

TAKING FULL ADVANTAGE OF MODERN MONITORING TECHNOLOGY, IMPROVING MECHANICAL AND ELECTRICAL MANAGEMENT IN MINE CONTINUOUSLY

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Abstract:

Monitoring system is applied to mechanical and electrical equipments in coal mine, which is not only an excellent opportunity but also a challenge for the mechanical and electrical management in mine. Application of monitoring technology is reviewed in coal mine equipment management, and application foreground of monitoring technology is prospected in the field. Monitoring system can not only monitor the conditions of equipment, but also achieve early diagnosis and prediction for the potential fault of equipment, so that it can effectively avoid catastrophic accidents with diagnosis technique. Specific proposals are suggested on how to take full advantage of monitoring technology to achieve the effective management for mechanical and electrical equipments, and to improve mechanical and electrical management.

Key words: monitoring technology; condition monitoring; mechanical and electrical equipment in mine; mechanical and electrical management

1 Foreword

Production safety is an eternal theme of mine enterprises, while ensuring the safe operation of coal mine production can not do without the effective mechanical and electric management. For years, a series of effective mode and methods of mechanical and electric management are gradually built during forming their own enterprise culture and exploring business management in the state-owned coal enterprises. Pursuing benefit and improving management efficiency is fundamental for survival and development of the enterprises, therefore, continuously improving the mechanical and electrical management in coal mine is extremely important aspect for improve the benefit in coal enterprises, and ensure Production safely in the coal mine.

Science and technology is the first productivity. The rapid development of science and technology provide condition for renewal and upgrade of mechanical and electrical equipment in coal mine. At present, computer technology, automation and information technology is rapidly applied to the mechanical and electrical equipment in the coal mines. A great deal of high-tech applications are not only an excellent opportunity but also a challenge for the

mechanical and electrical management in mine. Seize the opportunity and take full advantage of the advantageous conditions and factors from high and new technology, so as to maximize the benefits of technology appliance, and improve mechanical and electrical management level.

2 Appliance and prospects of monitoring technology in mine equipments

Mine monitoring technology has already begun to develop in other countries from the 1960s, but the appliance of monitoring technology is relatively late at home. In the early 1980s, the former Coal Department organized the large-scale inspection and introduction of mine monitoring technology from other countries, which has promoted the development of domestic monitoring technology. A passel of safety monitoring systems (such as DAN6400, TF20, MINOS and Senturion-200) is introduced successively from Poland, France, Germany, Britain and the United States; at the same time, by studying and basing on our actual coal mine situation, KJ2, KJ4 systems were developed and passed appraisal. Then, some of our scientific research institutes and related enterprises closely follow the world development tide of monitoring system, and developed a group of world advanced level monitoring systems, the main features: the intelligent level of branch station of measurement and control is further improved, connectivity with network, the Windows operating was used, and so on. Especially in recent years, as requirements of production safety to coal mine are continuously improve in our state and the needs of enterprise development, monitoring system develops rapidly in China and various monitoring systems and its supported products emerge as the tide, whose function are better, reliability greatly enhanced, and involving monitoring is more extensive. At present, more than ten kinds of monitoring systems are used in China's coal mines, and the mines equipped monitoring system account for about two-thirds of the total in state-owned coal mines. Appliance of mine monitoring and control system has played an important role for improving the security situation, the efficiency of coal production and the level of modernization in China's coal mines. At the same time, we must realize what is said above the mine monitoring and controlling more focused on the gas, ventilation systems and other major security aspects. With the investment of the state and the enterprises in

security strengthened and the advancing of science and technology, past major debt of safety in the coal mine is gradually eliminated, on this basis, in the elimination of goods insecurity, safety production will gradually improve, monitor and control will change to the forecast, to eliminate hidden dangers, to protect the equipment operation safely, Monitoring range is not limited to gas and ventilation, and developed to the ventilation system gradually, lift transport, tape transport, rail transport, power supply, drainage, mine, mining pressure, washing process, such as the monitoring system will be formed on the impact of All aspects of mine safety and the process of monitoring and controlling system, it will play an important role to guarantee coal mine safety, increase productivity and equipment utilization ratio and so on.

At present, the monitoring system for monitoring the operation of the mechanical and electrical equipment has been used widely, which is characterized by the use of sensor technology, computer technology, information and communication technology, software technology and fault diagnosis technology etc., while monitoring the operation of the mechanical and electrical equipment, through the diagnosis of possible equipment failure to achieve the early diagnosis and prediction, it 's possible to effectively avoid the occurrence of disastrous accidents.

(1) Monitoring System for Underground Substation will enable real-time monitoring the running state of Underground switch, the current status of the operation and other parameters. It could accomplish Remote Control by computer to switching closing, leakage test, reset and other operations in the Underground Substation, that is equal to achieve Remote Control to power off and on by ground computer, and Unmanned On Duty in the underground substation

(2) underground parking lots signal sets closed system which control the field network based on PLC, give full play to advantages of PLC with remote intelligent control and use artificial / automatic scheduling command functions, alarm to red light runners , the turnout reduction and fault self-inspection function, and Analog Board shows that self-inspection function, achieve network control and management to underground parking aiming to guarantee the safe operation of motorcycles

(3) In mine-used large-scale fixed equipment, monitoring to running and the level of mine and water, underground mobile communication systems, personnel positioning systems, industrial television system, the main auxiliary shaft elevator operating surveillance systems, monitoring the transport belt systems, air-monitoring system and so on are integrated through the computer network system, to achieve real-time surveillance, treatment, control to WEB interface , automatic control and remote monitoring. Particularly, through monitoring various parameters of various equipment in the operation, analyzing liable changes of parameters during the operation of equipment and the possibly failure types, making full use of fault

diagnosis technology, the new sensor technology, data integration technology and the principle of mathematical statistics and modern software technology, and other methods, it could result a relationship between faults and running parameters changes, and achieve the pre-monitoring and alarm functions for different types of equipment with the use of software programming methods.

Digital AC -DC mine hoist, in particular built-in mine hoist that structurally regard roller and drive as a whole to greatly simplify the mechanical structure, fully embodies the machinery - power electronics - computers - a synthesis of control. All-digital mine hoist has a high degree of reliability and repeatability , and contains abilities of addressing failures, completely diagnostic facilities and self-diagnostic and the capacity of simple and speedy communication; electrical installation is greatly simplified by bus way; it has the characteristics of simple hardware configuration, compatibility and with fewer spare parts; it can easily achieve soft start, software control and change the instantaneous acceleration.

Remote centralized control belt conveyors, not only has good start, parking, speed and power balance, and other functions, but also monitor the condition of Various parts of equipment, protect the abnormal state ,display the type of failure and has functions of perfect the protection and self-diagnosis, display and communications by technology of electro-hydraulic control soft-start (CST technology) and combining with computer and hydraulic technology.

(4) most of electrical haulage shearers now are equipped with a condition monitoring and fault diagnosis system taking computer as the core of the control, which takes the collection, processing, display, storage and transmission to the coal mining Machine operating conditions and parameters by the computer installed on Shearers accompanying with a variety of sensors, and provides operational guidance or manages control Shearers to take corresponding treatments and takes fault diagnosis automatically to the motors, bearings and other components . This will not only greatly enhance the operating rate of the shearer, but can also ensure the equipment work under the best condition. The Application of the hydraulic support by electro-hydraulic control combining organically computer technology and hydraulic control, achieves a bidirectional neighborhood planes with constant pressure or group automatically shift planes to avoid the impact load between the roof and support. Electro-hydraulic control device can also support the monitoring of working conditions. In addition, some imports of face-powered equipment use computer control technology to achieve failure tracing, artesian, the pilot protection and control functions.

In spite of the considerable development of the mine mechanical and electrical equipment monitoring technology, the own specific environmental conditions of mines restrain application of the results of high-tech to mining equipment immediately. Only in term of sensor, as we know, a stable, reliable sensor is a critical

technology and product for equipment monitoring system to correctly reflect the measured parameters. Although the developments and applications of some mining sensors to some extent meet the needs of the monitoring, but the varieties and specification of these mining sensors are still far failed to meet demands of monitoring to equipments actually. Additionally domestic sensors still have a long distance in life, adjust cycle, stability and reliability compared with similar foreign products. The stability of some sensors is still far away to meet the needs of users. From the communication protocol level, due to many manufacturers use their special protocol in their the monitoring systems, communication protocol and transmission equipment physical interface are not standardized which makes the system compatible with each other and not be free to upgrade hardware and software and then limits the development.

Therefore, in terms of the development of monitoring of coal mine electromechanical equipment, the remote monitoring and control is an inevitable trend. In communications, currently, on the basis of the field bus technology and the high-speed real-time fiber ring industrial Ethernet technology with the transmission rate to Gigabit, as a whole of digital net, sound net and image net, it could establish high-speed digital network information platform of full open and standardization, and achieve seamless coupling among network equipments, which could be easily expanded and upgraded according to the actual situation.

In the diagnosis and monitoring of Equipment failure ,the main methods used are: 1) vibration measurement that detecting the state of equipment operation through the vibration, by online or off-line detection testing methods, tests the various parts of the equipment and collect data, and then to the greater part of vibration data, uses sophisticated diagnostics and takes spectrum analysis (including the amplitude spectrum, power spectrum, the phase spectrum), spectral analysis and refinement spectrum analysis technology for far-reaching study to determine whether equipment failure and the cause, location, severity and so on. 2) By using oil analysis technology, through analyzing changes of lubricants performance parameters (including mainly change of lubricants physical and chemical in performance and operating parameters, such as change of oil pressure and change of tribological characteristics of lubricating oil),and the use of oil IR Analysis, particle count, oil performance indicators and test of tribology performance, working conditions of the major parts of equipment are understood indirectly, and the work of equipment is monitored timely and accurately. Methods mentioned above, mainly by offline now, are used to detect and diagnose equipment fault. With the deepening research and improvement to the technology, remote on-line real-time detection and diagnosis will gradually be used widely.

As for software for monitoring , the industrial configuration software ,which based on the Chinese operating system platform ,with characteristics of full

function, friendly interface, the realistic screen image, easy to learn and use, will be widely used.

3 Play a role of monitoring technology in the electromechanical management

Monitoring system on the application of coal mine electromechanical equipment, provided a good material basis to achieve a higher level of the mechanical and electrical management. How to make good use of monitoring system is an extremely important work in the electromechanical management. Taking full advantage of monitoring system in the electromechanical management can achieve the following objectives:

(1) improve management efficiency and quality continuously

monitoring system based on network technology and information technology, has changed the traditional mode of management so that managers ,who have a Clairvoyance and clairaudience, can timely and accurately understand the work site and the operation of devices for rapidly decision-making which based on a monitoring system . Monitoring system can improve the efficiency in the use of elements and enhance the management level.

(2) Find hidden causes of accidents timely and prevent accidents from occurring

Since the monitoring system of the equipment running is generally installed early diagnosis and prediction information, it can find hidden causes of accidents timely so that the hidden causes of accidents can be managed more comprehensively and thoroughly. In the process of running through the timely alarm, power off and blocking, the monitoring system prevents accidents from occurring and expanding ,and puts an end to catastrophic accidents effectively.

(3) To realize maintain and overhaul, the operation conditions of the mechanical and electrical equipment are understood in time

Monitoring system will enable managers timely grasp of the operation of equipment history and current situation, the equipment managers to facilitate the operation of the analysis to the situation in full knowledge of equipment under the conditions put forward a more reasonable maintenance strategies and programmes to improve equipment Utilization, reduce maintenance time and downtime, maintenance equipment from passive to predict the development of maintenance, greatly enhance economic and social benefits.

4) Achieving energy saving

To achieve energy-saving purpose, managers can understand the timely equipment operating conditions by monitoring system, and regulate working conditions in purpose, so that equipment work best in the efficient region, effectively use of resources, and reduce energy consumption.

To take full advantage of a good monitoring system and improve mechanical and electrical management level, works must be do as following:

(1) Increasing technology content in the mechanical and electrical equipment by increasing the strength of

Innovation.

Innovation is the driving force for enterprise development. To improve the monitoring system for practical, safety and reliability, technology upgrading, through increasing innovation, transformation and renewal make the mechanical and electrical equipment possesses function of remote monitoring, automatic diagnosis and control.

(2) Keep up with the pace of the times, select correctly Monitoring System

Quality of monitoring system directly effect on monitoring of the mechanical and electrical equipment, therefore, it's more important to select the system with full openness and good expansion and upgrading, which is good quality and excellent performance in many complex monitoring systems.

(3) Improve the technical quality of workers, use well monitoring system

Appliance of monitoring system is tests and challenges on the quality for a large number of workers, and only master the advanced technology to manage the monitoring of high-tech products, therefore, to control

and use well monitoring system, workers must first improve the cultural quality and technical quality.

References:

[1]Bangquan Zhou .Development Course and Tendency of Coal Mine Safety Monitoring Systems . Mining Safety & Environmental Protection, 2007.6(34 supplement):76-77

[2]Shengsan Hu,Dejian Tan etc. Traditional coal industry to be transformed by high and new technology. China Coal. 2002.3(28):5-10

[3]Chengxun Yin, Ling Wu etc. Application of Operation State Observation and Trouble Diagnosis Technique in Coal Mines. Mining & Processing Equipment. 2000.8:56-57

[4]Rixia Kang, Sheng Fu etc. Development of the System for Remote Measuring the Safe Operation of the Mine-Used Big Scale Fixed Equipment. Mining & Processing Equipment. 2007.5(35):10-11

[5]Zhijiang Chen, Sheng Fu etc. Application Study of New Technology In Mine Large-scale Fixed Equipment. Coal Mine Modernization. 2007.8(supplement):117-118