

The Effectiveness of Vibrating Screen on the Composition of Feeds at PT KSP AGRO

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ARTICLE INFO

Article history:
Published
February 25, 2026

Keywords:
Vibrating screen,
Effectiveness,
Feed Composition,
Palm Oil
PT. KSP Agro

ABSTRACT

Vibrating screen is a filter unit that plays an important role in clarification stations because it functions to separate coarse impurities from crude oil so that the quality of the oil is improved and the oil loss can be minimized. The data used in this study is in the form of bait composition consisting of oil, water, and NOS in several observation periods. The data was then evaluated to determine the relationship between the variation in the composition of the feed and the effectiveness of the resulting filtering. The results of the study show that the effectiveness of vibrating screen tend to fluctuate in each observation period. Effectiveness increases when the oil content in the feed is higher, as the oil is more easily separated from impurities.

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I. Introduction

Oil palm plantations produce fresh fruit bunches (FFB). FFB is processed by palm oil mills (POM) to produce crude palm oil (CPO) and other derivative products. One of the characteristics of FFB is that it is easily damaged. Crucial post-harvest period immediately after harvesting fresh fruit bunches (FFB) Towards optimal oil travel quality, not starting at the plant [1].

The dirt that follows at the post-harvest time can affect the material to be separated and the amount of dilution required when separated in the vibrating screen. Post-harvest, within 48 hours FFB must be processed to reduce damage in the form of loss of oil content [2].

In the process of processing palm oil, the separation between crude oil (crude oil) and solids are a very important stage to determine the efficiency of the production process and the quality of the oil produced. One of the tools that plays an important role in this stage is vibrating screen, which is a filter that works on the principle of vibration to separate solids such as fiber and sand from palm oil liquids. The vibrating screen finds widespread applications across various industrial sectors, including mineral separation, construction, and pharmaceutical engineering Industrial sectors, including mineral separation, construction and pharmaceutical engineering are widely found to apply vibrating screens [3].

Effectiveness of vibrating screen it is influenced by various factors, one of which is the composition of the feed that enters the tool [4]. The composition of this mixture of oil and diluent has a role in the separation of the material contained in crude palm oil, if it is too thick it causes difficulty in separating the solid material from the oil and if it is too diluted it will make it easier for the oil to follow in the mud if the temperature is not reached.

Significant advances have not been made in the last 30 years regarding milling technology related to the control of crude oil dilution [5]. The composition of the feed can include solids content, particle size, and moisture content. Feeds with too high solids content or non-uniform particle sizes can cause



blockages Screen decreased separation efficiency, and increased oil loss in solids. In addition, blockages can also occur due to the build-up of bait on the surface of the sieve. This condition usually arises when the inlet feed flow is greater than the outflow capacity, so that part of the feed is stuck on the surface and closes the sieve hole. This buildup makes the filtration process hampered and the separation rate decreases. At PT. KSP Agro, the variation in the effectiveness of separation that occurred is strongly correlated with changes in the composition of incoming feeds. If the effectiveness of the separation is low, not only the quality of the oil is affected, but also the potential oil losses in the next stage will increase. Therefore, the analysis of effectiveness vibrating screen It is important to do the composition of the feed, to find out how much the variation in composition affects the performance of the separation.

II. Literature Review

A. Vibrating Screen

Vibrating screen is one of the machine components in palm oil processing. Vibrating screens function to separate garbage and large fibers from sand or called non-oil solids (NOS) found in crude oil because they do not settle in the Sand Trap Tank. Meanwhile, the goal is to reduce the viscosity of crude oil so that it can improve the efficiency of oil extraction. The vibrating screens work is by the sieving process by utilizing an unbalanced system or vibration. This filtration occurs on a Crude Oil Tank (COT) vibrating screen which uses 2 filters (double deck). Dilluted crude oil (DCO) from the over flow sand trap tank enters the vibratung screen, the finer particles will pass through the filter hole (mesh), while the coarse particles (NOS) will be trapped on the deck and flowed with vibration to the outside of the deck, then accommodated in the sludge waste conveyor which is sent back to the fruit elevator. Using the identical characteristics of two large-scale double-deck vibrating screens, experimental data was collected [6].

The components of the Vibrating Screen are:

- The Screen Double Deck serves as where the separation process takes place. Smaller particles such as oil and water will escape through the mesh holes, while large particles such as fibers and shells are retained.
- The vibrator functions to produce vibrations that are transmitted to the screen deck.
- Springs absorb vibrations so that they do not propagate to the main frame and foundation.
- The Main Frame serves as the supporting structure of all vibrating screen components.
- Electro Motor functions to move the vibrating system or vibrator so that the screen vibrates with a certain frequency.



Fig 1. Double Deck Vibrating Screen

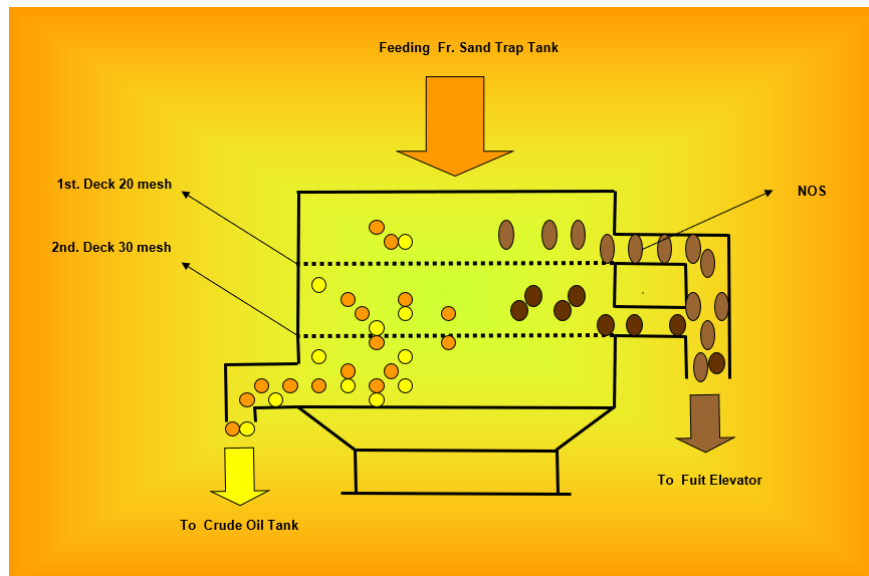


Fig 2. Sketch Double Deck Vibrating Screen

B. Effectiveness of Vibrating Screen

The large use of vibrating screens in all types of processes is often the cause of unstable filtration efficiency and the problem of clogging of vibrating screen holes increases where existing filtration systems find it difficult to adapt to changes in the processing stages of materials where different materials produce large differences in particle distribution [3].

In the palm oil processing process, the vibrating screen acts as an initial separator between crude oil and solids (fibers, shells, and mud). The effectiveness of vibrating screens is expressed in the form of the percentage of oil that has been successfully separated compared to the total oil that enters with the feed. The filtration efficiency of the vibrating screen is influenced by the material characteristics as the main factor [7].

C. Composition of the Feed

Feed composition is the arrangement or comparison of the material content in the mixture flow that enters a particular process unit, in this case to vibrating screen. The bait consists of a mixture of coarse oil (crude oil), Diluting water (water dilution), and solids (solid materials) such as fiber, sand, or dregs from the results of the pressing process (pressing) [8]. In an oil palm processing system, the balance between the oil, water, and solids content in the feed greatly determines the performance of the equipment that is responsible for separating these phases, including vibrating screen.

III. Method

This research started on June 16, 2025 until June 19, 2025, which is located at the palm oil mill of PT KSP Agro.

The tools and materials used in this research are as follows:

Table 1. Tools Used

Yes	Tool name	Information
1	Bottle	Used to store liquid samples and solids to be analyzed
2	Round plastic containers	Used to store liquid samples to be measured
3	Iron Pot	Used to take liquid samples

Yes	Tool name	Information
4	Ruler	Used to measure the height of the liquid in the container
5	Spatula	Used to transfer small quantities of samples
6	Tube	As a container to hold samples used in the centrifugation process
7	Centrifuge	Used to separate oil from NOS and water
8	Analytical Scale(gr)	To weigh samples and oven results
9	Vaporizer cups	Used to hold liquid and solid samples in the oven

Table 2. Materials Used

No	Material Name	Description/function
1	Diluted Crude oil Sand Trap Tank	Materials used to determine the level of Oil, moisture and sludge
2	Sludge Waste Vibrating Screen	Materials used to determine the level of Oil, moisture and sludge
3	Diluted Crude oil Vibrating Screen	Used to Know the effectiveness of vibrating screens

The following are the stages of this research:

A. Sample Analysis

The data needed is data on the effectiveness of the vibrating screen, and the composition of the feed. Data collection is carried out in the following stages:

1. Sample Point: Inlet and Outlet Vibrating screen
2. Objective: Estimate the effectiveness of the vibrating screen and the content of the feed
3. Analysis steps:

B. Material Composition

Determination of oil, water, and NOS content:

- Put the sample into a 10 ml sample centrifuge bottle
- Insert the bottle into the centrifuge at 3000 rpm for 4 minutes
- Calculate the yield after in the centrifuge

C. Effectiveness Calculation

Determination of effectiveness:

- Prepare a plastic container that has been measured in height and diameter
- Hold vibrating inlet for 10 seconds
- Holds vibrating outlet for 10 seconds
- Calculate outlet and inlet volume

IV. Results and Discussion

The data of this research was carried out within three days, where three samples were taken each day representing the time of operation. The sampling hours are not the same because the operating time varies every day.

A. Results of data calculation of feed composition samples

Based on the results of the research conducted, data and average graphs per day were obtained from the composition of the feed on the vibrating screen as follows:

Table 3. Feed Composition

Date	Time	DCO Feed Oil (Liter)	DCO Feed Water (Liter)	NOS Feed DCO (Liter)
16 June	12:00	21,00	13,12	18,37
	16:00	15,75	07,87	28,87
	20:00	23,62	10,50	18,37
18 June	14:00	21,00	09,97	21,52
	18:00	21,00	10,50	21,00
	22:00	21,00	10,50	21,00
19 June	16:00	18,37	11,02	23,10
	20:00	23,62	10,50	18,37
	22:00	21,00	13,12	18,37

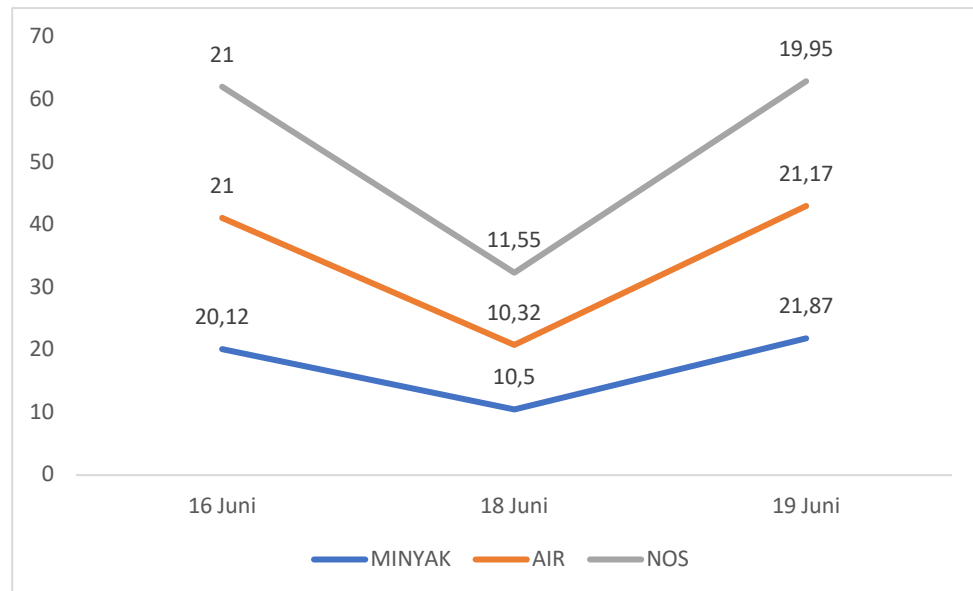


Fig 3. Feed Material Chart

Based on Figure 3 of feed materials on June 16, 18 and 19, there was a change in value in three main components, namely Oil, Water, and NOS. The data showed that the composition of the bait was not always stable and fluctuated during observation. In the daily data analysis table, the average vibrating screen feed shows the difference in results from oil content, emulsion, moisture content, non-oil solid, and temperature every day [9].

B. Results of data based feed composition that was retained in the vibrating screen

Based on the results of the research conducted, data and average graphs per day were obtained from the composition that was retained in the vibrating screen as follows:

Table 4. Feed Composition Retained

Date	Time	Retained Oil (Liters)	Retained Water (Liters)	NOS Restrained (Liters)
16 June	12:00	0,62	0,62	7,06
	16:00	0,71	0,62	6,97
	20:00	0,21	0,54	7,53
18 June	14:00	0,71	0,33	7,27
	18:00	0,75	0,41	7,14
	22:00	0,62	0,21	7,47
19 June	16:00	0,66	0,46	7,18
	20:00	0,79	0,79	6,97
	00:00	0,50	0,50	7,39

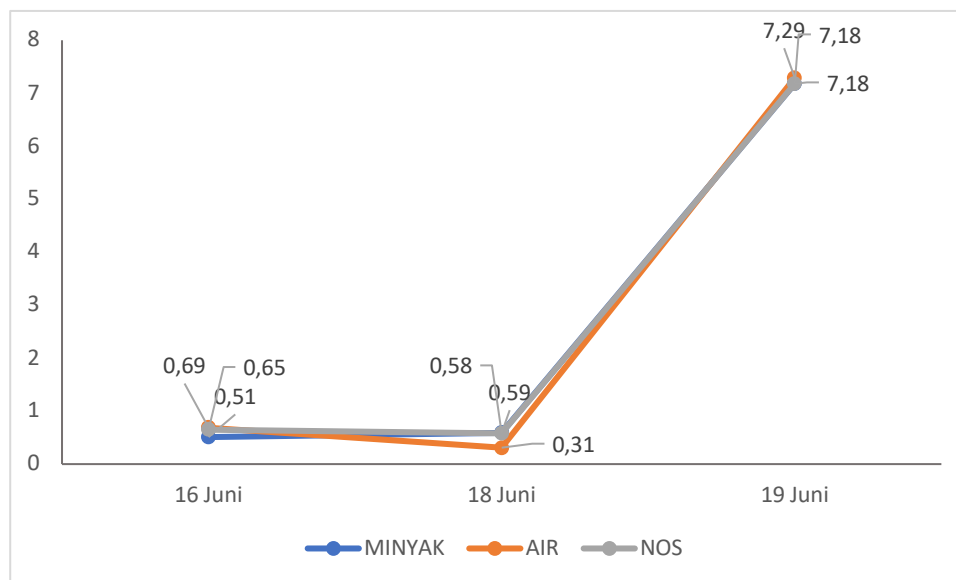


Fig 4. Retained Material Chart

Based on Figure 4 of the retained material, it can be seen that the amount of material retained in the *vibrating screen* was still low on June 16-19, especially in the oil and water components which were below 1 liter, while *US* is in the range of 7 liters. On June 19, all three materials experienced a considerable increase. Oil and water rose close to 0.8 liters, while *US* increased to about 7.28 liters. This increase shows that on that date more materials did not pass the screening than the previous day. The graph data shows that the dirt level that is close to the SNI standard is when the temperature is 90°C – 95°C, around 0.2% and 0.4% [10].

C. Results of data based oil composition that was retained in the vibrating screen

Based on the results of the research conducted, data and average graphs per day were obtained from the composition of feed oil and those retained in the vibrating screen as follows:

Table 5. Oil Composition

Date	Time	DCO Feed Oil (Liter)	Retained Oil (Liters)
6 June	12:00	21,00	0,62
	16:00	15,75	0,71
	20:00	23,62	0,21

Date	Time	DCO Feed Oil (Liter)	Retained Oil (Liters)
18 June	14:00	21,00	0,71
	18:00	21,00	0,75
	22:00	21,00	0,62
19 June	16:00	18,37	0,66
	20:00	23,62	0,79
	00:00	21,00	0,50

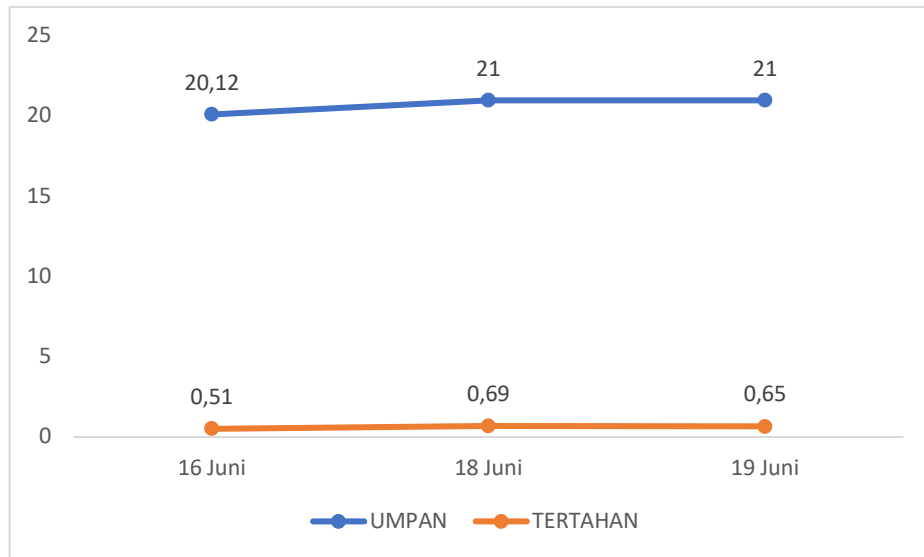


Fig 5. Feed and Retained Oil Chart

Based on Figure 5 of feed oil and retained oil, it can be seen that the amount of feed oil on June 16, 18, and 19 was in a fairly high range, which is around 15-23 liters, while the oil retained on the vibrating screen was only in the range of 0.2-0.7 liters. Overall, the graph shows that the amount of oil that enters is much greater than that that is retained, so that the filtration process runs quite effectively because only a small amount of oil does not pass through the filter. The output of the vibrating screen can reduce the level of impurities in crude oil, which is reduced by temperature, the higher the temperature, the lower the oil content makes it easier to filter so that the filtration becomes effective [9].

D. Results of data based oil composition that was retained in the vibrating screen

Based on the results of the research conducted, data and average graphs per day were obtained from the composition of feed water and those retained in the vibrating screen as follows:

Table 6. Water Composition

Date	Time	DCO Feed Water (Liters)	Retained Water (Liters)
16 June	12:00	13,12	0,62
	16:00	07,87	0,62
	20:00	10,50	0,54
18 June	14:00	09,97	0,33
	18:00	10,50	0,41
19 June	22:00	10,50	0,21
	16:00	11,02	0,46

Date	Time	DCO Feed Water (Liters)	Retained Water (Liters)
	20:00	10,50	0,54
	00:00	13,12	0,41

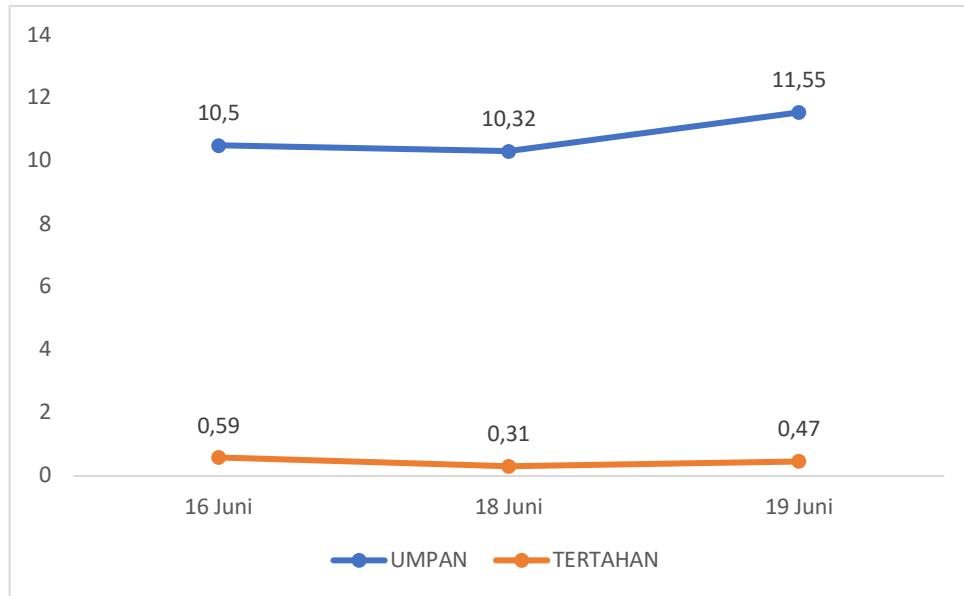


Fig 6. Feed and Retained Water Chart

It can be seen in Figure 6 that the feed water is around 7-13 liters, which shows that the amount of feed that enters the *vibrating screen* is not always the same. For retained water, it is in the range of 0.2-0.6 liters that it has fluctuated although it is not too significant. Oil with 0.2% water quality and 0.04% impurities is a good result to be marketable at a decent price [2].

E. Results of data based NOS composition that was retained in the vibrating screen

Based on the results of the research conducted, data and average graphs per day were obtained from the composition of the *NOS* feed and those held on the *vibrating screen* as follows:

Table 7. Composition of NOS

Date	Time	DCO Feed NOS (Liter)	NOS Restrained (Liters)
16 June	12:00	18,37	07,05
	16:00	28,87	06,97
	20:00	18,37	07,55
18 June	14:00	21,52	72,62
	18:00	21,00	07,14
	22:00	21,00	07,47
19 June	16:00	23,10	71,79
	20:00	18,37	06,97
	00:00	18,37	07,39

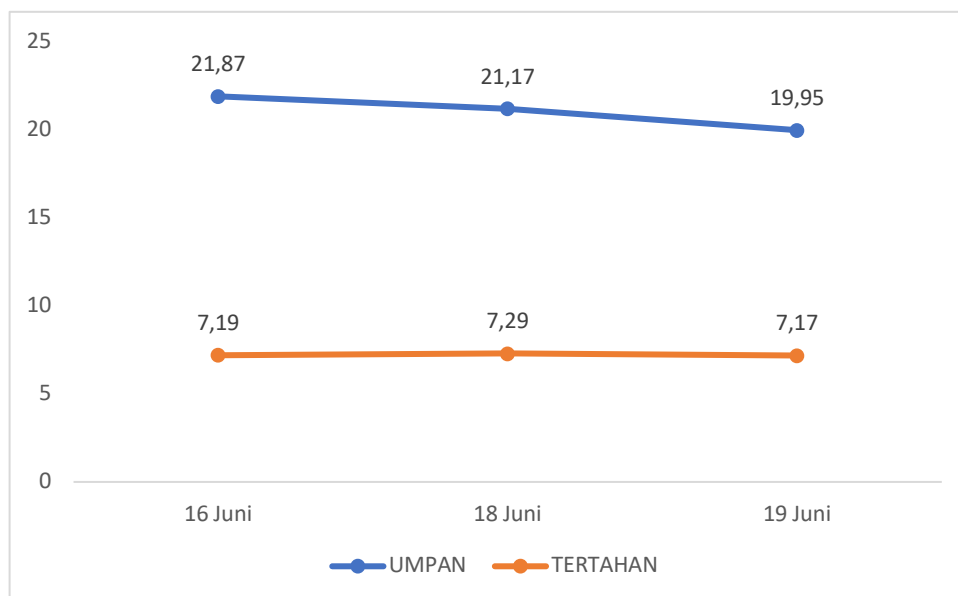


Fig 7. Feed and Retained Water Chart

Based on the Figure 7 NOS feed and retained chart, it can be seen that the feed value is in the range of 19-22 liters, with a slight downward trend from June 16 to 19. For NOS is held relatively stable at 7-7.3 liters. This shows that the separation process on the *vibrating screen* runs quite consistently, because the changes that occur are not too large and are still within the normal operational range, the norm for the composition of NOS is 10% [10].

V. Conclusion

Based on the results of the analysis of bait materials and retained materials on vibrating screen, it can be concluded that the separation process took place quite effectively. The oil content in the feed material fluctuates between 18.72–23.62 liters, but what is retained in the vibrating screen only ranges from 0.29–0.69 liters. This indicates that most of the oil makes it through the filter, so the oil loss can be said to be relatively small. The water content in the bait is also stable in the range of 9.27–12.25 liters, with a very low amount of retention, meaning that water tends to be carried along with the oil and is not significantly retained by screen. In contrast, solid materials (NOS) show a clear difference, where most of them manage to be held in the range of 7.17–7.41 liters.

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