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Analysis of Steering Wheel Heavy Komatsu Dump Truck Unit (HD) 785-7

Hasan Basri[1*], Ery Diniardi[2], Kisman H Mahmud[2], Syawaluddin[2], Firmansyah[2]
[1]Department of Automotive and Heavy Equipment, Faculty of Engineering, Universitas Muhammadiyah Jakarta, Indonesia
[2]Department of Mechanical Engineering, Faculty of Engineering, Universitas Muhammadiyah Jakarta, Indonesia

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ABSTRACT

Steering system is a system control unit that is used for deflecting the direction of motion straight into to the left or to the right in accordance with the will of the operator. At 785-7 HD unit using the steering system type full hydraulic steering valve, where steering valve serves as a directional control valve to direct the oil flow at the time of engine working (pump work), whereas when the engine died steering valve will serve as a hand pump and directional control valve. Abnormaly steering wheel because there is a scratch on spool demand valve causing internal leakage in the demand valve so oil pressure which served as the pilot sensing to move the spool valve is a pressure demand would drop because there is a leak and could not afford to drive the spool until the full open- as a result the oil flow from the steering pump cannot be fully prioritized to steering valve to be forwarded to the steering cylinder.

INTRODUCTION

The development of the mining and forestry world in Indonesia is very rapid, along with this development, it also influences the development of existing science and technology, especially in the field of heavy equipment [1-7]. For example in the HD 785 -7 dump truck unit. Dump trucks (HD) are trucks that have very high mobility, can carry soil, gravel and coal with large load loads [8-15].

HD 785-7 uses a full hydraulic type steering system to ease the operator's work when turning the unit left or right [3]. Based on the results of our survey in the field there is one unit that is experiencing heavy wheel steering trouble on the HD 785-7 unit. This can occur due to several factors, namely the lack of hydraulic oil in the steering system hydraulic tank illustrated for Figure 1.

Fig. 1. Komatsu dump truck unit HD 785-7 [1]

Steering System

Steering system is a unit control system that is used to turn the direction from straight to left or right according to the will of the operator. Various types of steering in heavy equipment. Whether it concerns wheel tractors or crawler tractors, presented Figure 2.

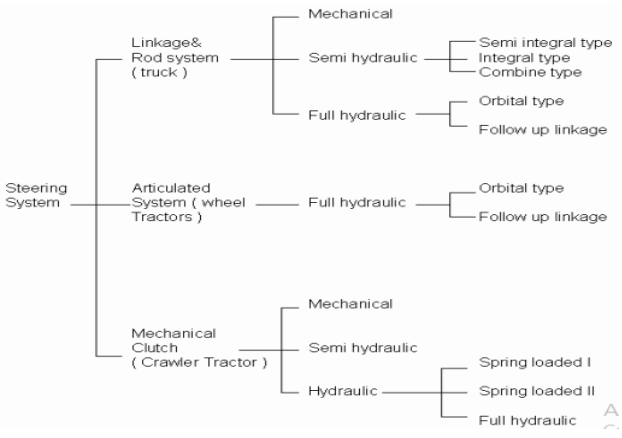

Fig. 2. Steering System Classification [4]

The picture above is the structure of the steering system classification applied to public vehicles or heavy equipment units. However, the author will not discuss it one by one but only discusses the steering system used on the HD 785 -7 unit which is a full hydraulic orbitrol type steering system.

* Corresponding author.
E-mail address: hasan.basri@ftumj.ac.id
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The HD 785 -7 unit uses the full hydraulic Obitrol type steering system, where the orbitrol functions as a directional control valve to direct the oil flow when the engine is working, whereas when the engine dies orbitol will function as a hand pump and directional control valve. The components of the orbitrol type consist of hydraulic tanks, hydraulic pumps, demand valves, steering valves/orbitrol, crossover reliev valves and steering cylinders with their respective functions can see Figure 3.

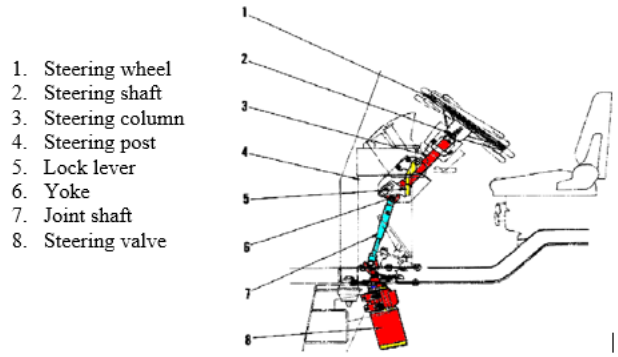

Fig. 3. Steering wheel [1]

EXPERIMENTAL METHOD

The steps of the experiment are carried out using 8 troubleshooting steps as in Figure 4.

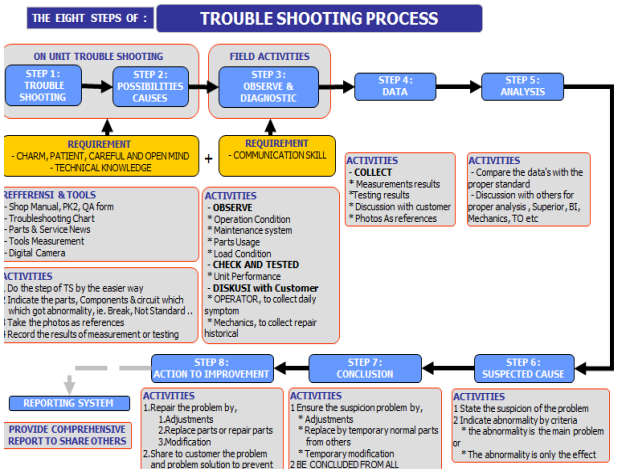

Fig. 4. Using 8 Steps for troubleshooting [4]

RESULTS AND DISCUSSION

After the inspection, the results of the examination can be analyzed. The following are the results of actual and standard data collection can be shown Table 1.

Table 1. The collection of actual and standard data

No	examination	rpm E/g & arah	Actual measurement results	Standard specifications	information
1	Level Oil Hidrolik	Low Idle & High Idle	Between min and max marks	Between min and max marks	OK
2	Relief Pressure Steering	Low Idle (1,900 rpm)	180 kg/cm^2	190±10 kg/cm^2	OK
		High Idle (650 rpm)	130 kg/cm^2	210±10 kg/cm^2	Not OK
3	Relief Pressure Hoist Raise	Low Idle	180 kg/cm^2	190±10 kg/cm^2	OK
		High Idle	210 kg/cm^2	210 kg/cm^2	OK
4	Relief Pressure Load Sensing	High Idle	130 kg/cm^2	180-210 kg/cm^2	Not OK
5	Turning Time Steering	From right to left	18 second (steering wheel cannot full stroke)	4 detik	Not OK
		From left to right	16 second (steering wheel cannot full stroke)	4 detik	Not OK
6	Filter Steering and Check Valve	-	Tidak Buntu	-	OK

Relief pressure steering

From the results of the examination carried out above, the data obtained are as follow Table 2.

Table 2. Actual measurement results data relief pressure steering and measurement standard specification

No	Engine Rpm	Actual measurement results	Standard specifications	Information
1	Low Idle (650 rpm)	180 kg/cm^2	190 ± 10 kg/cm^2	OK
2	High Idle (1900 rpm)	130 kg/cm^2	210 ± 10 kg/cm^2	Not OK

Based on Table 2, Pressure steering relief valve is not in accordance with the standard (low pressure), which is 180 kg/cm^2 at the time of Low idle and at high idle 130 kg/cm^2 while the required standard is 210 kg/cm^2.

Relief pressure load sensing

From the results of the examination carried out above, the data obtained are as follow can be shown to Table 3.

Table 3. Actual measurement Data relief pressure load sensing and measurement standard specification

No	Engine Rpm	Actual measurement results	Standard specifications	Information
1	High Idle (1900 rpm)	130 kg/cm^2	180 - 210 kg/cm^2	Not OK

Based on Table 3, the load sensing valve on the Demand valve is still functioning and works well because it can read according to the pressure output of the pressure steering relief.

Pressure steering relief valve and pressure relief load sensing are not in accordance with the standard (low pressure), which is 180 kg/cm^2 at low idle and at high idle 130 kg/cm^2 while the required standard is 210 kg/cm^2. Possible causes of damage to the demand valve and must be done disassembly on the demand valve to check to ensure the condition of the components of the demand valve.

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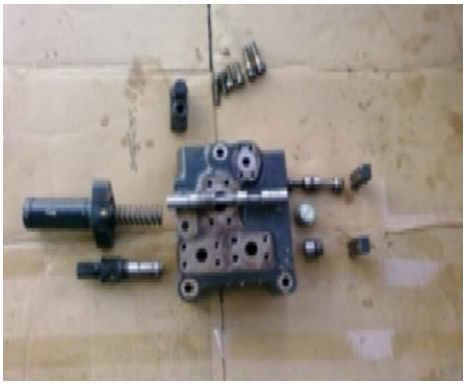

Fig. 5. Demand valve after disassembly

From the results of disassembly, there is a scratch on the spool demand valve. The following Figure 6 is scratch on the demand valve.

Fig. 6. Spool demand valve scratch

Identify of causes

From these results it can be identified that this scratch spool demand valve causes the steering wheel to be heavy when rotated. Spool demand valve damage due to lack of lubrication on the valve demand, this can be seen from the level of hydraulic oil that is below low at the time of inspection due to lack of lubrication resulting in the spool demand valve rubbing against the housing so that the spool has a scratch.

Scratch spool demand valve causes internal leakage inside the valve itself and makes the spool demand valve not open fully at high idle so that the oil supply from the steering pump which will be prioritized to the steering valve will be reduced and the pressure will drop and unable to move the steering cylinder. Causing the steering wheel to be heavy when being deflected this is due to the oil pressure that goes to the steering valve and the steering cylinder is low pressure.

Action for improvement

After the inspection process is then obtained the results of the inspection and then an analysis of the causes of the damage is done, it can be concluded that the cause of the non-operation of the steering system is caused by damage to the spool demand valve, i.e. the spool demand valve scratch which results in internal leakage, for that to be repaired/replacement of damaged spool demand valve components, replacing damaged parts with new parts.

In replacing parts, it is required to comply with the procedure, as for the steps taken when replacing parts, as follows:

1. Uninstall Demand valve assy. P/N: 702-21-01502
2. Uninstall Line filter hydraulic
3. Uninstall Hydraulic filter
4. Install Demand valve assy. P/N: 702-21-01502
5. Install Line filter hydraulic
6. Install Hydraulic filter
7. Perform a flushing hydraulic system

Table 4 data of Measurement of results Relief pressure Steering.

Table 4. Measurement of results Relief pressure Steering

No	Engine Rpm	Actual measurement results	Standard specifications	Information
1	Low Idle	180 kg/cm^2	190 ± 10 kg/cm^2	OK
2	High Idle	210 kg/cm^2	210 ± 10 kg/cm^2	OK

After replacing the Demand Valve due to the spool demand valve scratch caused by the lack of oil level in the hydraulic tank which results in less lubrication on the steering system components (demand valve) and greatly influences the performance of the steering system then a relief pressure steering measurement is carried out to ensure pressure setting for the steering system in accordance with standards. And to ensure that the problems that occur have been successfully corrected. In accordance with table 4 above, the results obtained are measurements of Relief pressure steering 180 kg/cm^2 when Low idle and 210 kg/cm^2 when High idle. The results of the pressure settings obtained are in accordance with standard specifications. And after running the steering wheel test is no longer heavy when deflected and the speed is normal. The Steering System is functioning properly, and the problem has been resolved.

CONCLUSION

From the results of analysis, checking & data collection, the authors conclude that the cause of the occurrence of heavy wheel steering on the HD 785 - 7 unit is the heavy steering wheel caused by damage to the Demand valve, there is a scratch on the spool demand valve which causes internal leakage in the valve demand. The scratch was caused by the lack of oil level in the hydraulic tank which resulted in less lubrication on the steering system components so that the spool rubbed against the housing housing. After the repair steps are carried out on the unit that is experiencing trouble by replacing the valve valve assy, then do measurements again to ensure the pressure reaches its standard, and the pressure reaches the standard.

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