Journal of Applied Science and Advanced Technology
Journal Homepage : https://jurnal.umj.ac.id/index.php/JASAT

Designing Special Tool Remove and Install Hoist Cylinder On Unit Dump Truck HD 1500-7

Rasma[1*], **Hendro Purwono**[2]

[1,2]*Department of Automotive and Heavy Equipment, Faculty of Engineering, Universitas Muhammadiyah Jakarta, Indonesia*

ARTICLE INFO

JASAT use only:
Received date : 14 September 2018
Revised date : 28 October 2018
Accepted date : 27 November 2018

Keywords:
Hoist Cylinder
Load Time
Rod Cylinder
Special Tool
Down Time

ABSTRACT

Hoist Cylinder is an important component of the Dump Truck HD 1500-7 unit that serves as a support for the vessel during loading and unloading. Leakage due to the loss of dust seal that is unable to block the dirt and lubricating oil, is one of the reasons for the replacement of the hoist cylinder. The solution of the leak is to replace the hoist cylinder, but the difficulty of removing and install hoist cylinder process causes the lead time to become longer and the percentage of non-operating units (down time) increases. This is because of the drop of the rod hoist cylinder and the narrowing of the work of removing and installing. To lift and prevent the release of mechanical rod cylinders, it is necessary to tie the cylinder rod by using the belt. But the method is dangerous and ineffective because of repositioning belt due to difficult position. Therefore, tool is made to lift the rod cylinder so as not to extend, so it can speed up the process of removing and installing and reducing the percentage of non-operating units (down time), as well as providing benefits in terms of save cost of man power and lead time, and in terms of save cost loss production.

INTRODUCTION

The development of the tooling industry provides a unique feel to all of us, because of open employment opportunities. Our country of Indonesia has abundant natural wealth, so heavy equipment industry in Indonesia is progressing rapidly. Such rapid technological advancement has led us to the effectiveness of time, effort, and cost. As for heavy equipment used in mining and logging such as: Dump Truck (HD) Excavator (PC), Bulldozer (D), Wheel Loader (WA), and others [1-3].

In the Dump TruckHD-7 unit, researchers see an obstacle in the process of removing and installhoist cylinder. Hoist cylinder which is an important component of moving the vessel at dumping, takes a long time if you want to do the replacement and install process. Replacement of the hoist cylinder caused by leakage, is often constrained in the narrow hoist cylinder position and rod hoist cylinder which always extends if the lifting takes place which causes the process of removing and installing into a long time [4-6].

In relation to the above issues, the researchers took the theme of innovation that is "Designing Special ToolRemove and Install Hoist Cylinder On Dump Truck HD 1500-7". The purpose of this tool is to make the process of removing and installhoist cylinder faster in the process and reducing costs and preventing the occurrence of work accidents.

EXPERIMENTAL METHOD

Methodology of research methodology in designing remove and install hoist cylinder tool design on 1500 d7 HD dump truck is as follows:

* Corresponding author:
E-mail address:rasma@ftumj.ac.id

DOI: https://dx.doi.org/10.24853/JASAT.1.2.59-62

 ISSN : 2622-6553 (Online)

a) Conducts literature study and design tool for removal and intall hoist cylinder on 1500-7 HD units.
b) Make weight calculations and material strength.
c) Test the special tool and SOP special tool
d) Comparison before and after special tool.

The research flow in the design and manufacture of special tool remove and install hoist cylinder at Unit Dump Truck HD 1500-7 as follows:

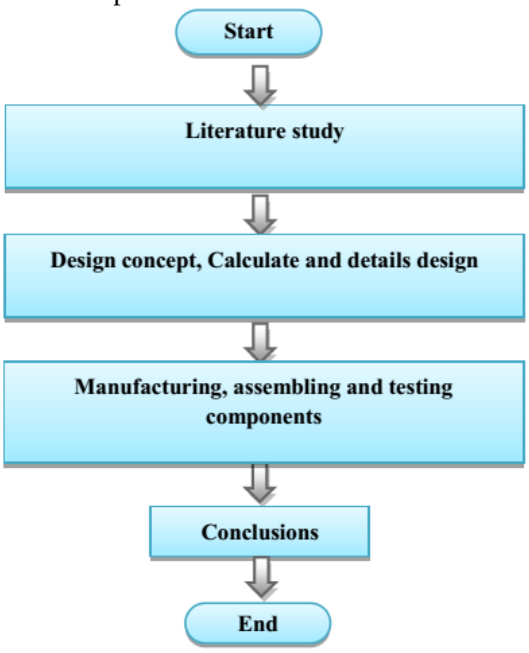

Fig. 1. Flow of research

RESULTS AND DISCUSSION

From the observations the researchers did, the researchers set design tools that could substitute the role of the belt on the hoist cylinder lifting process. This tool is designed to lower the rod cylinder as well as auxiliary tool. The tool is made into 3 parts to make it easier to use. The following researchers make designs in the form of 2 dimensions and 3 dimensions.

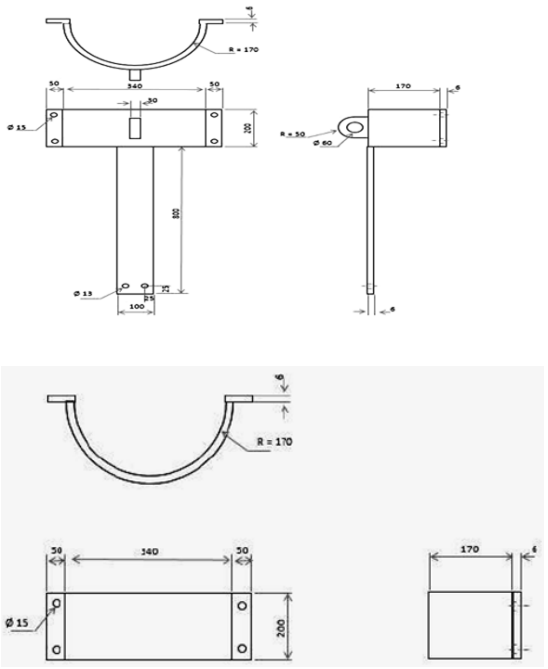

Figure 2. Design Dimension of 2 for tool part 1

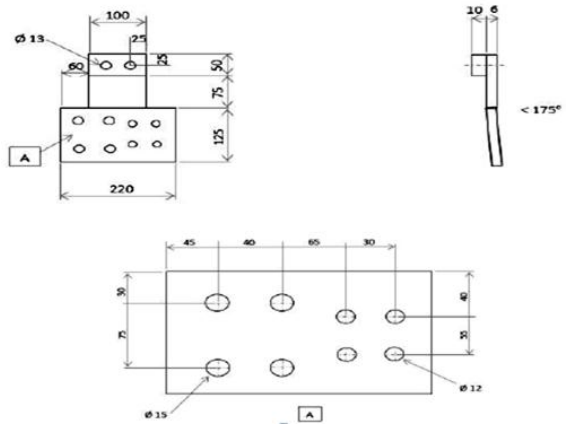

Fig. 3. Design Dimension of 2 for tool part 2

Fig. 4. The 3-dimensional design tool

Journal of Applied Science and Advanced Technology 1(2) pp 59- 62 © 2018

Fig. 5. Tool Assy

Weight Calculations and Material Strengths

Calculates the weight of the hoist cylinder component in order to find the difference between the weight of the component with the thickness of the iron plate material used as the base material of the special tool making material strength. Based on manual shop HD 1500-7 weight hoist cylinder about 330 kg.

After knowing the weight of the hoist cylinder component, it can be calculated the strength of the iron plate material used, assuming the weight of the hoist cylinder as a pull force. Since after use, the tool is lifted using a crane truck and hangs 3 mater grounds above the ground, the potential energy of the tool is:

$$Ep = mgh = [330\ kg].[10\ ^{m}/_{s}].[3\ m] = 9900\ N$$

Having known the potential of its potential energy is 9900 N, then determines the pull tensile of the tool.

Table 1. Strength of Metals

Metal	the strength of the crushed (MPa)	Tensile strength (MPa)	Tenacity % El
Au	-	130	45
Al	28	69	45
Cu	69	200	45
Fe	130	262	45
Ni	138	480	40
Ti	240	330	30
Mo	565	655	35

$$Tensile\ Stress\ (\sigma) = G(F) \div Wide\ area\ (A)$$

$$= 9900\ N(53.3\ m\ x\ 20\ cm) = 9.28\frac{N}{cm^2}$$
$$= 0.092\ MPa$$

Determine the maximum stress of the tool

$$\sigma m = 2\sigma(luas\ permuakaan \div radius)^{1/2}$$
$$= 2\ x\ 0.092(0.533\ m \div 0.17)^{1/2}$$
$$= 0.33\ MPa$$

So the maximum stress of the tool in holding the weight of the hoist cylinder is 0.33 MPa or 0.13% of the allowed voltage of the material (Fe) according to table 4.1. To unite the clam, using a maximum 24 M16 bolt bolt of 28.5 kg. The clam strength of the tool can be calculated using the multiplication results of the maximum torque bolts used:

$$Kekuatan\ Clam = maksimum\ torque\ x\ jumlah\ bolt$$
$$= 28.5\ x\ 4 = 114\ kg$$

Here is a comparative comparison of hoist cylinder replacement time before and after the special tool:

Table 2. The length of work before the Special tool

Work	Lead Time (minute)
Me-release hydraulic pressure, remove the hose and cover the oil	15
Remove the grease hose at the top of the pin	15
Prepare and fold the belt	15
Setting hoist with belt and repositioning belt for removal (removal)	15
Appointment (remove)	15
Preparing the belt (removing from the old hoist cyl)	15
Setting hoist with belt and repositioning belt for lift (install)	15
Installation and install the bottom pin	15
Installing pin and hose grease	15
Install oil supply-return hose and completed	15
Total	360

Table 3. Duration of work after a special tool

Work	Lead Time (minute)
Me-release hydraulic pressure, remove the hose and cover the oil	15
Remove the grease hose at the top of the pin	15
Installing a special tool	
Removing the pin and hooking the special tool to the hook crane and removal (removal)	15
Preparing the tool (removing from the old hoist cyl)	15
Installing a special tool and hooking it to a hook crane for lifting (install)	15
Put the pin down then up	15
Install oil supply-return hose and completed	15
Total	120

From the above table can be seen comparison of hoist cylinder replacement process and lead time before the special tool for 6 hours and after the special tool for 2 hours.

CONCLUSION

This tool simplifies and provides comfort during the process of removing and install hoist cylinder and can reduce the lead time process of replacement hoist cylinder from 6 hours to 2 hours. In addition, it can increase the safety value by eliminating the potential loss of cylinder rods and the loss of the belt during the lifting of the hoist cylinder.

ACKNOWLEDGMENT

The authors would like thanks to the Institute for Research and Community Service (LPPM) of Universitas Muhammadiyah Jakarta, which has funded this research through the UMJ Internal Grant.

REFERENCES

[1] Basri H., Ramadhan AI., Jurnal Teknologi Alat-alat Berat,*Analisa Kerusakan Suspension System Pada HD 1500*-5, Vol.2 (2013)
[2] Hadiyanto M., Diniardi E., Jurnal Teknologi Alat-alat Berat,*Analisa penyebab keruskan suspensi bocor pada HD 785-7*, Vol.2 (2014)
[3] Komatsu Ltd., *Shop Manual Komatsu HD 1500-7*, Komatsu Ltd,Japan (2010)
[4] Training Center Department,*Mechanic Development Setion Preventive MaintenanceHD 1500-7*, Jakarta. PT United Tractors Tbk (2000)
[5] Training Centre Department., *Basic Mecahanic Course, Tools*, Jakarta PT United Tractors Tbk (1996)
[6] Setiawaan B., Yulianto S., Jurnal Teknologi Alat-alat berat,*Analisa Rear Suspension Hard Pada Unit HD 785-7*, Vol.3 (2014)