Exploration of mechanical engineering equipment management and maintenance strategies

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Abstract. The management and maintenance of mechanical engineering equipment is critical to the proper operation and productivity of a business. The purpose of this paper is to discuss strategies for the management and maintenance of mechanical engineering equipment, including aspects such as preventive maintenance, breakdown repair and performance monitoring. Through reasonable management and maintenance methods, the reliability and extended service life of equipment can be improved, failure rates and maintenance costs can be reduced, production efficiency can be improved and sustainable development of enterprises can be supported.

Keywords: Mechanical engineering equipment, management, maintenance, preventive maintenance, breakdown repair, performance monitoring.

1. Introduction

With the continuous progress of technology and the acceleration of industrialization, mechanical engineering equipment plays an important role in all walks of life. Whether in the manufacturing industry, the energy sector or transport and other industries, the support and operation of various mechanical equipment is indispensable. However, with the long-term use of equipment and the inevitable wear and tear, equipment management and maintenance become particularly important. Mechanical engineering equipment management and maintenance is the process of taking a series of management and maintenance measures to ensure the proper operation and longevity of the equipment. A good management and maintenance strategy can reduce the frequency and extent of breakdowns and improve the reliability and stability of equipment, thus ensuring continuity and efficiency of production. Preventive maintenance is one of the key strategies in equipment management and maintenance. It involves regular equipment inspection, lubrication and cleaning, as well as the replacement and upgrading of components. Through regular inspection and maintenance, potential problems can be identified and repaired, preventing breakdowns from occurring. Preventive maintenance also involves developing maintenance schedules, recording equipment history and maintenance data to better manage the maintenance process of the equipment. A fault repair strategy is a way of responding to equipment failures when faced with them. Although the failure rate can be reduced through preventive maintenance, equipment failures are still unavoidable. Therefore, timely fault repair is very important. A sound fault repair strategy includes aspects such as fault diagnosis, quick fixes and spare parts management. By establishing a robust maintenance process and timely troubleshooting, downtime can be minimised and equipment availability and productivity increased. The performance monitoring strategy is an advanced approach to management and maintenance. It uses sensor technology and data analysis tools to monitor key parameters such as vibration, temperature and pressure of equipment in real time, and uses data analysis to predict the health status of equipment and potential problems. Performance monitoring strategies can help companies achieve predictive maintenance, take timely maintenance measures to avoid equipment failures that affect production and improve equipment reliability and stability [1].

2. Preventive maintenance strategies

Preventive maintenance is an important strategy in the management and maintenance of mechanical engineering equipment. It aims to reduce the probability of equipment failure, extend the life of the equipment and ensure its proper operation by taking measures in advance. The following are some preventive maintenance strategies:

Regular equipment inspection and maintenance: Regular inspection of the equipment includes the inspection of the exterior, internal parts and connections, as well as routine maintenance operations such as lubrication, cleaning and calibration of the equipment. This helps to identify potential problems and take timely action to prevent breakdowns [2].

Lubrication and cleaning measures: Regular lubrication and cleaning of equipment is an important part of preventive maintenance. Proper lubrication reduces friction and wear and keeps the equipment running properly, while cleaning removes accumulated dust, impurities and corrosion to prevent damage to the equipment.

Parts replacement and upgrade schedules: Parts replacement and upgrade schedules are developed based on the equipment's service life and maintenance records. Wear and tear or ageing parts are regularly replaced to prevent them from causing failures. Also, consider upgrading key components to enhance the performance and reliability of the equipment in line with technological developments and equipment improvements.

3. Fault repair strategies

Although preventive maintenance can reduce the incidence of breakdowns, equipment failures are still unavoidable. It is therefore vital to establish a sound fault repair strategy so that faults can be repaired and repaired quickly and effectively when they do occur.

Fault diagnosis and rapid repair: timely and accurate fault diagnosis is the key to fault repair. Using advanced diagnostic tools and techniques, combined with the equipment's fault phenomena and maintenance records, the cause of the fault is quickly determined so that appropriate repair measures can be taken quickly [3].

Sound maintenance process and team: Establish a sound maintenance process and standardised operating procedures to ensure that maintenance work is carried out in an efficient and orderly manner. At the same time, a professional maintenance team is established, including technicians and maintenance engineers with fault diagnosis and maintenance capabilities, capable of responding and dealing with all kinds of faults quickly.

Spare parts management and inventory control: Rational management of the inventory and use of spare parts for equipment to ensure timely supply and rational use of spare parts. Establish a spare parts list and inventory management system to reasonably arrange the procurement and storage of spare parts according to the maintenance needs of equipment and the frequency of spare parts usage, so as to avoid maintenance delays and downtime due to shortage of spare parts.

4. Performance monitoring strategy

Performance monitoring is an advanced approach to the management and maintenance of mechanical engineering equipment that uses sensor technology and data analysis tools to monitor key parameters of the equipment in real time and use the data analysis to assess the health and performance of the equipment. The following are the key elements of a performance monitoring strategy:

Application of sensor technology: The key parameters of the equipment are monitored in real time using various types of sensors, such as vibration sensors, temperature sensors and pressure sensors. These sensors collect data on the operating status of the equipment, vibration frequencies, temperature changes, pressure fluctuations, etc. and provide the basis for subsequent data analysis.

Real-time monitoring and analysis of key parameters: By monitoring key parameters of the equipment in real time, operational data and performance models of the equipment are established. Using data analysis and statistical methods, the data is processed and analysed to identify abnormal changes and trends in the equipment, predict the risk of equipment failure and develop corresponding maintenance plans.

Predictive maintenance and abnormality alert systems: implement predictive maintenance measures based on the results of performance monitoring. Based on the health of the equipment and the predicted risk of failure, maintenance plans are developed to prevent equipment failure by repairing or replacing critical components in a timely manner [4]. At the same time, an abnormality alert system is in place to prompt maintenance teams to take the necessary actions by issuing timely alerts when abnormal conditions occur in equipment.

5. Integrated application and case studies

The integrated application of strategies such as preventive maintenance, fault repair and performance monitoring can lead to more comprehensive and efficient plant management and maintenance. The following are some key aspects and case studies of integrated applications:

A management and maintenance plan that integrates different strategies: A comprehensive equipment management and maintenance plan is developed that combines preventive maintenance, breakdown repair and performance monitoring strategies with each other. The frequency and content of maintenance is tailored to the characteristics of the equipment and the operating environment in order to minimise failure rates and repair costs.

Case study: Successful application of strategies to improve equipment reliability and extend life. For example, a manufacturing company introduced performance monitoring technology, and through real-time monitoring of key equipment parameters such as vibration, temperature and pressure, abnormal vibrations in a key bearing were identified and timely repairs were carried out, avoiding serious equipment failure [5]. At the same time, a combination of preventive maintenance strategies, regular lubrication, cleaning and component replacement of equipment significantly reduced the failure rate and extended the life of the equipment.

The integrated application of various management and maintenance strategies can not only improve the reliability and performance of equipment, reduce failure rates and maintenance costs, but also effectively increase productivity and the competitiveness of the company. By continuously improving and optimising the application of strategies, companies can achieve continuous improvement in equipment management and maintenance, and lay a solid foundation for sustainable development.

6. Conclusions

The management and maintenance of mechanical engineering equipment is an integral part of modern industrial production. This paper discusses preventive maintenance strategies, breakdown repair strategies and performance monitoring strategies, and presents comprehensive applications and case studies. By developing and implementing these strategies in a rational manner, companies can improve the reliability and performance of their equipment, reduce failure rates and maintenance costs, and increase productivity and competitiveness. The integrated application of management and maintenance plans for different strategies and the successful practice of case studies can provide companies with comprehensive and efficient equipment management and maintenance solutions. Through the application of continuous improvement and optimisation strategies, enterprises can achieve continuous improvement in equipment management and maintenance, enhance production efficiency and quality, and lay a solid foundation for their sustainable development. In summary, the exploration of strategies for the management and maintenance of mechanical engineering equipment is a key factor in improving the reliability and efficiency of enterprises' equipment. Enterprises should

pay attention to equipment management and maintenance, develop comprehensive management and maintenance plans, and actively apply strategies such as preventive maintenance, fault repair and performance monitoring to ensure the normal operation of equipment and the sustainable development of the enterprise. Only by continuously strengthening equipment management and maintenance can enterprises be invincible in the fierce market competition.

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