

Tool Stocked Analysis On DMU 100 Monoblock DMG Machine Spindle

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Abstract - Spindle is a tool from the CNC machine parts that is very important to the manufacture of products. The spindle works by moving the axis that has been programmed before so that it can move according to what was ordered through the program. On the Mori DMU 100 Monoblok DMG engine spindle, there are components including Drawbar, Collets, Gripper and Tools. This component is very instrumental in opening and gripping the tool. The slightest damage to the component results in damage to the product made. The damage that occurs in this machine is that tools are not released automatically from the Spindle according to the program that has been determined. Analysis is carried out to find out why the tool cannot get out of the spindle. Steps taken to determine the cause of damage is to open all components in the Spindle. From the results of the component analysis found on the spindle, there is a loose component, the counter bolt that locks the collet. This is because Collet holds the load and turns the spindle. Repair is done by resetting the counter collet bolt using liquid adhesive so that the position of the collet does not change. Spindle test results after repair shows gripping and removing tools, according to the programmed instructions.

Keywords: Spindle, Collet, Drawbar, Gripper.

I. INTRODUCTION

CNC milling machine is a machine that is controlled by a computer using numerical languages (command data with codes, numbers, letters and symbols) according to the standard. This CNC technology work system will be more synchronous between computer and mechanics, so when compared to conventional machine tools, the CNC machine tools are more precise, more precise, more flexible and suitable for use as mass production. CNC machines have two or more directional direction of the tool called the axis axis. Movement on the axis is linear (which is a straight-line motion) and circular motion (which is a circular path motion). Generally, the axes in linear motion are X, Y and Z while the axis names in circular motion are A, B and C. One of the complications of a CNC machine is how many axes it has and the interpolation movements available.

In general, the workings of CNC machine tools are not different from conventional machine tools. The function of CNC in this case is more replacing the work of operators in conventional machine tools. For example the work of setting tools or adjusting the chisel movements to the position ready to cut, cutting movements and back to the starting position and others. CNC machines are controlled in a control panel. Here are the various control panels used in CNC machines.

Based on Spindle speed, CNC machines are divided into 3 types:

1) High Speed Machining

High Speed Machining is a CNC machine that is able to operate with a spindle rotational speed above 18,000 RPM. In this type of machine, it is devoted to the shaft of light cutting, where the application is little due to the high speed when the cutter is worn on the surface of a large workpiece will cause excessive vibration on the cutter. In this type of engine the locking system commonly used is the type of HSK and shrink fit. An example is the Mori DMC 210U DMG Machine.

2) Medium Speed Machining

Medium Speed Machining merupakan mesin CNC yang mampu beroperasi 7000-10.000 RPM. Pada mesin medium speed machining sistem penguncian yang biasa dipakai adalah jenis HSK dan BT 40. Contohnya adalah mesin Deckel Maho.

3) Low Speed Machining

Low Speed Machining is a CNC machine that is able to operate with spindle speeds between 5000-7000 RPM. The low speed machining locking system used is the BT 50 type. An example is the Cincinnati Milacron Router machine

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The spindle works by means of the axis of the programmed axis so that it is able to move according to what was ordered by the operator through a program that has been adjusted.

The problem in spindles that occur in this study is that the tool cannot get out. This is because the setting of the collet is too high, causing the tool to come up, causing the gripper to grip firmly so that the tool cannot get out automatically.

This research analyzes the spindle damage on the CNC Milling CNC DMG MORI DMU 100 MONOBLOCK.

BASIC THEORY

2.1 Dmg Mori Dmu 100 Monoblok Machine

The Dmg Mori Dmu 100 Monoblok machine is a DMG machine made from Germany and has a universal 5 axis, this milling type machine has 1500 spare parts and 63 packing hits then packed into 10 cases and shipped to various countries. The function of this machine is to manufacture aircraft components of medium size as in the manufacture of Hinge Rib 4 parts for aircraft



Fig.1 Dmg Mori Dmu 100 Monoblok

Specification Dmg Mori Dmu 100 Monoblok

Control	: heidenhain
Table speed	: 30 rpm
Spindle speed	: 10,000 rpm
Table indexing	: 0,001 Deg
Tool changer type	: 60 ATC
Spindle motor (hp)	: 20.1 Hp/13.4 HP
Spindle head swivel	: 135 Deg
Spindle head nutating	: 0-90 Deg
Table weight capacity	: 2,425 Lbs
Spindle taper (cat/bt)	: Hsk-63
X – axis travel (inches)	: 49,2”

Y – axis travel (inches): 28”

Z – axis travel (inches): 28”

1.2 Spindle

Spindle is a tool from the CNC machine parts that is very important to the manufacture of products. The spindle works by means of the axis of the programmed axis so that it can move according to what was ordered by the operator through a program that has been adjusted.



Fig.2 Spindle

2.3 Drawbar

Inside a spindle there is a device called a drawbar. This drawbar serves to press the collet with hydraulic power to be able to loosen the gripper, so that the gripper can release the tool.



Fig.2 Drawbar

2.4 Collet

Collet is a tool that attaches to the drawbar, the way it works will always follow the movement of the drawbar. When the drawbar is pressed, the collet will automatically press so that it is able to release the tool automatically.



Fig.3 Laser Measuring Tool

2.5 Gripper

Where humans have a hand that can hold or move an object. Then the machine that has a hand called a gripper. This gripper serves to grab the tool that has been selected by the machine input program.



Fig.3 Gripper

2.6 Tool

Tool is a cutter cutter that is gripped by a gripper and driven by a spindle to slice the workpiece.



Fig.4 Tool

II. METHODOLOGY

The method used to analyze the spindle meshing is to use a machine maintenance procedure that is delivered by the machine manufacturer. The following is the order of disassembling the spindle on the Dmg Mori Dmu 100 Monoblok machine.

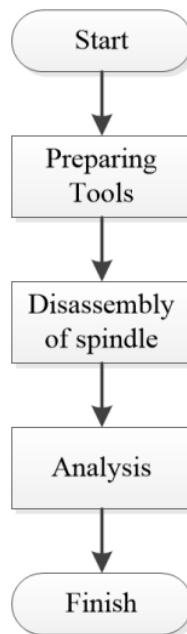


Fig.5 Flow chart Disassembly of Spindel

1) Tools Preparing

At this stage prepared tools are used to disassemble the Spindels:

- Manual operation guide
- Crane
- Tools for dismantling machines such as: wrenches, key rings, hammers, screwdrivers, pliers and others.

2) Demolition

At this stage, the spindle is demolished, which consists of dismantling:

1. Drowbar
2. Collet
3. Gripper
4. Tools

3) Analysis

At this stage, the parts that have been dismantled, examined and analyzed, such as visual, dimensional and functional mechanisms of the too

III. ANALYSIS AND RESULT

Each CNC machine is equipped with a tool called a spindle where the spindle is a tool from the CNC machine part that is very important in the manufacture of products, the spindle works by moving the pre-programmed axis so that it is able to move according to what was ordered by the operator through a program that has been adjusted.

In analyzing the spindle, it is necessary to dismantle the CNC DMG MORI DMU 100 MONOBLOCK MACHINE in the spindle section.

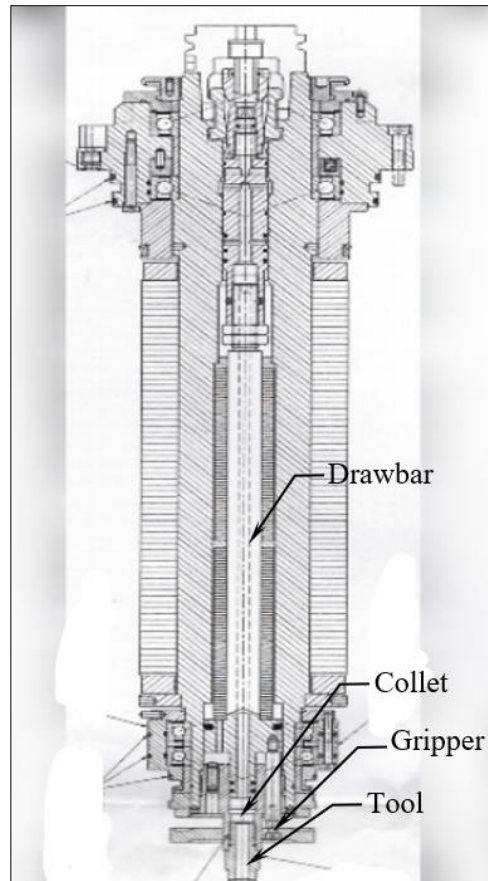


Fig.6 Sketsa Spindle

Collet is a tool that attaches to the drawbar, the way it works will always follow the movement of the drawbar, when the drawbar is pressed, the collet will automatically press so that it is able to release the tool automatically. If the collet changes in the settings, then all components contained in the spindle will also change and the performance is not optimal.

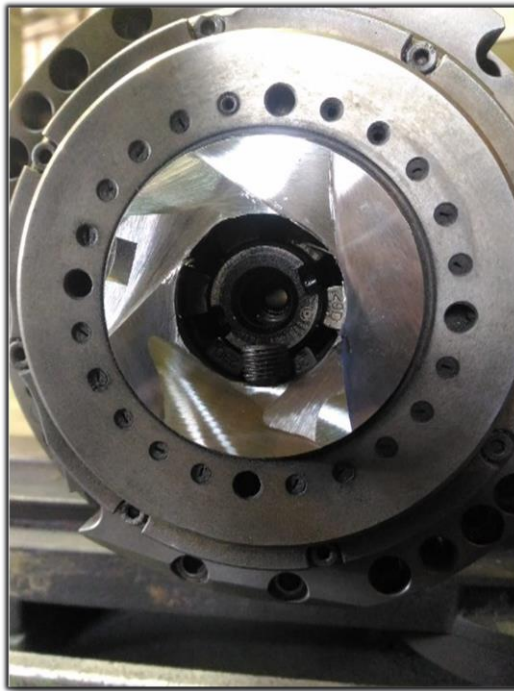


Fig.7 Collet before released



Fig.7 Collet after released

In the analysis of the Collet section it was not found damaged or changed settings. To do further analysis, it must be really the component that is damaged or found or changed setting.

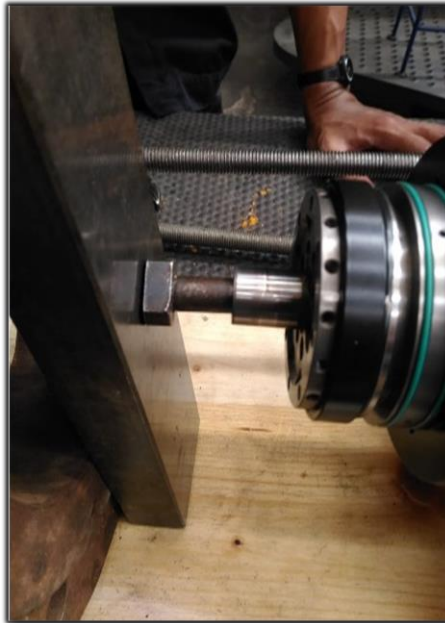


Fig.8 Collet opening process

Tool damage occurs because the tool cannot get out of the malfunction of the collet, where the command release tool has been input through the program.

The process of removing the tool is very difficult, because there is looseness of the bolt on the collet. This pushes the drowbar upward. So that the gripper grips the tool, so that the tool pulls out of the machine.

After observing the drowbar, the movement of the drowbar occurs because there is pressure from the collet. Other observations indicate that there have been changes in collet settings. Collet changes occur because there are loose counter bolts.

Analysis can be carried out after all spindle components have been removed. The steps are as follows:

- 1) Open the Hydraulic part by pressing the drowbar. The drowbar will push the collet and skal while pushing the tool, and open the gripper.



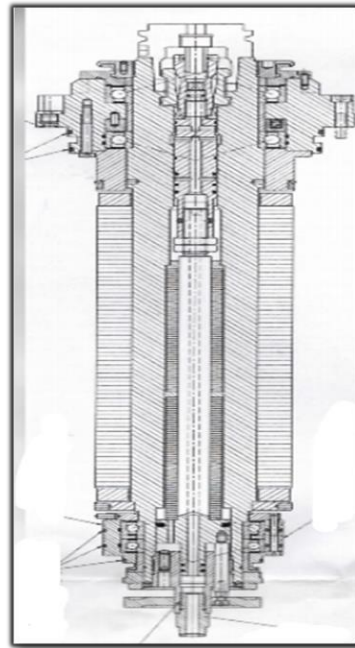


Fig.9 Pressing the drowbar

2) After this process, the tool will escape from the spindle. When the tool is released, the position of the griper remains in its original position. While the position of the collet, changes to up and locks the stick on the drowbar.

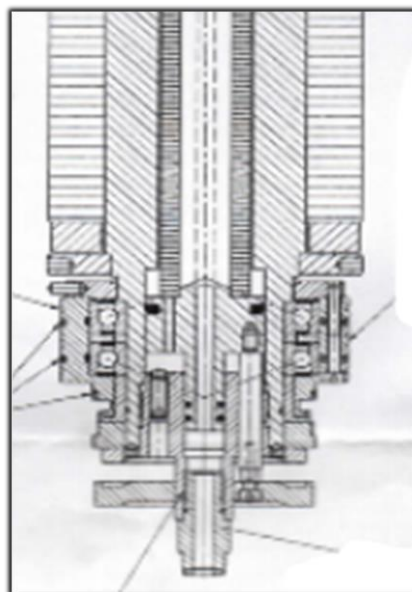


Fig.9 Position Collet

Results Analysis of the position of the collet turns up close to Rowbar, because the locking bolt (counter bolt) is released from the collet.

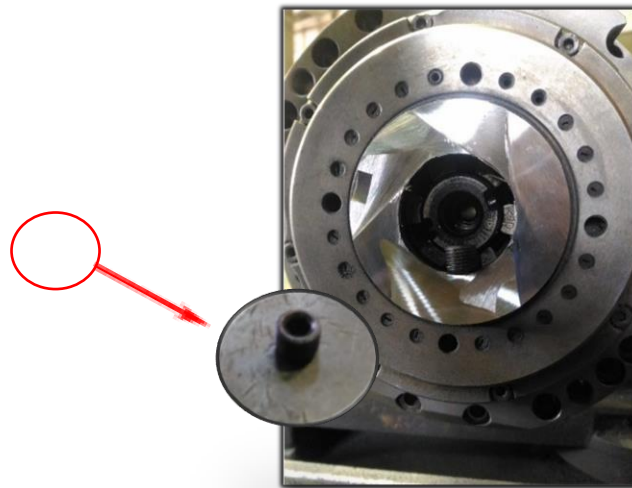


Fig.10 Position Bolt Collet

- 3) Next to replace the tool on the spindle, the collet position is set with a bolt (counter bolt) which, where the bolt was previously given liquid (adhesive glue) so that the bolt does not escape from the collet, so that the position of the collet does not change and is in accordance with machine settings.
- 4) Next, all parts (drawbar, collet, griper and tool) are reattached to the spindle. To ensure the position of the collet does not change, the spindle is tested by giving instructions (program) to the spindle machine parts, namely clem and unclem.
- 5) The test results show the spindle can release and grip the tool normally.

IV. CONCLUSION

Tool stocked on DMU 100 Monoblock DMG machine spindle due to the release of the bolt on the collet. This happens because the bolt that locks the collet's position cannot withstand the hydraulic load and spindle rotation.

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