Auto Drain Valve Water Separator inside the Unit of Komatsu HD 465-7R

V A T Manurung*, Y T Joko W and R I Poetra
Politeknik Manufaktur Astra Jakarta

* vuko.manurung@polman.astra.ac.id

Abstract. Water separator is a component that separate water from fuel, so the circulating fuel in the fuel system is not contaminated by water. If there is water inside the water separator, it will be carried by into the fuel system and then impacting to the engine performance. It’s such as lowering engine power because the fuel filter is clogged due to the fuel mix with water. Then the real danger is in case of the fuel mixes with the water. It will damage the fuel system components such as blockage of injectors due to corrosion and wear of fuel supply pump. As informed from daily maintenance record data, we have found that the low power engine trouble was caused by the fuel filter that was clogged high enough. Using the fishbone analysis, we got the main problem is there was water in the fuel separator at maximum level and did not discharge. In this condition, it is need optional device to automatically discharge the water from the water separator while maximum level reached, so the operator does not need to drain the water manually. The operator will be warned by buzzing active alarm and flashing caution lamp inside the cabin. By this method, the potential risk of mix up water with fuel would be avoided and the loss of others component failure would be mostly avoided. By using this tool, we can save net quality income around IDR (Indonesia Rupiah) 11,673,519,800.

1. Introduction

HD 465-7R is a huge dump truck material carrier, from medium to long distance, where material brought can be filled by excavator, wheel loader, or shovel. Seeing its function then Dump truck is very suitable to be used in mining [1].

At Komatsu HD 465-7R after observed then there is a weakness in the fuel system that is on the system of separation of water with fuel. In this unit fuel separator system use manual drain plug so that required attention from the operator when daily checking. The problem is the operator forgot to check the separator daily [2][3].

Figure 1 is a population of several types of heavy equipment used in PT XX mining area West Sumatra. It is seen that the population of HD 465-7R is very dominant [4].
Figure 1. The number of units and types of heavy equipment

Daily monitoring breakdown Data (DMBD) from May 2016 until May 2017 it found that engine breakdown of HD 465-7R around 28% from the whole trouble as figure 2 and totally 11232.8 hours. For 11232.88 hours of unit breakdown of the engine system is divided into 5 parts, from the turbo contributed 4675 hours, from low power contributed 2750 hours, the leakage of coolant and oil was 807.88 hours, engine can’t start 673 hours and the other 2327 hours [5][6][7].

Figure 2. Percentage of downtime unit HD465-7R

2. Low power engine trouble
Damage start from complaining of the operator HD 465-7R that is engine low power causing the unit to be breakdown (unscheduled breakdown), caused by fuel mixed with water (fuel quality is less good). As a result, the unit becomes breakdown and ultimately disrupts the production process. Countermeasures so far are doing the replacement of fuel filters. Table 1 shows the frequency of low power engines during on January 2017 [8][9].
3. Solution

By using the fishbone analysis, we got there was water in the separator at maximum level so the fuel mix with water. This condition makes the engine trouble [10]. Solving the problem should make a system that allows water to be automatically drained while the water in separator at the maximum level and also inside the cabin installed the buzzer so that the operator is informed when draining in the engine room. The electrical diagram for discharging water as a figure 3.

![Diagram](image-url)
Figure 3. Wiring Diagram of the Automatic Water Draining

The system work as follows:
While in the water separator there is water mixing with fuel, the sensor installed in the water separator will inform the electrical module, and then gives input to actuator and then the output of solenoid is buzzer, and indicator lamp. So, when there is input from the sensor, at the same time the solenoid valve will open and the indicator lamp and buzzer in the cabin will work until the water empty. During that process the operator is prohibited to turn on the engine until the device finished, to avoid air enter to the fuel system. This is done so that no air enters the fuel system.

4. Financial benefit.
Losses due to the unscheduled breakdown of HD 465-7R as follows:
   a. One-unit HD465-7R can carry 26 BCM (Bank Cubic Meter) Overburden. So, 1 hour can carry 5 times. 1 BCM = 1.74 USD (≈ IDR 23100), then 1 hour = 5 x 26 BCM = 130 BCM. If one year the total unscheduled breakdown due to low power for all units are 2750 hours, so the company lost is: 130 x 2750 (hours) x (IDR) 23100 = IDR 8,258,250,000
   b. Losses due to fuel filter changes. There are 218 times of engine low power troubles. If one-unit use 1 main fuel filter and 2 pre-fuel filters, its mean that there are 218 pieces of main fuel filters change and 436 pieces of pre-fuel filters change. If one main fuel filter ≈ IDR 1789100 and one pre-fuel filter ≈ IDR 253500, the total losses is IDR 1,490,269,800.
   c. Losses due to manpower. If 1-hour manpower cost is IDR 350,0000 and one trouble need 2 manpower. For 2750 hours the cost is IDR 700,000 x 2750 (hours) = IDR 1,925,000,000.

5. Conclusion
By using fishbone analysis, the main problem is there was water in the separator over the maximum level that cause the engine was low power. The application of auto drain valve water separator we can reduce losses of units can’t operate, spare parts and manpower. All are around IDR 11,673,519,800 can be saved.

References
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