

Fault Diagnosis and Maintenance of Marine Hydraulic Equipment

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Abstract. Hydraulic transmission technology is an important technology in China's ship equipment, and the development of this technology is greatly related to the improvement of China's automation level. Most of the equipment in the ship is distributed on the upper deck and vulnerable to the natural environment, so the fault diagnosis is an important work to ensure the normal operation of the ship. Scientific and reasonable diagnostic methods and maintenance measures are of great significance for the protection of equipment stability, safety and reliability.

Introduction

With the continuous development of automation technology and integration, the hydraulic transmission technology in ship equipment has been improved. The application of hydraulic transmission technology in marine equipment is of great significance to reduce the labor intensity of workers, improve work efficiency and enhance the stability of equipment. There are still some gaps between China's hydraulic transmission technology and that in foreign countries, so it is necessary to strengthen the training of operational management personnel, timely equipment troubleshooting, to strengthen the maintenance of equipment to improve the service life of equipment to effectively avoid the loss caused by accident.

Analysis on the Characteristics, Types and Causes of Ship Hydraulic Fault

Fault Characteristics of Ship Hydraulic Equipment. As the ship's hydraulic equipment has long been affected by the natural environment and human factors, so the failure to show the diversity and complexity of the characteristics of [1]. In addition, there are some links between the failure of the equipment, the cause of the failure is also multifaceted; operational management of the occurrence of failure has an important impact on equipment life and natural factors are also closely related. Mastering the fault characteristics of the ship's hydraulic equipment is of great significance to ensure that the cause of the failure is locked as soon as possible and the maintenance efficiency is improved.

Main Types of Ship Hydraulic Equipment Failure. As shown in Table 1.

Table 1 Types of Ship Hydraulic Equipment Failure

| Types of Failure | Demonstration |
|------------------|---|
| 1 | Action class does not normal start; poor precision when the commutation, the phenomenon of jamming; implementation of components does not respond to instructions; high-load operation of the hydraulic equipment was significantly lower than the normal speed |
| 2 | Electrical circuit fuse blown; power distribution board without power or the short circuit; relay wiring loose or stuck without action |
| 3 | When the pressure class parameters require insufficient pressure to meet the design requirements, it cannot adjust the pressure and pressure instability |
| 4 | Other types of failure oil temperature is too high, there are abnormal noise and vibration, hydraulic oil is contaminated |

Reasons for Failure of Hydraulic Equipment of Ship. The cause of ship hydraulic equipment failure can be analyzed from both internal and external causes. The main reason is that the design, installation is unreasonable, parts processing accuracy does not meet the relevant standards, the quality of components of the performance level is not enough, parts in the course of the use of long-term wear and tear, resulting in equipment disorders [2]; external causes mainly include: the ship hydraulic equipment in the transport installation of the damage occurred, the equipment in a harsh environment for a long time, by the temperature, humidity and pH of the greater impact of the operation of the construction staff due to improper operation caused by failure.

The Steps and Methods of Fault Diagnosis of Marine Hydraulic Equipment

Diagnostic Steps. General steps. General steps of marine hydraulic equipment fault diagnosis are: first, a clear diagnosis of the task. In order to ensure the diagnostic efficiency of equipment failure, an analysis of the situation should be made ahead of the failure with targeted diagnostic measures; Second, have an initial understanding of the scene. In the process, we should ensure that the information is collected on the scene according to the characteristics of the failure to make a simple analysis and judgment; third, to determine the work program. Fourth, according to the already determined program, use reasonable technology to detect the object of detection, decomposition and make a judgment, and the final decision is to determine the final work of the program [3].

Work contents. The main contents of the hydraulic fault diagnosis are: first, according to the characteristics of the failure of the fault on the nature and severity of a reasonable judgment; second, through a comprehensive investigation to determine the failure position and failure components; third, through the use of equipment Fourth, the use of mechanism analysis to determine the failure of the whole process; Fifth, the occurrence of existing failures to predict, effectively grasp the occurrence of failure trends.

Common Methods. In view of the factors influencing the failure of the hydraulic equipment of the ship, it is necessary to analyze the influence factors of the actual equipment in order to ensure that the fault location is locked as soon as possible, the maintenance efficiency is improved and the special position maintenance work is strengthened. According to the analysis result, Causes and major problems, and through the continuous accumulation of experience, improve the level of ship hydraulic equipment failure to deal with the issue [4]. The diagnosis of ship hydraulic equipment failure should be in accordance with the first simple and complex way, commonly used diagnostic methods are the following:

Watch. Observe the fuel tank and tubing in the equipment, mainly to check the presence of bubbles in the oil and tubing in the case of reflow, so as to provide an important basis for subsequent judgments. The equipment connected to the tank and tubing is also diagnosed in the process. Check the pressure gauge is normal, check the sealing of the interface, the hydraulic cylinder piston rod and hydraulic motor to observe whether there is vibration, crawling and other phenomena.

Hearing. Ship hydraulic equipment failure sometimes show the abnormal noise, for this type of failure, you can use the ear hearing method to judge a certain degree of failure. Specific operation should be based on the actual situation of the equipment, the common noise location to detect, if necessary, you can use a certain auxiliary equipment to improve the detection results.

Touch with hands. For the system failure for the performance of fever or a slight vibration of the situation, you can use the hand touch the way to perceive the fault.

Sniff with nose. Sniff with nose is mainly used for the presence of odor in the equipment, so as to further determine the fault situation to make a certain basis.

Fueling method. Fueling method is a test method in the existence of a risk of diagnosis, mainly used to determine whether the surface of the equipment there is oil, this approach should be used before the surrounding environment to be a certain detection, to ensure that it is on the basis of the burning area.

Segmentation method. In the ship hydraulic equipment fault detection, sometimes will encounter more trouble with more influencing factors, and there are more than one reason resulting in

equipment failure. These faults lie mainly in stress faults and malfunctions. Therefore, in the diagnosis, segmentation can be used for checking [5]. First, in accordance with the motor - coupling - the diagnostic sequence of hydraulic pump, check the key joints of each device, and ultimately check the peripheral and the details of the department, until the rough place of the fault is determined.

Common Trouble Repair and Maintenance Measures for Marine Hydraulic Equipment

Common Fault Diagnosis. The hydraulic steering gear cannot be ruddled. During the voyage of the ship, the hydraulic steering gear cannot be rudder is an important equipment failure. If the malfunction occurs, the operator should immediately adjust the steering gear to the spare servo device and use an emergency stop to take the lead in ensuring that a safety accident is avoided. After the rapid analysis of the fault, through the previous data to determine the experience, control line damage is an important reason leading to this failure, so the failure should be controlled when the main line structure to check [6]. If the fault can still not be eliminated after the diagnosis line is completed, further damage to the solenoid is required. And then follow the failure to eliminate the situation, followed by the rudder shaft bearing or rudder stuck, rudder blade caused by the steering gear cannot be rudder and other circumstances for analysis. If the fault caused by the latter, usually accompanied by a huge sound of the pump situation, this phenomenon can be obtained by ear hearing in a timely manner [7]. After determining the cause of the failure, it is an important measure to quickly resolve the problem according to the specific circumstances of the failure. Specific troubleshooting sequence is shown in Figure 1.

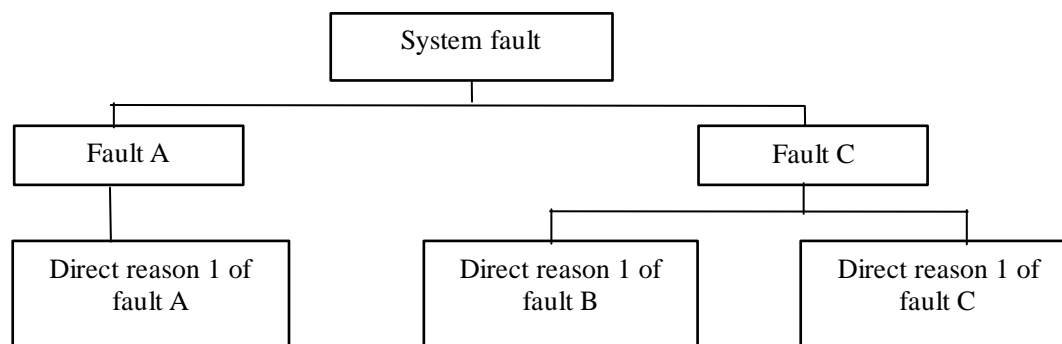


Fig. 1 Servo equipment fault diagnosis sequence

Vibration and noise. Through the study, it is found that when the system pressure maintains at 4.5-6.5MPa, the ship's hydraulic equipment's crane system will be screaming at work, and this sound will increase as the pressure increases. When the pressure reaches 6.5MPa and above, the sound will become a continuous scream. At this time, the fault is mostly caused by the spool, and the fault can be eliminated after the replacement.

The oil temperature is too high. Ship hydraulic equipment's high oil temperature is caused by a variety of reasons, mainly in the following areas: First, the oil pipeline has a serious leakage during the process. The pressure of the pump is too large, the seal gap is larger, the oil viscosity is small, the device damage has a direct relationship; Second, the pressure relief circuit failure. Pressure relief circuit failure will lead to higher oil pressure, resulting in a lot of hot oil, resulting in oil temperature rise, this situation to be repaired after the relief circuit can be eliminated; Third, the lower hydraulic oil viscosity of the location of the pressure value is not enough, there is too much loss of the situation [8]. Non-essential energy loss occurs under the influence of impact, resulting in an increase in ambient temperature. In this case, usually by adding a reasonable buffer device to eliminate; Fourth, the device system in poor heat dissipation. This situation becomes more pronounced with the extension of the oil circuit, which can lead to a continuous increase in oil temperature. Hydraulic oil in the ship's hydraulic equipment is an important role in the transmission

of energy. In order to ensure the normal operation of the equipment, there is a need to have a good control over the surrounding ambient temperature. Attention should be paid to the phenomenon of oil temperature. Through research and analysis, problems should be timely solved to ensure timely elimination of the failure [9].

The anchor oil motor runs slowly. The slowdown in the operation of the anchor oil motor is an important failure in the failure of the hydraulic equipment of the ship. This failure is different from other faults and is a slow continuous fault. If it cannot be dealt with in time, this failure will increase with time. The shaft jam and shaft bearing damage are the main cause of this failure, the fault will occur with the friction sound, and in the bearing position to release a lot of heat [10]; In addition, the decline in the quality of hydraulic oil can also lead to this problem, usually a large amount of hydraulic oil, the hydraulic oil material will react with the air, resulting in slow operation of the anchor oil motor. Therefore, if the use of troubleshooting methods to check, the exclusion of the above reasons, should be on the air bag around the composition of the inspection, by observing the experimental analysis to determine the final reason. If it is determined that the hydraulic oil is contaminated, the hydraulic pipe and oil pipeline should be strictly checked, and a rigorous inspection should be carried out towards leakage and ultimately ensure the normal operation of the system.

Maintenance Measures. Strengthen equipment maintenance. Ship hydraulic equipment system is relatively complex, this complex heart is mainly reflected in the complex types of failures, fault reasons and other aspects of complexity. The location of the hydraulic equipment determines the equipment in operation to be affected. Therefore, there is a need to strengthen the maintenance to improve the service life of equipment and control costs to ensure the safe operation of equipment, which is of great significance. In the conservation, we should choose reasonable measures based on the actual use of equipment. Attention should be paid to the regular inspection of hydraulic equipment and maintenance, for the repair process problems in the parts, they should be replaced in time to avoid serious impact in the production [11]. For the key parts of the parts, if there is a problem, we should take timely measures. Maintenance personnel are responsible, not for various reasons, reduce the working conditions of hydraulic equipment. Maintenance is an important measure to detect problems and reduce risk and impact. Relevant maintenance and repair departments should be technically excellent. Even for the non-problem of hydraulic equipment, should also adhere to the daily inspection, late inspection, monthly inspection, annual inspection system, prone to problems in the site of the key inspection, mandatory maintenance, before the failure to solve the problem. First in the equipment acceptance strict requirements, defective equipment cannot be taken into operation; second, responsibility should fall on the relevant leaders to improve the leadership of the mechanical equipment attention to avoid accidents; the last is to increase the maintenance of the mechanical equipment.

Improve operator's skills. The overall level of the operator has an important impact on the service life of the equipment. For the ship hydraulic equipment operators should undergo a rigorous screening assessment, to ensure professional capacity at the same time, through continuous learning to improve the level of proficiency in equipment operation, but also to develop the operator's sense of responsibility, through the rigorous assessment of work to reduce operational errors The situation takes place [12]. The technical staff is an important human resource for the enterprise and has an important role in the maintenance and review of professional maintenance. Especially the operator, must undergo a rigorous training, qualified before they can take the position. At the same time to strengthen the sense of responsibility training to ensure that the technical security risks can be timely detection, rapid processing, the relevant maintenance personnel to take responsibility. Do not overload and non-compliance repair to ensure safe operation of equipment. The level of operation of the relevant technical staff has a direct impact on the number of equipment failures and failure times throughout the coal mining process [13]. In order to improve the workers' ability to operate the equipment, we should mainly strengthen the training of workers to learn, improve professional skills and the ability to judge the production process, to deal with emergencies in a timely manner to reduce the scope of the impact of failure.

Conclusion

In summary, the ship hydraulic equipment fault diagnosis should be based on the actual form of failure to determine the form. On the basis of the existing diagnostic methods, we should also continue to sum up the maintenance experience and strengthen the maintenance of the equipment so as to continuously improve the fault diagnosis efficiency and maintenance efficiency.

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