Research and control of material completeness rate in coal machinery equipment overhaul

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ABSTRACT

In order to solve the current problems of low material availability rate for coal machinery equipment overhaul, which leads to long equipment overhaul period and high overhaul cost, through analyzing the reasons and problems caused by low material availability rate, it is proposed to optimize supplier delivery control , accurate production planning, detailed material classification management and setting up department KPIs and other measures to improve the material completeness rate. At the same time, we introduce constraint-based material re-planning and ABC material classification methods, and focus on key materials and key materials to comprehensively Improve the company's material management system and lay the foundation for high-quality and efficient development of the company.

Keywords: Material completeness rate, coal machinery equipment overhaul, material classification, KPI settingst

1. INTRODUCTION

Because coal machinery equipment operates underground in coal mines with high temperatures and high humidity for a long time, the equipment failure rate gradually increases after a cycle of normal use, seriously restricting coal mine production efficiency. In order to improve the operating rate of coal mining equipment and reduce its failure rate, it is often necessary to lift the well for overhaul after a certain period of use. Since coal mining equipment is generally a high-value asset, how to shorten the overhaul period and reduce ineffective waiting time is crucial. The material completeness rate during overhaul is an important factor that restricts the efficiency of overhaul and affects the cost of overhaul.

The complete set of materials refers to the ability of the inventory materials to meet the BOM materials during the overhaul of the coal mining equipment. The complete set rate is the percentage of the inventory materials before the coal mining equipment overhaul to the BOM materials of the product. The higher the ratio, the higher the production efficiency and the longer the construction period. The shorter, the lower the cost. The early arrival of materials before the start of equipment overhaul will lead to a decrease in the turnover rate of overstocked materials. The low completion rate of equipment after the start of equipment will lead to the extension of the overhaul period and the inability to complete on time. In addition, there are certain BOM materials used in the overhaul of coal machinery equipment compared with new equipment manufacturing. Changes have made it more difficult to get all the materials together. This article mainly analyzes and studies the reasons and problems caused by low raw material completeness rate during the overhaul of coal machinery equipment, and also proposes methods and measures to improve the material completeness rate.

2. PARTICIPATING DEPARTMENTS AND RESPONSIBILITIES FOR MATERIALS COLLECTION

Improving the complete set rate of coal machinery equipment overhaul materials requires the cooperation of all departments of the company.[1-4] It also requires accurate front-end planning, accurate equipment BOM, closed-loop process control-related processes, etc. The responsibilities of each department are shown in Table 1.

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Table 1 Responsibilities of the Department for Improving Material Completeness Rate

Department	Responsibilities
Planning and Scheduling Department	1) Responsible for the overall coordination of the overhaul work, maintaining communication with the purchasing department and production department to ensure the synchronization and accuracy of equipment overhaul plan, material demand plan and other information. 2) Responsible for the preparation, change and supervision of the equipment overhaul production capacity plan. 3) Responsible for the review of equipment overhaul material plans and the review of materials in the ERP system.
production department	1) Organize production according to equipment overhaul plan. 2) Responsible for the submission of material requirements plan for overhaul equipment. 3) Responsible for preparing the BOM of materials for overhaul equipment, and at the same time, making timely adjustments to necessary replacement materials and detecting the details of replacement materials according to the status of the equipment. 4) Responsible for controlling material classification and batch arrival according to the material supply period according to overhaul requirements.
Purchasing department	1) Responsible for the procurement of material requirements planning in the ERP system; responsible for supervising the on-time arrival of materials according to the production department's needs. 2) Responsible for emergency handling of abnormal materials.
Warehousing department	1) Responsible for the arrival, inspection, warehousing and outgoing of materials. 2) Responsible for the storage of materials and warehousing data support.
Information Technology Department	1) Responsible for the construction and maintenance of the company's ERP, WMS, SRM and other information systems. 2) Responsible for adding and changing material data in the ERP system.

3. ANALYSIS OF FACTORS AFFECTING MATERIAL COMPLETENESS RATE

The axle load of the front and rear axles of a forklift refers to the weight of the vehicle itself and other forces borne by the front and rear axles of the forklift. The axle load changes with the operation of the forklift, road conditions and load conditions. In this article, we discuss the axle load distribution of a certain type of 2t forklift when standing still on flat ground. At this time, the axle load of the forklift can be divided into the following two conditions: empty and fully loaded. The force analysis of the axle load under different conditions is shown in Figure 2 below, where Figure a represents the axle load of an empty forklift and Figure b represents the axle load of a fully loaded forklift[4,5].

3.1 Supplier delivery accuracy issues

The material supplier that has signed the contract fails to deliver on time, or the urgently needed materials cannot be delivered at the required time, or the supplier has poor delivery flexibility, which will lead to a low material delivery rate.

3.2 Fluctuations in production plans and forecasts

After the equipment overhaul capacity plan is released, the equipment may be returned to the factory for overhaul in advance due to customer production continuation reasons. At the same time, factors such as temporary equipment orders and rush repairs will disrupt the planned material matching, and the material completeness rate will decrease.

3.3 Material requirement data setting is inaccurate

The material supply cycle setting is inaccurate, causing the materials to arrive before or after the agreed delivery date, affecting the overall delivery rate; the BOM of the overhaul equipment is inaccurate, and the materials that must be replaced during the equipment overhaul process and the detection of replacement materials are inaccurate and not timely The demand plan was issued, which resulted in the inability to meet the material delivery date and the reduction of the completeness rate; for key strategic materials such as imported parts, the supply cycle was inaccurately grasped or the

early warning inventory quantity was set low, resulting in poor material consistency and the need for the materials being unavailable. The phenomenon of inventory and temporarily unused materials occupying a large amount of inventory.

3.4 Each department fails to fulfill its responsibilities

Planners and buyers do not understand the production capacity plan and only execute according to the plan in the ERP system. Emergency materials cannot arrive in time, and production and procurement cannot form a synergy; buyers are tired of coping with the arrival of emergency materials and ignore the overall production capacity. planning, resulting in a reduction in the follow-up equipment and material completeness rate.As shown in Figure 1.

Figure 1. Monthly inventory consumption

4. PROBLEMS CAUSED BY LOW MATCHING RATE

During the overhaul process of coal machinery equipment, if the material completeness rate is low, the planning and dispatching department will be unable to understand and control the production progress in a timely manner, and will be unable to accurately schedule the overhaul equipment, and the number of new equipment entering the factory will continue to increase, resulting in production scheduling management The difficulty increases and the corresponding equipment overhaul period is extended.

Materials for equipment overhaul in the production department are always not available, or work is stopped while waiting for materials, or rework is carried out first before the materials arrive at the next stage of the process, which will lead to a decrease in work enthusiasm of workshop employees, low raw material inventory turnover rate, and poor construction schedule. Frequent follow-up calls from customers are prolonged, and intangible costs such as labor, delay penalties, and inventory holding costs increase.

The purchasing department communicates with suppliers every day to issue urgent materials, and there is an urgent shortage of materials every day. The purchasing staff is tired of fighting fires and has no systematic planning. As soon as the materials for one piece of equipment arrive, another piece of equipment begins to wait. material. Over time, the cost of material procurement increases, the workload is huge and the result is half the result.

Conflicts between various departments became complicated, and the phenomenon of mutual blame gradually emerged. In the end, the on-time delivery rate of overhaul equipment dropped, which affected the corporate image and entered a disgusting cycle.As shown in Figure 2.

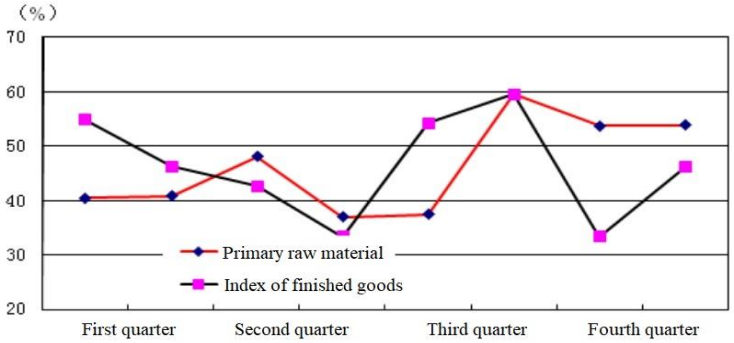

Figure 2. Quarterly change in inventory.

5. SOLUTIONS

In view of the above situation, improving the complete set rate of materials for coal machinery equipment overhaul is the key to high-quality and efficient development of enterprises. It needs to be improved from aspects such as supplier management, production capacity planning, material management, and KPI indicator setting:

5.1 Supplier delivery management

Material procurement is an important link that affects the material completeness rate. Timely and effective replenishment plans for missing materials are an important measure to improve the completeness rate. Among them, the timeliness and flexibility of supplier delivery are effective means to ensure the improvement of material completeness rate, and it is very necessary to include it in the supplier's KPI assessment.

There are always some suppliers who cannot deliver according to the delivery date. How to avoid additional inventory holdings and uneven materials, you can use material re-planning based on constraints (latest arrival materials) [5-8] to improve materials Complete rate. As shown in Figure 3, it is expected that key materials will be out of stock, so all normally arriving materials will be postponed.

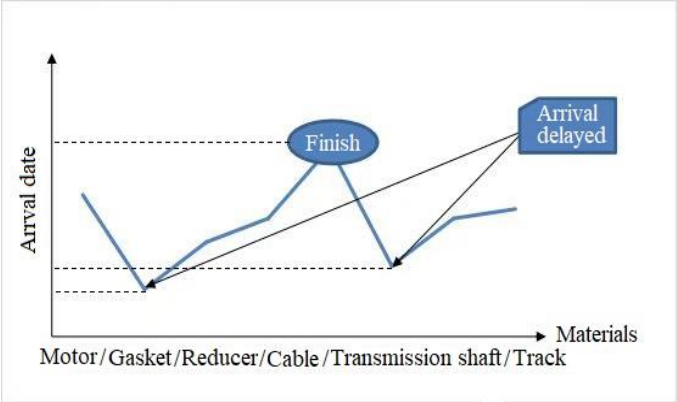

Figure 3. Material re-planning based on constraint.

And appropriately pre-invest in materials with long delivery periods and difficult procurement for regularly repaired equipment, so as to respond to market demand and prepare materials for emergency equipment entering the factory.As shown in Figure 4. Prepare overhaul equipment production schedule

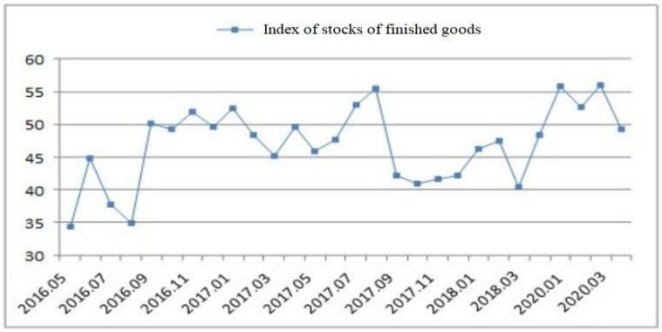

Figure 4. Index of stocks of finished goods.

5.2 ABC material classification

Sort out the BOM list of overhaul equipment, and classify and sort the materials according to their importance, value, capital occupation or consumption quantity, etc. By seizing the key few Category A materials, the key secondary Category B materials and the Category C materials purchased in batches, we prioritize and concentrate our efforts to achieve the purpose of improving the complete set rate. The general classification points are as follows:

Category A materials, the quantity accounts for 10% of the total quantity of BOM materials, and the value accounts for 70%;

Category B materials, the quantity accounts for 20% of the total quantity of BOM materials, and the value accounts for 20%;

Category C materials, the quantity accounts for 70% of the total quantity of BOM materials, and the value accounts for 10%;

For Class A materials, they should be listed as the primary focus. Because of their small quantity and high value, material investment should be made before and after the overhaul equipment maintenance date is determined. At the same time, the goods should be actively followed up one by one to ensure their completeness.

For Category B materials, it is also necessary to invest energy in paying attention to their inventory and completeness. If necessary, appropriate pre-investment can be made to ensure their completeness.

For Category C materials, their attributes are low value and large quantity. Once shortage occurs, Category AB materials will be stagnant. This type of material is often the easiest to ignore. Safety stock or buffer stock can be set up to ensure its consistency.

The division of ABC materials not only depends on the amount, but also the importance, scarcity, shortage risk, procurement cycle length, etc. of the material should be considered. Therefore, the division of ABC materials needs to be dynamically adjusted according to changes in demand. . In short, no matter how divided, the general distribution of ABC materials is shown in Figure 5.

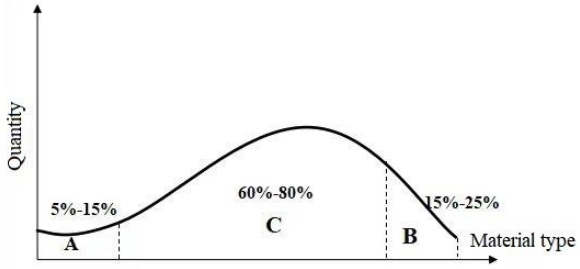

Figure 5. ABC material classification principles.

5.3 Establish clear KPI indicators

1) Suppliers: Assess situations such as failure to deliver according to the specified delivery date; emergency supporting materials requiring delayed delivery; material delivery flexibility being low.

2) Scheduling and planning department: If the production capacity plan is not prepared or changed in a timely manner or the information is not synchronized with the purchasing department and production department in a timely manner, the scheduling and planning department shall be assessed;

3) Production department: Failure to submit the material requirement plan for the overhaul equipment in a timely manner; BOM update of the overhaul equipment is not timely and inaccurate; inaccurate submission of the material requirement plan leads to material overuse or shortage; failure to pay attention to the equipment overhaul material completion rate in a timely manner, etc. , conduct assessment on the production department.

4) Procurement Department: Failure to timely initiate the procurement process for the material demand plan in ERP; failure to deliver goods according to the delivery date agreed in the contract; failure to timely feedback on abnormal purchased materials; assessment of the procurement department

5) Warehousing department: If the material inventory data is inaccurate; goods and materials are not received in time, etc., the warehousing department will be assessed.

6. CONCLUSION

By strengthening supplier delivery management, improving the accuracy of equipment overhaul scheduling, conducting ABC classification management of overhaul BOM materials, clarifying the responsibilities of each department and KPI assessment and other measures, we can effectively improve the rate of overhaul equipment materials, thereby shortening equipment overhaul Construction period, reduce equipment overhaul costs, promote the management level of coal machine overhaul enterprises, and promote the sustainable development of enterprise economic benefits.

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