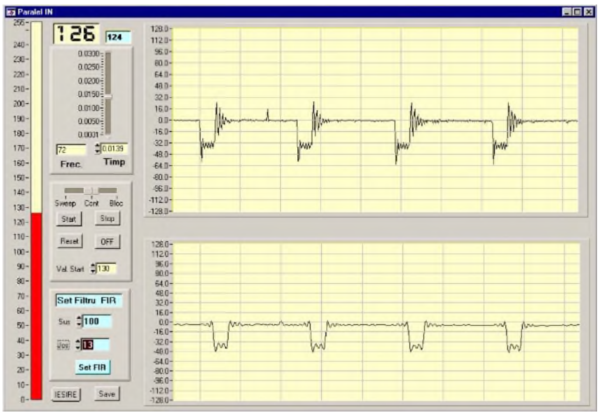


Figure1. The virtual instrument panel showing the detected vibration in graphic form

There is a wide range of vibration measuring instruments on the market, from the portable type to complex, fixed equipment for systems that require constant monitoring. The vast majority of vibration measuring devices work in the 10 Hz field... 1kHz, considered the best interval for problems such as imbalances, eccentricities, additional efforts [9].

More sophisticated devices work in a much wider band, up to 20 KHz and display both in the field time and in the frequent field on the LCD screen. Data can be processed immediately or downloaded to a computer for analysis and processing. These systems can be used not only for measuring vibrations, but also for diagnosing specific defects**.**

-The thermography is the use of an infrared camera to visualize and measure the heat emitted by an object. Thermal energy is a part of the electromagnetic spectrum that cannot be detected by the human eye, but is perceived as heat. In the infrared field, any body with a temperature other than zero emits heat. Even sub-zero-temperature objects emit infrared waves.

- The analysis of the lubrication fluid can be used to determine the conditions of mechanical wear, lubrication or fluid status [9]. The presence of metal particles in the lubrication fluid suggests the existence of wear and tear, their analysis providing information on the part subject to wear. The acidity of the fluid shows either oxidation due to high working temperatures or contamination with water particles or its prolonged use. Viscosity is also an important parameter and must be in line with that specified in the manufacturer's data. Alkalinity or its loss proves that the fluid is in contact with inorganic acids such as sulphuric acid or nitric acid.

3. TECHNICAL REQUIREMENTS

Complex systems such as 6-axis processing centres (Fig. 1) require, for maintenance and service, a large team of specialists to provide the extensive work force required for periodic revisions or interventions, with significant defects, the rest of the time the staff load is sometimes below normal**.**

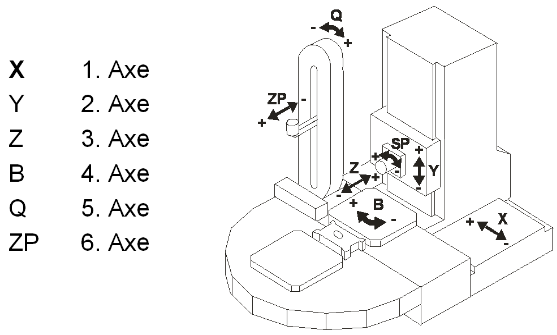


Figure 2. 6-axis processing center

• The SP axis represents the main rotational motion of the electrobrooche shaft, with which the tool rotation movement is performed.

• The X-axis is materialized by the movement of the central mount, on which the Y and Z axes are also found.

• The Y axis is represented by the vertical movement of the paper-port doll.

• The Z-axis is given by the advance movement of the electrobrooch.

• The ZP axis represents the movement of the control unit (Tool-Check).

• The Q axis is the circular movement of the tool shed (chain).

• The B axis is materialized by the rotational motion of the rotating plate around its axis.

As technological possibilities of the center, we can list:

- Milling flat surfaces and frontal surfaces
- Milling channels
- Milling of thresholds
- Complex mills
- Burgherea Vesireing
- Widening
- Widening
- Lamating
- Alasere
- Filetare

A more comprehensive preventive maintenance programme will call on the periodic evaluation of critical equipment, machines or systems to detect potential problems and to immediately schedule the necessary interventions that will prevent any degradation of operating conditions.

I. The initial (run-in) period during which falls have the highest frequency. During this period fall those elements with low mechanical strength, hidden defects, the use of qualitatively inadequate raw materials or the use of elements with manufacturing defects. This period can be reduced by careful design of the elements (system), increasing the requirement of manufacturing control, as well as carrying out running samples under operating conditions**.**

II. The normal period of life (useful life) is the actual period of operation, with the longest duration, characterized by random falls, with a relatively low and stable rate over time. Defects occurring during this period are minimal and are only detected in machine or machine performance sheets.

III. The final period (of wear), in which the rate of falls increases sharply in a relatively short period of time as a result of wear or ageing of the elements or components.

During this period the continued exploitation of the system, without replacing the elements, becomes technically and economically unreasonable, sometimes with catastrophic effects.

4. METHODS

It starts from the maintenance plan proposed by the supplier in Table 1, which will be improved by the R.E.E. method.

Table 1. Extract from the maintenance plan proposed by the supplier

Axa z	papusa	Raclor	Inlocuire raclor papusa port brosa de langa zona de lucru	0:45:00	24	HT	|					C	1:30:00	,4%
Masina	a, b	Axa x, y, z,	Verificare geometrie axe - km0	4:00:00	24	HT						C	8:00:00	,9%
Axa x, y, z		Carucior	Verificare stare patine cu role si ghidaje	0:30:00	24	HT						C	1:00:00	,2%
Dispoz. prindere 1		Dispozitiv	Verif. presiuni de lucru	0:05:00	02	HP	fis Cf					C	2:00:00	,5%
Dispoz. prindere 2		Dispozitiv	Verif. presiuni de lucru	0:05:00	02	HP	fis Cf					C	2:00:00	5%0

The report on the Preventive Maintenance Plan is generated

Table 2 Report of the Preventive Maintenance Plan

TIMP	TOT	MA	MP	TOT	MA	MP
0%	min	min	min	ore	ore	ore
PMP_Initial [min]	24767	18400	6367	413	307	106
PMP_Final [min]	24767	18400	6367	413	307	106

Actiuni	0%	MA	MP	Modif
PMP_Initial	89	37	52	
PMP_Final	0	0	0	0

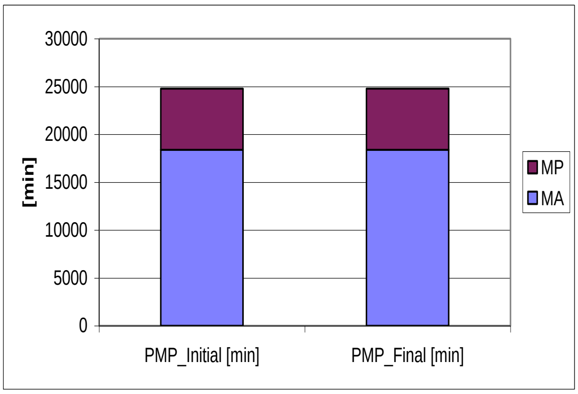
ESSYS Maintenance provides the ability to efficiently plan maintenance activities, thus preventing accidental malfunctions, reducing the costs of repairs and production losses, and increasing product quality. [10].

The **SIMON (Operational Maintenance and Nomenclature Information System)** programme enables the management and knowledge of all those categories of technical and economic information that are needed to carry out maintenance activities in optimal conditions [11].

The system carries out the total management of the equipment, by setting up a single and complete database of maintenance equipment and works, which takes advantage of past experience as well as all the technical and economic information available to it. As seen in table 3. maintenance actions proposed by the manufacturer of the machine and generated by the SIMON program are taken over without being reanalyzed and thus there is no improvement in the time of the repair program.

This required the plan to be reconsidered using an improvement method called R.E.E. presented in the next chapter.

Table 3 Comparison between initial and final plan



Application of the R.E.E. method (Achievable, Effective, Economic) for the 6-axis processing center because we have Preventive Maintenance actions. The expected effect of using the R.E.E. Method is to diminish the Preventive Maintenance Plan by leaving only the relevant actions, without effect on the performance of the moment.

4. Results and conclusions

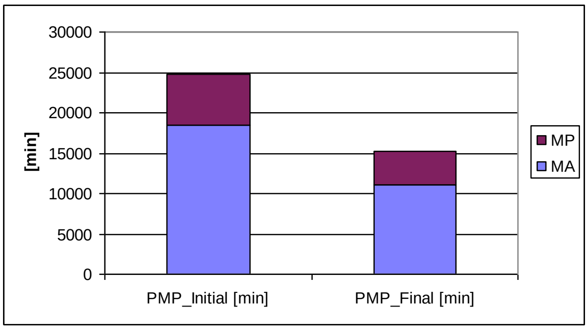
After applying the REE method, the following improvements have resulted:

Table 4. Report after REE method application

TIMP	TOT	MA	MP	TOT	MA	MP
38%	min	min	min	ore	ore	ore
PMP_Initial [min]	24767	18400	6367	413	307	106
PMP_Final [min]	15279	11029	4250	255	184	71

Actiuni	0%	MA	MP		Modif
PMP_Initial	89	37	52		
PMP_Final	0	0	0		20

Tabel 5. Grafic pentru compararea timpilor iniţial si final



After applying the R.E.E. method, the following results were obtained:

- the initial maintenance plan was scheduled for a period of 24767 min the initial maintenance plan was scheduled for a period of 24767 min

the final maintenance plan resulted in the completion of the

This results in a time gain of 9488 min. Using the R.E.E. method results in an efficient program and thus can save money, reduce the number of scraps, increase productivity and at the same time improve the performance of the processing center with 6 axes.

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