

# The Implementation of D155A-2 Bulldozer Steering Overhaul

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**Abstract:** Bulldozer is a unit that uses a track shoe or commonly called a crawler engine, where the steering system used in this unit uses a clutch with the basic principle of a disc consisting of an inner drum and an outer drum. When the unit is moving straight the clutch must be tightened so that the rotation can be transferred to the final drive and when the unit is going to be rotated the clutch must be released (stretched) so that the torque and power of the transmission are balanced. Overhaul bulldozer D155A-2 is a maintenance activity that aims to restore the state of a unit to its original state or according to factory standards. Steering overhaul activities include removing components from the unit, initial cleaning, component disassembly, washing, inspection, measurement, assembly, testing, adjustment, and installation on the unit. Some components such as dist, coupling and inner drum that are not standard must be replaced. The mechanism for steering overhaul activities as well as checking and measuring each component of the steering brake so that it can deepen and find out the causes of the damage contained therein and take precautions and actions if there is damage to the steering wheel. system.

## 1 INTRODUCTION

Heavy equipment is a tool that can be used to assist humans in doing work not only in the mining sector, the construction of an infrastructure, but also in plantation fields. For these matters there are some steps need to be done (Hadi, 1992). The selection of heavy equipment that is not appropriate to the conditions and situation of the work field. It is avoiding the rate of losses results such as low production, below performance of target production, and improper repair losses (Rochmanhadi, 1992). the type and number of equipment and their descriptions need to be identified both their function and applications (Septiani et al., 2019).

In term of a vehicle unit such as heavy equipment, it cannot be separated from the steering system. This steering system functions is to control the direction under the driver or operator control. That why maintenaning and repairing of the steering system must be well maintained in order to no errors occurs during the operation of vehicle unit. Heavy equipment, especially bulldozers, the steering system is usually called a steering and braking system where the systems are interrelated (Qing, 2015). Based on the research conducted by Carlo Ackermann et al. that the combines internal steering and braking is

avoiding collisions (Ackermann et al., 2015). The research conducted by Zhank et al. also shows that the combination of steering and braking is avoiding unexpected riders (Zhang and Wu, 2016), while based on the research conducted by Vivas et al. shows that the suspension, steering and braking is the main controls in advanced level control (Vivas-Lopez et al., 2015)

When the unit is running in the straight line, the clutch must be in the engagement position on both the RH (right) and LH (left) clutches, so the rotation of the transmission is transferred to the final drive to move the sprockets. In this matter, the clutch must be disengaged to be able to turn the unit. It is also the rotation and power of the transmission is not passed to any of the final drives in order to the sprockets can be controlled. Likewise, when experiencing is damage, an overhaul of the steering and braking system must be carried out, then disassembly and checking of both parts must be carried out. It needs to be done because the components of both parts are located in the same place. Based on these considerations, It is necessary to do the research regarding to an overhaul steering study on a large tool, namely the Bulldozer D155A-2.

## 2 RESEARCH METHODS

### 2.1 Collecting Data

Data were collected by observation, library research, and interviews. Observations directly in the field during the process of overhaul activities are carried out, observations are made when needed. Data collection by library research in this study refers to the shop manual D155A-2 and the Standard Operational Procedure (SOP). Meanwhile, the interview process is carried out by interviewing directly to the mechanic or supervisor.

The data collected is divided into 2 parts including primary data and secondary data. Primary data collection will be done by making some notes of observation and documentation in the fields. Secondary data collection was obtained from published company data, including: (1) Machine Condition Report (MCR); (2) Recommended Part List (RPL); (3) Quality Assurent (QA) D155A-2; (4) Job Sheet Schedule (JSS); and (5) Standard Operational Procedure Overhaul and shop manual bulldozer D155A-2.

### 2.2 Data Processing

The data obtained were then will be grouped based on the order of the overhaul processing. Then the results obtained are compared with the shop manual and SOP overhaul in order to obtain accurate results and it could avoiding the deviation and errors.

## 3 RESULTS AND DISCUSSION

This research is divided into 3 parts such as: (1) implementation of overhaul steering brake system; (2) results of overhaul steering brake system; and (3) discussion on overhaul steering brake

### 3.1 Implementation of Overhaul Steering Brake System

Carry out steering overhaul are by removing the steering brake and then disassembly of the steering brake. The first step is to remove the steering brake and then to open the plug that is under the unit at the bottom of the steering brake. The next step is to remove the linkage from the steering and brake pedals. It is also necessary to remove the spring assist brake cylinder and then to remove the hoses that are still attached. The next step is to mark the critical

points by marking the location on each component with the RH and LH mark. Marking aim is to make the installation process easier. The next then remove the chord rod that is inside the steering brake cover so that the cover is detached from the bracket, and remove the brake booster assy. Use a rope or sling that is physically small but strong to lift the bracket and steering clutch assy, lift it with the help of a crane (same RH/LH parts), then remove the steering clutch assy and remove the bavel gear shaft assembly. Next, pay attention to the shim on the edge of the signpost or the right and left sides. After the removal work is complete, close the steering case so that dirt and other objects don't get in, and then wash all the components of the steering brake so that the disassembly process is easy (Figure 1).



Figure 1: Remove steering brake.

The disassembly process is carried out carefully, which will be disassembly of the brake booster assy, cleaning and then washing components. After that disassembly steering clutch assy, then the critical point is "this process must be done carefully because the spring has a large enough strength, about 200kg large spring, 150kg small spring". The process is carried out carefully (Figure 2).

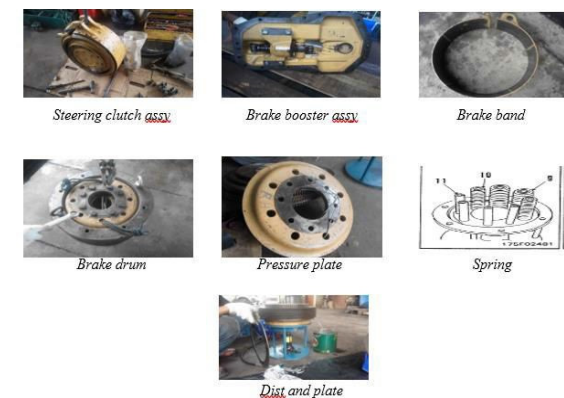


Figure 2: Disassembly steering brake.

### 3.2 Result of Overhaul Steering Brake System

This process is divided into several, namely the first is a visual check and measurement. This section is checked and measured carefully, referring to the QA sheet or guided using the shop manual according to the unit so that the results obtained are more accurate and do not deviate from the standard. There is also a visual check that usually looks for dents, cracks, dirt or anything else contained in these components.

This first part is done by washing and cleaning all components and classifying which ones use diesel, using soapy water and only using a cloth, and wrap it using plastic krap to wait in assembly or check and measure first. After that visual check and measurement on the dist and plate, then check on the visual check and measurement on the plate, then check on the inner drum (Figure 3).

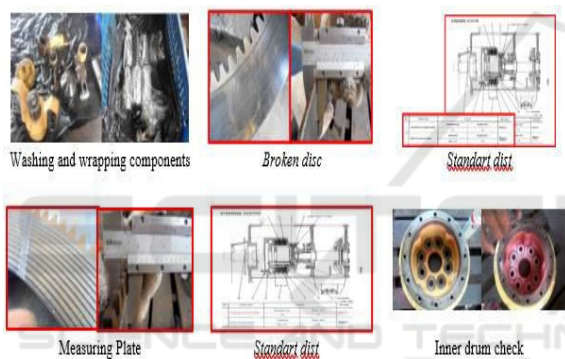


Figure 3: Disassembly steering brake.

The second is the component assembly process. This assembly part is done in the right way and carefully. After performing a visual check on the brake drum lining and seeing its age, the brake drum lining must be replaced (Figure 4).



Figure 4: Assembly component.

The third part to do is install the bavel gear. This process is carried out by installing the outer races (signs) and measuring the thickness of the shims, installing the bolt mouting outer races but not tightening them first (RH, LH). Then set the bavel gear in the case, then install the shaft from the right clutch housing, insert the shaft in the center hole of the bavel gear to the left housing, install the appropriate shim, so

that the bevel gear center. Then tighten the bolt mounting outer races and install or tighten the bolt mounting bavel gear by using special tools and the same method when removing, after that clean the steering brake housing until it is completely clean (because the housing is where the oil is) so that the oil is not contaminated, and also Clean the transmission bavel gear and pinion gear for measurement. Perform measurement acklash on the bavel gear (Figure 5).



Figure 5: Install bever gear.

The fourth process is to install the steering brake. This process is done by cleaning the steering brake housing, then attaching the steering clutch assembly to the housing. After that, the steering clutch (RH, LH) was measured. Then install the right and left side mounting bolts and tighten them, and also install the bracket, brake booster assy, attach the pins, connect the small host that is on the brake band. After that, adjust the steering brake on the spring assist brake, then install the steering brake cover and torque bolt, then fill in the steering oil for testing and adjusting (Figure 6).

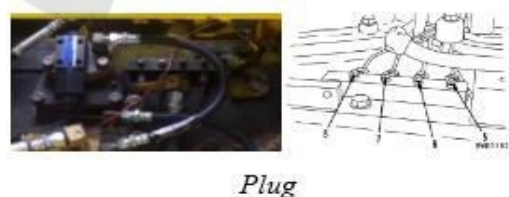


Figure 6: Install steering brake.

The fifth process is testing and adjusting the steering brake. The process carried out is running the engine

and measuring the oil pressure (Figure 7). Then the last process is replacing the filter and strainer. Previously the filter had not been replaced due to flashing the impurities contained in the new components, after which the filter and strainer were replaced after a test run (Figure 7).



Figure 7: Testing and adjusting steering brake.

### 3.3 Discussion on Overhaul Steering Brake

Based on the results of the inspection and measurement of the overhaul activities above, several damaged components must be repaired or replaced. The possibilities that cause damage to these components must also be known, so that preventive measures can be taken so that they can extend their service life and minimize expenses for component repair or replacement. These components include: (1) the dist and plate have scratches and dents which are most likely caused by the steering oil being contaminated by grams from the friction of objects that come into contact in the steering case. Even though at the time of measurement it was still within the standard limits, but because of these defects, the dist and palte components had to be replaced because it could result in not optimal steering performance; (2) The inner drum has a fairly severe crack which is most likely due to the unit undergoing heavy work or it could be due to the age of use that has passed the standard limit and must be replaced; (3) The brake drum lining on visual inspection of the brake drum lining already looks thin and it can also be seen from the historical unit that the canvas has never been replaced, so that during this overhaul, the lining must be replaced; (4) Tooth on the bavel gear at the time of measurement is still in good condition because the contact points made at the time of checking are still within the standard limits, as well as measurements on the backlash are still within the standard limits, so that the bavel gear can still be used; (5) the oil pressure measurement shows that the steering and brake

pressure has been achieved, so that during operation the unit will not experience trouble when turning and will not be held back when the clutch and brake work. Because when the pressure on the clutch and brake is not reached, it can cause a malfunction in the steering system.

## 4 CONCLUSIONS

The results showed that the overhaul process must be in accordance with the Standard Operating Procedure (SOP) so that the mechanism can be controlled and run properly, always referring to the shop manual as a guide for accuracy in every overhaul steering process. The steering overhaul work includes remove, namely removing the steering and brake components from the unit, prewashing, disassembly, namely dismantling steering and brake components, washing, inspection and measurement, namely visual inspection and measurement of the dist-plate-inner drum-bevel gear-campus components. brake-oil pressure-hose, assembly, testing and adjusting, and installing the steering brake components on the unit. After checking and measuring the steering and brake components, the results obtained include: (1) the thickness of the dist 4.65mm (standard 4.7mm repair limit 3.7mm) it can be said that the thickness of the dist is still within the standard, but there are scratches so it must be replaced ; (2) the thickness of the plate is 2.85mm (standard 2.9mm repair limit 2.0mm) it can be said that the thickness of the plate is still within the standard, but there are molds that must be replaced; (3) the RH inner drum is badly cracked and must be replaced; (4) measurements on the bevel gear, tooth contact are still within the standard limits and the backlash is calculated at 6kgm (standard 2-6kgm) so that the backlash is declared safe; (5) brake lining is not up to standard so it must be replaced; (6) on the oil pressure when checking, the results are 15kg/cm<sup>2</sup> for the clutch and 16.5kg/cm<sup>2</sup> for the brake so that the oil pressure is reached.

When checking finds components that are not standard, they must be replaced, because if they are not replaced, they will result in multifunction, namely malfunctions or not working optimally on the system and errors during operation of the unit. Things that must be done in the future when going to do overhaul steering and brakes, namely when doing work must always refer to the SOP, mark components, document activities, and check consistently before installing.

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