American Research Journal of Computer Science and Information Technology
ISSN: 2572-2921
Volume 4, Issue 2, pp: 1-4

AMERICAN RESEARCH JOURNALS
An Academic Publishing House

Research Article Open Access

Optimization of Low Pressure Protection for Lubricating Oil in Steam Turbine Unit

Mei-Feng ZHAO[1], Xue-Bin LIU[2]

[1]Electric Power Occupational Technical Institute of SEPC, Taiyuan, China.
[2]Datang Taiyuan Co-Generation Power Plant, Taiyuan, China.

Abstract: Steam turbine lubricant system is an important part of steam turbine equipment, lube oil pressure signals into the protection system to ensure the operation of the lubricant system, this paper describes the system importance and some optimization designed for the protection system.

Keywords: Protection, Low lubricant pressure, Oil level.

Introduction to Lubricating Oil System

Steam turbine units need to be equipped with a lubricating oil system during operation. Its purpose is to provide high-quality and sufficient lubricants for each unit bearing to promote the lubrication effect and cold treatment of bearings. In the process, the pressure oil can be supplied to the adjustment and protection system, maintains the system to operate normally. In addition, provide the required fuel for the top axle and wheel equipment when the unit is starting or will be shut down. Turbine safety work needs to rely on the normal operation of the lubricating oil system. If there is a sudden failure in the lubricating oil system, even if the time is very short, it will cause the phenomenon of bearing firing, which will lead to the occurrence of accidents. At the same time, it should be noted that the adjustment system can not operate effectively due to the loss of pressure due to the interruption of the oil flow. This will make the turbine uncontrollable, which will have even more serious consequences. Therefore, it is necessary to continuously provide suitable pressure and temperature quality lubricants for bearing components and adjustment systems.

Working Principle of Lubricating Oil System

The lubricating oil system has a closed internal circulation system. Under various operating conditions, it will provide sufficient amount and temperature oil to any unit bearings and other devices. Under normal working conditions, through the drive of the main shaft, the main oil pump extracts the lubricant from the lubrication tank, and some of the lubricant enters the second injector. When passing through the entrance, there will be a negative pressure state, after which the lubricant will be injected into the first injector, it is then introduced into the main oil pump import, which will ensure that the oil will not be interrupted. There is also a small amount of lubricant that will enter the parietal oil system. A small part of the pressure oil will pass through the backstop valve and then enter the manual buckling device in the front bearing box and the mechanical speeding buckling device to become the generator hydrogen seal reserve oil storage. When the equipment is started or shut down, the oil system will provide the required oil for each bearing in the case of the AC lubricating pump running. In this process, the main oil supply will be provided by the operation of the throttle orifice plate.

Lubricating Oil Pressure Effect

Lubricating oil pressure is the most important indicator of the working condition of the lubrication system. Lubricating system is one of the important components of the internal combustion engine. If the internal combustion engine is working under low lubricant pressure for a long time, it will accelerate the wear speed

of the parts and make the internal combustion engine life. Decline, there was even an accident. The lubricating oil system adopts the main oil pump and oil turbine system driven by the main shaft of the steam turbine. In normal operation, the high-pressure discharge oil from the main oil pump outlet to the oil turbocharged pump in the main fuel tank drives the fuel tank. The booster pump absorbs the turbine oil from the fuel tank and provides it to the main pump inlet. The high pressure discharge pressure of the main oil pump is reduced after the oil turbine has done work, and it is used as a lubricant to enter the cooler. After heat transfer, the bearings, wheel equipment, top axle oil system, and sealed oil system of the turbine unit are supplied with a certain oil temperature.

The function of the steam turbine lubricant system is to provide lubrication and cooling oil for the support bearings, thrust bearings and vehicles of the turbine generator set, to supply oil for the spare pipe of the hydrogen seal system, and to supply oil for the over-speed buckling device of the steering machine.

The lubricating oil system is driven by the main oil pump, cooler, top axle device, ejector, wheel vehicle device, smoke discharge system, fuel tank, lubricating oil pump, accident oil pump, filter, heater, oil level indicator, oil level switch, etc.. As well as various buckling and control devices, and connecting pipes, valves, reverse doors, various detection instruments, etc.

The oil supply pipeline of the steam turbine lubricant system is a suit type oil pipeline. Pressure oil flows in a small pipe in the suit pipe, and the oil returns to the oil flow outside the small pipe.

The main oil pump driven by the main shaft of the steam turbine during normal operation of the steam turbine lubricant system supplies all the oil used by the turbine generator set. In the case of normal starting and stopping of the unit and low lubrication pressure or accident, the oil pump is supplied by the lubricant pump to the lubricant system. The lubricating oil pump has two oil pumps, AC and DC. The DC oil pump is used as an accident oil pump under the condition of power loss in the entire plant. Under normal circumstances, the AC oil pump is operated as a spare pump for the main oil pump.

The pressure range of lubricating oil during normal operation is 0.096 to 0.124MPa. When the pressure of lubricating oil is reduced to 0.075MPa, the AC lubricating pump is started to ensure the normal supply of oil in the system.

Lower Protection of Lubricants

The main function of the Steam Body Emergency Protection System (ETS) is to monitor some parameters that affect the safe and stable operation of the steam engine in real time. When it exceeds a specific value, it controls the action of the on-site steam turbine blocking electromagnetic valve and quickly releases the AST tubing pressure, emergency shutdown, to avoid major accidents. Lubricating low pressure protection is an important part of ETS protection.

For low pressure protection of lubricating oil, four pressure switch signals are provided on site. The pressure switch is constant contact, and the drop is disconnected. Pressure switches 1 and 3 are a group. The results of the signal are sent to the AST solenoid valve # 1 and the AST solenoid valve # 3; The other group is 2 and 4, and the judgment results are sent to AST solenoid valve # 2 and AST solenoid valve # 4. At least one signal must occur in each of the two groups before the AST trip loop will act, that is, the signal itself also realizes the ""or" first "and" second" logical relationship, thus further improving the reliability of the system.

In some units, the pressure low protection trip signal of the lube oil adopts the "two-out-of-three" method, that is, three pressure openings have two signal protection actions with low lube pressure at the same time.

Optimization of Lubricating Pressure System Protection

Sampling Optimization

In the above-mentioned protection system, three signals or a combination of four signals have been adopted to improve the reliability of the protection, but one very important issue has been ignored. The sampling of pressure signals is the sampling of pressure switches. Many units are individually sampled, and all the way from the lubricating oil mother tube is sampled and distributed. Then the problem of sampling will lead to protection errors and leave hidden dangers. For example, a unit of lubricating oil protection is so configured. From the front box of the unit, all the lubricating oil is introduced into the lubricating oil online test device. The internal distribution of the test block is two roads. Each road has an electromagnetic valve(for online testing), and each road has two oil pressure switches. There are four pressure switches. The optimization plan is to add a new four-way independent sampling, connect the modified test block, and cancel the online test solenoid valve. Each group has an independent throttle and a return throttle for online testing. When doing the experiment, use the test block to manually throttle, throttle control oil pressure level test. Each group has its own local instrument. Each group of return oil pipelines is reconnected to a return pipeline, and the direct connection (not through the DCS system) is added to start the test block of the AC and DC lubricating pump.

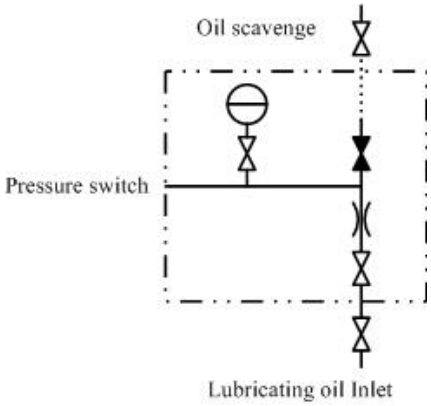

Fig1. *Hydraulic Principle Chart of Lubricant Low Pressure Test Device*

Increase Fuel Tank Level Low Protection

The lubrication oil level of the oil tank has a great influence to the pressure of the lubricant system. The low oil level of the fuel tank and the insufficient effective capacity of the fuel tank make the time for the system to stay in the fuel tank shorter, so that it is too late to eliminate the water and air in the oil. The suction inlet of the turbocharged pump(especially the upper suction inlet of the booster pump) is not deep enough below the oil surface to allow the turbocharged pump to inhale the oil containing large amounts of gas for a long period of time, causing the turbocharged pump outlet to accumulate air at the top of the bend head., When the air accumulates to a certain amount, it suddenly enters the main oil pump after disturbance, resulting in a sudden drop of oil pressure at the exit of the main oil pump. At the same time, it also caused the pressure of the lube oil master tube and the pressure of the lube oil to drop suddenly, triggering the low jump signal of the lube oil pressure, the trip of the unit, the start-up of the AC auxiliary oil pump, the AC start oil pump, and the DC accident oil pump.

The reliability of lubrication system protection is guaranteed by increasing lubrication oil level protection.

Summary

By increasing the sampling of the lubrication oil pressure and protection of lubrication tank oil level, the lubricant system protection in the steam turbine protection system is more perfect, and the safe and stable operation of the turbine unit is improved and reliable.

References

1. Hua-gui CHEN, Cause analysis of abrupt drop concerning lubrication oil pressure in 600 MW steam turbine unit, Thermal power generation, Vol40, NO11, 65-67.
2. Technical Committee on Thermal Automation in the Electricity Industry write, Reliability Configuration of Thermal Control System in Thermal Power Plant and Accident Pre-Control, China Electric Power Publisher.

Citation: **Mei-Feng ZHAO, Xue-Bin LIU, "***Optimization of Low Pressure Protection for Lubricating Oil in Steam Turbine Unit". American Research Journal of Computer Science and Information Technology; vol 4, no. 2, 2019; pp: 1-4.*