

## **COOLANT CIRCULATION IMPROVEMENT ON THE CHIP TUB OF THE MACHINE LNC OKUMA 0002 PT. KOMATSU UNDERCARRIAGE INDONESIA**

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### **ABSTRACT**

In general, coolant is a cooling medium used to cool workpieces and cutting tools during the machining process. In PT Komatsu Undercariage Indonesia, the LNC OKUMA 0002 chip crankcase contained a lot of stagnant coolants. The factor that causes the coolant to stagnate is that the growl is wasted through the chip conveyor and the coolant is carried along with the growl to the chip. Changing the coolant fluid needs to be done in a certain phase because the use of the coolant for too long causes sand to accumulate. Excessive sand can close the cooling duct system. The quality of the coolant can deteriorate due to heat and a dirty environment. In addition, corrosion on the radiator can also result in the deposition of dirt on the coolant. When this happens, the engine overheats easily and triggers a stall. The repairs that have been carried out are examining and repairing the components of the coolant system by adding a coolant channel and a pump that functions to suck the coolant so that the coolant returns to the LNC OKUMA 0002 engine.

**Keywords:** coolant; cutting tools; growers; machinery; pumps.

### **1. INTRODUCTION**

In the face of global market competition, Indonesia is expected to be able to compete with developed countries in the world both in terms of price and quality. One of its fields is the field of industrial technology. Nowadays, the industry in Indonesia is growing rapidly in line with the development of the times. Such as the establishment of Industrial Areas in Cikarang. It is the largest Industrial Area in Southeast Asia. For the development of national industry, Cikarang is able to produce export value that is more or less the same as the Industrial Estate in Batam. This is evident from the contribution of 34.46% of national foreign investment and export capability which

is in the figure of 22% to 45% of national export volume [1].

One of the many industries in Cikarang is PT Komatsu Undercarriage Indonesia which is a subsidiary of PT Komatsu Indonesia. Pt.. KUI is a business entity in the form of PT (Limited Liability Company). This business entity is a union of several private entrepreneurs into a unit to manage the joint venture, where the company provides an opportunity to the public to include its capital to the company by buying shares of the company. PT KUI manufactures parts undercarriage (bottom) excavator and bulldozer. In its production PT Komatsu Undercarriage Indonesia uses the standards set by Komatsu, so that the products produced have good quality and competitive price.

This will certainly make it easier for Komatsu customers in the procurement of spare parts that are undoubtedly of quality. In addition, it is also expected to be able to compete globally [2].

In terms of producing quality products certainly have a good production process, One of them is the production process on machining. Machining is the process of making workpieces with a link (removing unwanted materials from workpieces in the form of chips).

The machining process is part of the production process where the workpiece or product is obtained from the cutting process using machine tools. Machine tools used in the machining process include lathes, milling machines, scrap machines, drilling machines and other machine tools. [3]

Every company really needs good work safety. Occupational safety and health is very important for employees. Both workers who are in the field and in the office. Although people who work in the office have a lower risk than workers who work in the field. Apart from these two locations, both are very important corporate assets and must be well maintained. Because if there is something bad in the employee, than the company itself suffers losses on it. Therefore, why basic safety is very important in PT. Komatsu Undercarriage Indonesia [4].

Currently at PT. Komatsu Undercarriage Indonesia has a CNC machine that does not meet the basic safety standards according to researchers' observations. CNC machines in the machining section of PT. Komatsu Undercarriage Indonesia experienced a coolant or coolant circulation leak in its chip box. So that it can endanger the working operator or even hinder the operator's movement.

CNC machine is a machine that uses a computer program, which stands for CNC is Computerization Numerik Control. It is a machine tool automation system operated by abstractly programmed commands stored in storage media, as opposed to the previous custom where machine tools are usually controlled by hand rotation or simple

automation using CAM (Computer Aided Manufacturing) [5].

The word NC itself stands for numerical control which means Numerical Control. In this case the machine tool is usually added with a motor that will move the controller following the points inserted into the system by the paper recorder. This fusion machine between servo motor and mechanical was soon replaced with analog system and than digital computer created a modern machine tool called CNC Machine which in the future has revolutionized the design process [5].

In general coolant is a cooling medium used to cool workpieces and cutting tools during the machining process. It is also used to lubricate the cutting tools so that they have a longer service life. Coolant is a liquid mixed with ethylene or propylene glycol and water. Usually the ratio of comparison of mineral substances is around 50/50 [6].

Based on the above background, the objectives to be achieved in the implementation of this research, namely; to know the production process of machining department of Production in PT. Komatsu Undercarriage Indonesia and to apply leakage solution to coolant circulation in the chip body LNC MACHINE OKUMA 0002 PT. Komatsu Undercarriage Indonesia.

## 2. METHODS

### 2.1. Data Collection Techniques

Explanation During Research, the method used in data collection is by observation, discussion, and literature study.

- a. Observations are made with data obtained by conducting direct observations to the field with the guidance of mentors / supervisors Research, technicians or supervisors along with related parts in the production process to obtain data.
- b. Data collection by discussion by way of the author conducting discussions directly with mentors and with parties related to the field that the author studied in order to obtain the necessary data.
- c. Collection of literature studies, authors get data through several reference books,

manual books, and standard work documents on the production process.

## 2.2. Data Analysis Techniques

The method used to analyze the data in this study is to use a fishbone diagram and why-why analysis.

Fishbone diagram or fishbone diagram is called because of its shape that resembles a fish bone. This diagram is a method or tool used to improve quality. The benefit of a fishbone diagram can help us find the root cause of the problem by using a user-friendly and easy-to-use tool, which is loved by people in the manufacturing industry because the process is known to have many potential variables. Cause problems [6].

Why analysis is a method used in root cause analysis to solve problems, namely looking for the root cause of the problem or the cause of the defect in order to find the root cause of the problem. Another term for why analysis is 5 why analysis [7,8].

According to Mind Tools, Why why analysis or the "5 Whys" strategy is a simple and effective tool to find the root cause of the problem. You can use it for troubleshooting, problem solving and quality improvement plans. Start with the problem, and then ask why it happened. Make sure your answer is indeed correct, and then ask the question again [7-9].

## 2.2. Types of Research

This research includes a type of descriptive research, which is research whose main characteristic is to provide objective explanations, comparisons, and evaluations as decision-making materials for the authorities. The purpose of descriptive research is to seek an explanation of a fact or event that is happening, such as an existing condition or relationship, a developing opinion, the consequences or effects that occur, or an ongoing trend.

The steps of the research carried out can be seen in Figure 1.

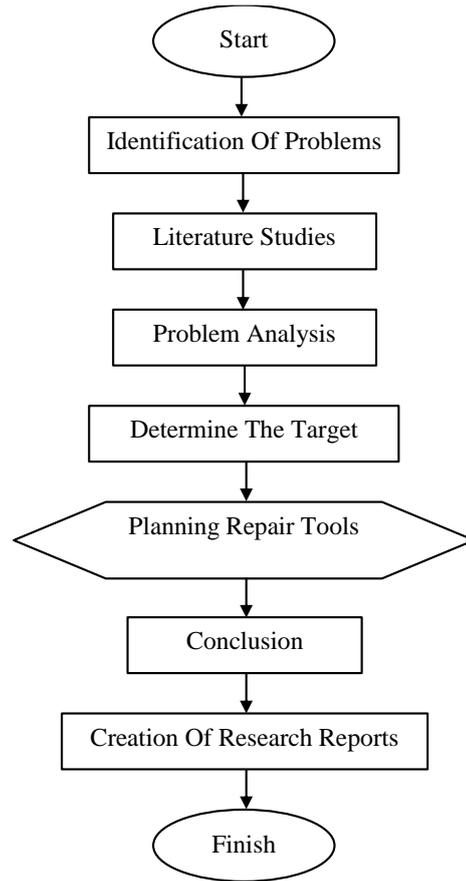


Figure 1. Flow Chart

## 3. RESULTS AND DISCUSSION

### 3.1. Number of Coolants on the Chip Body

At the time of research at PT. Komatsu Undercarriage Indonesia, author made the theme Coolant Circulation Improvement on LNC OKUMA 0002 Machine. The author created the theme, because in LNC OKUMA 0002 machine, there are many coolants inundated on the chip tub.

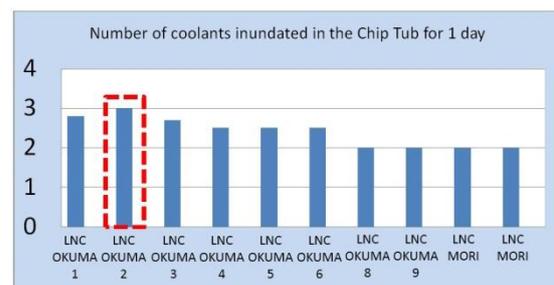


Figure 2. Graph Number of coolants inundated for 1 day

In the graph above shows data wasted coolant liquid for 1 day. From the graph above the author plans an improvement on the LNC OKUMA 0002 engine, because the amount of coolant inundated on the chip tub as much as 3 liters in a day. This led to the discharge of coolant on the LNC OKUMA 0002 engine.

### 3.2. Problem Analysis

The machine operates 24 hours, which causes the coolant not to circulate properly. Coolant that is not circulated properly causes the coolant to carry the chip through the conveyor chip to the chip body. Coolant drips on the floor and causes the coolant to be wasted.

The stagnant coolant makes the operator have to make a coolant container under the chip tub, after which the operator must pour the coolant back into the coolant tank of okuma 0002 LNC machine which results in the coolant dripping to the floor. The process of pouring coolant into LNC OKUMA 0002 machine is done while the production process is running, so it will take time and slow down the production process.

### 3.3. Current State

In the chip tub of LNC OKUMA 0002 machine there are many stagnant coolant. The factor that makes the coolant inundated is the fury wasted through the conveyor chip and carrying the coolant carried along with the growl to the chip tub, seen in figure 3.



Figure 3. Coolant container

### 3.4. Determining The Target

In this fix, the author wants to make improvements by specifying the targets that you want to achieve in this fix. The target specified by the author is:

- Not inundated coolant on the chip tub.
- No container so it does not cause coolant to spill onto the floor
- Operator does not pour coolant into coolant tank .

### 3.5. Fishbone Diagram Analysis

Fishbone diagrams or Ishikawa diagrams are cause and effect diagrams that help managers trace the cause of defects, mutations, defects or failures. The picture looks like the bones of a fish, there is a problem in the head, and the cause of the problem has also entered the spine.

The figure 4 explains the factors that affect the stagnant coolant in the chip tub of OKUMA 0002 LNC machine in the Machining section of Production Department PT Komatsu Undercarriage Indonesia.

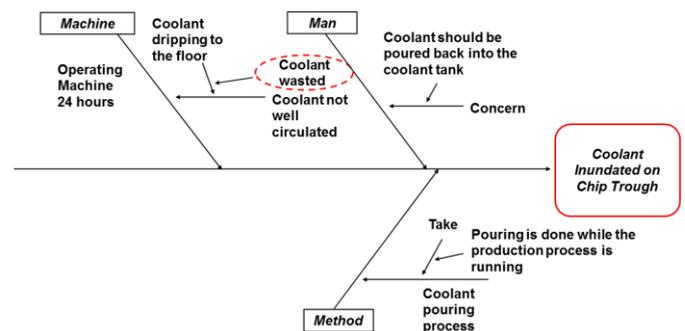


Figure 4. Fishbone diagram

### 3.6. Why – Why Analysis

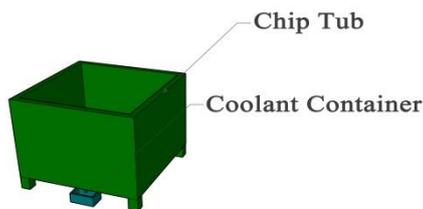
Table 1 explains the problem that occurred in the chip body of LNC OKUMA 0002 machine in the Machining section of Production Department PT Komatsu Undercarriage Indonesia.

**Table 1. Why – Why Analysis**

Why –why analysis					
Factor	Problem	Why1	Why2	Why3	Repair Ideas
Mach	There	Coolant	Lots	Many	Make
ine	is a	is	of	coolant	circulati
	coolan	carried	cool	s are	on
	t	to the	ant	not	coolant
	puddle	chip	wast	recircul	to the
	on the	trough	ed	ated	machin
	chip	the			e using
	Body	conveyo			a pump
		r chip			

### 3.7. Coolant Container Repair

Currently, the coolant container on LNC OKUMA 0002 machine in machining department of PRODUCTION PT. Komatsu Undercarriage Indonesia is still placed under the tub of growl / chip. Thus causing the coolant to be inundated and resulting in the coolant spilling onto the floor or causing the coolant to be wasted. The coolant container before and after repair can be seen in the figure 5 and 6.



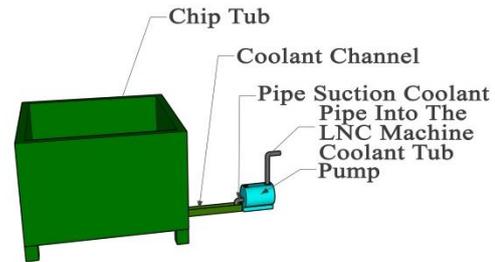
**Figure 5.** Before repair

Repair of the coolant container suggested from the author that the coolant container has not been placed under the sink / chip.

In the coolant container is given the addition of coolant channels and pumps that serve to suck the coolant so that the coolant returns to the machine LNC OKUMA 0002.

The pump has several specifications needed, namely:

1. Voltage : 220 v
2. Hz : 50 hz
3. Output Power : 125 W
4. Capacity : 10 l / minute



**Figure 6.** After repair

### 4. CONCLUSION

Production process in machining department of Production at PT. Komatsu Undercarriage Indonesia consists of several stages, from raw materials, cut according to pt standard size. Komatsu Undercarriage Indonesia uses cutting machines, than materials through drilling, turning, and boring processes. After that, the process of hardening the material through heat treatment. Than the last process is finishing, in this process the material is turned back.

Solution of leakage on coolant circulation in chip body LNC MACHINE OKUMA 0002 PT. Komatsu Undercarriage Indonesia is to add coolant lines and pumps that serve to suck the coolant to return to the LNC OKUMA 0002 engine.

The advice that can be submitted from the implementation of this research is to improve Occupational Safety Health (K3) on operators in PT. Komatsu Undercarriage Indonesia mainly in the working environment of LNC machinery area.

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