

CHAPTER 4 – RESULTS AND DISCUSSIONS

4.1 Find the Problem and Objective

PT XYZ has four Komatsu EXCAVATOR PC1250-8 units, which are used for production operational activities. In the agreement between the Operation team and the Maintenance team, the Maintenance team is required to be able to present unit performance in accordance with the agreement, namely a minimum unit availability value of 85%.

To be able to realize this target, of course the PT XYZ Maintenance team must try to be able to minimize the occurrence of damage and minimize the length of time the unit is damaged, and here are some of the maintenance carried out by PT UT to be able to achieve the target availability of 85%.

- a. Periodic inspection (PI) is a unit inspection activity carried out every two days for each unit. Every two days the unit will be checked and the presence/absence of symptoms of a problem (collect backlog) will be identified. Then, based on these findings, improvements will be prepared so that Unschedule Breakdown does not occur.
- b. Condition Monitoring is observing the condition of a machine, data for condition monitoring is obtained from maintenance technology data that is available in the unit and also data from PAP (Lubricant Analysis Program).
- c. Periodic Service (PS) is maintenance that is carried out periodically every 250, 500, 1000 hours of unit operation. The work carried out in this periodic maintenance is Preventive Maintenance according to the unit manual, CBM follow-up and execution of the backlog that has been planned
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- e. Unscheduled Breakdown is unplanned, unpredictable unit damage, without

detectable symptoms of damage. This type of damage is the most undesirable damage in the unit maintenance process, because the impact is quite long, starting from the readiness of mechanics, tools, spare parts for support equipment and also the location of the damage which is not necessarily ideal for carrying out repairs. Of course, this will make the unit breakdown time longer so that unit availability will be low.

4.2 Data Analysis

The obligation of the Perawan PT In Figure 4.1 is the company's internal data regarding the availability of Komatsu Excavator PC1250-8 units, starting from January to December 2022.

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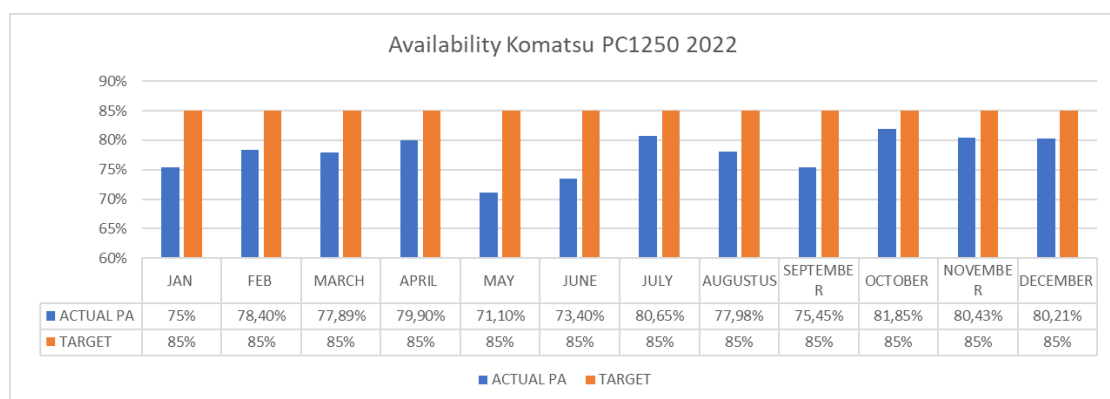


Figure 4.1 Availability Komatsu Excavator PC1250-8 PT XYZ in 2022

Based on the data in Figure 4.1, the average performance of the Komatsu Excavator PC1250 unit in 2022 is 78% or in other words it has not met the availability target of

85%. This is of course a serious problem for the company because it cannot meet the unit performance targets in accordance with the agreement with the Operations team.

4.2.1 Data Daily Breakdown PC1250-8

Based on the theoretical studies that have been carried out, it is known that the amount of damage and the length of time the unit is damaged greatly influences the unit availability value, the more often and longer the unit is damaged, the lower the unit availability value will be so that we need to minimize unplanned damage or unscheduled breakdowns to a minimum possible.

Unit Code	SMR Hours	Trouble		RFU		LTH	Component	Action
		Date	Time	Date	Time			
MG818	52820	1-May	6:00	2-May	6:00	24,00	Mis Operation	OFF day
MG818	52820	2-May	6:00	3-May	6:00	24,00	Mis Operation	OFF day
MG818	52820	3-May	6:00	4-May	6:00	24,00	Mis Operation	OFF day
MG816	57314	3-May	11:12	3-May	15:20	4,13	AC system	* Replace Magnet Clutch
MG817	57727	3-May	13:43	3-May	15:41	1,97	Hydraulic Line	* Replace Hose Steering Cyl RH Sisi Bottom * Add Oil Hyd 10 Liter
MG4005	42477	3-May	13:51	3-May	14:34	0,72	Elektrik	* Jumper Battery * Adjust Belt Alternator
MG818	52820	4-May	6:00	5-May	6:00	24,00	Mis Operation	Waiting part
MG4005		4-May	9:40	5-May	6:00	20,33	Maintenance	* PM500hrs
MG816	57318	4-May	11:22	4-May	23:02	10,25	AC System	* Request Ke WS Jam 14:08 - 15:33 * Replace AC compressor

Table 4.1 Data Daily Breakdown PC1250-8

Table 4.1 is sampling data on all damage that occurred to the Komatsu EXCAVATOR PC1250 which consists of unit code data, time of damage, description of damage, corrective action, and duration of repair (internal company data), while complete data is in the attachment.

4.2.2 Pareto Diagram Komatsu Excavator PC1250-8

To narrow down the problems that occur in the next unit, the data above is converted into a Pareto diagram and will be grouped into two; Pareto diagram based

on frequency (number of events), and Pareto diagram based on length of unit breakdown (Downtime).

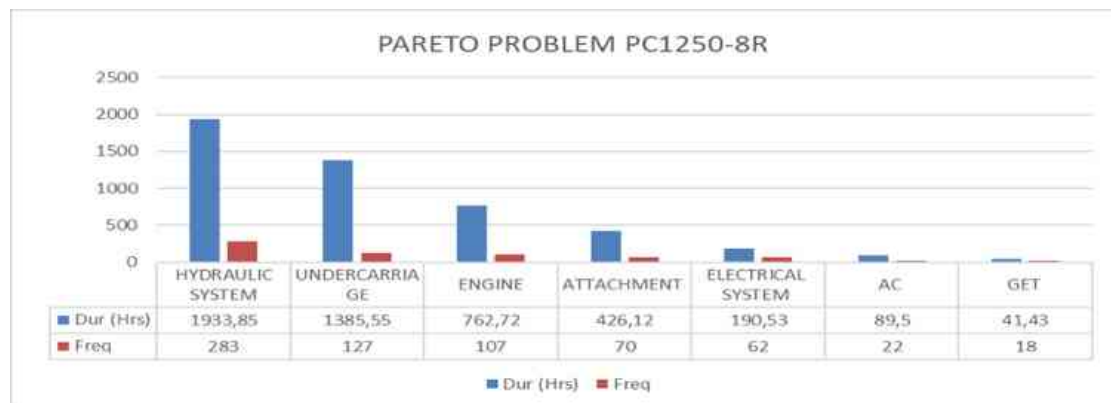


Figure 4.2 Pareto Diagram Kerusakan (by frequency) tahun 2022

From Figure 4.2, the damage pareto for the year 2021 shows that the highest/most frequently occurring damage is to Attachments, namely 283 times, while the second is undercarriage, namely 127 times, and the third is Engine with 107 times.

Next in Figure 4.2 is a Pareto diagram based on the length of time the unit experiences damage or (downtime) in each component group. Maintenance is ranked first with downtime of 1933 hours, of the total breakdown in 2022, Then second is Undercarriage with 172 hours of the total breakdown in 2022

Based on field analysis in figure 4.2, it was found that the cause of damage to the Hydraulic System components was found. In Table 4.2 it can be seen that the causes of the front axle experiencing breakdown are Oil Leak (61.84%), Poor Lubrication (17.67%), Miss Operation (13.43%), Miss Assembly (7.07%).

Root Cause	Frequency	Prosentage
Oil Leak	175	61,84%
Poor Lubrication	50	17,67%
Miss Operation	38	13,43%
Miss Assembly	20	7,07%
Frequency Problem	283	100,00%

Table 4.2 Root Cause PC1250 in 2022

To analyze in more detail the root of the problem of the high breakdown frequency of Hydraulic System components, a fishbone diagram is used to make it easier to analyze the root of the problem.

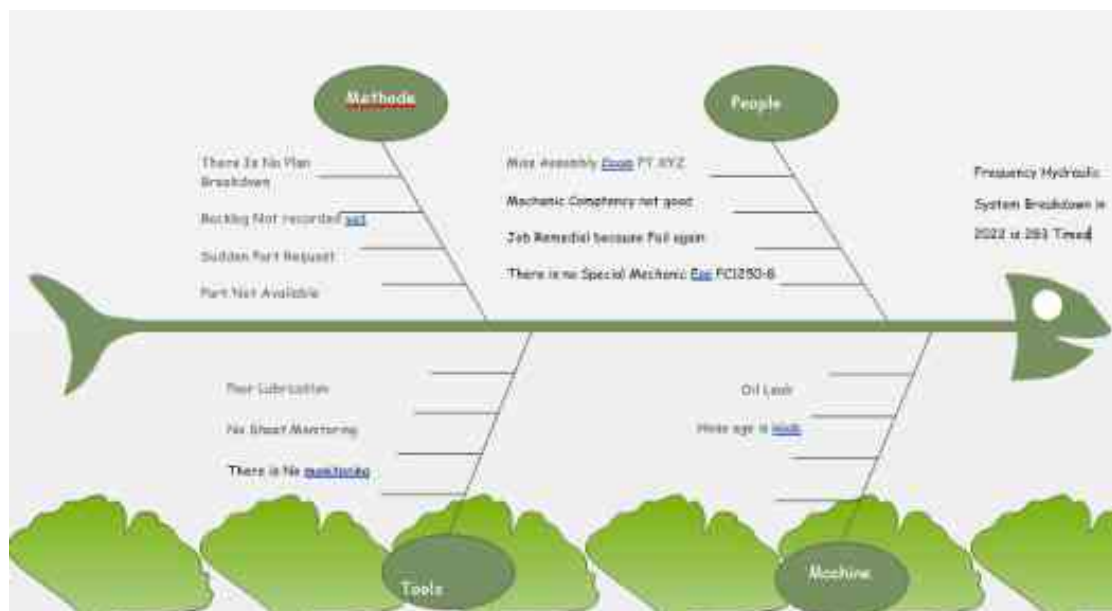


Figure 4.3 Fishbone Diagram Breakdown Hydraulic system

The results of fishbone analysis can be described from 4 factors, namely

- 1 Machine: There is one factor from the machine side that causes the frequency of Hydraulic system in 2022 to be 283 times, namely 175 times root of the oil leak turned out to be the hose which more than 20.000 working hours old
- 2 Tools: The tools factor is also an important part that causes problems. The frequency of front axle breakdowns in 2022 is 50 times out of 283 times, namely Poor Lubrication, which is caused by the absence of monitoring and recording the actual condition of the Hydraulic system. This happens because there is no autolube monitoring sheet on the hydraulic system and backlog system components.
- 3 Method: The method factor that causes the problem is that the frequency of hydraulic system breakdowns in 2022 is 283 times is low part availability, because there is no coordination regarding the actual condition of the unit. So there is no preparation for procuring parts. If there is damage in the field, and components or parts are needed, the parts are not available on site. So it takes time to procure the part from the vendor. This condition will cause high downtime.
- 4 People: Miss Operation, which is caused by the unit operating refresh process not running. Mechanics also contributed 58 times out of 283 times hydraulic system breakdowns caused by Miss Assembly. Uneven competency is the cause of errors in installation (Miss Assembly). And there is no mechanic who focuses on monitoring the Komatsu Excavator PC1250

The results of the fishbone analysis showed that all the factors previously explained were interrelated, with process factors, namely because the maintenance program had not been well structured, resulting in poor monitoring of the condition of the front axle components, which caused breakdowns unschedule is high, and the main part that is the root of the main problem in the process sequence is the uneven competency of the mechanics.

4.3 Potential Solutions

The next step after finding the root of the problem is to find a solution to the root of the problem, from the fishbone diagram shown in Figure 4.3. Using the 5W1H method in Table 4.2, several alternative.

What	Why	Where	When	Who	How
Dedicated Mechanic PC1250-8	• Mechanics haven't focused on the PC1250 yet • Mechanical competency is not evenly standard • Create documents that guarantee the quality of mechanical work	Maintance Team PC1250	W4 Februari 2023 W4 Feb – W4 Mar2023 W4 Februari 2023	Julius (UT Separi Mechanic)	• Choose dedicated Mechanic • Provide mentorship from senior mechanics to juniors • Create document quality work and socialization.
Operator Competencies PC1250-8	• Refresh training or Operator development methods do not yet exist	Operational team PT XYZ	W4 Feb – W4 Mar2023	Joni (Instructor UT Separi)	• carry out refresh training for PC1250 operators • Provide mentoring at the start of each shift before work
Reporting Backlog	There is no form to record and check backlog	Maintance Team PC1250	W1 – W4Mar 2023	Rizky (Planner PT XYZ)	Create forms backlog, and socialize it to mechanics
Level High Hose	There is no standard lifetime hose yet	Maintance Team PC1250	W2 – W4Mar 2023	Dimas (ASC UT SPR), Arya (LOG PT XYZ)	Start replacing the hose gradually
Sheet Monitoring Autolube	There is no sheet for autolubemonitoring	Maintance Team PC1250	W1 Mar 2023	Zulkarnain & Dimas (UT Separi)	Create an autolube monitoring sheet and socialize how to use it

Table 4.3 Alternative Solution Breakdown Hydraulic System PC1250-8

The following is an explanation of the Alternative Solutions in Table 4.2 which have been determined, agreed, and chosen by the team to be implemented.

- 1 People: In terms of the operations team and the maintenance team, they both have the same obstacles, namely competence. Competency improvement can be done through in-class training or mentors. Then, so that the Maintenance team can focus more on maintaining the Komatsu Excavator PC1250 unit, it is necessary to appoint a special PIC who will be responsible for the performance of the PC1250. Apart from that, to overcome the quality of missed assembly work, documents are needed that record the quality of the work.
- 2 Machine: Oil leaks are a problem with machine parts caused by the age of the hose, which on average is more than 20.000 hours of operation. By replacing hoses that are more than 10.000 operating hours old. To maintain availability, this hose replacement can be done in parts or not all at one time.
- 3 Tools: If poor lubrication is not handled immediately, it will result in high unit downtime, because it requires repair by the fabrication team. So that when poor lubrication occurs quickly, there must be a daily inspection carried out by a mechanic and an auto lube inspection form that guides the mechanic to carry out auto lube checks from the pump to the lubrication point.
- 4 Method: When an unscheduled breakdown occurs and the spare parts are not ready, it will cause the work lead time to be high. Because repairs cannot be carried out immediately, you have to wait for spare parts and support tools to be available. To overcome this, if abnormal conditions are found when carrying out daily inspections, they must be recorded and then immediately reviewed and prepared support equipment and mechanics for the work. Meanwhile, the Backlog form is not yet ready to be used to record findings so it needs to be made, then communicated to mechanics about how to fill it.

4.4 Develop an Implementation Plan

Alternative solutions that have been found and agreed upon will be implemented. Before implementation, it is necessary to make an implementation plan for the agreed solutions. Table 4.3 is the timeframe for implementing this implementation.

NO	ACTIVITY	PIC	MARCH				APRIL				MAY				JUNE			
			W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1	Define Problem dan objective																	
	Identifikasi masalah	DMS																
	Menentukan tujuan	DMS																
2	Analyze The Fact																	
	Mengumpulkan data	DMS																
	Menari akar masalah	DMS																
3	Generate Potential Solution																	
	Menari alternatif solusi	ALL TEAM																
4	Develop Implementation Plan																	
	Persetujuan Team	ALL TEAM																
	Time Frame	ALL TEAM																
5	Implementation																	
	Memilih Mekanik Dedicated	ZUL																
	Mentoring Mekanik	JON																
	Create Document quality kerja	ZUL																
	Refresh training operator EXCA PC1250	JON																
	Create Form Bedlog dan sosialisasi	ZUL																
	Penggantian Hose hydraulic System	JUL																
	Create Sheet monitoring autolube dan sosialisasi ke mekanik	DMS																
	Monitoring	ALL TEAM																
6	Check & make sustain																	
	standarisasi	DMS																

Table 4.4 Time Frame Implementation

4.5 Improve (Program Implementation)

Corrective steps for program implementation are taken from 4 main root factors that must be corrected, namely people, methods, tools and machines.

4.5.1 People

At the implementation stage, several activities were carried out to increase the competency of PT XYZ mechanics, especially in standard maintenance processes. Apart from regular training, the competency development process is also carried out using the mentor method, mechanics with a higher grade share knowledge with other mechanics. The main goal is to equalize competencies so that maintenance work can be of high quality and reducing the gap between senior mechanics and junior mechanics. Mentoring is carried out once a week with a theme according to problems often found in the field. Figure explains the mechanical mentoring process regarding current problems.



Figure 4.4 Mentoring, means of increasing competence

The supervisor determines a team of mechanics who remain and focus on carrying out daily inspections, service execution and backlog. This team does not only focus on maintaining the Komatsu Excavator PC1250-8 unit, it does not join in maintaining other units such as the HD785-7 and PC Small. Team PC1250 consists of four people, according to the distribution of daily inspection locations and work. And a written commitment was made regarding the responsibility to maintain the performance of the Komatsu Excavator PC1250.

Figure 4.5 shows the commitment of the PC1250-8 dedicated team along with several responsibilities to maintain the performance of the PC1250-8 unit.

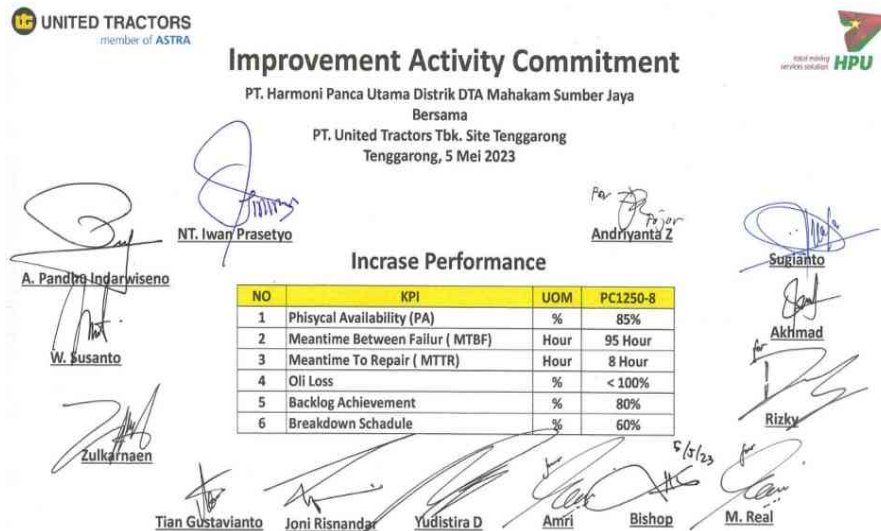


Figure 4.5 Commitment Team Excavator PC1250-8

In Figure 4.10 is a WA group to facilitate and speed up the communication process, including pending jobs, a communication group was created via the online media Whatsapp



Figure 4.6 Communication Whatsapp Group of Excavator PC1250

Figure 4.7 explains the Quality work form for carrying out the work of installing and removing the front axle. Apart from using manual units, mechanics too

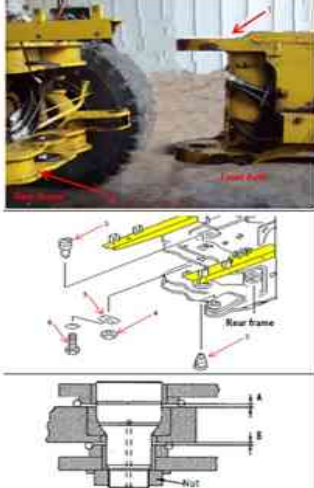
QA : 4A (QA SECTION)		PT UNITED TRACTORS Tbk SERVICE DIVISION				QA - FORM : GD825A-2/2408/Y/4A4A/12(0)	
LEMBAR KERJA PEMASANGAN		MODEL : GD825A-2	WAKTU PROSES		TOTAL WAKTU	CUSTOMER :	
		S / N :	TANGGAL	JAM		JOB NO :	
		COMP : FRONT AXLE	START			NO S/R :	
		S / N :	FINISH			MEKANIK :	
						DIKETAHUI :	
						PARAF :	
						PARAF :	
GAMBAR KERJA		HAL-HAL YANG HARUS DIPERHATIKAN (URAIAN KERJA)				DIPERIKSA / CHECK ITEM	
		★ Sebelum Front frame dihubungkan dengan rear frame, bersihkan dahulu area center bracket mounting pin dari kotoran yang menempel 1. Angkat Front frame (1) dan hubungkan dengan Rear frame (2) ★ Posisikan lubang pin pada front dan rear frame bagian atas dan bawah sejajar Front frame : 2982 Kg 2. Masukkan pin (3) ke lubang bracket mounting pin bagian atas dan bawah 3. Pasang Nut (4) ke mounting pin bagian bawah, kencangkan dan lakukan adjustment ★ Adjust nut ketika mengencangkan supaya celah "A" dan "B" sama 4. Pasang Nut (4) ke mounting pin bagian atas dan kencangkan nut Mounting nut: Step 1 : 25 ~ 27 Kcm Step 2 : Kendor nut Step 3 : 3 ~ 8 Kcm 5. Pasang Plate (5) dan kencangkan bolt (6) Mounting bolt : 27 ~ 29 Kcm					

Figure 4.7 Form paperwork quality Remove and install hose Hydraulic system PC1250-8

To maintain operator competency, refresh operator training is carried out. Done at least once a year. Figures and explain the Refresh process for Inclass operator training and mentoring in the field along with reporting.



Figure 4.8 Refresh Training Operator PC1250-8

NO	INFORMASI PERSONAL		INFORMASI KEGIATAN			NILAI	
	NIK	NAMA	KATEGORI	TANGGAL	MATERI	PRE-TEST	POST-TEST
1	0028S1	Abdul Muin	Training	23 - 24 Februari 2022	Pengoperasian & Perawatan Harian GD 825A-2	50	76
2	0103S1	Achmad Rani Tepu	Training	23 - 24 Februari 2022	Pengoperasian & Perawatan Harian GD 825A-2	52	78
3	0194S1	Arpiansyah	Training	23 - 24 Februari 2022	Pengoperasian & Perawatan Harian GD 825A-2	56	76
4	0312S1	Yuliansyah	Training	23 - 24 Februari 2022	Pengoperasian & Perawatan Harian GD 825A-2	52	79
5	0053ABM	Arif Pujianto	Training	23 - 24 Februari 2022	Pengoperasian & Perawatan Harian GD 825A-2	58	75
6	0145ABM	Yusuf Arianto	Training	23 - 24 Februari 2022	Pengoperasian & Perawatan Harian GD 825A-2	61	78
7	0132ABM	Yusransyah	Training	23 - 24 Februari 2022	Pengoperasian & Perawatan Harian GD 825A-2	53	76
8	0116ABM	Yulianus	Training	23 - 24 Februari 2022	Pengoperasian & Perawatan Harian GD 825A-2	63	79
9	0138ABM	Irawansyah	Training	01 - 02 Maret 2022	Pengoperasian & Perawatan Harian GD 825A-2	59	77
10	0135ABM	Jamrun	Training	01 - 02 Maret 2022	Pengoperasian & Perawatan Harian GD 825A-2	58	80
11	0109ABM	Rahmani	Training	01 - 02 Maret 2022	Pengoperasian & Perawatan Harian GD 825A-2	55	77
12	0128ABM	Muhlis Hamidin	Training	01 - 02 Maret 2022	Pengoperasian & Perawatan Harian GD 825A-2	60	80
13	0111ABM	Sunarko	Training	01 - 02 Maret 2022	Pengoperasian & Perawatan Harian GD 825A-2	52	78
14	0313S1	Yulius Bara	Training	01 - 02 Maret 2022	Pengoperasian & Perawatan Harian GD 825A-2	51	76
15	0220S1	H. Asriansyah	Training	01 - 02 Maret 2022	Pengoperasian & Perawatan Harian GD 825A-2	59	79

Table 4.5 Data Base Training Operator PT XYZ

As in Table 4.5 That PT UT Implement Training for operator to minimize error from operator when operated PC1250-8

4.5.2 Machine

Improvements to the machine are by rejuvenating the hoses on the Hydraculic System. In Figure , the hose replacement process is carried out when the unit is serviced in the workshop. To maintain unit availability, this hose replacement is carried out in parts, or not at one time.



Figure 4.9 Procces Replacement Hose PC1250-8 in Hydraulic System

Equipment	Order	Purchase Requisition	Purchase Order	Operation Description	Op/	Material	Material Description	Reqmt Q
EX12113KM	1000587197	1400138773	8400071591	PIPING DELIVERY MP LEAK	0010	07095-01241	CUSHION	2
EX12113KM	1000587197	1400138773	8400071591	PIPING DELIVERY MP LEAK	0010	07000-B3048	O-RING	2
EX12113KM	1000587197	1400138773	8400071591	PIPING DELIVERY MP LEAK	0010	07000-B3032	O-RING	1
EX12113KM	1000587197	1400138773	8400071591	PIPING DELIVERY MP LEAK	0010	07000-B3035	O-RING	1
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	07095-01241	CUSHION	8
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	21N-62-34660	HOSE ASS'Y,2800MM	1
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	21N-62-33411	CLAMP	2
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	205-62-54460	CLAMP	2
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	01010-81250	**BOLT**	4
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	01643-31232	WASHER	4
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	07099-41023	HOSE	2
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	07099-41022	HOSE	2
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	21N-62-34670	HOSE ASS'Y,3000MM	1
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	21N-62-34681	HOSE ASSY	1
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	21N-62-34650	HOSE ASSY	1
EX12113KM	1000582986	1400137015	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	08036-03014	CLIP -p	6
EX12113KM	1000582986	1500120134	8400070928	RECONDITION HOSE TRAVEL (FATIQUE)	0010	07095-20318	CUSHION	6
EX12113KM	1000555407	1400126271	8400064263	HOSE DELIVERY PTO	0010	02760-00314	HOSE	1
EX12113KM	1000555407	1500115836	8400064263	HOSE DELIVERY PTO	0010	07002-22034	O-RING -P	4
EX12113KM	1000555407	1400126271	8400064263	HOSE DELIVERY PTO	0010	02896-11009	O-RING	4
EX12113KM	1000555407	1500115836	8400064263	HOSE DELIVERY PTO	0010	02896-11015	O-RING	4
EX12119KM	1000588494	1400139416		hose swing drain	0010	02762-00547	HOSE	2
EX12119KM	1000588494	1400139416		hose swing drain	0010	02896-11015	O-RING	8
EX12119KM	1000588492	1400139413		Hose Lubricating PTO Leak	0010	21N-38-41320	HOSE	1
EX12119KM	1000588492	1400139413		Hose Lubricating PTO Leak	0010	02896-11018	O-RING	2
EX12119KM	1000588492	1400139413		Hose Lubricating PTO Leak	0010	07002-22434	O-RING	2
EX12119KM	1000588492	1400139413		Hose Lubricating PTO Leak	0010	07000-E3028	O-RING	2
EX12119KM	1000588473	1400139417		hose cylinder bucket leak	0010	21N-62-38610	HOSE	2
EX12119KM	1000588473	1400139417		hose cylinder bucket leak	0010	21N-62-38620	HOSE	2
EX12119KM	1000588473	1400139417		hose cylinder bucket leak	0010	07000-13048	O-RING	10
EX12119KM	1000588473	1400139417		hose cylinder bucket leak	0010	07000-13038	O-RING	10
EX12119KM	1000588473	1400139417		hose cylinder bucket leak	0010	07000-13034	O-RING	6
EX12119KM	1000588473	1400139417		hose cylinder bucket leak	0010	07000-13035	O-RING	6
EX12119KM	1000588470	1400139418		Hose Sguttle Valve Leak	0010	02778-003A3	HOSE	1
EX12119KM	1000588470	1400139418		Hose Sguttle Valve Leak	0010	02777-00308	HOSE	1
EX12119KM	1000588470	1400139418		Hose Sguttle Valve Leak	0010	02777-00309	HOSE	1
EX12119KM	1000588470	1400139418		Hose Sguttle Valve Leak	0010	02760-00312	HOSE	1
EX12119KM	1000588470	1400139418		Hose Sguttle Valve Leak	0010	02761-003A3	HOSE	1
EX12119KM	1000588470	1400139418		Hose Sguttle Valve Leak	0010	02896-11009	O-RING	20
EX12119KM	1000588470	1400139418		Hose Sguttle Valve Leak	0010	07002-12434	O-RING	10
EX12119KM	1000587195	1400138774	8400071846	HOSE RETURN SWIVEL JOINT LEAK	0010	07297-41223	HOSE	1
EX12119KM	1000587195	1400138774	8400071846	HOSE RETURN SWIVEL JOINT LEAK	0010	07000-13038	O-RING	2
EX12119KM	1000582831	1400136721	8400070210	Seal PPC Travel Leak	0010	702-16-53140	RETAINER	4
EX12119KM	1000582831	1400136721	8400070210	Seal PPC Travel Leak	0010	702-16-53170	PISTON	4
EX12119KM	1000582831	1400136721	8400070210	Seal PPC Travel Leak	0010	07000-12020	O-RING	4
EX12119KM	1000582831	1400136721	8400070210	Seal PPC Travel Leak	0010	702-16-54170	COLLAR	4
EX12119KM	1000582831	1400136721	8400070210	Seal PPC Travel Leak	0010	702-16-51270	SEAL	4
EX12119KM	1000567552	1400130425	8400066480	CV LEAK EX12119KM	0010	700-80-61260	O-RING	20
EX12119KM	1000567552	1400130425	8400066480	CV LEAK EX12119KM	0010	700-80-61430	RING** -p	20
EX12119KM	1000567552	1400130425	8400066480	CV LEAK EX12119KM	0010	07000-12065	**O-RING**	15
EX12119KM	1000567552	1400130425	8400066480	CV LEAK EX12119KM	0010	02760-00349	HOSE	1
EX12119KM	1000567552	1400130425	8400066480	CV LEAK EX12119KM	0010	02760-00353	HOSE	1
EX12119KM	1000567552	1400130425	8400066480	CV LEAK EX12119KM	0010	02761-00340	HOSE	1
EX12119KM	1000567552	1400130425	8400066480	CV LEAK EX12119KM	0010	02760-00314	HOSE	1
EX12119KM	1000567552	1400130425	8400066480	CV LEAK EX12119KM	0010	02761-00314	HOSE	1
EX12119KM	1000567552	1400130425	8400066480	CV LEAK EX12119KM	0010	02761-00315	HOSE	2
EX12119KM	1000507475			HOSE TRAVEL LEAK	0010	301SN-6	HOSE	136
EX12116KM	1000587218	1400138768	8400071994	HOSE RETURN LEAK	0010	21N-62-31730	HOSE	1
EX12116KM	1000587218	1400138768	8400071994	HOSE RETURN LEAK	0010	21N-62-31741	HOSE HANSEI	1
EX12116KM	1000587218	1400138768	8400071994	HOSE RETURN LEAK	0010	07000-B3048	O-RING	4

Table 4.6 List item Replacement Hose Phase 1

4.5.3 Tools

As a means of documenting daily inspections and reminding mechanics about auto lube inspection items, it is necessary to add an auto lube inspection form when the mechanic carries out daily inspections.

Figure 4.10 Form Daily Check Autolube PC1250-8

After creating the daily auto lube inspection form on the front axle, the next step is to introduce or socialize the form to mechanics. The goal is so that mechanics can use the form as a tool work instruction when carrying out daily checks on the Komatsu Motor Grader GD825A-2 unit. The supervisors are responsible for outreach to mechanics. Figure 4.11 is process of socializing the daily auto lube inspection form for the Komatsu Motor Grader GD825A-2 unit to mechanics, carried out by SPV.



Figure 4.11 Socialisizing from Autolube

Figure 4.12 the daily inspection process carried out by a mechanic on the Komatsu Motor Excavator PC1250 unit. Along with the results of findings of abnormal conditions in the unit.



Figure 4.12 Daily check from mechanic and finding in PC1250 Hydraulic System

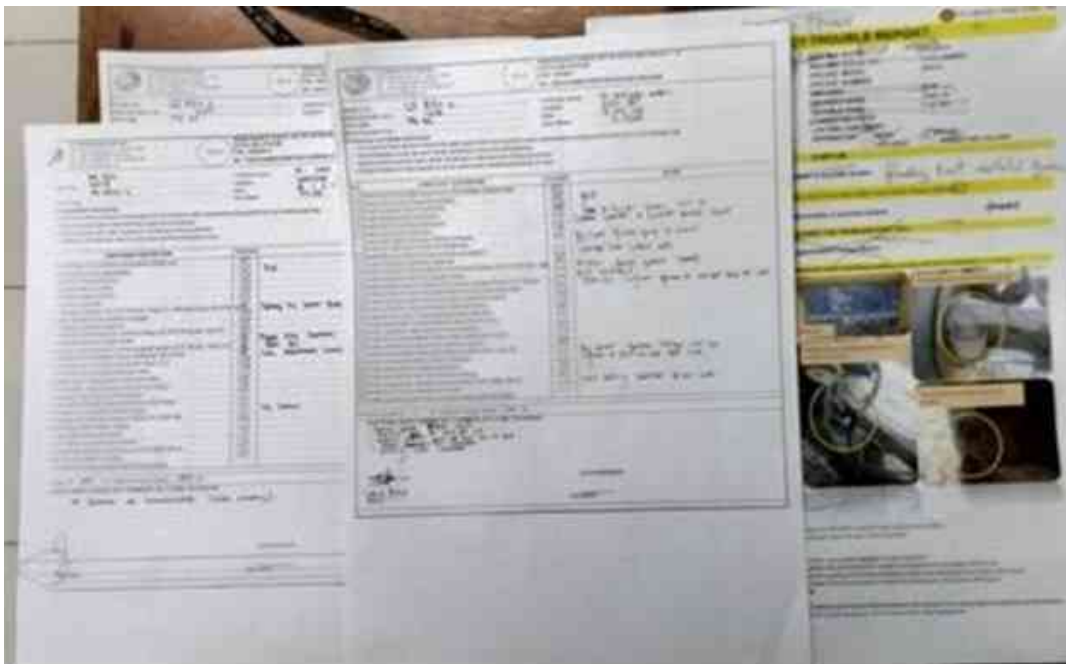


Figure 4.13 Form Document Daily Check PC1250

Figure 4.13 is a document of the results of the daily inspection of the PC1250-8 carried out by the mechanic. This document is validated by the SPV and if there are findings of abnormal conditions it must be discussed in a review at the end of the shift.

The inspection result data on the daily inspection form will be monitored and entered into the database. From this database a "Find Fact" report will then be created which will be submitted to the Production team as the "user" and used as material for joint evaluation both in the Production team and the Maintenance team. Apart from that, when abnormal conditions are found, an autolube backlog needs to be created and this data submitted during the coordination meeting, to follow up on these abnormal findings.

Figure 4.14 is a Find Fact Report Document, a document of daily inspection results that is shared with the entire maintenance team and the Operation team, as material for joint evaluation.

FINDING FACT REPORT				
CLAIM ADMINISTRATION EVALUATION				
MACHINE MODEL	EX1250	COMPONENT NAME	TRANSMISSION ASSY	
SERIAL NO.	13182/EXPC1250116	MODEL	235-15-21014	
SERVICE METER	21.873 hrs	SERIAL NO.	QK-102041	
CUSTOMER	PT XYZ	LIFE TIME	871 hrs	
BRANCH / SITE	SEPARI	JOB ORDER NO.	#REF!	
CLAIM NUMBER	-	COMP IN DATE	2022-11-30	
Symptom		UNIT CAN NOT FORWARD		
A. Main Part Failure:				
Part Number	Description	Qty	Finding Fact / Condition	
235-15-22710	DISC	7	EXCESSIVE WORN	
B. Completeness of ASS Data				
Description	Availability	Requirement	Remarks	
COMMISSIONING & PLM CLIMC REPORT	Yes	Yes	OCC	
PI 1000	No	No		
PI 2000	No	No		
PI 3000	No	No		
PLM CORRECTION REPORT	No	No		
C. Support Technical Data				
Description	Available (y/n)	Received Date	Remarks	
ETR	Yes	27-Oct-22	OCC	
PAP REPORT	No	-	Not Receive	
MAINTENANCE RECORD	No	-	Not Receive	
PLM RECORD	No	-	Not Receive	
VHMS	Not Applicable	-	Not Receive	
D. Life Time and Periode of Component				
Description	Installed	Failed	Total Attainment of component	
Time periode of component	28-Aug-21	27-Dec-22	486 days	
Life Time Hours of Component	21.002 hrs	21.873 hrs	871 hrs	
		Status	Warranty	
E. Technical Analysis Result				
Caused by	Main Cause	Factor		Responsibility
		Int.	Ext.	
	Poor workmanship / Material Defect			Reman
	Incomplete Concept claim			Distributor
	Incomplete commissioning / KCS Support			Distributor
	Improper Maintenance / Operation		✓	Customer
FINAL DECISION				
Based on aspect A, B, C, D, E this case can be classified as claim category with decision "REJECTED"				
Balikpapan, 22 Dec 2022.				
 (JULIUS) SUPERVISOR		 (ZULKARNAIN) SERVICE DEPARTMEN HEAD		

Figure 4.14 Find Fact Report

4.5.4 Methode

There are several improvements in the Method section that have been improved, creating a Backlog Monitoring Form which is used to monitor the backlog on each Komatsu Excavator PC1250 unit. As shown in Figure 4.15 monitoring sheet form contains Log Date, Hours Metter, Component Code, Part Description, Part Number, Quantity, Work Order, Order Date, Estimated Time, and Part Status.

<i>Backlog Monitoring Sheet (BMS)</i>										
ID Backlog	Log Date	HM	Problem Component Code)	Part Description*	Part Number*	Qty	Working Order	Order Date	Estimated Time of Arrival	Status Parts
1	8-Oct	22275	Oring & backup ring HFF leak oil	07001-02070	Oring	1	57249751	10/18/2012	10/18/2012	Ready
				07000-12070	Oring	1	57249751	10/18/2012	10/18/2012	Ready
2	8-Oct	22275	Seal kaca cabin kiri depan rusak bocor air	217-64-36161	Runchannel	1				
3	18-Oct	22447	Main ladder broken accident by operator	Fabrikasi						
4	18-Oct	22447	LH Carrier Roller No 1 & 2 + RH carrier roller no 1 leaking	217-30-00220	Roller	3				
5	18-Oct	22447	Nozzle wipper buntu	416-925-3930	Connector	1				

Figure 4.15 Form Backlog Monitoring Sheet

Then the method that needs to be improved is the review and monitoring process. Regular Maintenance Team briefings, daily routine meetings held by mechanics and SPV to discuss obstacles faced when carrying out maintenance are carried out at the end of the shift



Figure 4.16 Briefing Regular Maintenance team in the end of shift

Figure 4.16 is a regular briefing for the maintenance team at the end of each shift, discussing today's performance achievements, conveying obstacles encountered during implementation. There are problems with daily checks. In this briefing, activity plans for the following day are also discussed.

The second one shown in Figure 4.17 is a regular weekly meeting to create a Periodical Service plan. A regular meeting at the beginning of the week to plan PS execution and backlog which is attended by SDH, Supervisor, PPC, parts team and other related parties.



Figure 4.17 Weekly meeting Plan periodical service and backlog

The third is shown in Figure 4.17 regular performance meeting. Routine meeting every week to discuss the previous week's performance achievements which are attended by SM, SDH, PDH, Supervisor, PPC, PA and other related parties.



Figure 4.18 Regular perfomance meeting For PC1250-8

4.6 Check and continuous Plan

From the eight activities carried out and described in sub-chapter 4.5, the results obtained are Pareto data for June 2023 as in Figure which shows the frequency of Attachment breakdowns from January to December 2023.

Sampling of Availability (PA), MTBF, MTTR calculations in June 2023, It is known Komatsu Excavator PC1250-8 with unit code EX12116 during the month of June was 314.03 hours, while the number of working hours from 01 June to 30 June 2023 was 712 hours, the number of hours the equipment was not used was 62 hours.

So from that condition above we know that:

$$W = 712 \text{ Hour}$$

$$R = 32,35 \text{ Hour}$$

$$S = 62 \text{ Hour}$$

So the availability and the equation is =

$$\begin{aligned} &= \frac{712 + 62}{712 + 32,35 + 62} \times 100\% \\ &= \frac{744}{806,35} \\ &= 0,9598 \times 100\% \\ &= 95,95\% \end{aligned}$$

From the sampling example of 4 Komatsu Excavator PC1250 units in June, it was found that the unit availability value was 95.95%.

Mean Time Between Failure (MTBF)

To calculate the MTBF (Mean Time Between Failure) value on the EX12116 unit, equation 2.2 can be used where: In the period 01 June to 31 June 2023, the number of breakdown units was obtained 4 times (Schedule 1x) with HM data as follows:

$$\text{HM unit 1 Mei} = 52760$$

$$\text{HM unit 31 Mei} = 53108$$

So the Total Operating Time is $53108 - 52760 = 348$

$$\text{Total Operation Time} = 348$$

Frequency Breakdown = 3

The value MTBF is : $53108 - 52760 = 348$

$= 348 = 116 \text{ Hour}$

- Mean Time To Repair (MTTR)

It is known that in the period 01 June to 31 June 2023 the EX12116 unit downtime was 32.35 hours and the number of down times was 4 times (including 1x schedule breakdown), so the MTTR value uses Equation:

So the equation is:

Breakdown Time = 32,35

Frekuensi Breakdown = 4

So the equation is $= 32,35 / 4 = 8,85 \text{ Hour}$

PA	MTBF	MTTR
MIN 85%	MIN 110 HOUR	MAX 5 HOUR
95%	116	8,85

Table 4.7 Comparison PA, MTBF, MTTR Before and after Project

The following is the performance of the Komatsu Excavator PC1250 unit at PT XYZ after improvement. Figure 4.19 explains the results of the implementation of this project, Availability compared to 2022 (as of June 76%) managed to improve in 2023 to 85%.

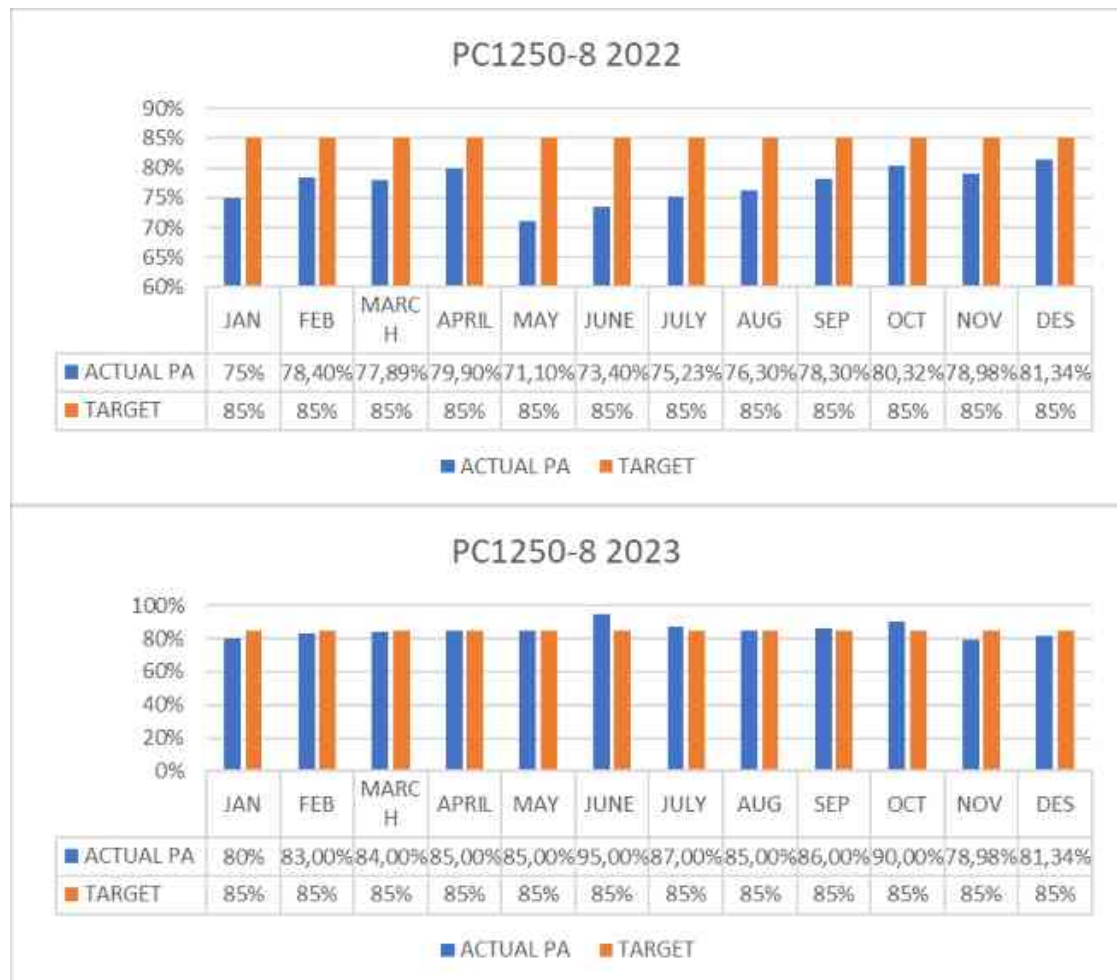


Figure 4.19 Comparison performance Before and after Improvement

Several new forms of daily inspection sheet, backlog entry sheet (BES) and backlog monitoring sheet (BMS) will make it easier for planners to prepare maintenance plans for PC1250 units, so as to reduce the potential for unscheduled unit breakdowns. But all employees must have a commitment to carry out their respective responsibilities properly.

Process improvements which include regular weekly meetings to create periodic service plans, regular meetings at the beginning of the week to plan PS execution and backlog. Regular performance meeting, Regular meeting every week to discuss the previous week's performance achievements. Regular daily PPC team

briefing, daily routine meetings held by PPC and ADM to discuss problems within the scope of PPC and the team. Regular daily Maintenance Team briefings, daily routine meetings held by mechanics and SPV to discuss obstacles faced when carrying out maintenance.

Process improvements which include regular weekly meetings to create periodic service plans, regular meetings at the beginning of the week to plan PS execution and backlog. Regular performance meeting, Regular meeting every week to discuss the previous week's performance achievements. Regular daily PPC team briefing, daily routine meetings held by PPC and ADM to discuss problems within the scope of PPC and the team. Regular daily Maintenance Team briefings, daily routine meetings held by mechanics and SPV to discuss obstacles faced when carrying out maintenance. As well as improving MPI (Maintenance Performance Indicators) which consists of Job Re-Do, Maintenance Accuracy, Availability, MTTR and MTBF. As an item that is assessed from maintenance performance, accompanied by an agreed scale