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Strategy to Improve The Productivity of The Sakai Sv700tf Compactor by Reducing Unscheduled Engine Breakdowns Due to Low Power in The Fuel System at PT Amm Jobsite Mifa Bersaudara Mining Area (2024)

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ABSTRACT

Compactors are one of the heavy equipment that is needed in the process of mining activities which is closely related to the hauling road maintenance process. The impact that can occur directly due to unsuitable road conditions will affect the lifetime of the tire dump truck coal hauling unit, fuel consumption, and safety aspects. The deterioration of the condition of the mining road will also have a direct impact on the cycle time of the hauling unit so that the duration/cycle of operation will be longer, which of course will have an impact on production targets that are not achieved. One of the compactor models utilized in the mining area of PT Antareja Mahada Makmur site of PT MIFA Bersaudara is the Sakai SV700TF Model. The unit model has problems with the fuel system when operated in Indonesia because the actual parts installed and the excisting system still apply Japanese standards as manufacture. The quality of fuel in Indonesia that applies B35 (35% biodiesel) causes many Compactor units to have Low Pressure Engine Fuel problems, causing many Unscheduled Breakdown frequencies. The improvement strategy used in increasing SV700TF productivity is to modify the fuel system lines by installing the SV526D model Water Separator which has a larger filtration volume, as well as adding fuel additives to improve engine combustion efficiency. The evaluation of the improvement is by comparing the frequency of unscheduled low power engine breakdowns before and after the improvement based on actual breakdown report data during the trial period. The improvement strategy for the modification of the Sakai SV700TF fuel system compactor lines at the PT AMM site PT MIFA Bersaudara has been proven to reduce the frequency of low power engine breakdowns. The results of this study show that the improvements made have a positive impact on engine performance with the result of a decrease in the frequency of low power engine breakdown reports by 87% and a reduction in lost costs due to clogged filter replacement by 95%. The success of this improvement has increased the productivity of the hauling road maintenance process which has a major impact on the operational productivity process of coal hauling.

INTRODUCTION

The utilization of biodiesel in Indonesia has shown a consistent and growing trend since its national implementation in 2006. This is evidenced by both the increasing production capacity and the rising blend ratio of biodiesel in diesel fuel. The policy started with B01 (1% biodiesel and 99% diesel) and gradually escalated, culminating in the B35 mandate in February 2023, which mixes 35% biodiesel with 65% diesel (Oktaviani et al., 2021; Siregar et al., 2022). These developments position Indonesia as a global leader in biodiesel utilization, both in terms of production scale and mandatory blending policies (Suhariyanto & Widodo, 2020). Biodiesel policies have significantly contributed to reducing fossil fuel dependency and promoting energy security (Putra & Maulidia, 2023). In addition, studies confirm that higher biodiesel blends like B30 and B35 contribute to emission reduction and are part of Indonesia's commitment to carbon neutrality (Utomo et al., 2021; Wahyuni & Ramadhan, 2023). However, challenges related to fuel quality, engine compatibility, and distribution infrastructure still need to be addressed for long-term sustainability.

Biodiesel itself is a methyl-ester compound produced from the process of esterification or transesterification of vegetable oil or animal fat oil. Remarkably, biodiesel itself has the same physical properties as diesel fuel so it can be used as a fuel instead of environmentally friendly diesel-engine vehicles (Knothe & Van Gerpen, 2005; Mittelbach & Remschmidt, 2004). Another goal of the massive government in the use of biodiesel is to reduce greenhouse gases, climate change due to air pollution, increase the use of renewable energy, support the development of clean energy and reduce dependence on imported fuel imports (Adi et al., 2021).

Along with increasing the biodiesel content of diesel, it turns out to have a negative impact on its actual use in vehicles if special treatment is not carried out both on the vehicle directly and in the B35 storage tank (Fitriana et al., 2021). Biodiesel has the characteristics of high saturated fatty acid content, hygroscopicity, high viscosity, and metal contaminants from its production process (Wirawan et al., 2024). These properties can cause damage to engine components when biodiesel fuel is used. In addition, according to one of the journals for the use of B20 alone can form more carbon deposits in the injectors compared to B0. The deposits contain metals, which can have an impact on accelerating the breakdown of the fuel system. Deposits formed on the injectors can also affect increased fuel consumption and decreased engine power due to low flow rates of fuel injected into the combustion chamber. However, the higher turbidity point of palm oil biodiesel can also result in fuel filter clogging during low-temperature operations (Reksowardojo et al., 2020).

In mining operations at the PT Antareja Mahada Makmur site PT Mifa Bersaudara, with a total of more than 200 units of heavy equipment, fuel consumption is understandably high. The adoption of B35 biodiesel has introduced several operational challenges, including frequent unscheduled breakdowns due to clogged fuel filters, low fuel pressure, and frequent injector replacements, all attributed to the inconsistent quality of B35 fuel (Nugroho et al., 2023; Alamsyah et al., 2022). Specific equipment, such as the Sakai SV700TF compactor, has been particularly affected due to the limited filtration capacity in its fuel system, which was originally designed

based on Japanese manufacturing standards (Wijaya & Susanto, 2021). These fuel-related issues have compromised maintenance efforts for the hauling road, reducing its effectiveness and resulting in further operational losses such as reduced tire life, damage to DT Coal Hauling springs, and the inability to meet targeted transport speeds (Fitriansyah et al., 2023; Prasetyo et al., 2022; Purnomo & Hartono, 2021). Such cascading effects underline the critical importance of ensuring fuel quality and compatibility in heavy-duty operations in the mining sector.

Previous research by Kusdiana and Saka (2004) investigated the physical and chemical properties of palm oil-based biodiesel and concluded that biodiesel is a viable alternative fuel due to its similarity to conventional diesel. However, their study was conducted under controlled laboratory conditions and did not assess the real-world impact of biodiesel use on the performance of heavy-duty equipment in industrial operations. In contrast, Harsono et al. (2020) examined the impact of B20 biodiesel on vehicle performance and found that its usage resulted in increased carbon deposits in injectors, which could reduce combustion efficiency. Nevertheless, their study was limited to light-duty vehicles and did not address the technical failures experienced by heavy equipment in high-demand environments such as mining operations. This study addresses that gap by directly investigating the operational effects of B35 biodiesel on the performance of heavy equipment—specifically, the Sakai SV700TF compactor—at PT Antareja Mahada Makmur's mining site. The objective of this research is to evaluate the technical impact of B35 on fuel systems and overall equipment productivity in field conditions. The significance of this study lies in providing strategic and technical recommendations for mining companies regarding fuel procurement, maintenance practices, and system upgrades to minimize the negative consequences of B35 usage and support efficient, uninterrupted operations.

METHOD

The research concept used by the author is to implement it based on direct experiments to reduce unscheduled low power engine breakdown due to B35 fuel. The main method is to change the actual water separator PN 4418-98002-2 to PN 4421-39001-0 with a larger filtration area. In addition, the addition of optional additive EON Fuel 708 as a dispersant and detergent is a microbial prevention improvement solution to maintain the lifetime of engine components and improve the quality of filtration and compression.

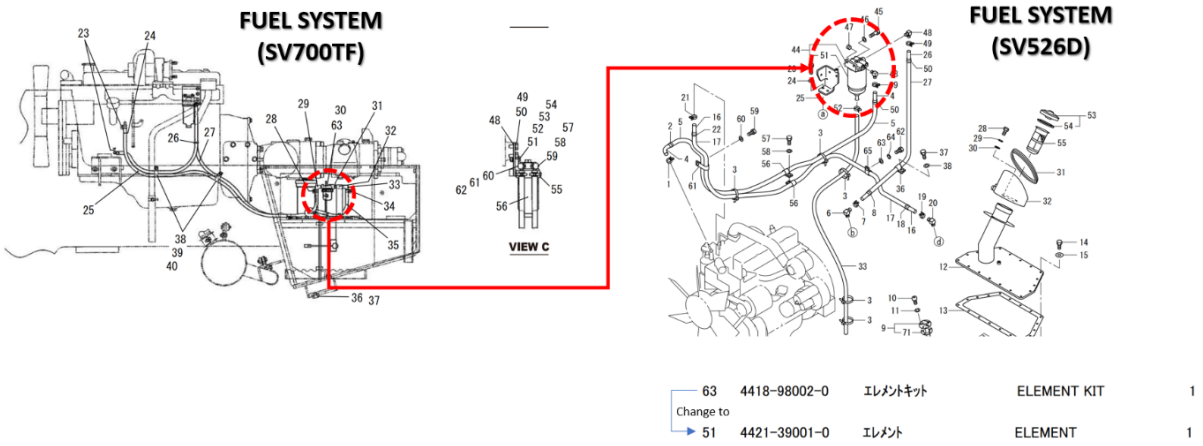


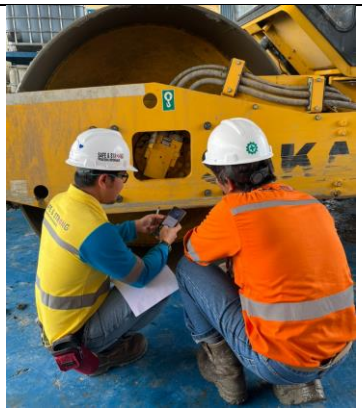
Figure 1. Lines Fuel System SV700TF dan SV526D

This research activity began by collecting data on the highest low power engine problems caused by clogged fuel filters that occurred in June 2024 at the mining operations of PT Antareja Mahada Makmur and the jobsite of PT Mifa Bersaudara. The installation of water separator PN 4421-39001-0 was carried out within a span of 3 months according to the installation opportunity. The steps taken in this study include the activities in the table below.

Table 1. Method Stages in Reducing Low Power Breakdown

No.	Activity	Implementation	Documentation
1	Problem Identification and Initial Analysis	Collected historical maintenance data on SV700TF related to engine low power issues. Initial analysis indicated poor B35 fuel quality and undersized existing water separator filtration (Part No. 4418-98002-2).	

No.	Activity	Implementation	Documentation
			
2	Water Separator Trial	Installed new water separator assembly (Part No. 4421-39001-0) on Sakai SV700TF compactor unit.	
4	Additive Fuel Trial	Applied EON708 fuel additive at a 1:1000 liter ratio during the trial period.	

No.	Activity	Implementation	Documentation
4	Data Collection and Analysis	Compared improvement effectiveness by measuring reduction in engine low power breakdowns due to filter clogging, based on actual frequency and duration.	
5	Evaluation and Follow-Up	Analyzed the effectiveness of water separator PN 4421-39001-0 and its element under various operating conditions. Conducted socialization sessions for mechanics and operators on the improvement's function and success.	

The improvement steps that have been taken are solutions to the Low Power problem in the Sakai SV700TF Compactor. The success of the experiment is expected not only to reduce unscheduled breakdowns due to low power in frequency and duration, but also to increase operational efficiency SV700TF in supporting hauling road maintenance activities at PT Antareja Mahada Makmur Jobsite PT MIFA Bersaudara.

RESULT AND DISCUSSION

The Sakai SV700TF pareto problem breakdown unscheduled data is to compare data in June 2024 (before improvement) and October 2024 (after improvement) with the results as shown in the figure below.

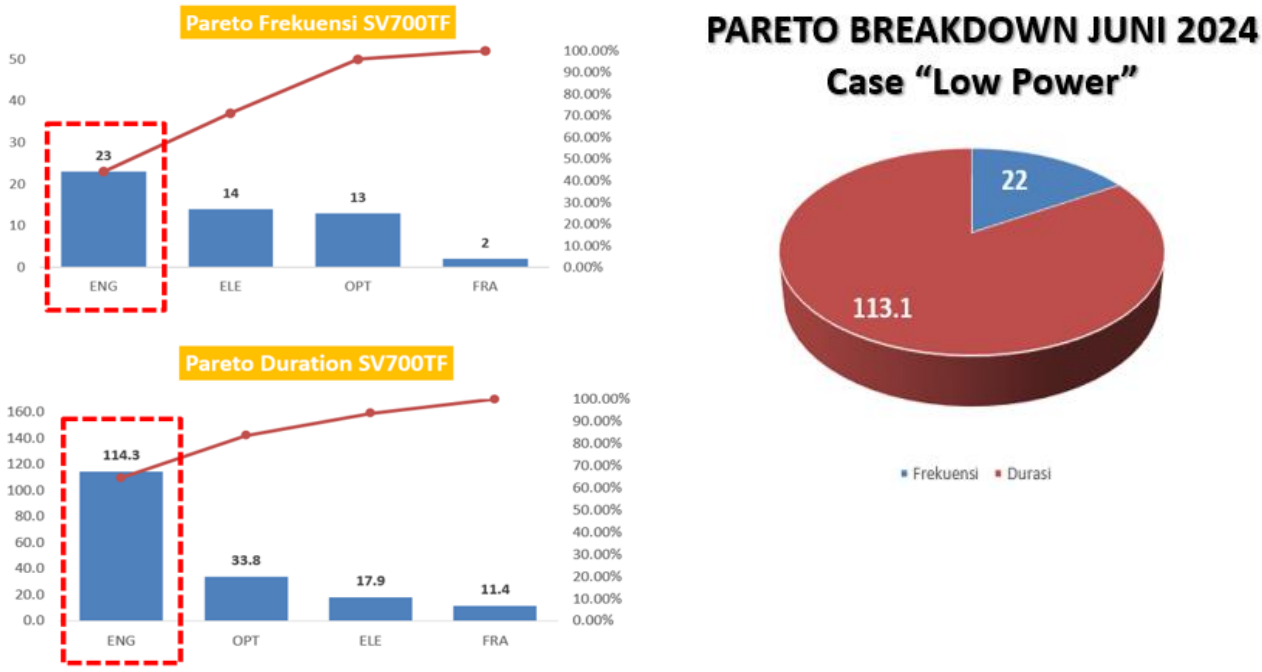


Figure 2. Pareto Breakdown Unscheduled SV700TF Juni 2024 (Before Improvement)

The author also calculated the potential saving cost resulting from the success of this improvement by comparing the lost cost incurred in June 2024 (before improvement) with the potential saving cost in October 2024 (after improvement), as shown in the table below.

Tabel 2. SV700TF Potential Saving Cost Calculation

POTENTIAL SAVING COST	Value	Unit
EWH	18	Hours
Rental Rate	18.94	USD
Days	30	Days
Exchange Rate	15,635	IDR/USD
Total Revenue	$10,227.60	USD
	Rp159,908,526	IDR

Note :
EWH : Effective Working Hours

Based on the potential saving cost calculation at PT AMM, Jobsite PT Mifa Bersaudara, for the Sakai SV700TF compactor unit model, the lost cost due to low power issues amounted to Rp33,506,100 or 21% in June 2024. In contrast, the success of the improvement is reflected by a significant reduction in lost cost to only 1%, or Rp2,309,789, in October 2024. This indicates that the implemented improvement was effective in reducing costs, as illustrated in the figure below.

Table 3. Comparison of Lost Cost Between June 2024 and October 2024

June 2024			October 2024	
Lost Cost Due to Low Power			**Lost Cost Due to Low Power**	
Potential Cost	Rp159,908,526	➡	Potential Cost	Rp159,908,526
Lost Cost	Rp33,506,100.68		Lost Cost	Rp2,309,789.82
% Lost Cost	21%		% Lost Cost	1%

CONCLUSION

The implementation of an improved water separator with a larger filtration area in the SV700TF and the addition of EON708 additive to the fuel tank have proven highly effective in reducing unscheduled breakdowns caused by *Biodiesel 35* (*B35*) fuel issues at the PT Antareja Mahada Makmur jobsite, PT Mifa Bersaudara, leading to notable improvements in energy efficiency and productivity. These measures reduced the frequency of unscheduled breakdowns from 22 to 3 incidents (an 87% improvement) and shortened total downtime from 113.1 hours to 7.8 hours (a 93% reduction), while potential lost costs due to low power issues dropped from 21% to just 1% (a 95% cost saving) by October 2024. This research not only offers an effective technical solution but also serves as a strategic approach to enhancing proactive maintenance quality. For future research, it is recommended to conduct a comprehensive analysis of the long-term effects of *B35* biodiesel on engine performance and maintenance costs, particularly for the SV700TF Sakai compactor model, and to strengthen the implementation of a *Condition Based Monitoring* (*CBM*) system to ensure more reliable operations and inform the development of more effective heavy equipment maintenance strategies in Indonesia's mining industry.

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