Noise analysis of mud pump motor and method of reducing noise

1 Introduction

Because of the particularity of operating environment, such as anti-corrosion and explosion-proof requirements and small working space, the performance index of the mud Pump motor (900kw AC variable frequency motor) is put forward higher requirements. In general, the marine platform with mud pump motor noise is not allowed to exceed 90dB.

2 Site Field Investigation analysis

In the construction of offshore drilling platform, mud pump as the core equipment, the factory test of its motor has been highly valued by all parties involved in construction. Therefore, representatives of the parties to the electrical machinery manufacturing enterprises on the acceptance of 18 motors.

The acceptance content includes the determination of the static pressure and air volume of the inlet, the determination of the insulation resistance of stator windings, the determination of the current resistance in the test cold state of the stator windings, the equivalent temperature rise test, overspeed test, vibration test, noise test, no-load test, the plugging test, the withstand voltage test of the stator windings, and the inter- In addition to excessive noise, the remaining items meet the technical requirements.

Only the noise test is 92~95db, which exceeds the 90dB stipulated by the Offshore Platform Noise Technical index. It is necessary to carry out noise analysis and noise reduction for the motor.

3 Motor Noise Analysis

The causes of motor noise are manifold, and a variety of noise sources exist simultaneously. In general, it is divided into electromagnetic noise, duct noise and mechanical noise. These noises are unavoidable, but can be minimized. The size of the noise is closely related to the motor design, manufacturing, assembly quality and operating conditions. For example, in high-speed operation, mainly aerodynamic noise, in the middle and low-speed operation, mainly electromagnetic noise.

3.1 Electromagnetic noise

Electromagnetic noise is mainly caused by two aspects. The first is generated by the radial component of the air-gap magnetic field acting on the stator core, which is transmitted outward through the magnetic yoke, causing the stator core to deform and vibrate. The second is the tangential component of the air-gap magnetic field, which, contrary to the electromagnetic torque, causes the deformation vibration of the core tooth locally. When the radial electromagnetic wave is close to the natural frequency of the stator, it can cause resonance,

enhance the vibration and noise, and endanger the safety of the motor seriously.

3.2 Mechanical Noise

Mechanical noise is manifold, including noise caused by bearing noise, unbalance of rotor, and assembly accuracy. Most motors use rolling bearings. Rolling bearings consist of an inner ring, an outer ring, a ball and a cage, where, when the motor rotates, there is a relative movement between these components, the surface is not smooth or there is a foreign body, causing mutual friction and collision resulting in noise.

The unbalance of rotor is divided into two kinds: static unbalance and Dynamic unbalance. If the mass distribution of the motor rotor is uniform, the roundness and concentricity of the manufacturing and assembly are qualified, the operation is smooth, the pressure on the bracket or bearing is only the weight of the rotor itself. If the rotor mass distribution is uneven, then the rotation will produce centrifugal force, the bearing or the stent will be subjected to periodic centrifugal force, causing vibration, resulting in noise. In addition, attention should be paid to the dynamic balance accuracy of motor additional parts such as fans.

In addition, the noise value generated by the motor is closely related to the assembly accuracy, such as bearing balls, surface roughness, dimensional accuracy of inner and outer ring grooves and geometric tolerances, etc. assembly discomfort will cause vibration, resulting in noise.

3.3 Air-powered noise

Aerodynamic noise is divided into two types: Eddy current noise and beep noise. The eddy current noise is caused by alternating eddy currents on the rotating surface caused by the rotating rotor and the cooling fan that rotates with the shaft, the faster the flow, the more drastic the change, the greater the noise, and the more noisy the sound is the "wind whistle" produced by the compressed high-speed air flow sweeping over the obstacles (such as bumps, slag, etc.)

4 Motor noise identification and noise reduction treatment

Electromagnetic noise will increase significantly with the voltage or load, which is particularly loud during the start-up of the motor, disappeared immediately after the power outage; the mechanical noise is mainly related to the speed of the motor, which can be determined by adjusting the motor speed and measuring the vibration of the motor. The determination of aerodynamic noise can focus on the noise of the air inlet and outlet. The change of noise is detected by changing the speed of the motor, artificially blocking the tuyere or removing the fan.

In this mud pump 900kw AC frequency Conversion motor acceptance, 18 motors are the problem of excessive noise. Therefore, further increase the same motor no load and load test, the same motor vibration test and other repeated contrast test, in the test, the initial determination of the lot of motor noise is mainly duct noise. The random extraction of a motor to remove the test. After the disassembly, the following problems were found: The fan impeller weld is not continuous and the leaf is not smooth.

After on-site analysis and test, impeller in the case of the weld is not continuous, variable speed rotation to the 1400r/min process can produce a "wind whistle", that is, beep noise, the leaf is not smooth, impeller rotation caused by high-speed air flow friction will also produce a "wind whistle." This is the main noise source for this batch of motors. After the batch motor impeller closed welding, slag removal, sanding and foliar work, after the re-assembly test, the successful noise reduction to less than 90dB.

In addition, in terms of mechanical noise, the author believes that in addition to the bearing noise, rotor dynamic balance and assembly accuracy, but also in the motor shell Research, it is known that the same material in vibration prone to resonance, will cause greater noise. Therefore, in order to control the noise of the motor, it is possible to avoid the same material in the design of the motor housing.