The Importance of the Industrial Equipment Management in Warranting the Production Quality

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Abstract

Fromthe investigations performed, technical surveillance equipment is a weakness of the majority of the industrial companies in our country. An efficient management of fleet equipment in production quality assurance approach is involving technical fleet equipment tracking, requiring a high reliability of each device and obtaining of maximum equipment efficiency.

History of preventive interventions made and accidental failure history are essential elements in managing industrial equipment on basis of these could be defined periodicity and content of preventive actions of maintenance.

Keywords: *administration, preventive maintenance, accidental failure analysis, history of accidental failure, history of preventive maintenance.*

JEL classification: D24, L23, M11.

Introduction

The industrial equipment maintenance activity isn't a purpose in itself, it's a necessity which isn't fully accomplished by the production and which is thought to be "too costly". It often exists a conflict between the production units and the maintenance department, which is responsible with the equipment's condition and surveillance, not only on the short run, but often on the long run. In many cases, the industrial companies, in their desire to reduce the current total costs, considering their above-mentioned mentality, the uncertainty related to the companies' future (let's not forget how many Romanian industrial companies "transformed" and were sold as scrap heaps), the urgency with which an order must be delivered, etc., choose to reduce the budget dedicated to the preventive maintenance and to delay the maintenance proceedings. In reality, this policies' effect isn't the wanted one, which would be decreasing the costs; on the contrary, the costs related to the corrective maintenance will increase, as a result of an increasing of the accidental failures (faults) frequency, altogether with the increasing losses related to a poorer production quality, generated by the

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equipment's damage or the degrading of the functioning parameters. In the same time, the maintenance proceedings' increase in number and in value will bring about in the future a decrease in the preventive maintenance's available resources, the industrial company entering into a vicious circle from which it will be able to come out really hard.

In order to reconcile these points of view which contradict each other just on the surface, the activity of maintenance must be put in its proper place inside the company and each person's responsibilities should be properly defined (this is an issue of policy and structure). In the same time, the maintenance activity should be organized in such a manner, that it should allow solving all the problems specific to maintenance, in the most efficient possible way (the economic criteria should become a priority, in the most of the cases).

In the same time, an efficient equipment management is necessary, all these aspects having an important positive impact in warranting a good production quality. (Lavina, Y., Perruche, E., 1988)

An efficient equipment managementm, whose purpose is to warrant the production quality, involves taking measures in these main directions:

- the technical equipment surveillance, in other words a complete knowledge of what has happened before and what it can be further done to obtain the best equipment performance, in the best economic circumstances;
- reaching to a high viability for each item of equipment;
- obtaining the maximum performance for each item of equipment.

As the performed investigations showed, technical equipment surveillance is a weakness displayed by the majority of the industrial companies in our country.(Deac, 2010).

Maintaining an item of equipment in a good functioning condition involves, according to the applied maintenance methods, the following actions: (Deac, V., Pârvu, F., 2010).

- organizing the stipulated preventive interventions (when it comes to the systematic preventive intervention) or initiated by an alarm system, a system of detecting a failure (when it comes to the method of circumstantial preventive maintenance);
- performing the troubleshooting and the repairs following some derangements, dysfunctions or defects (when it comes to the method of corrective and palliative maintenance).

1. Industrial equipment management

The interventions mentioned above involve, year after year, a certain amount of work, certain costs related to the replacement parts and to the maintenance materials and, eventually, paying the interventions performed through cooperation. All these costs lead to a certain total maintenance cost and a certain equipment availability or lack of availability, a certain frequency and seriousness of

the accidental failures. Having these absolutely necessary information in mind, **we can define the technical equipment surveillance as the totality of the actions performed in order to correctly establish the types of interventions, the purpose being to obtain the smallest maintenance costs in relation to the established performance objectives**, according to figure 1 (Deac, V., Badea, F., Dobrin, C., 2010).

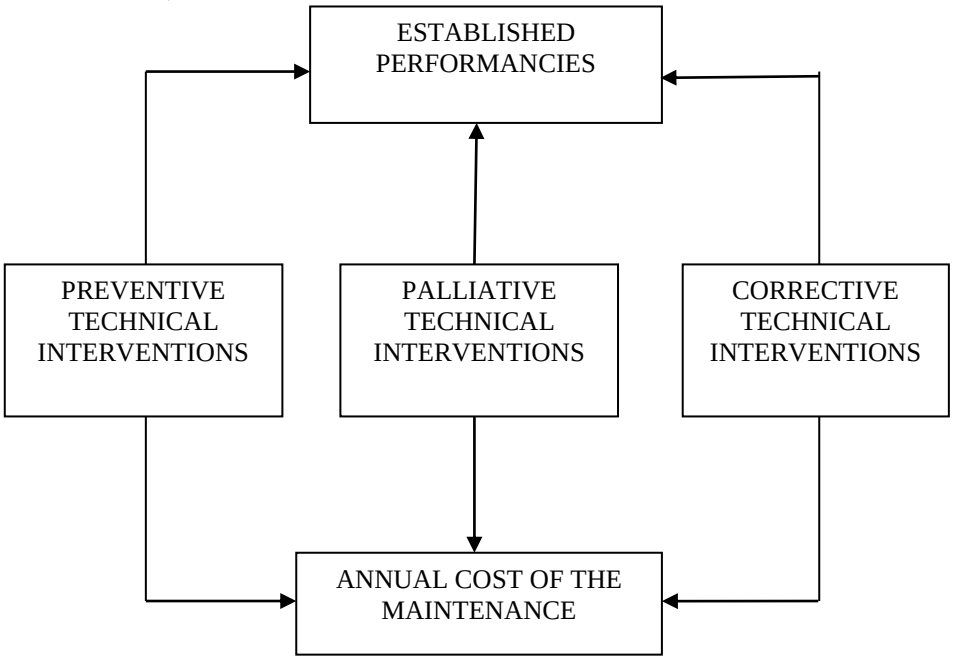

Figure 1. Defining the technical equipment surveillance

The maintenance management must be able to answer, anytime, the following questions: (Cuignet, R., 2008).

•Can we talk about a judicious preventive maintenance?

•Is the equipment fully adapted to the operating conditions?

•What improvements can be done?

In order to answer these questions, some items of information, more or less detailed regarding the equipment weaknesses must be made available. These items of information can be categorized in two groups: the one related to the preventive interventions performed and the other related to the accidental failures. According to these items of information, it can be established the frequency and the nature of the preventive actions.

As soon as a history of the failures is confronted with that of the preventive interventions, for each item of equipment, there will be highlighted the following aspects which are crucial for maintaining a top production quality:

- if the interval between the planned technical interventions is correctly determined (too long in the case in which accidental failures appear or, maybe, too short, in the opposite case);
- if the content of the performed interventions was the proper one and the manner in which they were performed was satisfactory.

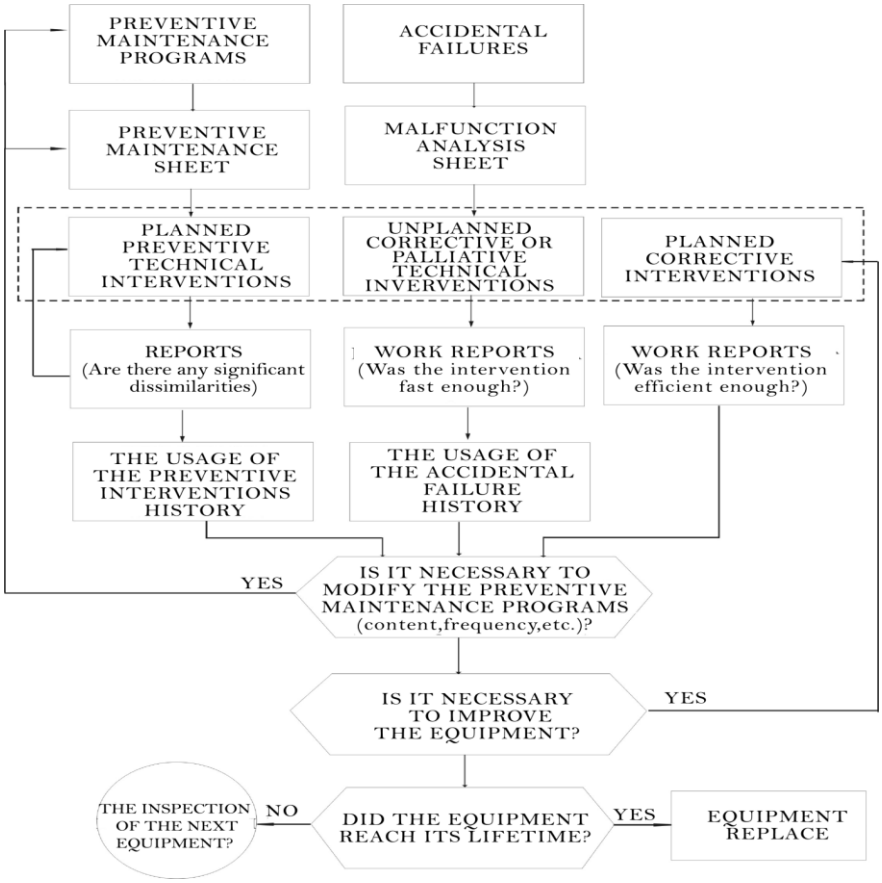

Figure 2. The process of technical equipment surveillance

In order to perform this examination there is absolutely necessary to elaborate a „**Preventive maintenance sheet**", in the case of the technical preventive interventions stipulated in the maintenance plans, respectively a „**Failure analysis sheet**", for the corrective interventions. The scheme of the process of technical equipment surveillance is presented in Figure 2 (Boucly, F., 2007).

It results that it's absolutely essential for the technical equipment surveillance to perform a continuous updating and to make use of the of the equipment "history".

2. The history of industrial equipment

We consider that there must be recorded, continuously updated and put to use five „histories", presented below.

a. The history of the accidental failures

It's absolutely necessary to know all the troubleshooting and the repair interventions performed due to an accidental failure, in order to determine the best frequency with which the technical preventive interventions must be performed, to detect the equipment's weaknesses, which reflect into a poorer production quality (which should be rectified thorough a planned corrective maintenance). In order to systemize the items of information that must be known after an accidental failure, it will be recorded a "history" of the equipment. This "history" will cover all the corrective interventions suffered by it as long as it functions.

The equipment history will cover all the corrective interventions suffered by it as long as it functions. It represents the equipment's "health card". Its continuous updating will be a task performed by the department "maintenance methods", according to the intervention sheets and the work directives.

A model of equipment "history sheet" is to be introduced in Table 1 (Deac, V., 2000).

Table 1. History sheet

<table>
<tr><td colspan="4">Equipment history.....
No. .....</td><td colspan="6">Priority degree.....
The date in which the equipment was put into operation: .....</td></tr>
<tr><td></td><td colspan="3">The code of functional assembling

A functional group.....
B.functional group.....
C functional group.....</td><td colspan="6">D.. functional group.....
E functional group.....
F functional group.....</td></tr>
<tr><td rowspan="3">Data</td><td rowspan="3">Functioning meter (functioning hours)</td><td rowspan="3">Work command</td><td rowspan="3">Failure detection code</td><td rowspan="3">Intervention Description</td><td colspan="2">Period (hours)</td><td colspan="3">Error code</td></tr>
<tr><td>Intervention</td><td>Interruption</td><td>a</td><td>b</td><td>c</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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Grouping the failures into categories is made according to the equipment building structure, and the causes are often codified, according to the example below:

• codea: „failure causes"

0- unpredictable accident;
1- inner detectable cause;
2- undetectable inner cause;

3- maintenance failure;
4- wrong previous intervention;
5- wrong exploit (disregarding an exploit rule) ;
6- other causes.

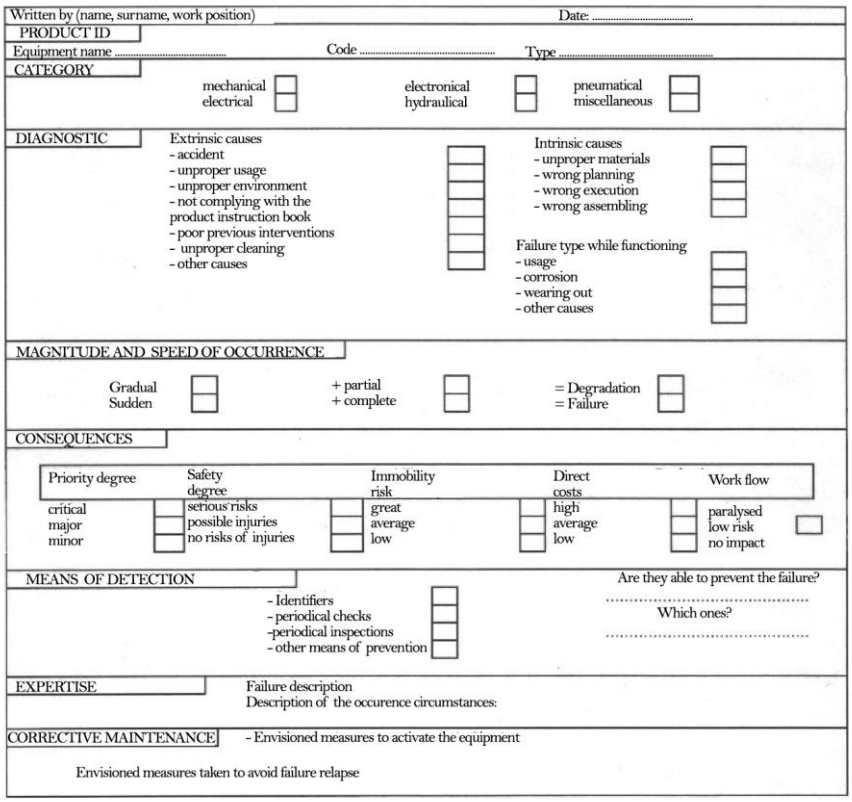
• code b: „the nature of the causes":

0- mechanical
1- electrical ;
2- electronic ;
3- hydraulic.

• code c: „seriousness":

0- critical failures;
1- major failures;
2- minor failures.

Normally, all corrective interventions that are meant to fix the equipment failures are to be written in the history sheet, while the systematic preventive interventions do not appear here. All the critical and the major failures are to be studied in great detail according to the "Failure analysis sheet", whose model is presented in Table no. 2 (Boucly, F., 2007)



The equipment's "history sheet" can be used for the equipment analysis, the global analysis of an item of equipment, the analysis according the functional groups, the study of the modules and of the fragile components.

In order to highlight its importance when it comes to the study of the equipment's behaviour, we underline some of its uses:

• when it comes to viability study: it can be inferred the viability laws, the evolution of the failure rate, the mean times between failures, the product's nominal life cycle, the corresponding intervention cycles, etc.;

•when it comes to the method analysis: selecting and amending the fragile components, preparing for the frequent and costly failures;

•when it comes to stock management: the history sheet informs regarding the demand of spare elements;

• in the maintenance policy: it informs regarding the frequency of the interventions and their costs, allowing a grouping of the interventions, according to the machines on which they occur, to the failure types, to the intervention types and implicitly establishing an optimal maintenance politics for each type of equipment, fully adapted to it, in order to ensure a good production quality.

b. The preventive interventions history

We also consider that all the preventive, planned interventions (visits, revisions, inspections, tests, systematic redeployments), must be recorded in order to:

- to discover the cases in which the interventions' frequency can be reduced;
- to discover the cases in which derangements tend to appear more frequently, taking further measures, in order to address these weaknesses in the system and to avoid, this way, the danger of being confronted to a serious failure ;
- to detect the weaknesses in the system, which must be seriously analyzed in order to improve the equipment, in order to eliminate once for all the causes of the major failures.

c. The amendments' history

Generally speaking, the technical documentation is rarely brought up-to-date after the equipment suffers amendments. To get to know the equipment perfectly it's absolutely necessary to systematically record all the interventions in which the equipment is modified.

This history must cover the date and the content of the amendment, the amendment purpose and the registered results. All the amendments must be authorized, checked and carefully monitored through all their stages.

d. The intervention proceedings history

This history regards the keeping of the data related to the operation period and the maintenance costs (the great majority of the companies don't record these items of information, according to an investigation performed by us), having a

manifold importance: (Deac, V., 2000)

- it represents an information source meant to make us appreciate the importance and the effort made by each and every manufacturing plant;
- it helps to estimate the time at which the future interventions will occur, comparing them to the intervention proceedings from the past;
- it helps to lay out the expense estimate according to the intervention types;
- it helps to substantiate the decision regarding the optimal moment in which an equipment must be replaced.

In fact, it's a complete history of the intervention proceedings performed related to a certain item of equipment, gathering all interventions.

e. The used replacement parts history

For each piece of equipment, it's established a terminology of the replacement parts and especially of the ones for which demand the existence of replacement parts stocks. This terminology which has to be established from the very start will have to be completed, according to the actual replacements performed while the equipment is in use.

Hence, all the replacements of the spare parts should be marked out, the reason of this replacement being specified (for example: systematic replacement, accidental failure, replacement made as a result of an equipment change), a fact that will allow the study of its lifetime, a review of the replacement parts terminology for which it will be formed replacement parts stocks, a review of the number of replacement parts for each category. These aspects are extremely important (becoming even more important in the context of the current crisis), having in mind that the companies try to minimize the locking up of the financial resources as replacement parts.

Conclusions

The Romanian industry, even if it's mostly private, undergoes a period of profound crisis and great difficulties (financial blockages, a shrinking market regarding the "inputs" and the "outputs", price rises, etc.), in the context in which the production capacities usage decreased significantly (30-40% of the capacity, in some cases even less).Considering all these aspects, the management's choice not to place the equipment maintenance as a top priority on the list of companies' major concerns may seem reasonable.

The current uncertainties regarding the future of many industrial companies, considering the current financial-economic crisis, the state of confusion that still lingers in our economy can easily offer an explanation to the situation we're confronting with right now: the restriction of the maintenance proceedings to the minimum, in order to reduce as much as possible the production costs. On the other hand, the current economic juncture makes all the industrial companies to be "at war" to each other. Considering this state of affairs, it's absolutely necessary not

to become a fatalist, to be passive or to admit that we undergo a period of endless economic recession.

The winners of this difficult, but challenging situation will be only those trading companies whose managers will prove to be imaginative and creative, capable to find solutions to progress, to adapt to the economic realities and to act with an increased efficiency, finding ways to increase the company's competitive spirit. Among these solutions, the one regarding the production quality improvement needs to remain the top priority and, let's not forget, the industrial equipment maintenance is the one to warrant the quality of all the production stages. The main task of the industrial maintenance, in order to ensure a good production quality, is the one regarding the identification of the items of equipment that might have an impact over the production quality, warranting that, through the performed maintenance interventions, all the failures and the malfunctions that might affect the production's quality will be successfully prevented.

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