THE MAINTENANCE OF A WORKSTATION SPECIALIZED IN HEATING PRESS OPERATIONS

Loredana PĂTRAŞCU[1]

Rezumat: *Continuitatea activității de producție a unei întreprinderi industriale necesită, ca o condiție de bază, o bună organizare a reparării şi întreținerii echipamentelor. Acest lucru este impus de faptul că în procesul utilizării lor productive, activele fixe şi echipamentele de producție, ca o componentă a acestora, sunt supuse uzurii fizice şi morale. Pentru a păstra caracteristicile funcționale ale maşinilor în timpul utilizării acestora în condiții optime şi cu caracteristici tehnice apropiate de cele inițiale, în cadrul întreprinderilor se organizează un sistem de întreținere şi reparații.*

Abstract: *Continuity of the production activity of an industrial enterprise requires, as a basic condition, a good organization of the repair and maintenance of the equipment. This is required by the fact that in the process of their productive use, fixed assets and production equipment, as their component, are subjected to physical and moral wear and tear. In order to preserve the functional characteristics of the machine during its use and operation in optimum conditions and with the possibilities closest to the initial ones, a system of maintenance and repair of the production equipment is organized.*

Keywords: process, maintenance, hydraulic press, automotive industry.

1. Introduction

As we all know, the two fundamental forces of the universe are Life and Time. Everything that exists in the world, alive or lacking life, including equipment and machinery components, is under the influence of time.

This force is so strong that the role of Maintenance is not so much to prevent degradation as to slow it down, to keep the parts working for as long as possible, or to substitute defective parts, or to mechanically process the device, and to reduce the effects of hundreds of unfavourable parameters.

The necessity of maintenance naturally occurs to resist degradation forces and may be the result of an intervention following a maintenance or repair plan.

The efficiency of the industrial process as well as the minimization of costs can only be achieved by combining various factors: increasing machine reliability,

[1] Master CMP student, Politehnica University of Bucharest, IMST Faculty, Spl. Independentei 313, sector 6, zipcode 060042, Bucharest. E-mail: patrascu.loredana94@yahoo.com

increasing operational safety, lowering operating costs, all resulting in a totally streamlined cost.

Consequently, machine maintenance cannot be viewed in isolation.

On this line, the present paper presents a study of the processes of management of the maintenance and repair activities of specialized equipment for heating pressing operations in the automotive industry.

The objectives of the paper are to identify the importance of machine maintenance and repair processes as well as their objectives, to highlight the main monitoring techniques as well as the possibilities of increasing the economic efficiency of maintenance and repairing of the equipment and means of modernization of the equipment.

2. Current Stage

Repeating the production activity of an industrial enterprise requires, as a basic condition, a good organization of the repair and maintenance of the equipment. This is required by the fact that in the process of their productive use, the fixed assets and the production equipment, as their component, are subject to physical and moral wear.

As a consequence of the physical wear of the production equipment, there is a process of gradual loss of the machining capacity of the equipment.

The physical wear of the production equipment, when used in the production process, is accompanied by the transfer of value on the products created and its permanent recovery by selling it to different beneficiaries.

In order to keep the functional characteristics of the equipment during its use and operation in optimal conditions and with the possibilities closest to the initial ones, a system of maintenance and repair of the production equipment is needed.

By investigating the physical wear and tear behaviour of parts, semi-finished products, assemblies or mechanisms that make up the production equipment, it is noted that their wear has a different course over time.

In the case of an industrial enterprise, the importance of the maintenance and repair processes of the production equipment is significant. In doing so, performing these activities in optimum conditions guarantees the normal operation of the production equipment according to the production schedules, thus preventing decommissioning, thereby helping to perform a rhythmic activity.

Maintaining and repairing the corresponding production equipment ensures its maintainance in accordance with the technical and economic performances

provided in the technical book, influencing directly the efficiency and precision of operation and performance of the production in the quantities and quality provided.

We define repair as the work performed at certain time intervals to ensure the maintenance of the functionality of the fixed assets as a whole and of the production equipment, in particular by means of which the permanent defects in operation are removed and the total or partial replacement of the needles fragments that have a shorter running time compared to others.

Initially, the organization of machine repair processes was based only on experience, leaving behind theoretical support. In this respect, repairs were carried out on the machines when they were out of service due to wear. This procedure proved inappropriate in economic terms, representing a serious brake in the operation of the machine.

In order to design and optimize the maintenance of the production equipment, it is necessary to understand its operation, its structure and its characteristics.

For this reason, in the first phase, the present paper describes the equipment, the hydraulic press with force press of 400 tons force, presenting the component parts, and in particular the maintenance processes of the latter.

3. Tasks for the Organization of Maintenance and Repair of Machinery

The basic tasks with regard to the organization of the maintenance and repair of the equipment at the level of the industrial enterprise are as follows:

- Ensuring that the machine is in perfect working order;
- Preventing excessive machine wear and early or accidental lifting of the machine;
- Increase the machine's operating time, both by increasing operating time between two repairs and by reducing the time required to perform the repairs;
- Increase the productivity of the work of repair works, ensure minimal and high quality repairs;
- Modernization of obsolete machinery and equipment.

The basic tasks of the maintenance and repair of the equipment belong to the Chief Mechanic and can include:

a) Planning all maintenance and repair work on the fixed assets of the enterprise.

b) organizing and executing the repair plan.

c) ensuring that the machine is properly maintained between two repairs.

d) the adoption of the necessary measures for the safety of work equipment and fire protection related to the machinery.

e) ensuring the dismantling of disused equipment and drawing up reports on the state of the maintenance and repair plan.

4. Monitoring Techniques for the Equipment

4.1. Visual inspection

It is the most used monitoring technique, it is easy and fast to use and has a relatively low cost. Normally, it is used to visually detect the condition of each piece, alignment, shape, or cracks.

Benefits: Easy and fast execution, relatively inexpensive and requiring no special equipment for direct viewing.

Limits: Its main limit is the fact that it discovers only obvious discontinuities and its quality is limited by the viewing ability of the human eye or the visual field improvement tools.

4.2 Vibration analysis

One of the basic tools used in the predictive maintenance of equipment and installations is given by the measurement and analysis of vibrations due to the fact that 90% of the failures that occur in the machines are due to a change in their operation, which for the most part can be sensed by emphasizing vibrations.

Therefore, vibration analysis tools are shown in Figure 1.

Fig. 1: Vibration analysis

Issues that can normally be detected and corrected by the vibration analysis program include:

- Resonance;
- Weakening of mechanical joints;
- Defects in bearings;
- Pump problems;
- Electrical problems associated with motors;

5. Functioning and Maintenance of the 400 Tons Force Hydraulic Press

The 400 tone force Hydraulic Press is a hydraulic press with 1600x3000mm axle spacing. It has two cylinders that can be adjusted according to different pressures and races.

The press is equipped with protection systems for human health and equipment protection.

The 400 tons, force of the hydraulic press can be used for many purposes at the values specified in the Technical Characteristics section. Field of use within the company: the manufacture of roofing parts and sound insulation.

The press can be operated either manually or automatically by command on the operator screen. All pressure and stroke limitations can be made on the operator panel.

In the case of manual operation, as long as the "down" button is pressed, the presser will lower and rise to the mechanical and electrical limiters, and in the case of automatic operation it will lower and climb according to the values entered in the system.

Pressure Circuit: While the master cylinder is at stroke 0, the product is positioned in its place on the die and the system resets to the operator panel and the automatic actuator button is pressed, thus moving the main cylinder, the jam will fall to a certain race and then actually perform the operation, then return.

If there are none of the errors that could hinder the operation of the system and the other necessary conditions are provided, the main engine can be started.

Fig. 2: Hydraulic press – 400 tons force

6. Technical Chart of Hydraulic Press

Figure 3 shows the technical diagram of the hydraulic press of 400 tons force and in the table number 1 the parts of the hydraulic press are presented.

Table 1. Components of the hydraulic press

Hydraulic press 400 tons		
Crt.	**Component name**	**Number**
1	Hydraulic unit and tank	1
2	Staircase and railing	1
3	Top connector	1
4	Cross	1
5	Column	4
6	Light field	2
7	Lower crossing	1
8	Tightening cylinders	2
9	Hydraulic cylinder assembly	2
10	Machine elements	4
11	Framework	1
12	Mechanical assembly	2

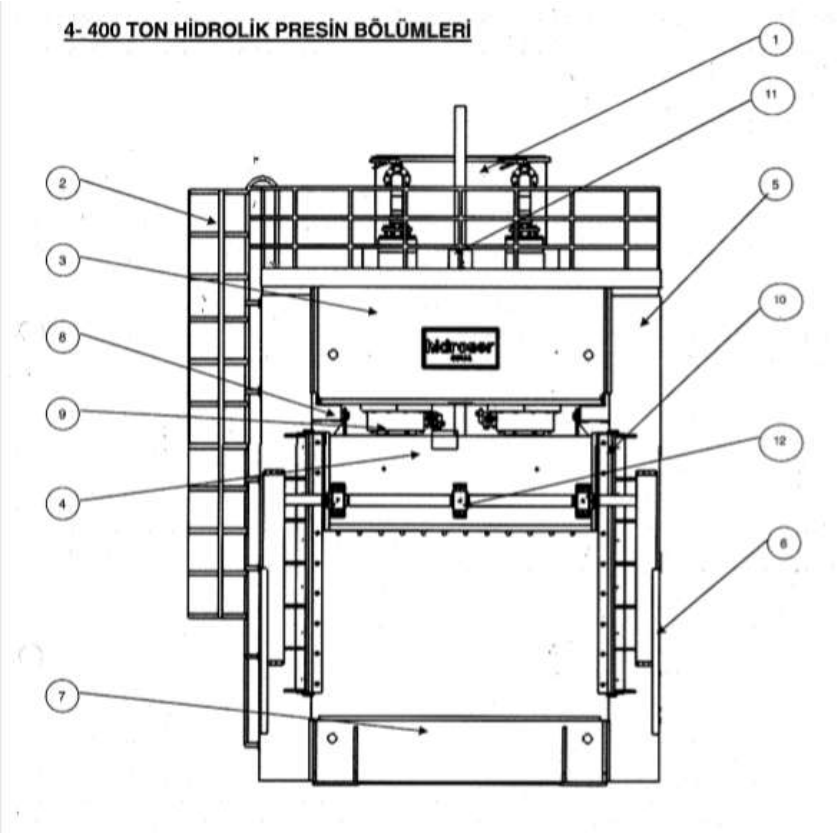


Fig. 3: Technical chart of hydraulic press

7. Hydraulic Press Maintenance

The maintenance of the hydraulic press requires the following machine lubrication actions that must be done in accordance with the machine book prescriptions:

- checking all assembled parts for the purpose of periodically checking the tightening of the bolts from the slides and bearings;

- cleaning clutches and brakes; checking games from camps;

- checking the operation of electric motors, reducers and the entire motion transmission system.

The oil tank, together with the plant filters, is designed to help maintain the properties of the hydraulic agent, eliminating solids by decanting and filtering, and maintaining the temperature within the allowable limits.

Decreasing is applied to working fluids with large liquid stocks, such as recirculation lubricant oils in rolling mills, compressors, high speed gauges, etc.

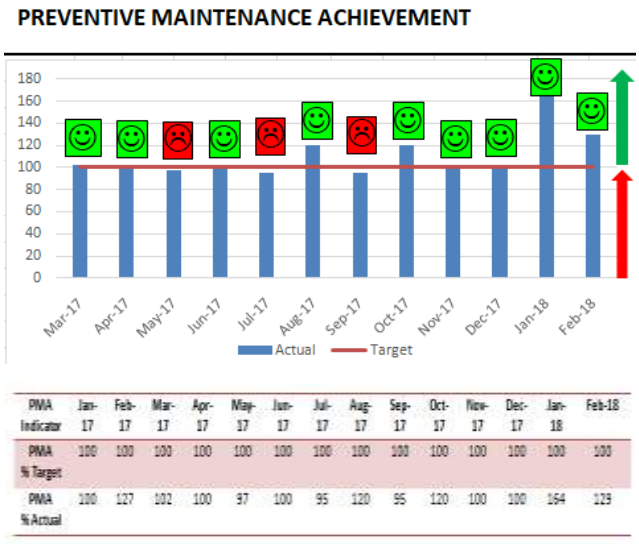
The separation of contaminants, the relative density of which is very different from that of oil, is done gravimetrically. Particles that cannot be removed from the circuit by decantation will be removed by filtration. Working fluid filtration is a widely used process because filters can easily be changed without affecting the oil system.

Elements of the hydraulic system most often subject to maintenance are: pipes, fittings, tanks.

7.1 Hydraulic press maintenance

This type of maintenance is performed at specified intervals and according to established criteria designed to reduce the probability of failure or impairment of the operation of an entity.

The preventive maintenance achievements applied on the machine versus target for 2017 are shown in Figure 4.



PMA Indicator	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
PMA % Target	100	100	100	100	100	100	100	100	100	100	100	100	100	100
PMA % Actual	100	127	102	100	97	100	95	120	95	120	100	100	164	129

Fig. 4: Achievements of hydraulic press maintenance in 2017

Figure 4 shows that the preventive maintenance objectives of the hydraulic press have been achieved in nine of the 12 analysed months.

Figure 5 shows how far the target hours for preventive maintenance have been reached according to planning from the beginning of 2017 until the end of the same year. August is a peak month, with a 192 percentage point. Planned while

the months of September, October, November and December are the months with a percentage of 0 achieved vs. Planned. As far as 2018 is concerned, the same diagram is shown in figure 6.

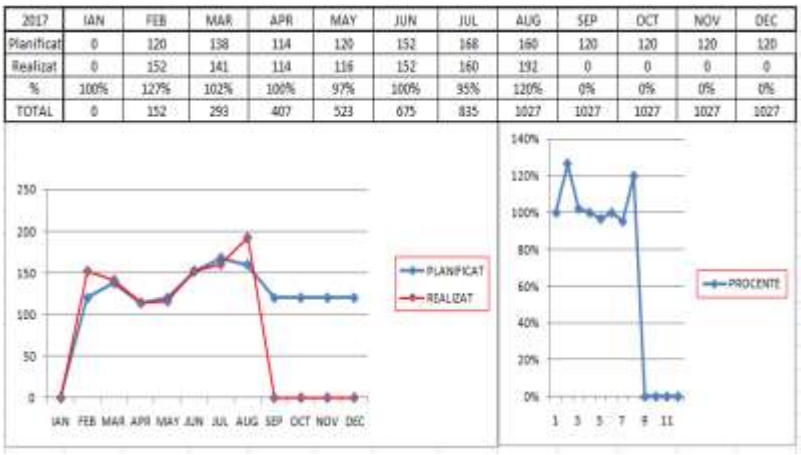


Fig. 5: Preventive maintenance chart in 2017

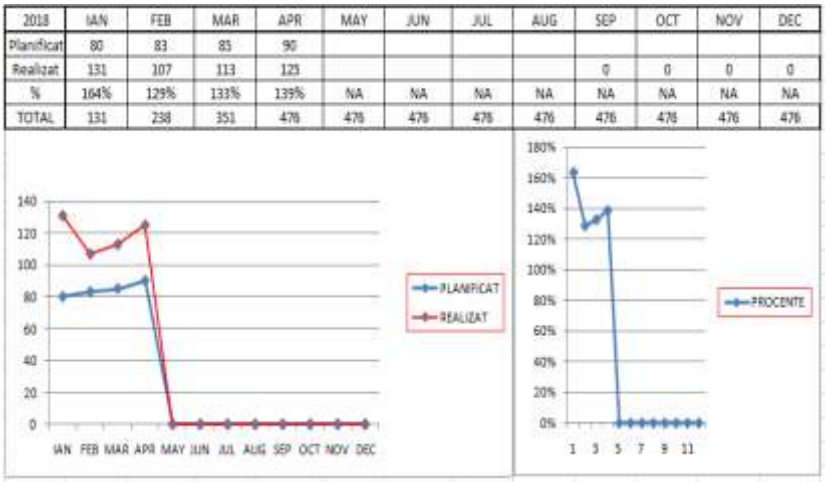


Fig. 6: Preventive maintenance chart in 2018

Comparing 2017 to 2018, we notice that since the beginning of 2018 to date, the target is reached and at the same time it is noticed that the planned hours for 2018 are reduced compared to 2017 for the months of February, March and April, with the 80 hours allocated in January 2018, compared to 0 hours scheduled in January 2017.

7.2. Predictive maintenance of hydraulic press

Hydraulic press as well as other production equipment gives early warning signs, indicating the occurrence of an imminent defect. The use of modern and effective diagnostic methods allows alerting the maintenance department, offering the possibility to make the best decisions on intervention planning and production.

In this way, effective data analysis becomes a powerful tool in decision-making.

In the analysed company, with regard to predictive maintenance, a maintenance plan is carried out annually as in Figure 7. Therefore, for the hydraulic press, the following are included in the predictive maintenance: the oil temperature, the current values, the temperature of the pan but also the three vibration values. The action plan will be used when a problem related to the predictive maintenance plan is identified.

The Action Plan is in line with the new IATF 16949: 2016 Quality Management System in the automotive industry.

Predictive maintenance determines the state of the machinery and production equipment in order to predict the periodicity and mode of maintenance to be performed. This approach offers cost savings both in terms of energy consumption and spare parts and the cost of equipment failure.

Predictive maintenance determines the state of the machinery and production equipment in order to predict the periodicity and mode of maintenance to be performed. This approach offers cost savings both in terms of energy consumption and spare parts and the cost of equipment failure.

By correctly using the various predictive maintenance tools that maintenance personnel have at their disposal, certain defects can be easily identified and subsequently recognized for the effective diagnosis of a possible defect with a certain degree of precision over time. Among the most popular predictive maintenance methods that the maintenance department can provide at no cost can be cited: vibration analysis, lubricant analysis, thermography and non-destructive ultrasound control. The use of modern and effective diagnostic methods allows the maintenance department to stay alert and provides to the top management the ability to make the best decisions about intervention planning and production.

Table 2. Predictive maintenance plan in 2017

No.	**Activity description**	**Frequency**	Jan	Febr	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
1	Oil temperature	TBC	37.6	37.6	37.6	37.6	37.6	37.6	38	39	38	37	37	37
2	Current values	TBC	68.7	68.7	68.7	68.6	68.5	69	69	69	69	69	69	69
3	Panel temperature	TBC	31.8	32	31.9	32	32	31.8	32	32	33	34	34	32
4	Vibration Value 1	TBC	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
5	Vibration Value 2	TBC	2.6	2.5	2.7	2.7	2.5	2.5	2.6	2.5	2.6	2.7	2.5	2.5
6	Vibration Value 3	TBC	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1

8. Conclusions

First, it is recommended to insist on proactive maintenance, this kind of maintenance having some strategic nuances (stemming from risk management approaches, legal safety regulations). Moreover, from the expenditure perspective, maintenance will be more and more between the need to ensure continuity in operation, compliance with the rules and the financial weight required by the objective of higher economic efficiency.

In other ways, however automated our production process is, most maintenance actions are carried out by people. If small businesses can outsource this business component, large organizations have to organize their own service for maintenance and repair. For this reason, it is recommended to insist on the good organization of the entire team that maintains the maintenance part of the company, including the operators who work with the machines in the company.

By using teamwork, the work team becomes more solid, an ever-increasing effective force, reaching targets and working in a very effective atmosphere. The long-term target objectives set by a maintenance department involved in a fully integrated maintenance system can be very ambitious, namely:

1. General Emergency Reduction of Equipment Up to 75%
2. Reducing acquisition costs by more than 25%
3. Improvement of warehousing and inventory optimization by 95%
4. Increase in maintenance efficiency by almost 100%

R E F E R E N C E S

[1] Badea, F., *Managementul producției industriale*, Partea I, Editura All, Bucureşti, 1998.

[2] Badea, F., Bâgu, C., *Sisteme de organizare a producției*, IDD, ASE, 1999.

[3] Grădinaru, D., *Managementul producției. Aplicații. Modele matematice de optimizare a problemelor de transport şi a deciziilor în întreprinderile industriale,* Editura Universității din Piteşti, 2002.

[4] Nicolescu, O., Verboncu, I., *Management*, Ediția a III-a, Editura Economică, Bucureşti, 1999.

[5] Dan, V. *Management industrial*, Editura Economică, Bucureşti, 1994.

[6] Nicolescu, O., *Sisteme, metode şi tehnici manageriale ale organizației*, Editura Economică, Bucureşti, 1996.

[7] Drumea P, Matache G., Dumitrescu C. - *Acționări de hidraulică şi pneumatică* – curs 2013.

[8] Hiatt B – *Cele mai bune practici de mentenanță* – Mobil industrial AG -2010.

[9]. Marin V., Moscovici R., Teneslav D – *Sisteme hidraulice de acționare şi reglare automată*, Ed. Tehnică 1981.

[10] Internal documentation from S.C. SCP PIMSA S.R.L, 2018.