

IMPROVING PERFORMANCE OF FLY ASH PUMP IN COAL BOILERS

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Abstract

Fly ash is a system of dry ash handling system burning coal by boiler before getting to the chimney so as not to pollute the environment (air). Abu will pass the E lecture Static Recipient (ESP) and be temporarily accommodated at hopper. Then the ash will be transferred through the pneumatic AV pump system to fly ash silo. Fly ash transfer system failure occurred due to disruption of the pneumatic control system pump pa da AV system. This is because of the dome valve insert seal on AV pump leak and control system pneumatic fault because of contaminated by fly ash dust. The working intensity of the AV pump system in operation creates friction between the dome valve and dome valve insert seal which can cause erosion and leak on the dome valve insert seal. Frequent leakage at dome valve insert seal, has an impact on the spare part control system pneumatic contaminated by fly ash dust which causes damage to pneumatic spare parts and the cessation of the transfer process of ash to fly ash silos. The research was conducted with the addition of protection to the system pneumatic control AV pump by installing a quick exhaust valve on the system pneumatic AV pump in fly ash system, so that dust does not enter the AV pump's pneumatic control system when a dome valve insert seal leaks.

Keywords: fly ash, tansfer system, protection, av pump, dust

1 Introduction

Fly ash system is a system for handling dry ash from burning coal by the boiler before reaching the chimney so that it does not pollute the air. Ash will pass through the electrostatic precipitator (ESP) and be accommodated

temporarily in the hopper which will then be transferred through the AV pump line transfer system to the ash storage silo.

The operation of the fly ash transfer is noted several times with disruption to the AV pump transfer system in Units 1-3. This interference is in the form of a leak on the dome valve insert seal which causes the pneumatic control system to fault and impacts the transfer of fly ash dust to a standstill. This will interfere with the performance of the fly ash system. The problem of dome valve insert seal leakage on the AV pump is found in many parts of pneumatic systems contaminated with fly ash dust. When AV pump transfers experience problems, the action taken is to clean and replace the pneumatic control system parts.

To overcome the above problems, it is important to design a protection system on the pneumatic AV pump so that the dry ash from combustion does not enter into pneumatic spare parts so that the fly ash transfer system can be more reliable.

The insert seal dome valve leak on the AV pump Unit 3 caused disruption of the pneumatic control system and the cessation of the fly ash transfer process. Damage graph of the AV pump pneumatic system based on Work Order made by the Operator regarding the condition of the AV pump is not normal, either from the leak seal insert dome valve problem or from the fault indication on the AV pump can be seen in Figure 1.

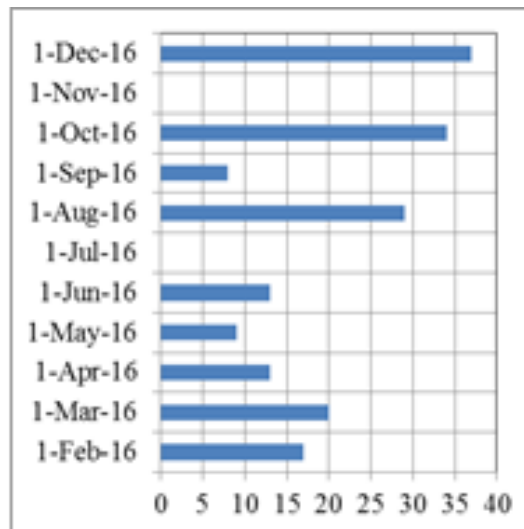
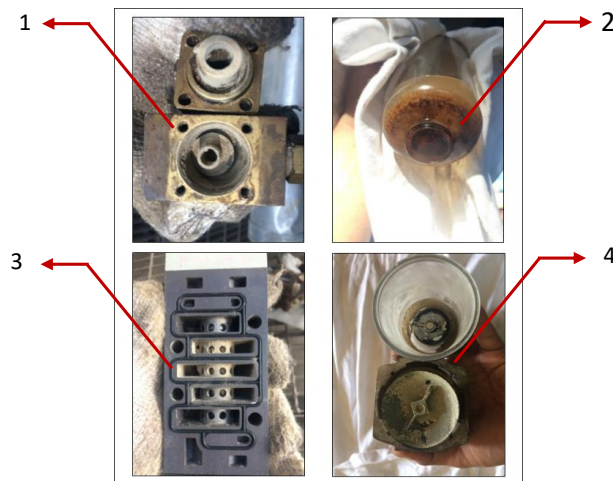


Figure 1. AV pump damage chart in 2016

Several problems reported, there were many findings of damage experienced by AV pump pneumatic spare parts, one of which was the contamination of fly ash dust pneumatic spare parts due to leakage of the dome valve insert seal. Dust that enters and contaminates pneumatic spare parts causes the work of the AV pump to be abnormal and the process of transferring the fly ash to a standstill. The following are some pictures of pneumatic spare parts contaminated with ash can be seen in Figure 2.



1. Directional limit switch; 2. Oil lubrication; 3. Solenoid directional valve; 4. Air filter

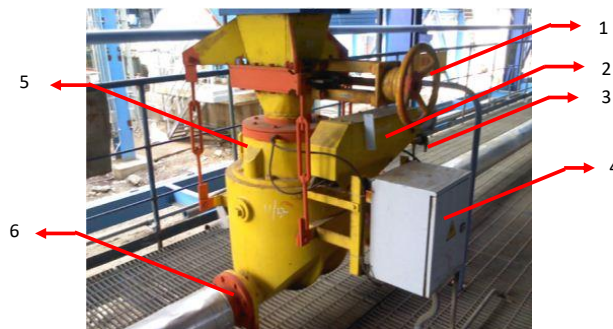
Figure 2. Pneumatic spare parts contaminated with fly ash dust

2 LITERATURE REVIEW

The froth flotation of coal fly ash can be best described by the classical first-order model which was investigated by Yang *et al.* (Yang, Zhu, Li, Yan, & Zhang, 2019) The effect of particle size on the flotation behavior of coal fly ash was investigated in this study. Other research such as Rathnayake *et al.* (Rathnayake, Julnipitawong, Tangtermsirikul, & Toochinda, 2018) mentions that, Feasibility of sulfur dioxide (SO₂) reduction from a coal fired power plant using fly ash and bottom ash as solid sorbents is evaluated.

2.1 AV Pump System

AV pump transfer system is an important part of the fly ash system (Su, Li, Sun, & Zhang, 2019). The system is used to transfer ash to the ESP hopper that has been captured by the electro static precipitator. At the flow of fly ash before going out into the atmosphere the temperature is maintained at 120 °C to 80 °C after passing ESP. Captured fly ash will be collected in the ESP hopper and subsequently transferred by the AV pump to transfer an auto-operated system with a continuous pneumatic control system (Zhao, Sun, Yang, & Wang, 2019) together with each line transfer without having to alternate and be temporarily accommodated in Fly ash Silo, then disposed to Ash final disposal Valley uses a Dump Truck.



1. Manual Gate Valve; 2. Actuator Piston Cylinder; 3. Quick Exhaust Valve; 4. Directional Solenoid, Pressure Indikator, Pressure Switch; 5. Insert Dome Seal and Dome Valve; 6. Conveying Line Transfer

Figure 3. AV pump Transfer System

3 METHODOLOGY

The methodology used in preparing this innovative work is:

1. Make direct observations of problems that occur in the field.
2. Gather information and references regarding the working principles of the system.
3. Conduct analysis to determine the right innovation.
4. Implement innovation in the system.

3.1 AV Pump Pneumatic Control System

Pneumatic control system is a drive that uses air pressure as its driving force. In the world of generators, the use of pneumatic control systems is widely used. One of them is the operation of the AV pump transfer system. AV pump transfers an auto-operated system with a pneumatic control system combined with electricity such as a PLC facilitating its application.

3.2 Factors determined for the reliability of pneumatic control systems

To be able to guarantee the reliability of pneumatic control systems, pressurized air of sufficient quality must be provided. These factors are determined as follows:

1. The right pressure
2. Dry air
3. Clean air

If these requirements are not met, this can result in increased equipment downtime along with higher operating costs.

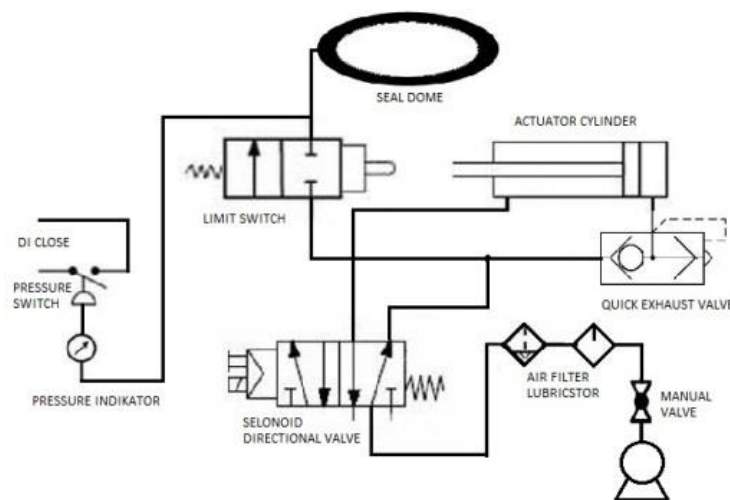


Figure 4. AV Pump Pneumatic System Series

3.3 Parts of the AV pump pneumatic system

In operation , the AV pump pneumatic system has several spare parts. The pneumatic spare parts consist of:

1. Manual Valve. Manual valve is a device that regulates, directs or controls the flow of a liquid by opening, closing, or closing part of the flow path.
2. Filter Lubricator. Filter Lubricator in the AV pump is used to filter air (wind) so that the air entering the spare parts is not contaminated with foreign particles that can damage other spare parts. And gives lubrication to moving pneumatic parts such as pistons and solenoids.
3. Solenoid Directional Valve. Solenoid directional valve is a valve that is controlled by electric current both AC and DC through coils / solenoids. This solenoid valve is a control element that is most often used in fluid systems.
4. Actuator Cylinder. Cylinder actuators are actuators or mechanical devices that use pressurized air power to produce power in alternating movements of the actuator cylinder in a linear manner, in operation, a pneumatic actuator is controlled by a solenoid directional valve.
5. Quick Exhaust Valve. The Quick Exhaust Valve function that is installed here is to accelerate the discharge of pressurized air inside the piston, so that the Actuator Cylinder will move open close quickly.
6. Directional Limit Switch. Directional limit switches are included in the category of mechanical sensors, namely sensors that will provide electrical changes when there is a mechanical change in the sensor. The limit switch will connect when the valve is pressed at a certain pressure limit.
7. Pressure indicator. Pressure Indicator is a device used to measure intrument air pressure in a closed loop. The unit of this pressure gauge is psi (pounds per square inch).
8. Pressure Switch. Pressure switches are pneumatic spare parts that can connect and disconnect electrical current based on a certain pressure value according to the arrangement. The equations are an exception to the prescribed specifications of this template. You will need to determine

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4 RESULT AND DISCUSSION

4.1 Root Cause Failure Analysis (RCFA) AV Pump Pneumatic Control System

The cessation of the fly ash transfer process is a frequent disruption to the AV pump line transfer (Bonnett, 2000). This was caused by a broken dome valve insert seal which disrupted the pneumatic control system on the AV pump.

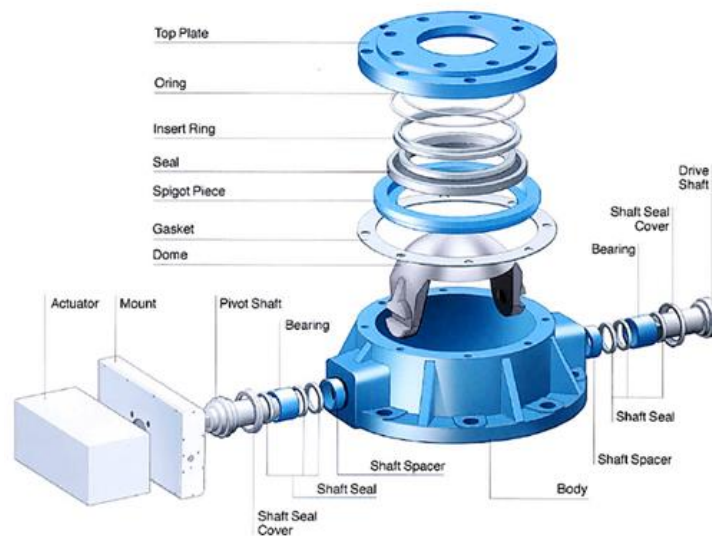
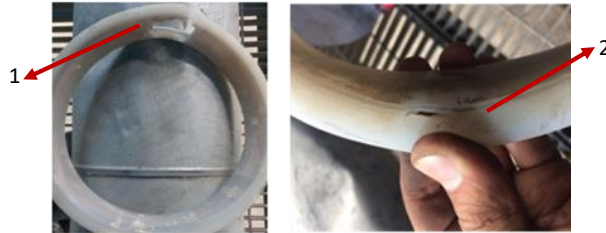


Figure 5. Dome Valve Construction

In the process, the insert seal dome functions to close the gap during the dome valve so that no leak occurs during the transfer process of ash. The insert seal dome valve also maintains pressure when transferring fly ash to the Fly Ash Silo.

The insert seal dome valve itself often experiences damage such as tearing or melting, causing disruption to the AV pump transfer system. This is due to the

inclusion of fly ash dust into the pneumatic control system and has an impact on the cessation of the transfer process of ash to fly ash silo.



1. Insert seal dome broken; 2. Insert seal dome broken

Figure 6. damage Insert dome valve seal

4.2 Addition of Protection to the AV Pump Pneumatic Control System

The addition of quick exhaust valve protection with a fluorocarbon diaphragm material on the AV pump's pneumatic system. So that the AV pump pneumatic control system has protection if there is a leakage of the dome valve insert seal. The following is a picture of a series of pneumatic control systems after innovation.

Valve 0R 12VB model as protection are: Re-engineering the series of Pneumatic Control Systems with the addition of protection. Re-engineering of the AV pump Pneumatic Control System (after innovation).

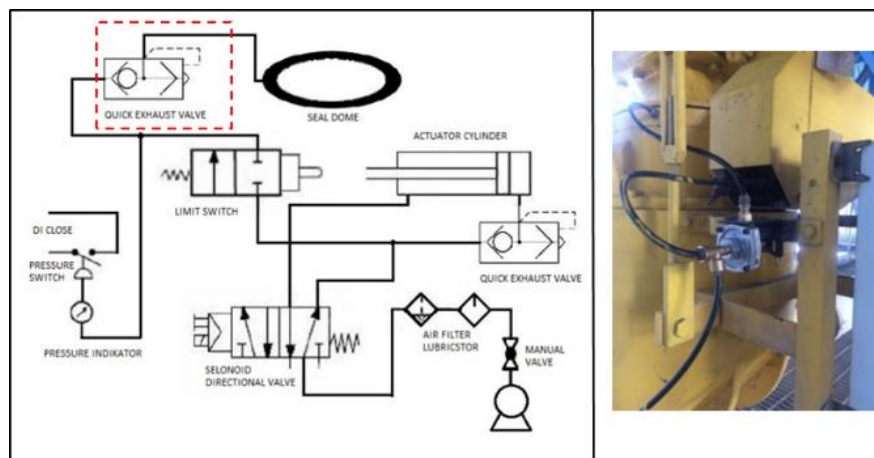


Figure 7. AV pump Pneumatic Control System circuit (after innovation)

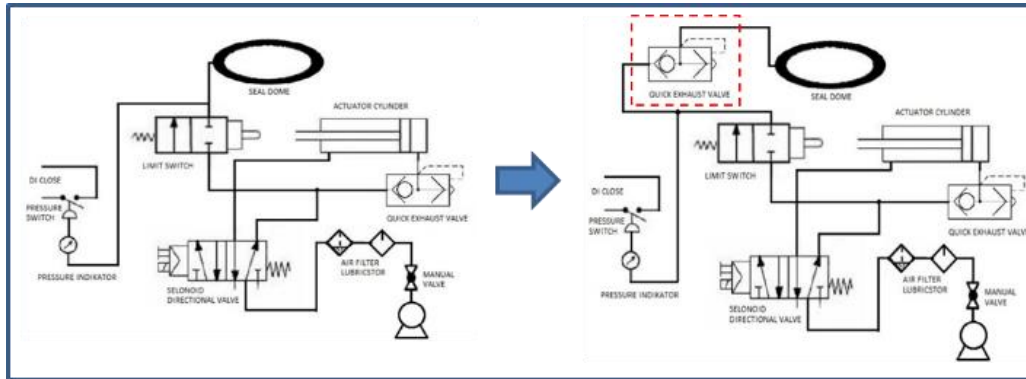


Figure 8. Re-engineering Pneumatic AV Pump Control System (after innovation)

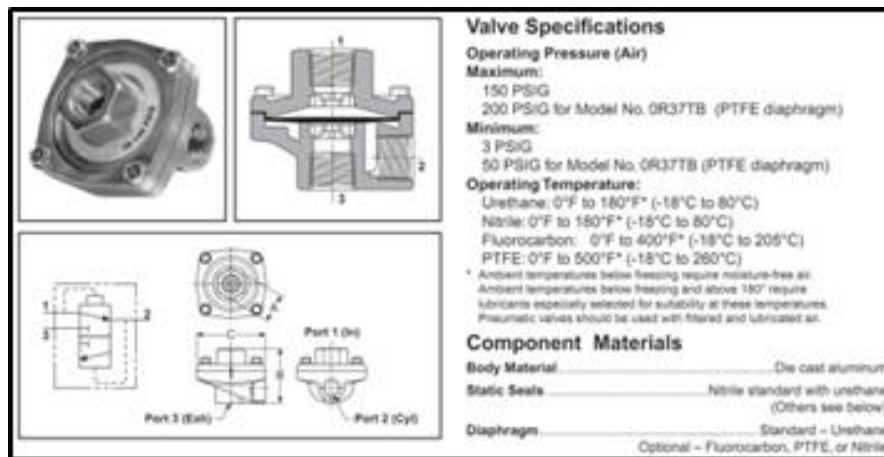


Figure 9. Operating Data Performance Specifications

4.3 Implementation of design results

The implementation of the AV pump system with the addition of Quick Exhaust Valve has been carried out on January 24, 2017, precisely at AV pump Unit 3, Palabuhan Ratu PLTU and proven to reduce interference due to leakage on the seal seal dome valve. on the AV pump pneumatic control system. The following work order graph regarding AV pump in 2017 can be seen in Figure 10.

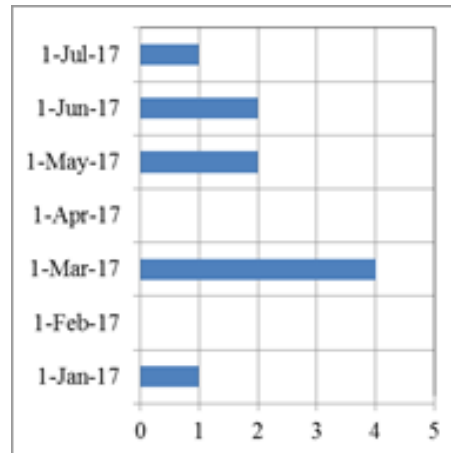


Figure 10. AV pump damage graph in 2017



1. Solenoid directional valve; 2. Directional limit switch

Figure 11. Condition of pneumatic control system spare parts after quick exhaust valve installation

5 Conclusion

The mechanism for improving the AV pump's performance for fly ash systems has been implemented and monitored for performance. The results show that there is an increase in the performance of the AV pump in handling ash from burning coal boilers. This is expected to increase the performance of the AV pump on the boiler.

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