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Analysis of Floating Seal Damage Due to Over Travel against the Performance of a Reduction Excavator Motor Traveler

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Abstract-
Excavators are heavy equipment used to dig and move soil from one place to another. The part that functions as a driving force on the excavator is a travel motor reduction. If there is damage in this section, the excavator cannot operate in moving places. The amount of damage that arises during the operation of the heavy equipment so that in this paper the problem that is focused is about the damage to the floating seal on the traveler motor reduction excavator. Travel motor reduction is a major part of excavators as movers in moving places. To solve the problems that occur in the travel motor reduction excavator using a combination of qualitative and quantitative research methods. The method used is a Literary Study conducted by finding sources of references from books and similar research related to problems regarding the malfunctioning of heavy equipment, Field studies are conducted by interviewing operators, supervisors and also seeing firsthand the condition of the work field and also heavy equipment in the field. Direct testing is done to calibrate the data recorded on the H-mate and OMM to analyze and find out directly the cause of damage from the travel motor reduction component. From the results of data collection and direct testing in the field, it is known that the cause of damage to the travel motor reduction gear is due to overheating due to over-travel excavator which causes damage to the floating seal which results in leakage so that the lubricating oil is contaminated with material from outside the engine. As a result of leakage from the floating seal results in the quality of the lubricating oil and the function of the lubricating oil being unfavorable which has an impact on the performance of travel motor reduction. There is no field supervision for excavator operating hours, due to the lack of operator understanding of machine maintenance and operation. The beginning of the damage to the travel motor is known by the presence of noise (noise) on the travel motor and the operator does not heed until finally the engine jammed cannot move (jammed).
Keywords: *over travel, excavator, floating seal, noise.*

1. **Introduction**

Heavy equipment is a device that is very important as a support in carrying out development. To support the implementation, it can be carried out according to a predetermined schedule, the supporting equipment must also be ready and can be operated in every condition. There are so many types of heavy equipment used in the construction process, one of which is an excavator. Excavators are heavy equipment used to excavate and move material from one place to another. Lots of damage arising during the operation of the machine. In this study the problem focused is about floating seal damage analysis on the traveler motor reduction excavator. Travel motor reduction is the main part of the excavator that serves as the main driver in moving the place.

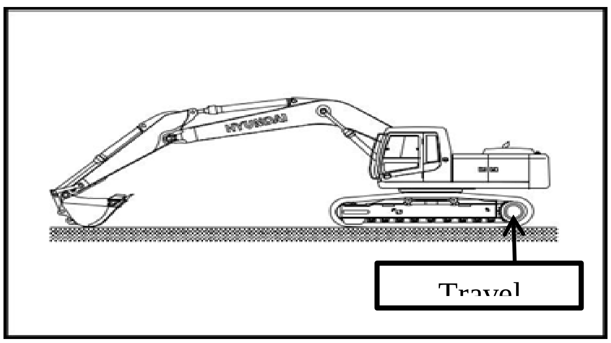


Fig 1. Travel motor reduction position

Based on the problems discussed in this study, as a reference is obtained based on the previous article, including; Damage to the bucket wheel excavator can be caused by the effects of design, manufacturing, service conditions, quality of welded joints and their defects. Damage caused by fatigue due to the effect of the load moved by the structure of the bucket wheel excavator (Danicic, 2014). Excavators are heavy equipment that uses a mechanical system so maintenance is highly considered in the lubrication system. To improve the performance of the lubrication excafator must function properly and must not be contaminated. To get accurate technical information about the condition of the excavator using the condition based maintenance (CBM) method (Felix Ng, 2017). Increasing efficiency and reducing pollutant emissions is a challenge that must be faced, energy saving solutions in excavators by using devices equipped with load sensors in the excavator hydraulic system (Bedotti, 2017). The use of automatic control on the part related to the load of the excavator bucket as a development to improve the excavation path and fill of the excavator bucket (Danko, 2013). The operation of the excavator is adjusted to the type of mechanical or hydraulic electronic equipment, the ratio between linear parameters, the capacity and weight of the excavator can increase the energy consumption efficiency of a single excavator (Placeholder1) The application of the appropriate operating machine construction style can reduce the greenhouse gas emissions associated with hydraulic excavators. Therefore educating operators to choose engine speed and bucket depth is an effective approach to reduce operational costs and carbon emissions through lower fuel consumption and longer engine life (Felix Ng, 2016). Procedure for automatic calculation techniques for soil excavation forces applied by bucket swing using Mathcad software

(Kudryavtsev, 2017). Operation of Bucket wheel Excavators and structures to carry improper loads in operation of the type of load being transported, calculation and experimental testing procedures must be adjusted to the load being transported because if it is incorrect it often leads to accidental work (Pietrusiak, 2017). Increasing the capacity and weight of excavators according to their particular functions in order to remain efficient with the power consumption available for each type of electro mechanical or hydraulic excavator (Komissarov, 2016). In order to obtain a large energy savings in the operation of the excavator made a grouping on the special function of the excavator drive system which consists of several motors and pumps as a supply of pressure presses to the hydraulic drive system (Liu, 2016). The use of the decomposition method with iteration in a flexible multi-body system where the flexible connection system and the electro-hydraulic drive system are combined with each other (M. Mosavat, 2018). The procedure method uses the Mathcad software application to determine the area of operation for excavating land with excavators equipped with backhoe attachments (Imanishi, 2013). Learning on excavator operators so that they can operate excavator buckets properly to avoid mistakes and increase the efficiency of excavator operations using the algorithmic method to simulate according to regional policy (Hodel, 2018). Increased life span of floating on rotating parts to protect from mud or sand dirt. Increasing the durability of floating seal life can improve machine performance in difficult operations (Velikanov, 2016).

The method used in this study is first using a qualitative method based on literature from previous related studies and secondly using a quantitative method by analyzing data obtained through examination and testing in the field. The material that is the focus of research is travel motor reduction in hydraulic drive type excavators.

Excavator

Excavators are heavy equipment used to excavate and transport (loading and unloading a material such as coal, stone, earth, etc.) Based on the driving system, excavators are divided into two types:

1. excavators using a rope system, which is now rarely used because it is less efficient in operation.
2. excavators using a hydraulic system where the main media is fluid. Excavators with a drive system using fluid are widely used and continue to develop due to more efficient operation and easier and simpler maintenance.

In excavators, hydraulic propulsion usually consists of two types of propulsion, namely propulsion using engine type (diesel) and battery type (electric motor). In general, the main driving force of an hydraulic excavator is a diesel engine that converts mechanical energy into hydraulic energy to produce movement. While the electric motor is used to mestarter and supply energy to electrical components such as dynamos, lights and instruments on excavators. The following is the name of the components and function of the drive on the excavator:

the attachment component consists of:

a. Boom is an attachment component that connects the base frame to the arm with a certain length to reach the loading / unloading distance.
b. Arm is an attachment component that connects the boom to the bucket.
c. Buckets are attachment components that are directly related to the material when loading.
d. Track frame is a component that consists of a center frame and a crawler frame which is the operational foundation of the excavator.

e. Carrier roller is one of the undercarriage components that serves to hold the roll from the track shoe assembly so as not to bend downwards and maintain the alignment between the track shoe assembly and the idler.
f. A sprocket is a component that transmits motion to the track through bushings turning it into a rotation so the unit can move.
g. Track link functions to change the rotary motion moving the track roller. The main components of the track link consist of: link, pin, bushings and seal assy.
h. Track shoe is a component that functions like a wheel on a vehicle, to move the excavator.
i. Travel motor is a mechanical actuator that converts hydraulic flow and pressure into torque or rotational power which will rotate the travel motor reduction and be forwarded to the sprocket, then the excavator can move forward and backward.

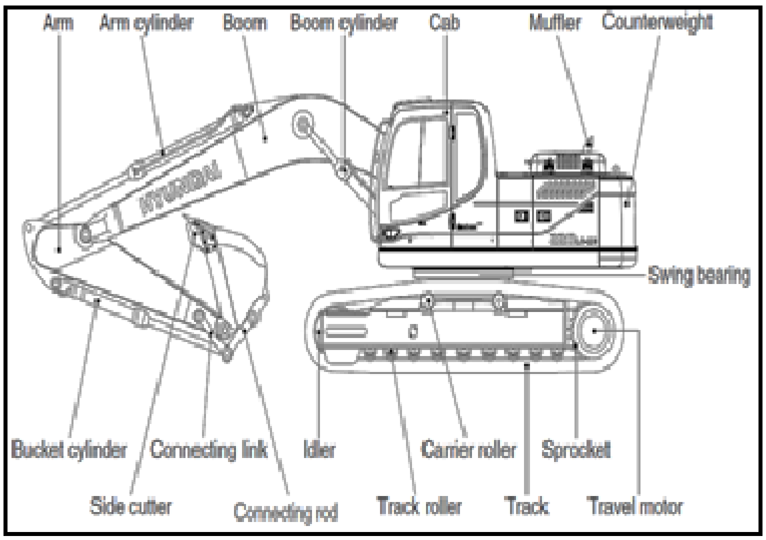


Fig 2. Excavator Parts

Seal

Seal is a supporting component in the engine. Seals are used to prevent fluids or gases from leaking and dirt or moisture from entering the system, sometimes seals can also be used to maintain pressure or vacuum. Seals can be said to be good if the seal is able to prevent leakage, but not all can be designed that way. For this type of dynamic seal there must be a slight leak to lubricate and make a thin layer of lubricant as a lubrication and cooling of moving parts.

In its application, a seal is complex and very precise and its installation must be considered carefully and thoroughly. If an error occurs seal installation will result in leakage to the system which will result in more fatal damage. This is where the importance of seals and various types of seals according to the needs in the system whether the system is affected by extreme temperatures, friction and the nature of the sealed fluid. There are two types of seals used:

1. A dynamic seal is used to insulate moving parts
   Example: shaft and rod seal, compression packing and piston ring
2. Static seal is used to block the parts that do not move

Examples: gaskets, O-rings or packing and sealants.

Dynamic seal types are subdivided according to their use:

A. Radial lip seal

Generally used to insulate the lubricant in the system that has a rotating shaft.

a. single lip seal without spring is used to maintain very thick fluid such as grease.
b. single lip seal with spring which is used to seal the fluid which is thinner on the shaft that rotates more quickly in a clean environment.
c. double lip seal, one side uses a spring to seal the oil and the other side has no spring to hold the dust.
d. dual lip seal, both lip using a spring, to hold the fluid on one side and block the fluid on the other side.

The advantage of using a lip seal is:

1. can enter in a narrow room.
2. the price is not too expensive.
3. Easy installation.
4. very effective in insulation.

B. Exclusion seal

This type of seal is used to keep foreign materials out of the moving parts of translation (back and forth) on a machine. This type of seal is very susceptible to abrasive material.

Floating seal

Floating has a flat and very smooth surface. This floating seal is often found for insulation against rotating parts and silent housing. The advantage of this seal is that the leak is very small, but if the surface is abrasive it will result in a fatal leak. A floating seal consists of:

1. a rotating seal ring
2. seal ring that does not rotate
3. static seal (O-ring)

Fig 3. floating seal

2. Methodology

To solve problems that occur in excavators use a combination of qualitative and quantitative methods. The method used is:

1. Literary study.
   Literary studies are carried out by looking for sources of references from books and similar research related to the problem of severe dysfunction.
2. Field studies
   Field studies are carried out by interviewing operators, supervisors and also seeing firsthand the condition of the work field and also heavy equipment in the field.
3. do a direct test to verify the data recorded with the H-mate and OMM to find out directly the cause of damage from the travel motor reduction component

Identification of damage to the travel motor reduction

Identification is a step to get data about the causes of excavators cannot operate. Data from the research results are obtained based on inspection and information in the field about the existence of excavator units that cannot operate and also the results of inspections at the time of overhaul. The examination of the Excavator that was damaged was the Hyundai R220-9S Excavator on the hour meter 3359.

Table 1. Check sheet damage to travel motor reduction in all branches of PT. UEP

No	Model	Branch Uniquip	Number of Units	Damage type			Description (Amount of Damage)
				Burn	noise	Jammed	
1	Hyundai R220-95	Banjarmasin	82	1	3	1	5
2	Hyundai R220-95	Pekanbaru	44	0	0	0	0
3	Hyundai R220-95	Pontianak	36	0	0	0	0
4	Hyundai R220-95	Balikpapan	86	2	2	0	4
5	Hyundai R220-95	Medan	33	0	0	0	0
6	Hyundai R220-95	Bali	52	0	0	0	0
7	Hyundai R220-95	Semarang	41	2	2	0	3
8	Hyundai R220-95	Makasar	67	1	1	0	3
9	Hyundai R220-95	Palembang	38	0	0	0	0
10	Hyundai R220-95	Jakarta	45	1	1	1	4
Amount			524	8	9	2	19

The stages of inspection carried out are as follows:

a. The inspection begins by conducting a direct interview with the operator on how to operate the excavator. The maintenance that has been done and the problems that occur in the travel motor reduction.

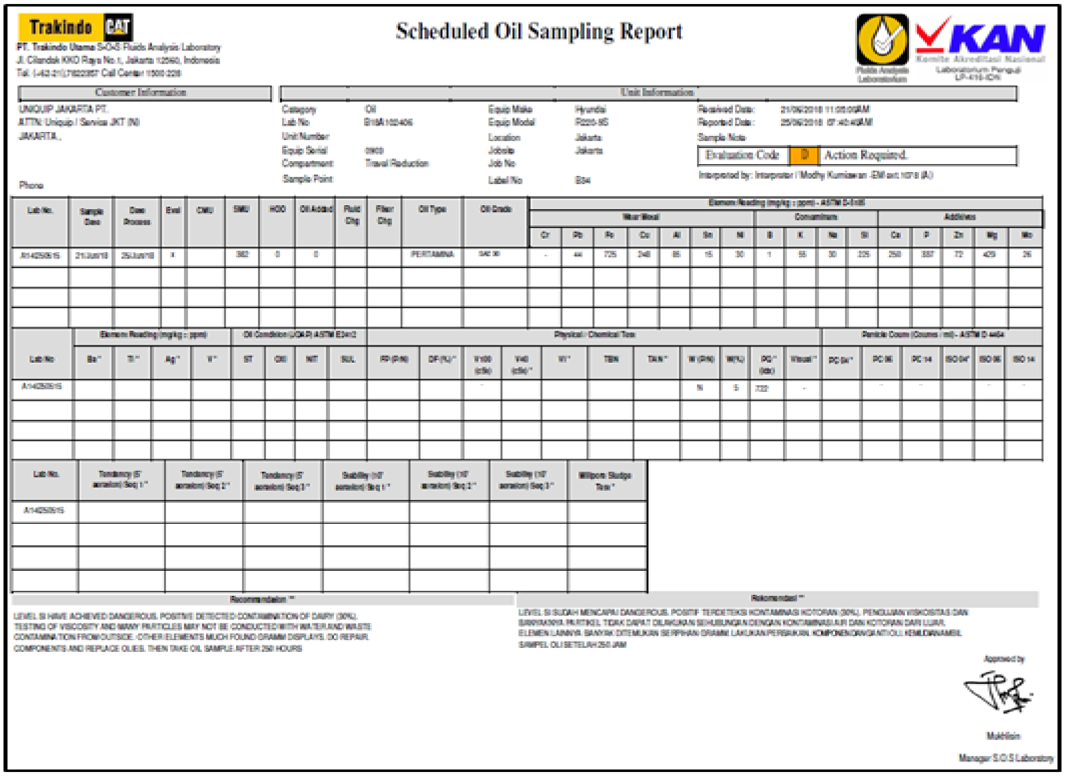
b. Examination of the oil sample is carried out to determine the quality and quantity of the oil. Because the lubricating oil functions as a lubricant in order to reduce the friction that causes heat or in other words so that the performance of the travel motor reduction mechanism is maintained.

c. Inspection of any component on the travel motor reduction gear that is damaged.

d. data collection excavator operational hours by downloading through Hi-Mate Hyundai.

Based on the identification data obtained as follows:

A. travel motor reduction lubricant oil sampling for further testing in the laboratory. From the results of sampling found the presence of metal debris in the sample of the lubricating oil and the color of the lubricating oil is black. Based on the results of laboratory tests it is known that oil has decreased in quality where the value of Si and other substances has reached a dangerous warning and positively detected have been contaminated with dirt by (30%). For viscosity testing of lubricating oil can not be done because it has been contaminated with impurities from the outside and also water mixed with lubricating oil. Lubricating oil in this case is included in the D (bad) category.


Trakindo CAT
PT. Trakindo Utama S•O•S Fluids Analysis Laboratory

Scheduled Oil Sampling Report

Customer Information: UNIQUIP JAKARTA PT. ATTN: Uniquip / Service JKT (N) JAKARTA, Phone

Unit Information: Category Oil; Lab No B18A102406; Equip Serial 0903; Compartment Travel Reduction; Equip Make Hyundai; Equip Model R220-9S; Location Jakarta; Jobsite Jakarta; Label No E04; Received Date 21/06/2018 11:05:09AM; Reported Date 25/06/2018 07:40:40AM

Evaluation Code D Action Required.

Lab No.	Sample Date	Date Process	Eval	CMU	SMU	HOO	Oil Added	Fluid Chg	Filter Chg	Oil Type	Oil Grade	Cr	Pb	Fe	Cu	Al	Sn	Ni	B	K	Na	Si	Ca	P	Zn	Mg	Mo
A14250515	21Jun18	25Jun18	X		382	0	0			PERTAMINA	SAE 90	-	44	725	248	85	15	30	1	55	30	225	250	337	72	429	26

Lab No	Ba	Ti	Ag	V	ST	OXI	NIT	SUL	FP (P/N)	DF (%)	V100 (cSt)	V40 (cSt)	VI	TBN	TAN	W (P/N)	W (%)	PQ (idx)	Visual	PC 04	PC 06	PC 14	ISO 04	ISO 06	ISO 14
A14250515											-					N	5	722	-		-	-		-	-

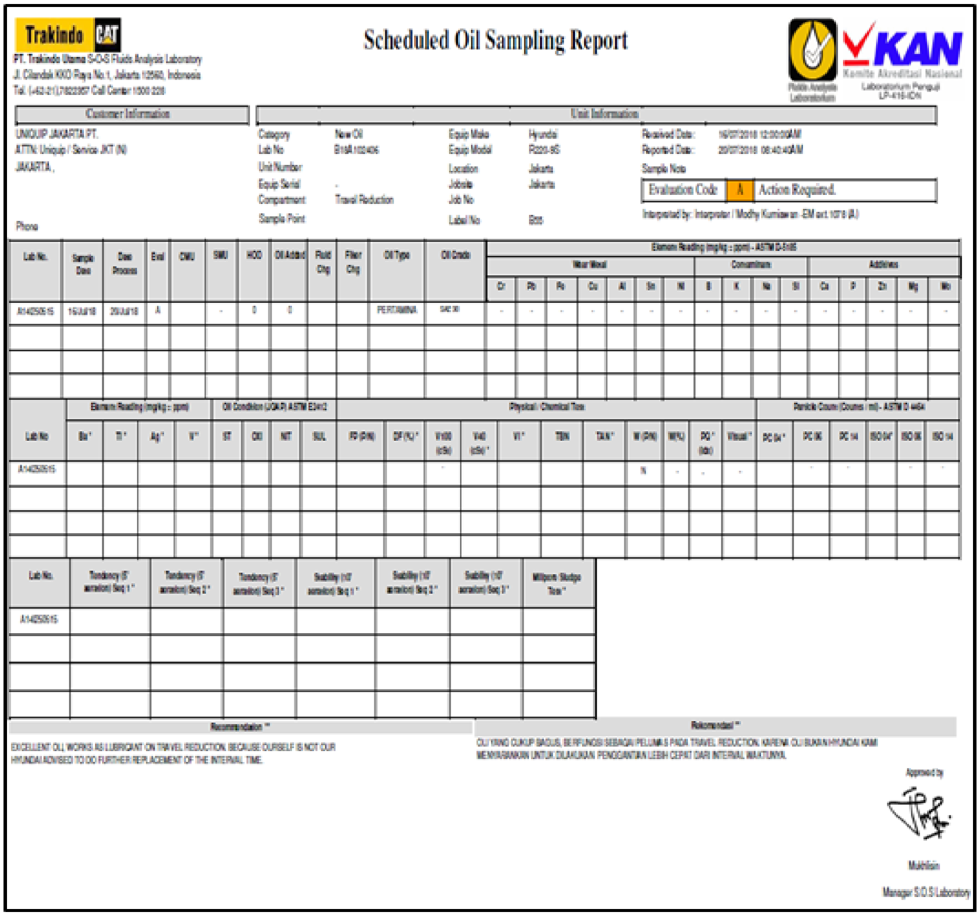
Lab No.	Tendency (5' aeration) Seq 1	Tendency (5' aeration) Seq 2	Tendency (5' aeration) Seq 3	Stability (10' aeration) Seq 1	Stability (10' aeration) Seq 2	Stability (10' aeration) Seq 3	Millipore Sludge Test
A14250515							

Recommendation: LEVEL SI HAVE ACHIEVED DANGEROUS. POSITIVE DETECTED CONTAMINATION OF DAIRY (30%). TESTING OF VISCOSITY AND MANY PARTICLES MAY NOT BE CONDUCTED WITH WATER AND WASTE CONTAMINATION FROM OUTSIDE. OTHER ELEMENTS MUCH FOUND GRAMM DISPLAYS. DO REPAIR. COMPONENTS AND REPLACE OLIES. THEN TAKE OIL SAMPLE AFTER 250 HOURS

Rekomendasi: LEVEL SI SUDAH MENCAPAI DANGEROUS. POSITIF TERDETEKSI KONTAMINASI KOTORAN (30%). PENGUJIAN VISKOSITAS DAN BANYAKNYA PARTIKEL TIDAK DAPAT DILAKUKAN SEHUBUNGAN DENGAN KONTAMINASI AIR DAN KOTORAN DARI LUAR. ELEMEN LAINNYA BANYAK DITEMUKAN SERPIHAN GRAMM. LAKUKAN PERBAIKAN KOMPONEN DAN GANTI OLI. KEMUDIAN AMBIL SAMPEL OLI SETELAH 250 JAM

Approved by
Mukhlisin
Manager S.O.S Laboratory

Fig 4. Used oil inspection results



Trakindo CAT
PT. Trakindo Utama S·O·S Fluids Analysis Laboratory
Jl. Cilandak KKO Raya No.1, Jakarta 12560, Indonesia
Tel. (+62-21) 7822367 Call Center 1500 228

Scheduled Oil Sampling Report

KAN Komite Akreditasi Nasional
Laboratorium Penguji LP-416-IDN

Customer Information

UNIQUIP JAKARTA PT.
ATTN: Uniquip / Service JKT (N)
JAKARTA ,
Phone

Unit Information

Category: New Oil
Lab No: B18A102406
Unit Number:
Equip Serial: -
Compartment: Travel Reduction
Sample Point:
Equip Make: Hyundai
Equip Model: R220-9S
Location: Jakarta
Jobsite: Jakarta
Job No:
Label No: B05
Received Date: 16/07/2018 12:00:00AM
Reported Date: 20/07/2018 08:40:40AM
Sample Note:
Evaluation Code: A Action Required.
Interpreted by: Interpreter / Modhy Kurniawan -EM ext 1078 (A)

Lab No.	Sample Date	Date Process	Eval	CMU	SMU	HOO	Oil Added	Fluid Chg	Filter Chg	Oil Type	Oil Grade	Cr	Pb	Fe	Cu	Al	Sn	Ni	B	K	Na	Si	Ca	P	Zn	Mg	Mo
												Element Reading (mg/kg = ppm) - ASTM D-5185															
												Wear Metal							Contaminant				Additives				
A14250515	16Jul18	20Jul18	A		-	0	0			PERTAMINA	SAE 90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Lab No	Ba*	Ti*	Ag*	V*	ST	OXI	NIT	SUL	FP (P/N)	DF (%)*	V100 (cSt)	V40 (cSt)*	VI*	TBN	TAN*	W (P/N)	W(%)	PQ* (Idx)	Visual*	PC 04*	PC 06	PC 14	ISO 04*	ISO 06	ISO 14
	Element Reading (mg/kg = ppm)				Oil Condition (JOA/P) ASTM E2412				Physical / Chemical Test											Particle Count (Counts / ml) - ASTM D 4464					
A14250515											-					N	-	-	-		-	-		-	-

Lab No.	Tendency (5' aeration) Seq 1*	Tendency (5' aeration) Seq 2*	Tendency (5' aeration) Seq 3*	Stability (10' aeration) Seq 1*	Stability (10' aeration) Seq 2*	Stability (10' aeration) Seq 3*	Millipore Sludge Test*
A14250515							

Recommendation *

EXCELLENT OIL WORKS AS LUBRICANT ON TRAVEL REDUCTION. BECAUSE OURSELF IS NOT OUR HYUNDAI ADVISED TO DO FURTHER REPLACEMENT OF THE INTERVAL TIME.

Rekomendasi *

OLI YANG CUKUP BAGUS, BERFUNGSI SEBAGAI PELUMAS PADA TRAVEL REDUCTION. KARENA OLI BUKAN HYUNDAI KAMI MENYARANKAN UNTUK DILAKUKAN PENGGANTIAN LEBIH CEPAT DARI INTERVAL WAKTUNYA.

Approved by

Mukhlisin
Manager S.O.S Laboratory

Fig 5. New oil inspection results

B. To identify the damage that occurs in the travel motor reduction component, an overhaul is performed on the travel motor reduction gear section. From the identification results, it is known that the burning lubricating oil which is attached to the gear reduction as shown in Fig .6.

F he gear

- Burning lubricating oil attached to the planetary gear as shown in Fig .7.

Fig 7. Lube oil burns on planetary gear

- floating seals damaged by friction as shown in the following image

Fig 8. Deformed floating seal is damaged

Fig 9. floating seal is damaged

- - damage to the ring gear component

Fig 10. broken ring gear components

- damage to the shaft gear component

Fig 11. broken shaft gear components

- damage to the sun gear component

Fig 12. damaged sun gear component

From the results of the identification then analyzed what the main causes of damage to the travel motor reduction. Based on the results of the analysis and also the inspection of the travel motor reduction component, a temporary assumption is made in the order in which the damage occurs. These assumptions are:

1. Noise on the travel motor reduction
2. The color of black lubricating oil is assumed to be due to burning and contamination of impurities entering from outside which are mixed with lubricating oil.
3. Burning lubricating oil adheres to the travel motor reduction component
4. The floating seal is deformed and damaged (destroyed)
5. Components of the travel motor reduction such as ring gear, shaft gear and sun gear have cracks and broken.
6. Travel motor reduction jammed (locked)

Based on the results of the interim analysis it is suggested what are the main causes of the occurrence of the six problems mentioned above.

Operation Maintenance Manual

Operation maintenance manual is a manual used to guide the operation and service of heavy equipment produced. This book is used as a reference for diagnostic processes, tips, assembly and disassembly, operating systems, testing, settings and all system specifications on the machine.

The contents of the Operation maintenance manual consists of:

- How to operate a tool or engine, so that the tool or engine is protected from possible damage.
- The method or standard operating procedure for dismantling the component or engine recommended by the manufacturer.
- Instructions on how to calibrate and adjust the device or engine.

Important information about the specifications of the tool or engine that is made.

2. Result and Discussion

After decomposing into six problems out of the six problems, it was concluded that the main causes that cause the color of black lubricating oil such as burning and contamination of impurities that enter from the outside, the burning lubricating oil adheres to the components of the travel gear reduction and floating seal which are deformed until destroyed starting from the existence of over heat on the travel motor reduction gear due to over travel, while the noise that arises is the impact of decreased oil quality which if still being operated can result in travel motor reduction jammed (locked). From the results of temporary conclusions that assume that the main cause is over heat, the next step is to test to operate the excavator so that correction data are obtained to prove it with engine operational data.

Fig 13. Excavator operational location

Table 2. Engine operation history data

Warning

ENGINE CHECK

276L

Hourmeter

Date	Hourmeter	Local time
07-Apr-2018	3359	GMT +7

Working Status

History of engine operation	Fuel
0 6 12 18 24	

Scope	A day's hours	Total average hours
Engine run	2h 6m 36s	4h 48m 6s
Working	0h 29m 16s	1h 59m 6s
Traveling	1h 25m 43s	1h 9m 32s
Idling		
Breaker		
Crusher		

Fig 14. hour meter results on the excavator

Table 3. Running excavator test results

Checking	Speed of Travel Excavator	Initial temperature before travel	Temperature after travel 250 m	Temperature after travel 500 m	Temperature after travel 750 m	Temperature after travel 1000 m
First	3.8 km/hour	30 ^{0}C	54 ^{0}C	76 ^{0}C	103 ^{0}C	127 ^{0}C
Second	3.8 km/hour	32 ^{0}C	54 ^{0}C	75 ^{0}C	102 ^{0}C	125 ^{0}C
Third	3.8 km/hour	29 ^{0}C	52 ^{0}C	75 ^{0}C	101 ^{0}C	124 ^{0}C
Fourth	3.8 km/hour	33 ^{0}C	56 ^{0}C	78 ^{0}C	104 ^{0}C	128 ^{0}C
Fifth	3.8 km/hour	31 ^{0}C	54 ^{0}C	76 ^{0}C	102,5^{0}C	126 ^{0}C

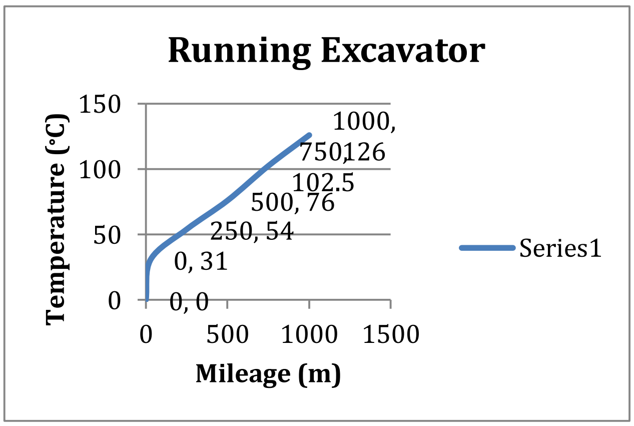


Fig 15. Graph of the relationship between distance and temperature on a travel motor

From the results of the excavator operation test above, the reason for testing is based on traveling excavator data obtained from Hi-mate. From these data it is known that the excavator traveling exceeds the recommended travel limit in accordance with the operating procedure based on Oepration Manual Maintenance (OMM).

Based on excavator operational test data, component damage check, oil inspection used, laboratory oil inspection results that have been used and the results of excavator operator interviews and also with the results of excavator operational test directly to compare data obtained from Hi-mate, the analysis results are as follows:

a. Burn motor travel

Based on the operational excavator maintenance manual (OMM) that track type excavators are not advised to travel too far, because it can cause heat which results in the travel motor reduction. Excavators are advised to stop for five minutes for the cooling process to rub against parts after traveling a maximum distance of 200 meters. Based on the results of the interview we got information that excavator operators often travel more than the recommended distance which is above 200 meters. As a result of frequent travel excavators of more than 200 meters and without cooling for 5 minutes resulting in overheat which can affect the quality of the lubricating oil and components that are sensitive to the influence of high temperature changes, namely the float seal as part of the impurities insulation on the travel motor reduction made of rubber. By comparing the results of direct travel tests and data from H-mate and interviews it is known that the travel excavator is more than the recommended travel limit and based on the measurement results obtained temperature due to over travel which results in lubricating oil and float seals become damaged because it has exceeded the endurance limit in table 5 (rubber material durability table) used on rotating machinery parts.

Based on data from the table, it is known that floating seals can be used well at temperature limits between 25 0C to 100 0C. From the results of direct testing and compared with data from Hi-mate it can be seen that the cause is overheat based on the test data obtained from the temperature value of 125 0C which exceeds the limit of temperature resistance of floating seal material made of NBR rubber type at temperatures of -25 to 100 0C which causes the floating seal component to be abrasive until it is destroyed which results in leakage and dirt entering the travel motor reduction section so that the lubricating oil that has been damaged by burning plus added to the dirt from the outside and also the dirt from the floating float seal. The results of laboratory tests said that lubricating oil has deteriorated where the lubricating oil is damaged due to the influence of tempratur and also many external elements that enter the lubricating oil.

Table 4. Specifications maximum temperature of lubricating oil

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature °C (°F): -50 (-58), -30 (-22), -20 (-4), -10 (14), 0 (32), 10 (50), 20 (68), 30 (86), 40 (104)
Engine oil pan	Engine oil	24 (6.3)	★SAE 5W-40
			SAE 30
			SAE 10W
			SAE 10W-30
			SAE 15W-40
Swing drive	Gear oil	Type 1 : 5.0(1.3) Type 2,3 : 6.2(1.64)	★SAE 75W-90
Final drive		5.8×2 (1.5×2)	SAE 80W-90

Table 5. Rubber material resistance

sumantry.id	SBR	NBR	EPDM	Silicone	Viton	PU
Temp Celcius	-25 to 80 C	-25 to 100 C	-45 to 130 C	-60 to 260 C	-20 to 230 C	-40 to 90 C
Compresion Set	Baik	Cukup	Baik	Baik	Baik	Cukup
Tensile Strenght	Baik	Baik	Baik	Cukup	Cukup	Sangat Baik
Abrasive Resist	Sangat Baik	Baik	Baik	Rendah	Baik	Sangat Baik
Gas Permeability	Baik	Baik	Cukup	Rendah	Baik	Baik
Weather Resist	Rendah	Cukup	Sangat Baik	Sangat Baik	Sangat Baik	Baik
Water Resistance	Baik	Baik	Sangat Baik	Cukup	Sangat Baik	Cukup
Ozone Resistance	Rendah	Rendah	Sangat Baik	Sangat Baik	Sangat Baik	Baik
Mineral Oil Resist	Rendah	Sangat Baik	Rendah	Rendah	Sangat Baik	Baik
Chemical Resist	Rendah	Cukup	Baik	Rendah	Sangat Baik	Cukup
Price Level	Murah	Sedang	Sedang	Tinggi	Mahal	Tinggi

*Gunakan bagan ini hanya sebagai acuan, data di lapangan dapat berbeda karena banyak variable yang mempengaruhi

b. Travel Motor Noise

Travel motor noise occurs in the excavator recorded in the Hours meter for analog operating hours is still low at 3359 hours. This damage occurs due to operators who do not understand and do not understand how to operate and maintain excavator properly and correctly in accordance with Operational Manual Maintenance (OMM). Excavator damage should not occur at 3359 Hours meter, because the damaged component or part has a long service life with a record of operation and periodic maintenance carried out periodically in accordance with OMM.

In a travel motor that is noise found some components that are damaged and wear, namely the gear component, components that rub against each other and touch.

c. Travel Motor Jammed

Jammed motorcycle travel is caused because there are parts of the mechanism can not move properly. The existence of parts of the machine does not move because of damage so that it blocks, based on the results of inspection of the damage resulting in travel motor jammed because parts of the mechanical system are cracked or broken so that the mechanical system components are imperfect which results in travel motor being jammed.

Fig 15. sun gear, shaft gear and ring gear are broken

4. Conclusion

Damage that occurred in the travel motor reduction of excavator heavy equipment type was initially started with noise until finally jameed. The main cause of damage is over heat due to lack of understanding of excavator operators in operating the heavy equipment. Over heat occurs because the operator does not understand maintenance and operation where the operator does not use the lubricant referenced for the travel motor reduction, operating the travel excavator beyond the farthest limit of the excavator to travel, which is more than 200 meters without cooling down, which should be the excavator must stop for 5 minutes after traveling as far as 200 meters. Due to the frequent excavators traveling more than 200 meters, the temperature on the travel motor part rises to exceed the temperature limit for maximum floating seal resistance of 1000C. The temperature that occurs exceeds the maximum resistance limit, so the floating seal becomes fragile and damaged which results in the non-functioning of the floating seal as an insulator for lubricating oil and impurities from outside which enter the travel motor reduction excavator. The entry of dirt into the travel motor reduction makes the lubricating oil damaged so that it affects the travel components which ultimately the lubrication and cooling system in the travel motor reduction does not function properly which can make travel excavators that were previously based on OMM can travel a maximum distance of 200 meters cooling makes the excavator travel distance even shorter. Operation of such excavators occurs repeatedly which results in the travel motor being damaged.

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