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Analysis and Control of Vibration Characteristics of Coal Handling Equipment in Thermal Power Plant

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Abstract

With the rapid development of China's economy, the demand for power resources is becoming more and more urgent. For a long time in the future, thermal power generation will still occupy an important leading position in power resources. The fuel coal handling system of thermal power plant has become an important link to ensure the normal power supply, and its structural safety is becoming more and more important. Among them, the vibration in the process of coal conveying is a research hotspot. In order to reduce the harm caused by the safety management loophole of coal handling system to operators, it is imperative to introduce UWB positioning technology to realize the personnel positioning management of coal handling system. The test results show that the application of UWB positioning technology in coal handling system of thermal power plant is practical and feasible, and meets the requirements of on-site positioning accuracy.

Keywords

Coal Handling System, Shock, Efficiency.

1. Introduction

Coal handling system is the lifeline of coal-fired power generation enterprises. It is composed of different operation links, process equipment and auxiliary buildings such as coal unloading system, coal transportation system, coal blending system and coal storage system. It is responsible for providing coal for boiler raw coal bunker on time and in quantity, which is very important for the safe and reliable operation of power plant [1-3]. Coal handling equipment can be divided into coal unloading equipment, stockyard stacking and reclaiming equipment, conveying equipment, screening and crushing equipment, auxiliary equipment, etc. due to the narrow and long operation line, dense rotating machinery, high noise and high dust concentration, the coal handling system has become one of the high-risk production and operation areas of thermal power plant [4]. The high noise of coal conveying belt may bring two adverse effects: one is to seriously damage the physical and mental health of power plant employees, and the other is that excessive noise will affect the normal operation of belt conveyor [5-6]. The causes of excessive noise of coal conveying belt are unreasonable placement of reducer, damage of bearing or uneven pipe material of idler. When the position of the reducer is not the most suitable state, it will cause the vibration of the coupling, but the noise caused by it is not easy to be detected. After the bearing is damaged, the coal conveying belt will make a sharp and harsh sound when running [7]. When the pipe material is uneven, the coal conveying belt will produce noise and strong vibration during operation. When the position of the reducer is unreasonable, the noise generated by the coal conveying belt is very small, but for a long time, the unreasonable position will cause the shaft breakage of the reducer.

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2. Ultra Wideband Positioning Technology

According to the definition of UWB by FCC of the United States, UWB refers to the relative bandwidth (the ratio of signal bandwidth to center frequency) greater than 20% or the absolute bandwidth greater than 500 MHz. Compared with narrowband technology [8], UWB technology has high transmission rate, low transmission power, high time resolution, strong anti-interference and penetration ability, and can achieve good positioning performance under less obstacles or line of sight transmission. It is these advantages that make this technology widely used in various complex indoor or outdoor positioning scenes.

2.1 Programme Overview

The UWB high-precision real-time positioning management system suitable for coal handling system of thermal power plant is introduced. The system adopts advanced ultra wideband (UWB) real-time positioning technology [9-10]. By setting up ultra wideband positioning base stations in areas requiring key monitoring, such as coal handling corridors, transfer stations and other coal handling routes, and equipped with corresponding cameras with image recognition function, the operators carry positioning labels, the labels send positioning data, and after the positioning base station receives the positioning data, The data is solved through the positioning engine, and then the personnel position information is accurately fed back to the system background in real time to realize personnel real-time positioning and trajectory tracking, and give an alarm in case of abnormality [11]. The bearing at the tooth end of the driven rotor of the fan is bonded with the shaft and cannot be disassembled normally. The bearing is cut with a gas cutting. The bearing position is worn and the shaft diameter is reduced by 0.01 mm. The bearing position at the coupling end of the driven rotor of the fan runs a race, the bearing position is worn and the shaft diameter is reduced by 0.12 mm. The above worn positions need to be processed and repaired [12]. In order to ensure the repair quality of the fan and the stability of operation after installation, the fan needs to be tested for rotor runout and dynamic balance [13]. The measured value of driving shaft coupling position runout is 0.05 mm, the measured value of shaft extension seal position runout is 0.02 mm, the measured value of gear position runout is 0.03 mm, and the measured value of driven shaft gear position runout is 0.02 mm. The runout value and dynamic balance results of all mating parts meet the use requirements. The gear, rotor (impeller) and casing can continue to be used without replacement after derusting, cleaning and polishing. However, due to long-term operation or a certain degree of wear and damage, it can not be completely repaired [14]. After the maintenance of the fan, the parameters such as temperature rise, vibration and noise will increase during on-site operation, but they are within the acceptable range, which will not affect the normal and safe use of the fan [15]. After maintenance and reassembly of the fan, the flange surface at the inlet and outlet of the casing shall be blocked in time to prevent foreign matters from entering the rotor chamber, resulting in rotor wear and even damage during operation. Before the fan is installed and aligned on site, ensure that the rotation direction of the motor is consistent with the rotation direction of the fan, and prohibit the fan from rotating in the opposite direction to avoid unnecessary losses. After the on-site installation and alignment of the fan, it is necessary to manually turn the gear for inspection, and reconfirm that there are no sundries in the fan casing, and the main shaft can rotate flexibly without clamping stagnation point and abnormal sound.

2.2 Precautions for Operation and Maintenance

The deviation of coal conveying belt from the established track will also seriously affect the normal production and operation of power plant. There are three reasons for the deviation from the original track: (1) there are errors on both sides of the coal conveying belt due to the negligence of the staff in their work, which causes the coal conveying belt to deviate from the original track in future production. (2) If the center of the belt conveyor is not stable enough during production, it will cause imbalance at both ends, resulting in deviation of the coal conveying belt on the original track. (3) The long-time operation of the coal conveying belt will gradually cause the deviation between the coal

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conveying belt and the original track. The third factor is the main cause of deviation from the track, which is common in power plant production.

2.3 The Coal Conveying Belt Deviates from the Established Track

When lubricating oil is added to the fan on site, the oil level shall be the oil level when the fan is at rest. More or less oil filling will affect the operation state of the fan. During normal operation of the fan, since the fan adopts splash lubrication, the oil level in the oil mirrors on both sides of the oil tank will fluctuate or vary, which is normal. Regularly observe the oil level, which shall be subject to the oil level displayed in the oil mirror when the fan is stopped and stationary. After the fan is repaired, it can be loaded and operated step by step after no-load operation for 2 ~ 4 hours for the initial operation [16]. After cumulative operation for 2 weeks, the old lubricating oil shall be completely drained, and the oil tank shall be flushed by manual turning with new lubricating oil, and then filled with new lubricating oil of the correct model. The later lubricating oil replacement cycle can refer to the on-site operating conditions of the fan and the discoloration and deterioration of the lubricating oil. A vent threaded hole is designed at the bottom of the front and rear end plates of the fan, and the high-pressure oil and gas discharged from the oil tank is occasionally attached to the base panel below the vent hole, which is normal. Regularly check, clean or replace the imported filter wool. The filter wool is seriously blocked, which will increase the load of the fan, resulting in abnormal temperature and vibration. During the operation of the fan, daily patrol inspection records shall be made to record the temperature rise, vibration, outlet pressure, operating current and other data of the main parts of the fan, so as to compare and judge in case of abnormal operation in the later stage. Other routine maintenance items for site fan operation can refer to the instructions for use and maintenance of Roots fan.

3. Conclusion

With the increasing power demand, the production efficiency of power plants is facing great challenges. However, in the production process of power plant, coal conveying belt is the main means of transportation of raw materials, which plays a decisive role in the production efficiency of power plant. Therefore, it is necessary to analyze the possible problems in the process of coal conveying belt operation. The personnel positioning intelligent safety management system based on UWB technology will have broad application and promotion prospects in coal conveying and other production areas of thermal power plant.

References

[1] Gao Manda, Li Gengda, Wang Xin, Liu Miao, Tao Zhigang, Cui Qingru, Hu Vincent Typical construction direction and application research progress of intelligent fuel in thermal power plant [J] Thermal power generation, 2021,50 (05): 10-17 DOI:10.19666/j.rlfd. two hundred and two million seven thousand two hundred and ten.

[2] Xiong Rui Design and application of electrical control system in thermal power plant [D] Nanchang University, 2020 DOI:10.27232/d.cnki. gnchu. 2020.003651.

[3] Dong Tingting From reverse start to smooth start: the process reengineering of coal handling system is successful! [J]. Team Tiandi, 2020 (10): 58-59.

[4] Lu Yanlin, Wang Wei Application of intelligent design in electrical specialty of phase III project of Ezhou power plant [J] China Construction, 2020 (S1): 128-130.

[5] Zhang Yuying Exploration on centralized control technology of coal conveyor in power plant [J] Science and technology information, 2019,17 (26): 40-42 DOI:10.16661/j.cnki. 1672-3791.2019. 26.040.

[6] Liu PU Application of micro fog dust suppression system in coal-fired power plant [J] Sichuan building materials, 2019,45 (08): 37-38.

[7] Zhang Ya Analysis on water balance test scheme of a power plant [J] Shandong chemical industry, 2019, 48 (15): 149 + 153 DOI:10.19319/j.cnki. issn. 1008-021x. 2019.15. sixty.

ISSN: 2414-1895 DOI: 10.6919/ICJE.202201_8(1).0096

[8] Li Weiguo Optimization of coal blending ratio and safety management of power plant units [J] Labor protection, 2019 (08): 98-99.

[9] Li Ruyan, Li Jia, Liu Xiwen, Wang Yi Design and commissioning of coal handling program control system in thermal power plant based on DCS [J] Jilin electric power, 2018,46 (06): 43-44 + 56 DOI: 10. 16109/j.cnki. jldl. 2018.06. seventeen.

[10] Xiong Yongzhu Research on hoisting technology of long-span heavy steel structure of coal handling system in power plant [J] Value engineering, 2018,37 (34): 168-169 DOI:10.14018/j.cnki. cn13-1085/n. 2018. 34.065.

[11] Zhu Jinhui Operation fault analysis of coal handling system in power plant [J] Technological innovation and application, 2018 (29): 136-137.

[12] Zhao Yan, Zheng Nan Application of maintenance management mode based on precision diagnosis technology in Luohe Power Plant [J] Northeast electric power technology, 2021,42 (01): 16-20 + 24.

[13] Wang Rui Summary of commissioning problems of 350 MW supercritical steam turbine in a power plant [J] Electromechanical information, 2020 (36): 18-19 DOI:10.19514/j.cnki. cn32-1628/tm. 2020.36. nine.

[14] Li Hu Treatment measures for vibration and overtemperature of a supercritical unit [J] Thermal turbine, 2020,49 (04): 315-317 DOI:10.13707/j.cnki. 31-1922/th. 2020.04. fifteen.

[15] Zhao Haiping Research on vibration monitoring and fault diagnosis system of wind turbine [J] China Equipment Engineering, 2020 (16): 149-150.

[16] Pan Jian, Ma Lele, Liu Xiangjie Vibration fault early warning of forced draft fan based on gated cycle network [C] / / summary of the 31st China Process Control Conference (CPCC 2020), 2020:255. Doi: 10. 26914/c.cnkihy.2020.030046.