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MAINTENANCE ACCORDING TO THE TECHNICAL STATE WITH USE OF THE ENTERPRISE ASSET MANAGEMENT SYSTEMS

1. Introduction

Companies are buying more and more complex devices. In consequence they are forced to continually spend a significant financial and human resources for the maintenance and restoration of these very expensive production techniques to assure their maximum productivity. These considerable resources are not always spent efficiently, when unnecessary rises the prices of the overall production costs. Inaccurate information about the actual operation of production facilities, improper timing of inspections and preventive maintenance, inappropriate use of procedures of maintenance, faultyly evidence and inventory planning spare parts, insufficient utilization of human potential - these are examples of typical problems that are occurring in the maintenance of many companies.

Principal aim of maintenance is unconditionally ensure the proper function of the maintained equipment with minimal cost. This aim can be reached only when maintenance is well managed. Maintenance management is based on effective planning and operation of maintenance activities, that have to maintain the operability of the equipment. The processes of planning and maintenance management include a lot of different functions, beginning from the preparation of maintenance activities through their execution to ensuring the necessary resources for their completion. For quality planning and management of maintenance is necessary to have informations about the maintained equipment, required spare parts and materials, technological processes of repairs and required scope of work. It is also necessary to consider requirements in single professions, urgency of maintenance intervention, the available time, and the availability of equipment for maintenance [4, 5]

2. Information systems

Information Systems and computing machinery were first used for administrative activities in the fields of finance, trade, warehouse management, purchasing materials and personnel (this category is known as ERP - Enterprise Resource Planning). After the expansion of data systems. After the widespread use of information systems in business administration there is a mass use of computer technology also on their own premises.

For computerized maintenance management activities were aimed systems known as CMMS (computerized maintenance management systems). These systems are focused on basic maintenance functions such as scheduling of work orders and preventive maintenance and they are used especially to reduce the number of failures and downtime of production equipment.

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For advanced CMMS systems have been developed systems known as EAM (Enterprise Asset Management), which connects the functions of CMMS with management of stock with spare parts, spare parts trade brokering and maintenance services or even predictive maintenance [8, 9].

2.1. IS Infor EAM

Infor EAM Enterprise, a comprehensive enterprise asset management solution, lets you keep a constant watch on your asset condition and performance, evaluate data to find key trends and anomalies, forecast performance concerns, and make decisions that drive action (Fig. 1).

With over 20 years of asset management experience built in, EAM Enterprise has been helping companies around the world—including more than 60% of the Fortune 500.

EAM Enterprise addresses your most challenging asset issues, from preventative maintenance for discrete manufacturing, to predictive maintenance for food and beverage companies, emissions and energy demand management in pulp and paper, risk-based maintenance in life science organizations, fleet management for transportation companies, linear asset management for oil and gas, asset tracking and condition-based maintenance for public sector organizations, and more.

![Fig. 1. Moduls of INFOR EAM [1]](image)

With EAM Enterprise, we can:
- cut your purchasing costs, inventory levels, and inventory carrying costs, while making your workers more productive,
- comply with regulations and requirements without breaking a sweat,
- keep your assets up and running, and know when to replace them,
- reduce expenses by collecting on warranty claims [1].
3. Maintenance within Infor EAM

Within the IS is possible to process and monitor preventive, predictive and corrective maintenance.

The different types are shown in the example of the traction vehicle. Technical eligibility of vehicle in operation is provided by maintenance.

3.1. Implementation for maintenance

Vehicle in IS presents a lot of information. Of course, it depends on the user which information is necessary for him.

An essential part of the implementation of the track vehicle’s repairs system into the information system is the creation of a structure from the input data – the definition of the device’s structure, employees, professions and changes [10] (Fig. 2).

![Fig. 2. View on a vehicle in IS [8, 9]](image)

3.2. Preventive maintenance

The basis of maintenance in system of vehicle consists of preventive maintenance, which consists of regular alternating maintenance steps, whose main feature is the prevention of the failures.

The determining index is the cycle of repairs defined as maintenance cycle. A track vehicle has the maintenance cycle determined by mileage run, which is monitored with the help of a logical meter, that is installed of each device (every object individually) [6, 7].

Users of the system have exact and actual Activity data that have to be undertaken during the next period (week, month, year), and the tasks that had to be finalized.

If a track vehicle achieves the limit of the mileage (for the TV series 162 it is 4,500 km that are necessary for carrying-out the service), the IS will warn of released
jobs that contain activities which are necessary to carry-out within the scope of preventive maintenance (Fig. 3).

Fig. 3. Activities for periodical maintenance [2]

The scope and content of the activities for the TV series 162 is defined in the work standard almanac. In IS INFOR it contains a database of all maintenance interventions that are carried-out.

The system allows detail knowledge of necessity of working hours per maintenance work orders, whether by type of work, type of equipment, individual equipment or individual worker who carries out maintenance. With this informations can master of maintenance optimally assign a work to the individual serviceman. This will achieve a savings of working capacity, which can be used for further preventive maintenance.

Recorded are also all activities undertaken on every device, including the completion of data and results. The user of application can detect repeating equipment failures and keep records of the causes of these problems. Based on this information can be decided if the maintenance procedures will be changed (eg. to shorten the period of preventive maintenance) or the fault equipment will be replaced.

3.3. Predictive maintenance

The maintenance system according to the technical condition widely uses measurement techniques. Tribotechnique and optimization methods. Maintenance intervention is carried out after identifying actual technical condition of object by any of the methods of technical diagnostics and the calculation of the period during which the object was probably without failure. This maintenance system according to the technical condition will be shown by monitoring a wear of wheel flange on traction vehicle 162.

On the wheel flange is measured height, thickness and steepness, which measured dimensions are shown in figure 4. Information system is able to record and evaluate these inputs arising from measurement.

The spots for the check are identical and on every wheel the measurement is carried/out once. The check monitors and records the technical shape of the object consists of the following steps (Fig. 5):

- release of the job for PPM depending on the surveyor or another value,
  - carrying-out the PPM – for every object,
  - determining of the inspection procedure,
o defining the spots of the check,
o carrying-out the check and recording values,
- generating of the job if a limit has been exceeded,
- standard job – contains activities necessary to recover the original condition.

Fig. 4. Measured values on the rim’s profile [2]

Change of state of the measured value can be observed in the monitored data on the object where the inspection was carried out. By trend analysis from the results of the inspection, system predicts the dates, assumed dates when the value for the place of inspection – type of inspection reaches the limit of criticality. If the measured value exceeds the maximal criticality or reaches the maximal extreme then occurs automatically generated orders based on pre-prepared standard orders (Fig. 6).

This contract includes the activities that are necessary to eliminate improper state and subsequently return the state to the nominal value. This order includes the activities which are necessary to eliminate improper state and subsequently return to the state of nominal values (Fig. 7).
Fig. 5. Conduct of an inspection [8]

Fig. 6. Graf of the measure values
3.4. Corrective maintenance

The main advantage of corrective maintenance is that it uses the full range of machine operating life and puts low requirement to the information system. The disadvantage is that occurred faults often cause a chain reaction with larger consequences and there is difficult planning.

Based on the data in the data system can be through an information system processed and evaluated various parameters. Therefore are data systems very important and make work with large inputs databases easier [2, 3].

4. Conclusion

Systems of category EAM are in recent years more and more staggered as the one of the most important means to achieve and maintain a competitive advantage of company. Right established procedures use modern software technologies with an open architecture that can bring significant savings thanks to more efficient implementation of maintenance, including labor saving, material reduction in storage costs and purchases of spare parts and minimize downtime in production caused by the failure of machines.

With Infor EAM Enterprise, you'll gain many benefits, including these likely returns on your investment:

- 20% improvement in labour productivity,
- 30% reduction in inventory levels,
- 20% reduction in inventory carrying costs,
- 5% reduction in new equipment costs,
- 10% increase in fleet availability,
- 50% increase in warranty cost recovery,
- 10% reduction in materials costs,
- 50% reduction in purchasing process costs.

Manage your equipment, facilities, and vehicle assets from the point of purchase to the point of disposal—while cutting costs and increasing profits [1, 8].
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References:

[1] EAM Infor, user guide 2015

Abstract

The paper offers an overview of the changes of monitoring parameters for a vehicle with the help of information system - specifically with the help of the information system EAM INFOR. The single parts contain the description of the implementation of the system of the vehicle repairs into the information system, the system of preventive maintenance and the definition of predictive maintenance – on an example of measuring the height, thickness and steepness on the rim’s profile of wheel on a vehicle – the
changes of a parameter are defined and evaluated. If a maintenance information systems
is used for operation support, it has to be capable to record all the necessary data about
machines and equipment but also provide records for operative maintenance control and
system analysis. The right choice and application of an appropriate maintenance
information system supports the effectiveness of the maintenance which means
optimization of the maintenance costs, cutting loses from drop-outs, failures and
breakdowns of equipment as well as optimization of stock levels and purchase
management and in the end affects the economy of the enterprise.

**Keywords:** maintenance, preventive maintenance, predictive maintenance, information
systems

**OBSŁUGA WEDŁUG STANU TECHNICZNEGO Z ZASTOSOWANIEM
SYSTEMÓW ZARZĄDZANIA ZASOBAMI PRZEDSIĘBIORSTWA**

**Streszczenie**

Artykuł przedstawia przegląd zmian wynikających z monitorowania parametrów
pojazdu za pomocą systemu informatycznego - w szczególności za pomocą systemu
informatycznego EAM INFOR. Poszczególne części zawierają opis wdrożenia systemu
napraw pojazdów do systemu informatycznego, system konserwacji prewencyjnej i
definicję obsługi predyktywnej - na przykład mierząc wysokość, grubość i kąt nachylenia
profilu obręczy w kołach na pojeździe - zmiany parametru są określone i ocenione. Jeśli
systemy informatyczny obsługi służy do wsparcia operacyjnego, musi być w stanie
zapisać wszystkie niezbędne dane dotyczące maszyn i urządzeń, ale również mieć
możliwość przekazania zapisanych danych dla kontroli obsługi operacyjnej oraz analizy
systemowej. Właściwy wybór i zastosowanie odpowiedniego systemu informatycznego
obsługi wspiera skuteczność obsługi, co oznacza optymalizację kosztów utrzymania,
obniżenie strat z powodu przedwczesnych awarii maszyn, unieruchomienia sprzętu i
wyłączeń z ruchu, jak również optymalizację stanów magazynowych oraz zarządzanie
zakupami i na koniec oddziałuje pozytywnie na gospodarkę przedsiębiorstwa.

**Słowa kluczowe:** obsługa, obsługa prewencyjna, obsługa predyktynwa, systemy
informatyczne