Failure Analysis and Research of Key Auxiliaries in Thermal Power Plant

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Abstract. The key equipment of thermal power plants such as feed pump ,condensate pump, circulating pump and induced draft fan, blower fan, oxidation fan, air preheater's vibration information are monitored and tracked. Bearing failure accounted for the largest proportion. Problems such as misalignment and unbalance are still very common. Attention should be paid to the fault diagnosis and maintenance work.

1 Introduction

With the improvement of peaking flexibility of thermal power units the timeliness and stability requirements of equipment response are getting higher and higher. Auxiliary equipment is an important part of the operation system. The stability of auxiliary equipment's operation is also important. The analysis of the operated and fault conditions is carried out after 1600 equipment's management. The faults frequently occurred in the key equipment of the thermal power plant are analyzed.

2 equipment failure statistics

After classified and managed the auxiliaries of the thermal power plant the key auxiliaries are monitored for vibration and the cause of the auxiliary failures are counted. The key equipment of the thermal power plant are selected including feed water pump^[1-3], circulating water pump^[4-5], condensate pump^[6-7], induced draft fan^[8], blower^[9-10], primary fan^[11-13], booster fan, oxidation fan^[14-16] etc. The operation and the cause of the failure is tracked and studied through a year of time. This study provides a reference for the stable operation and optimization of the key auxiliary equipment of the thermal power plant.

2.1 pump equipment

Two hundred and forty-three condensate pumps, two hundred and sixty-eight feed pumps, two hundred and one circulating pumps are monitored. The statistics of the equipment about different failure type numbers can be seen in Figure 1- Figure 3.

Fig.1. Fault distribution map of feedwater pump

Fig.2. Fault distribution map of water circulating pump

Fig.3. Fault distribution map of condensate pump

In the statistics of all the equipment failure, bearing failure occurred more times. During routine inspection more attention should be paid to the vibration state of the equipment and the lubrication management should be strictly implemented.

2.2 fan equipment

Two hundred and thirty-four blower, two hundred and forty-two pilot fan, two hundred and twenty-seven primary fan, two hundred and twenty-six oxidation fan and one hundred booster fan are observed. The vibration monitoring of equipment are carried out. The causes and quantities of equipment failure are shown in Figure 4-Figure 10.

Fig.4. Fault distribution of blower

Fig.5. Fault distribution of induced draft fan

Fig.6. Fault distribution of primary fan

Fig.7. Fault distribution of booster fan

Fig.8. Fault distribution of air preheater

According to the statistics it can be seen that the bearing component has the highest failure rate. The unbalanced faults are very common. Misalignment of the equipment during installation and the looseness of the components are still one of the main causes of failure. According to statistics the equipment failure rate is generally between 10% to 25%(shown in Figure 9). The failure rate of primary fan and circulating water pump are higher than 20%. Monitoring and maintenance should be strengthened during subsequent operations.

Fig.9. Rate of fault about different equipment

Fig.10. Numbers about different failure type

Fig.11. Different fault ratio analysis

As can be seen from the figure above, bearing faults occur most frequently, and non-neutralization and loosening faults account for a large proportion

3 Equipment fault diagnosis and unit operation analysis

In recent years, there have been many researches on auxiliary engine faults in thermal power plants. The key auxiliary equipment that caused the unit shutdown are counted during the past five years. The results are shown in Table 1.

Table 1 Statistics on equipment of unit shutdown in the past five years

year	Faulty device name		
2014	Feed pump	Air preheater	Booster fan
2015	Feed pump	Induced draft fan	Air preheater
2016	Induced draft fan	Feed pump	Air preheater
2017	Feed pump	Booster fan	Primary Fan
2018	Booster fan	Primary Fan	Feed pump

According to the unit shutdown statistics caused by major equipment from 2014 to 2018 it presents a downward trend year by year as shown in Figure 12.

Fig.12. Precision inspection of the unit shutdown accidents caused by main auxiliary equipment

4 Conclusion

Among the unit shutdown accidents of the auxiliary equipment the failure of the auxiliaries is one of the main reason. The failure mainly concentrated in the feed water pump, air preheater, booster fan, primary fan, induced draft fan. The fault manifestation mainly depended on vibration. The statistical analysis of the failure of the key auxiliaries is done. The failure of the key auxiliaries are understood. The outage and derated of the unit is effectively avoided.. Effectively avoiding unit shutdown accidents and lowering forces. Strengthening the monitoring of specific equipment and components based on normal monitoring can reveal problems of auxiliaries. From the statistical data the trend of declining year by year it should be emphasized. Each power plant can attached great importance through precision inspection. Strengthen the auxiliaries management can be used to reduce and avoid the occurrence of unit shutdown accidents.

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