

# Maintenance Informatician on the Mining Machines Used for the Modern Coal Mines

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## Abstract:

Shendong Coal Company of Shenhua Group has a yearly coal production of 120 million tons. The foundation of the million-tons coalmines relies on the world first-class machines in cutting, roof supporting, transporting, wash preparation as well as loading. The mining machines have become larger in size, continuous, cooperating with each other with high automation. The machines' daily checks, preventive maintenance and the rebuilding management provide a completely new maintenance pattern for our country's safe and high-efficient coal production. In this paper, it introduces the machines maintenance pattern and management informatician used in the Shendong company, and also analyses and implements results of this system and the effect of this pattern will bring to Chinese coal industries.

**Keywords:** Informatician; preventive maintenance; EAM system; mining machines' rebuilding and wash-brush; innovation

## 1 Summary

The mining machines become large in size, continuous, cooperating with each other with high automation, so the coal production is centralized. Therefore, we should focus on the reliability and availability of the mining machines in order to increase and stabilize the coal production. In those high-production and high-efficiency coal mines, the mining, transportation machines and roof support weigh 7500 tons or so, if there is something faulty in the working machines in the production site, it is impossible to replace or change the big assemblies on the mining machines. So except the daily maintenance and the rebuilding & wash-brush in the workshop, the preventive maintenance in the working area is very important. I can even say that without preventive maintenance in the production

period, we can't reach the planned coal production in a certain working face. Furthermore, the preventive maintenance is also the most important measure to ensure the working life of the machines. This is the big difference from other preventive maintenances in other industries.

## 2 Preventive maintenance based upon the informatization

( 1 ) Check system flow chart is as follows:

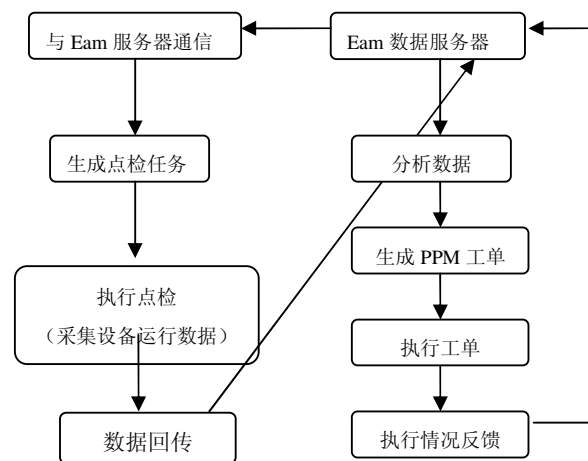


Figure 1 Check Management Flow Chart

a. The check system sends request to EAM data server and reads the basic machine information, for instance, the machine's target code, locations, maintenance center, history operation and responsible man ect. The check system will automatically create that day's check task according to the setting standards, checking period and checking items, and then save them to EAM data server to wait for the action of the checking operators.

b. The authorized check operator should download the check task on time to the check equipment (within 24 hours after the task occurs), after that, the operator should go to the work site to



and the related materials in advance and use EAM system to adjust and move the parts.

- The rebuilding center should make the fabrication parts and assembly tools as the maintenance plan required and also supply the required manpower and technical support.
- The production service center should arrange the specific vehicles as applied.

c. Implement supervision of the preventive maintenance

When implementing the plan, the safety technical measure should be made out and the responsible man should be authorized. The approved preventive maintenance plan should be executed strictly according to EAM system. The execution result will be brought into every month's mechanical and electrical examination to every production branches.

#### **(4) Information management of the preventive maintenance**

In the process of identifying, collecting, organizing, absorbing and commanding the knowledge, research, practice and application in the maintenance, we turn them into the practical and useful resources. Through our evaluation, information processing, storing, passing and sharing and application, we try to improve the value-created ability.

a..Set-up information database to display the recessive knowledge

Shendong company has set up the information database for all of the mining machines, in this database, some topics are selected and it has adopted the standardization and systematization compiling methods to gather and sum-up the accumulated experiences. It displays the working staff's experience and the gained knowledge from the experience. Currently, Shendong company is writing the checks and maintenance standard, compiling the faults that occurred in the machines monthly and the preventive maintenance technical inquiry brochure, publishing *Typical Faults on Mining Machines*; collecting the

disposal and preventive measures of more than 100 accidental cases; constantly compiling the *Innovation Brochures* and PDF files; naming the technical innovation after the inventor's name; except the above, this database also collects a big amount of mechanical, electrical and equipment modification information, research and the experiences. The feeding back of opinions regarding the make-in-China parts are also included in it.

b. Set up the information platform and network to promote the idea exchange and sharing

On promoting the machines informatization construction, three systems are formed, they are machine management information system, production management system and faulty monitoring system. The machine management information system uses the website to send different information collected from different working staff. The cases, experiences, checks and the training document about all kinds of the maintenance are all sent to the website in time as to show the working staff on line and let them keep learning, reforming and updating their knowledge.

c. Train the working staff to be experienced and strengthen their team cooperation

In order to improve the working staff quality and help them to adapt to the special requirement in skills and experiences, Shendong company has always organized the working staff for professional training and education and try to make the working staff possess the comprehensive skills in maintenance, checks, diagnosis and management. To deal with the important machine problems, we have formed many problems-disposal teams to respond the issues. Because we create harmonious working environment, the working staff are willing to exchange and share their own experiences and knowledge.

### **3 Machines rebuilding management relied on EAM information platform**

#### **(1) The EAM system's successful application in the maintenance work**

In the EAM system, the maintenance work of the 9 coalmines, 5 centers and coal loading departments belonged to Shendong company is completed by work order, it includes the equipment, materials, maintenance staff information (names, job titles, daily effective working hours and holiday- off information),

job titles and pay rate of the titles, maintenance company or departments, the nature and the priority of the maintenance work, and also the maintenance cost. In EAM, it shows you every maintenance's labour cost, spare parts cost, subcontract repair cost and the tools usage cost, at the same time, the working completion situation will be recorded in the work order and input in the system for the future check.

### **(2) Informatization management in the maintenance**

Through the EAM application and implementation, we stress business process and capital outlay of electrical and mechanical equipment management. We link the data input, work order, the inventory analysis and equipment management in order to make the machine maintenance management work to realize the smooth running from planning, control, information feedback and the continuous improvement. We changed the traditional after-work maintenance into the planned daily checks and preventive maintenance. This gave the management personnel the long-term and effective electrical and mechanical management consciousness.

EAM system provides powerful periodical preventive maintenance (PPM) work order. Through the maintenance experience in the work order, makes the periodical preventive maintenance systemic management come true, reducing the existing man-made defect, improving the maintenance quality and ensuring the machines' good working condition and performance.

On the basis of accumulating, analyzing and optimizing the experiences, we make the standard maintenance into the work order and input them into the system to standardize the maintenance. Then we popularize, implement and apply these work orders. When the rebuilding center rebuilds these machines, they are using these work orders, optimizing and making them perfect accordingly in order to improve the maintenance's accuracy and working efficiency.

We found the faults after summarizing, and corrected them as the maintenance manuals.

### **(3) The rebuilding project management**

Using the work order in EAM system and the project management of the system, the set up of the rebuilding project, execution and the balancing are all displayed in the EAM system, we can completely

control the rebuilding cost, time limit and the quality to ensure the scheduled rebuilding plan. All machines rebuilding cost can be finished in a day, what is more, the labour, spare parts, consumable material, tool and the subcontract cost are accurate and well-recorded for future check.

### **(4) The spare parts management in the preventive maintenance system**

1) Adopting different purchase and storage management methods according to different spare parts

a. Consumable parts management---the consumable parts are usually general parts. They are used a lot with quick turnover and easy purchase. Therefore, except a reasonable low stock for them to meet the production requirement, if the situation is allowable, zero stock management can be consulted with the parts suppliers and be carried out. The parts suppliers should prepare the lowest limit parts in the warehouse and implement the spare parts supply and the all-round technical service. The customer can balance the bill according to how many parts they are taken from the warehouse.

b. Parts for special purpose---those parts are generally non-generic. They are high-technology ones with low consumption and slow turnover. Their purchasing needs a long time and they are target parts. Therefore, they should be taken into the decentralized management, that is, managed by those who used them in the working period. For those highly specialized machines, they can be contracted with the machines manufactures, asking them to maintain and replace the parts (including spare parts preparation and storage management).

c. Parts for planned maintenance-----those parts should be managed strictly as the maintenance schedule, purchasing and storing them as scheduled. The operators can be examined by how many spare parts he used on the machines.

d. Parts stripped from the machines stored in the warehouse---this method is only used in the coalmines. It means to strip the needed parts from the machines kept in the warehouse.

e. Spare parts working status and working life control

If possible, all the parts mentioned above should all be monitored to ensure their status and check their

faulty in order to reduce the consumption and prolong the parts' working life. The manufactures and the customers are responsible for the parts' lifetime. They controlled the whole process to the parts' design, fabrication, application technology, invalidation analysis, information feedback, quality and management. Refer to figure 4.

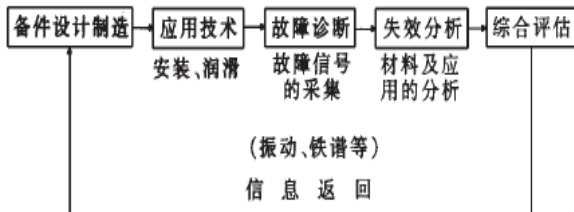


Figure 4 Spare parts lifetime management flow chart

To the enterprises, the spare parts management is always in an insipid position, but sometimes the spare parts relate to the business cost and machines running status. For the future consideration, the management for the spare parts is primary important. The enterprises (including the parts designer, manufactures, users and parts supervisors) not only need to change the concept, but also need to be equipped with the necessary equipment in order to set up an independent management system for the spare parts.

## 2) EAM storage/ purchase management

It mainly includes three sections, namely planning management, purchase management and storage management.

- a. Establish storage ration, automatically creating the purchase plan

After implementing the EAM system, all the past consumed parts data will be figured out through the system and be designed a reasonable lowest stock limit. Combined with the supply period, the system will make out the scientific purchasing order, when it is under the lowest safe stock, it will be automatically created request order. In this case, it greatly reduces the overstock and takes full advantages of the current stock, increasing the plan accuracy and establishing a good foundation for reducing the capital.

- b. Available inventory of warehouses  
All the parts warehouses including the service stations,

JOY warehouse and the bonded warehouse all can be visited, inquired and checked the inventories. You can also inquire and gather the information about the parts which have been purchased but not arrived yet. Up to now, Shendong coal company has used EAM system to check the inventory of the production parts and the rebuilding parts, through the checking, we don't need to buy the requested parts if we got the inventory in the warehouse, the inventory rate can reach to 100%, and that reduces the inventory capital 230 million RMB.

- c. Promote cooperation and development of the supply chain

The supplier management function in EAM system can evaluate the suppliers. We can choose, optimize and expand our supply channels with the agreed contract and the samples sent from the suppliers. Through the system we can acquire preferential price and quality service, the supply cycle can be shortened. The material quality management can full-scale expanded to the suppliers as to promote the whole logistic work and increase the benefit. We put the spare parts' purchasing information into EAM system to make the cost transparency and convenience for the cost management and control. In the premise of strict quality control, all the purchases should be carried out according to the purchase plan in the system.

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Wang Shengxiao(born in 1950), the paper writer, is from Yulin of Shanxi province, graduated from Northern-west Industry Institute. He is now a senior engineer and senior expert of China equipment engineering and is currently working in equipment management center of Shendong coal company, Shenhua group as a test & diagnosis supervisor.

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