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Analysis Structure and Function Cooling System on Unit D155A-6

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ABSTRACT

As time went on many problems were encountered in the unit, one of which was the problem experienced by the D155A-6 unit, which was overheating troubleshooting caused by abnormal fan motors. In handling the problem, it is difficult to determine the data of the motor fan. Therefore, an initiative is needed to create tools to help deal with problems that occur. The purpose of this study is the manufacture of adapter tools for measurement of hydraulic pressure fan motors in troubleshooting the overheat engine in D155A-6 units. The results of this study are analyzing the structure and function of the cooling system in troubleshooting the overheat engine in the D155A-6 unit.

INTRODUCTION

The existence of advances in the science and technology of heavy equipment industry that led to the increasingly sophisticated technology used in companies, especially in the mining sector that requires heavy equipment as a support in order to achieve high productivity, with the conditions of work equipment that is always ready for work, it is expected that all mining activities can be implemented effectively and efficiently.

Bulldozer is a heavy equipment that has a large traction, as one of the supporters of mining which functions to do the work of digging, evicting, leveling, and can be operated on a muddy, rocky, hilly and forested area. Bulldozer needs, especially in mining companies that can be a problem is if the unit unscheduled breakdown occurs. These problems must be addressed immediately, because they will disrupt the productivity of the company.

Based on the background above, it becomes the basis for conducting an analysis on unit D155A-6, to get a solution and improvement so that the Physical Availability (PA) unit is always maintained.

EXPERIMENTAL METHOD

The research method conducted can be seen in Figure 1.

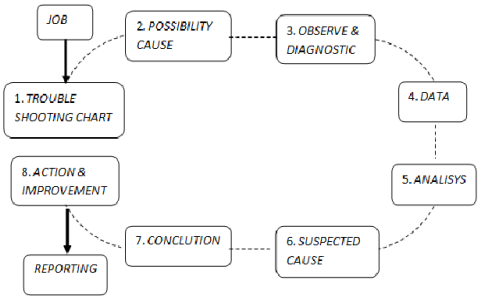

Fig. 1. Trouble shooting chart

RESULTS AND DISCUSSION

Before doing trouble shooting there are a number of preparations and work equipment both reference, equipment and also in identifying problems that need to be prepared, so that the handling of problems is more effective and efficient quickly resolved.

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Troubleshooting the overheat engine chart
The overheat chart engine troubleshooting is done using Table 1.

Table 1. Troubleshooting chart engine overheat

Trouble	• Fan speed is abnormal (Sound and/or vibration are abnormally large or engine over heats).		
Related information	• Before starting troubleshooting, check that oil level in hydraulic tank is normal.		
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1 Defective engine speed		★ Start engine and carry out troubleshooting.
		Measurement conditions	Engine speed
		Engine at low idle	740 $^{+40}_{0}$ rpm
		Engine at high idle	2,100 $^{0}_{-50}$ rpm
		If engine speed is not increased to specification, carry out trouble-shooting for "S-5 Engine hunts".	
	2 Defective PTO (fan pump drive)		Fan pump drive of PTO may be defective. Check it directly.
	3 Defect in fan pump or fan motor		★ Prepare with starting switch OFF, then run engine at high idle and carry out troubleshooting.
		Measurement conditions	Fan pump EPC circuit basic pressure
		—	3.78 – 4.46 MPa {38.5 – 45.5 kg/cm²}
			★ Prepare with starting switch OFF, then run engine at high idle and carry out troubleshooting.
		Measurement conditions	Fan drive circuit pressure
		Fan 100% mode	15.7 ± 2.5 MPa {160 ± 25 kg/cm²}
			★ Prepare with starting switch OFF, then run engine at high idle and carry out troubleshooting.
		Measurement conditions	Fan speed
		Fan 100% mode	1,100 $^{0}_{-5\%}$ rpm
	4 Defective fan		Fan may be broken or may be installed defectively. Check it directly.

Possibilities cause
As per the data below, it was checked from the simplest method where the engine overheated after being operated for 2-3 hours, ambient temperature in the range of 30-33^{o}C and the unit experienced engine overheat problem at 15358 of HM as shown in Figure 2.

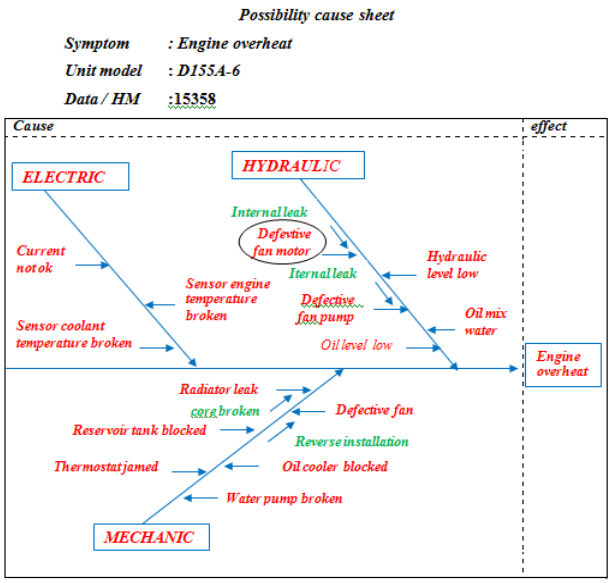

Fig. 2. Possibility cause

Analysis of the fishbone diagram above can be seen in the Table 2 below:

Table 2. Summary of possible fishbone diagrams

Possible Root Cause	*Check*	*Root Cause*
HYDRAULIC		
Oil engine low	*Oil engine ok*	No
Oil mix water	*Oil not mix water*	No
Hydraulic level low	*Leveling hydraulic tank ok*	No
Reducing valve broken	*Reducing valve ok*	No
Defective fan motor	*Pressure fan motor not ok*	Yes
Defective fan pump	*Pressure fan pump ok, not internal leak*	No
MECHANICAL		
Radiator leak	*Radiator ok*	No
Defective fan	*Fan installing ok, not broken*	No
Reservoir tank blocked	*Reservoir tank ok*	No
Raber radiator broken	*Ruber radiator ok*	No
Strainer hydraulic tank blocked	*Strainer blocked and facum, replacement*	No
Belt selip (if make belt)	*Make fan motor*	No
Oil cooler blocked	Belum dilakukan cek	No
Thermostat jammed	Belum dilakukan cek	No
Water pump leak	*Water pump ok*	No
ELECTRICAL		
Sensor coolant temperature broken	Belum dilakukan cek	No
Sensor engine temperature broken	Belum dilakukan cek	No
Current not ok	*Current ok*	No

Observe and diagnose
After observing the visual, checking and testing obtained the overheating engine hypothesis because the fan speed was not reached, can see Table 3.

Table 3. Checking and testing

Observe visual	Checking and testing
a.) Component : genuine komatsu	a.) Unit performance ok
b.) Not leakage, strainer hydraulic tank cloged	b.) Pressure fan motor not ok (monitor)
c.) Level oil hydraulic low, leveling	c.) Fan speed not ok (monitor)

Data
In this stage data collection is used as a consideration to analyze the problem and the data retrieval scheme can be seen in Table 4.

Table 4. Collecting Data

Component check	Standard measure	Actual
Unit check visual	There were no findings of leakage, component color changes, noise, and component burning in the unit area.	Ok
Checkfan	Fan speed is not achieved	Not ok
Radiator	Not bubbles, coolant not spurts back	Ok
Radiator core	Not dirty and mud	Ok
Coolant	Level, not leaking from hose	Ok
Radiator	Not clogged	Ok
Engine oil level	Level	Ok
Oil	Not milky flowating on coolant	Ok
Engine (speed)	Low idle:740 $^{+400}$Rpm	735 Rpm (39^{0}C)
	High idle: 2,100 $^{-500}$Rpm	1861 Rpm (41^{0}C)
Fan motor	Low idle: 13,5-18 Mpa	2,8 Mpa
	High idle:13,5-18 Mpa	8,9 Mpa
Fan motor mode 100%	1150 Rpm	880 Rpm
Fan pump	Low idle: 135-180 Mpa	3,4 Mpa
	High idle:135-180 Mpa	16,0 Mpa
Self reducing valve	38,5 - 43,5Mpa	41Mpa
internal leak fan motor	2000-3000cc/ 60 detik	± 3000-4000 cc/ 6 detik

Basic analysis to determine the suspected cause: From the results of the examination can be concluded that the fan motor rotation is not achieved because the internal leak exceeds the allowable standard. Because all the pressure control fan pump and pressure output from the fan pump are in standard conditions. Internal leak can occur due to excessive wear in the motor fane component. Of these problems that cause nonstandard fan rotation and cooling in the cooling system to be less than maximum can be seen in Figure 3 and Table 5.

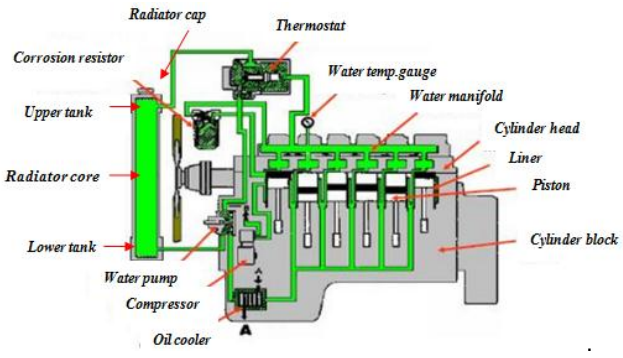

Fig. 3. Structure engine cooling system

Table 5. Data of Analysis

Analysis			
Component	Standard measure	Actual	Note
Fan pump	15,7 ± 2,5 MPa {160±25kg/cm^2}	16 MPa	Ok
Self reducing valve	3,78 – 4,46 MPa {38,5-45,5kg/cm^2}	4,1 MPa	Ok
Internal leakage fan motor	Max. 2000-3000 cc/ 60 detik	± 3000-4000 cc/ 6 detik	Not ok
Fan motormode 100%	13,5-18 MPa 1150-1300 Rpm	8,5 MPa 780 Rpm	Not ok

Suspected cause

Possible root problems related to the cause of the problem. Possible causes of damage can be caused by many things, including foreign material entering the cooling system such as dust when hose replacement is sometimes contained in dust, so in hose replacement it is better to pressurized wind first, or when replacing or adding hydraulic oil can also foreign material enters the cooling system so make sure the cleanliness around the filling hole and others, then the absence of the previous motor fan replacement data, physically the fan motor does not look damaged, and concluded the fan motor is damaged probably because fatigue fracture can be seen in Figure 4.

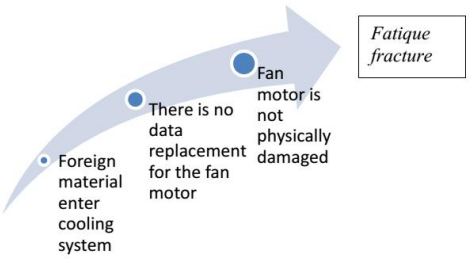

Fig. 4. Suspected cause

CONCLUSION

From the results of analysis, checking and data collection, it can be concluded that the occurrence of trouble Engine Overheat in this case is caused by the external leakage that is too large in the fan motor, so that the cooling fan rotation is not achieved, causing cooling by the cooling fan to cool the radiator does not work optimally, the effect of coolant experiencing a temperature rise too fast and not cooled to the maximum causes the engine not to be cooled to the maximum until the temperature is too high or the engine overheats.

REFERENCES

[1] Basri, H.,Rasma, Ramadhan, A.I., Diniardi, E., 2017, Analisa Kerusakan Alternator Semi Konduktor Regulator Pada Charging System Pada Unit Dump Truck 465-5, Prosiding Semnastek

[2] Rasma, Basri, H., Ramadhan, A. I., 2013, Analisa Pengaruh Tekanan Terhadap Steering Control Valve Alat Berat Pada Unit Grader (GD) Tipe 621R-1, Prosiding Seminar Inovasi Teknologi dan Rekayasa Industri 2013

[3] Purwono, H, Rasma, 2017, Analisa Engine Overheat Pada Unit Komatsu Bulldozer D155A-6, Prosiding Semnastek

[4] Part Book, KOMATSU D155A-6. PT. United Tractors Tbk.

[5] Kamsar. Hasbi, Muhammad. Rachman, Aditya, 2016. Analisis Sistem Hidrolik Pengangkat Pada Alat Berat Jenis Wheel Loader Studi Kasus Dinas Pekerjaan Umum Kab. Bombana, DINAMIKA – Jurnal Ilmiah Teknik Mesin,Vol. 1 No. 1.

[6] Mulyanto, S., 2018, Analisa Fan Control Declinepada Unit AlatBerat Bulldozer Komatsu D375-6, DINAMIKA – Jurnal Ilmiah Teknik Mesin, Vol 9 No 2

[7] Basic Competency 1 TC, Hydraulic System. PT. United Tractors Tbk.

[8] Purwono, H, dan Rasma, 2017, Analisa Engine Overheat Pada Unit Komatsu Bulldozer D155A-6, Prosiding Semnastek

[9] Diniardi, E., Ramadhan, A. I., Basri, H., 2014, Analisis Kekuatan Mekanik Dan Struktur Mikro Pada Material Polimer Penyusun Kipas Radiator, Jurnal Teknologi, Vol 6 No 1

[10] Nugrahanto, I., 2016, Analisis Monitoring Pelumas Hidrolik Wheel Loader, Jurnal Ilmiah - VIDYA, Vol. 24 No. 2