

Research on Equipment State Management Mode Based on "League System"

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Abstract. Under the background of the decline in the hours of operation of thermal power generation equipment, based on Internet technology, a new mode of equipment state management, which integrates equipment responsibility to personnel, continuous tracking and updating of equipment status, and integration of test analysis and processing, A new idea of equipment maintenance for technology sharing, data sharing, and experience sharing has been realized. It has realized the orientation control of the daily work of the professional technicians of power generation enterprises, and at the same time, the equipment status tracking based on the equipment status is further exploration for the field of state maintenance.

1 Background Overview

Since the founding of the People's Republic of China, on the basis of learning the experience of the former Soviet Union, China's thermal power equipment maintenance has implemented a time-based preventive plan maintenance system [1]. With the development of the times, the requirements for resource utilization have been continuously improved, The requirements for resource utilization are constantly increasing, and planned maintenance cannot meet current needs. The current industry equipment management has many drawbacks, mainly in the following: unplanned downtime, equipment overhaul and under maintenance, and uniform maintenance strategy.

In order to explore the solution to the current equipment management problem, through repeated demonstration and pilot verification, the initial innovation has formed a sophisticated diagnostic mode for equipment design diagnosis, classification diagnosis, comprehensive diagnosis and continuous improvement. A device state management system based on a remote monitoring and diagnostic platform. Equipment status tracking management is an effective way to plan maintenance to the state maintenance, which can effectively improve equipment reliability and greatly reduce equipment maintenance costs.

2 Equipment Management System Innovation

From the initial preventive maintenance, especially in the pre-knowledge and state maintenance concepts and methods in equipment management, the equipment inspection mode and inspection system can not meet the requirements of equipment management, The device check is transitioning to a precise check of the multiple parameters of the fusion device state. At the same time of technological innovation, the innovation of the management model must be updated with the times, thus ensuring the rationality of the equipment management model.

2. 1 Precision check mode establishment

Precise inspection is the use of more and more advanced testing equipment to determine a certain characteristic parameters (such as vibration, temperature) of the equipment, and analyze the fault information of the extraction equipment, Compare with the standard and historical records, combine the fault mechanism with the actual situation to conduct comprehensive analysis and diagnosis, accurately understand and master the health status during the operation of the equipment, discover the early failure signs and causes of the equipment, and predict the development trend of the fault, and implement

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the equipment. State maintenance and management provide an accurate basis.

On the remote tracking management platform of the equipment, the basic information account of the equipment in the area is established. Based on the complete understanding of the basic information of the equipment, through the experience summary, the precision inspection technology combines the vibration, infrared, ultrasonic, oil, and current spectrum. For different types of equipments, establish a technical matrix for equipment matching to achieve fusion analysis and diagnosis of equipment status.

The vibration analysis technology can effectively evaluate the operating state of the equipment, and quantitatively measure the problems existing in the bearing and rotating equipment through time domain, frequency domain and envelope analysis. Infrared technology can accurately detect the surface temperature distribution of equipment, provide clear and intuitive temperature parameters, and is applied to electrical equipment and transfer equipment, Ultrasonic technology can be used for partial discharge detection of power transmission and transformation equipment. It can also be used for abnormal sound detection of rotating parts of rotary equipment. It can also be used for leak detection of pressure vessels and pipelines. It can quickly locate noise sources and accurately identify equipment problems. Oil technology is used for oil quality monitoring of transfer equipment. Oil monitoring is to use the information of the working conditions of the equipment carried by the oil to judge the current working condition of the equipment, thus providing an effective basis for the correct maintenance of the equipment, The current spectrum analysis technology detects the running current of the motor, can find the rotor fault, solve the problem of motor monitoring and diagnosis such as broken strip, uneven air gap and casting defects.

According to various technical analysis methods, combined with domestic and foreign experience and relevant standards, artificially delineate the equipment status, comprehensively analyze the current status of given equipment through precise diagnosis, and guide equipment operation and maintenance.

2. 2 League system

In order to strengthen the daily work management of precision inspection professionals, the league system was introduced in the daily production of power generation enterprises. The so-called league system is a work accumulation process, through the quantitative assessment of the daily work of the players in the power generation enterprise. The final target of precision inspection professional services is equipment. Through a large number of research preparations, based on the professional workflow of precision inspection of power generation enterprises, detailed evaluation methods have been formulated and deployed in the form of Internet+.

In order to realize the state tracking management of thermal power generation equipment, based on the work related to precision inspection, it takes a year of effort to

build a remote platform for monitoring the operation status of thermal power generation equipment, and realize the equipment information, equipment status, daily work of personnel through the platform. Experience sharing.

The content of the league can be divided into two categories: daily work and achievement sharing. The daily work is a review of the daily work of the players' precise inspection, including work plan, equipment information entry, equipment test diagnosis and work summary. The result sharing is a review of the skill level and technical achievements of the players' precision inspection, including original cases and real-time case exchanges. The original case is the result obtained in the daily work of precision inspection since the project started. The real-time case communication is to discuss and exchange the hidden dangers or failures of the existing equipment in real time. All relevant work systems are automatically and manually scored

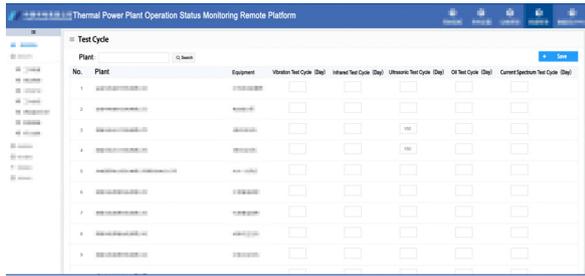
2. 3 Data-based tracking decision

The status of the device follows the running time of the device constantly changing. How to perform device tracking decision according to the actual running state of the device is the content that needs to be explored in the device state management mode. In the daily production, an effective pipe mode is usually not formed because the number of devices in the field is large and the state is complicated. In order to effectively implement device tracking and coordinate management of device status, according to the Internet + technology, a device status tracking management system has been developed. Based on the latest equipment operating status, an effective equipment status tracking strategy is developed to guide professional technicians to perform daily equipment testing to form a pattern in which the problem equipment is continuously tracked and the normal equipment is regularly tracked.

The platform data statistics take the equipment maintenance time as the tracking management starting point, and the standby testing period of the same type of equipment is determined according to the equipment category, In principle, the equipment test cycle is based on the shortest period of the pre-test test, and the tracking test cycle of the device is adjusted according to the first device test. The system realizes that according to the test data, based on the corresponding national standard or line standard, the device status level is determined by itself, and it is divided into four levels: normal, slight, medium and serious. The device will automatically remind the device to change the test period according to the device status.

The device status tracking policy established by this mode can effectively achieve continuous tracking based on the device status. The maximum time for the system to set the device status tracking update time must not exceed 7 working days. If the device status is not updated after more than 7 working days, the system will automatically alert the professional to update the device status. At the same time, the device status update cannot be completed

by human intervention, and must be updated by the latest data detected by the corresponding instrument.



The screenshot shows a web-based interface for monitoring thermal power plant operations. A table titled 'Test Cycle' is displayed, listing various equipment and their test schedules. The table has columns for 'No.', 'Plant', 'Equipment', and several test cycle dates: 'Version Test Cycle (Day)', 'Initial Test Cycle (Day)', 'Ultimate Test Cycle (Day)', 'Off Test Cycle (Day)', and 'Current Operation Test Cycle (Day)'. Each row represents a piece of equipment with its corresponding test dates and status indicators.

Fig. 1 Set up the equipment test cycle

2. 4 Data-based remote analysis and diagnosis

When there is a problem with the equipment, the power plant professional technicians provide the expert team with a rough and rough description of the equipment status. The expert team often cannot clearly control the actual state of the equipment, so the implementation of remote analysis and diagnosis has been stagnant. The analysis of equipment status is not a single parameter, single time data status. On the basis of equipment state management, the expert team can clearly grasp the basic information and structure of the equipment. Experts can adjust the relevant operating parameters and precise diagnostic information of the equipment in real time, which can fully guarantee the first-hand data of the expert team to ensure the accuracy and reliability of the required data.

Remote diagnostic tracking not only realizes the direct transmission of data. For vibration data, the simple frequency value is often unable to extract useful equipment information for expert analysis. In the equipment remote state tracking system, the detailed analysis data of the power plant equipment test is transmitted to the big data platform in real time. The expert team can accurately analyze the status of the equipment in combination with the equipment information and structure provided in the previous period, which provides a strong guarantee for the decision of the emergency situation of the equipment.

3 Professional management innovation

In the innovation of equipment management mode, it is indispensable for the management of personnel. Under the multi-device status test method, personnel operation plays a vital role. If the effective control personnel perform daily work according to the equipment operation characteristics, it is the basis for ensuring effective tracking of equipment status. Through the control of many years of work, the professional management mode is carried out from the aspects of personnel skill improvement and regular personnel assessment.

3. 1 Skills improvement

As a professional that combines multi-disciplinary and multi-technical means, the precision inspection professional has put forward high requirements for the quality of employees. At present, it has gradually formed a management mode of training, communication and rotation teaching. Regularly invite experts from relevant fields at home and abroad to conduct theoretical knowledge training, which is the main way for professional and technical personnel to carry out self-improvement. The monitoring and judgment of equipment status is by no means pure theoretical study, and has extremely high requirements for the field experience of practitioners. Therefore, the communication of practitioners is particularly important.

In the current Internet era, the online and offline communication system has been realized. Based on the device status remote management platform, the BBS mode can be used to implement the follow-up communication tracking of technical issues. At the same time, regional company seminars are organized regularly to conduct daily problem exchanges. Technical exchanges will be carried out by region, and classic problems and classic cases will be screened through the region, and then cross-learning exchanges between regions will be carried out through the pattern of rotating lectures. In this way, the technology improvement is realized, and the communication and experience sharing among the practitioners are promoted from the side.

3. 2 Regular evaluation based on the league system

Based on the statistical means of big data, the equipment state management platform displays the working status of the player in real time. Through the league system, the equipment responsibility is realized. The responsible person needs to complete the statistical sorting of the equipment brand name, structure and parameters, and establish detailed equipment information and equipment maintenance files with the power plant as the unit, so that the equipment status can be checked.

The platform automatically counts the state of the power generation enterprise equipment on a monthly basis, and realizes the continuous tracking of the equipment status. At the same time, according to the division of equipment responsibility, the real-time display professional is responsible for the overall status of the equipment, and realizes the division of the equipment status, and can directly provide the jurisdiction equipment. The status provides an intuitive basis for the maintenance of the device status.

The league manages the daily work of professionals, from work plan to equipment failure treatment, from work summary to experience sharing, all of which are counted in a quantitative way, and finally form the ranking of all employees, and regularly in the form of red-headed documents within the group. It creates a healthy competition and provides the impetus for the active maintenance of the state of the equipment.

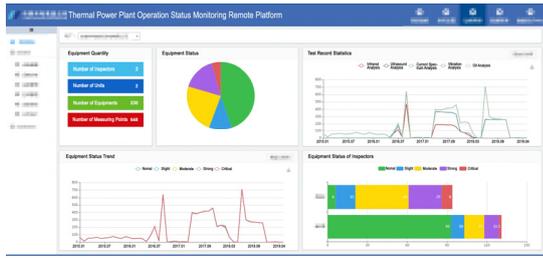


Fig. 2 Statistics of equipment status of a power generation enterprise

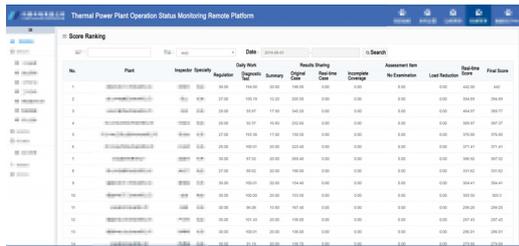


Fig. 3 Professional league performance rankings

3. 3 To promote learning

In the spirit of "promoting training with training and promoting learning with training", the company has established a competition mechanism for coordinating and coordinating the competition, and has realized an incentive mechanism to encourage employees to learn technology and drill business. The game got rid of the shackles of the regular game mode, and took the actual fault of the actual production equipment as the content of the game, creating a new mode of professional skill competition, and maximizing the concept of combining theory with practice.

The competition consists of three parts: daily work (league), theoretical level, and actual operation. The daily work results are derived from the league's results. The actual players in the game are used to learn and use the on-site decision-making ability to verify the field equipment and judge the players. Grading, the theoretical competition is fundamentally grasped, and the technical staff's theory is fundamental.



Fig. 4 Actual operation competition site

4. Initial results

With the advancement of the precise inspection and diagnosis work of the equipment running state of the fusion league system, the lean management of the equipment state has been effectively realized, and the equipment and production management capabilities have been substantially improved. At present, 226 units have been realized, tracking management of more than 19, 000 pieces of equipment, and daily work management of 176 professional and technical personnel have achieved fruitful results. In the process of pattern exploration, through the overall investigation of the equipment, a total of more than 7, 800 problematic equipments were discovered and handled. Among them, 1123 equipments requiring urgent maintenance were not fully counted, and 270 equipments needed to be scheduled for maintenance were required to be partially adjusted. There are 1276 sets of equipment and 3232 sets of equipment that need trend monitoring. The equipment status tracking ensures the safe and reliable operation of the equipment.

Through the operation tracking of equipment based on big data platform, the real-time control of the state is realized. With the support of such a large number of devices, it is believed that the precision inspection and remote diagnosis system will play a more significant role in the tracking and management of equipment status of the group company.

5. Outlook and summary

Based on the equipment management system of "precision inspection and remote diagnosis", combined with the current situation of low utilization hours of equipment, over-repair of equipment and under-repair, how to optimize and start to enter the scope of thinking of power generation enterprises. Based on the current situation, Huadian Group has defined a new mode of optimization and overhaul of Huadian Group based on the current equipment state management mode. That is, the power generation enterprise no longer monitors the equipment according to the planned time, but keeps track of the running state of the equipment, and operates the equipment hours. The number is based on the judgment of equipment maintenance.

The proposal of optimized maintenance mode is another improvement of equipment state management, and it is also a further integration of precision inspection with other professions. It is a further exploration of the state of the power industry.

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