Application Research of Multiple Detection Technology in Equipment Fault Diagnosis

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Abstract. With the development of detection technology, there are more and more detection methods for devices[1,2]. Multiple detection technologies[3,4] make targeted detection of devices to make the state judgment of devices more comprehensive. In the detection of auxiliary equipment in thermal power plants, vibration detection is generally used, but infrared and ultrasonic detection technology analyzes the fault state diagnosis of auxiliary equipment from another aspect, which plays a very important role. Multi-tech detection and mutual verification more and more methods are applied to equipment detection.

1 ultrasonic and vibration detection

The cooling water pump usually used as an important equipment in the factory to provide cooling water for steam turbine systems, lubricating oil systems, generators, vacuum pump coolers, etc., to keep the temperature of each system controllable and normal[5-6]. The pump information is shown in Table 1.

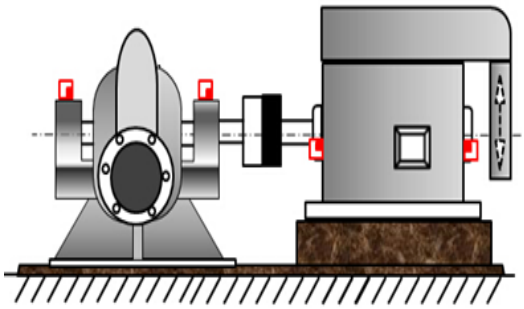

Figure 1 Equipment structure

Table 1 Cooling water pump information

Rated power: 650kw	Head: 30m
Flow rate: 4230 t / h	Speed: 980 r/min
Must have NPSH margin: 8.6m	design temperature: 23 ° C (winter), 33 ° C (summer)
Pump and motor connection: flexible coupling	Installation location: zero meter

1.1 Detection and fault diagnosis

(1) Open cooling water pump vibration detection can be seen in Table 2 and Figure 2.

Table 2 Test data

time	vibration frequency value(mm / s)	Peakvue peak (g)
First time	2.9	9
Fifty days later	4.6	13

(2) Ultrasonic detection of abnormal sound

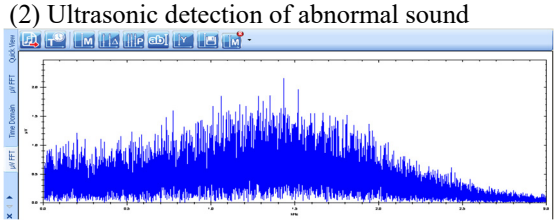

Figure 2 Ultrasonic test chart

The spectrum shows that the abnormal spectral line is mainly concentrated at the frequency of 350hz-650hz. This frequency range is typical of the wear of 6318 bearing; the fault frequency of the inner ring of the bearing and the 1x frequency sideband are obvious. Combining the data and phenomena above the inner ring of the bearing can be used to judge about wear, pit or peel[7-8].

1.2 Maintenance suggestions

(1) Arrange for inspection and replacement of the drive end bearing.

(2) Clean the bearing chamber during maintenance and replace the packing.

(3) Adjust the clearance and tightening force of each component to meet the requirements of the maintenance regulations.

1.3 Disintegration

(1) Demolition inspection of the drive end bearing, the bearing inner ring raceway is spread over the pit and peeling (Fig. 3).

(2) Replace the bearings and packing at both ends.

(3) Re-check the bearing tightness and adjust the gasket to pass.

1.4 Post-repair situation

(1) After running the pump, the abnormal sound disappears, the ultrasound is normal, and the RMS drops to: 23 (dBμV).

Figure 3: Large peeling, pits

(2) The vibration frequency value, the peak value of peakvue and the PK value decrease after the maintenance. (Table 3).

(3) After the bearing is replaced, there is no bearing fault frequency in the vibration spectrum. The frequency ranges about 350hz-650hz. The spectrum is clean and there is no abnormal spectrum line.

Table 3 Data comparison before and after bearing replacement

Time	Drive end vibration frequency value (mm / s)	Peakvue peak (g)
Before	4.6	13
After	2	6

2 Infrared detection

The heat generated during engine operation is cooled by hydrogen. The oil pressure generated by the sealed oil pump isolates the hydrogen from the outside world. It enables the generator to be fully and reliably cooled. The hydrogen can be charged safely and fully. The appearance and parameters of the oil pump are shown in Figure 4 and Table 4.

Table 4 Sealing oil pump parameters

Speed: 2900r/min	Export pressure: 1MPa
Drive mode: motor	Installation location: #2 machine zero meter

Figure 4 Appearance of the device

2.1 Fault phenomenon and temperature detection

(1) It was found that the sealing temperature of the oil pump drive was as high as 110 °C during operation. After one week of operation, the temperature reached 117.5 °C, as shown in Fig. 5, Fig 6.

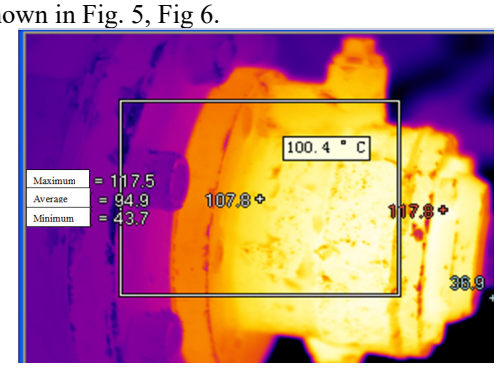

Figure 5 Oil pump infrared map

The oil pump vibration test data is normal. The ultrasonic test is normal. The machine seal has no sputum oil phenomenon.

2.2 Analysis from infrared temperature image

(1)After the pump is replaced, the original machine seal ring spring has a compression of 7.5mm-8mm and is adjusted to 5mm. After closing the sealing force of the small machine, the sealing temperature of the machine is raised from 80 °C to 118 °C.

(2) The temperature difference about the gasket one side with anther is 36 °C. Therefore it can be judged that there is a problem in the gasket installation at the oil return hole.

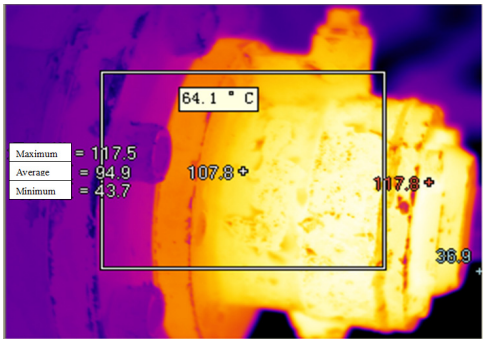

Figure 6 Temperature after the oil hole gasket 64.1 °C

2.3 Diagnostic analysis and advice

(1) It is necessary to stop the pump to check the gasket at the oil return hole of the machine and clear the oil return hole.

(2) AS the data is normal when detecting the vibration of the equipment. There is a certain risk in the operation of the air-side sealed oil pump during the operation. And it would not be processed temporarily. The standby group would be overhauled during the mediation.

(3) Check the sealing temperature of the sealed oil pump machine on time. The maintenance and repair suggestions are according to the temperature rise trend [9-11].

2.4 Maintenance situation

After the unit is arbitrarily adjusted, the airside seal oil is switched to the high reserve pump for oil supply, and the airside side seal oil pump is checked.

(1) The gasket at the oil return hole of the machine is deflected by an angle. The installation position was incorrect and blocking the oil return hole. Replace the gasket at this point and leave the oil return hole, see Figure 7.

Figure 7 Machine seal return hole

(2) The gasket of the machine seal and the gasket at the static ring is aging and the machine seal and gasket are replaced.

(3) Recalibration the center. The circumference and the mouth deviation Should be limited within 0.05 mm.

2.5 Effects

After the completion of the overhaul, the oil pump was started. The machine seal temperature was at about 73 °C. After one week of equipment operation, the temperature is stable and unchanged; the temperature deviation before and after of the gasket is 5 °C.

3 Conclusion

(1) Vibration and ultrasonic detection technology was used in the detection. Through a variety of detection methods, we can analyze the condition of the equipment from different perspectives[12-14]. The bearing of cooling water pump is damaged due to improper adjustment of bearing tightening force.

(2) The pump is often not adjusted in time due to water leakage enters the bearing chamber and causing deterioration of oil quality. And then lead to peeling and pits in the raceway. It is necessary to adjust the clearance and tightness between the components to the specified range according to the requirements of the maintenance regulations. And all parts should be clean.

(3) By infrared temperature analysis the abnormal temperature of the equipment is caused by the maintenance worker's unfamiliar construction of the equipment. The work is not carefully performed. It is not properly returned to the original position, causing the clogging machine to seal back to the oil hole, requiring the machine seal temperature to rise abnormally. It is recommended that the maintenance worker to strengthen the study of the maintenance procedures.

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