

Making Automatic Unloading Tools on the Goodway GV-500 Machine

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Abstract

To increase profit, every company must make an improvement or innovation, both in the form of system and machine. Improvement in the machine usually by modifying the machine to be automatic, cycle time faster and revive the unused machine. In this case one form of improvement to do is reduce the handling time operator in line machining, especially in line BD6 which produces brake drum D80N. One of the machines that have a high time handling is Goodway GV – 500 machine which we an OP 4B machine in line BD 6. To reduce handling time operator on the Goodway GV - 500 machine then be made automatic unloading tool or in Japanese is called hanedashi. Hanedashi is a device mounted on the machine and automatically eject the product when the operation of the machine has been completed. Hanedashi operators do not need to carry out the process of unloading the material into the machine. With this instrument of automatic unloading, the operator handling time in Goodway GV – 500 machine has been down to 4 seconds from 12 seconds and increase the productivity of the line BD 6. With increasing line productivity BD 6 makes profit of the company increased.

Keywords: Goodway GV-500 machine, automatic unloading, handling time

1. Introduction

This object research is one of manufacturing companies that produce component/ part of automotive and non automotive. In the production process there is delay in the completion of the brake drum DB06. Line BD 6 is a place to produce this part. In this line is composed of 9 machine with 2 operators on duty to carry out the process of loading unloading material into the machine manually. Each machine has a different handling time. Handling time is the time that the operator needed to carry out the process in accordance with the machine working elements that exist in the standard work table. One of the machines that have a high time handling is Goodway GV – 500 machine that is an OP 4B machine in line BD 6. OP 4B machine is a machine that used to make the process of grooving on the part BD80N. This machine has the operator handling time by 12 seconds. To reduce the handling time operator on the Goodway GV – 500 machine then we made automatic unloading tool or in Japanese is called hanedashi. Hanedashi is a device mounted on the machine and automatically eject the product when the operation of the machine has been completed. Hanedashi operators do not need to carry out the process of unloading the material into the machine. This tool will be installed on the turret of Goodway GV – 500 machine. For the control system utilizes a CNC program by connecting the actuator this device to relay in according with the M Code in the machine. With this tool we expected to decrease handling time operator that exist on the Goodway GV – 500 machine.

2. Goodway GV – 500 Machine

Goodway GV – 500 machine is a type of turning machine that used on OP 4B in line BD 6. This machine is classified as vertical turning CNC machines. As with any other CNC machine Goodway GV - 500 used the code number / Numerical Control (with a mathematical formula) to run or operate.

Below is the position of Goodway GV – 500 machine that is an OP 4B machine in line BD 6.

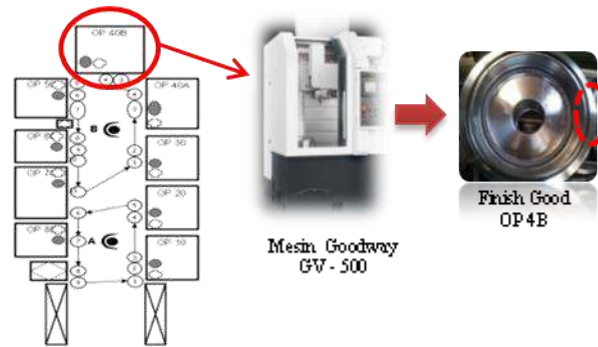


Fig. 1: Location Goodway GV-500 machine

From the picture above we can see that position Goodway GV - 500 machine contained in the OP 4B. Machining process of OP 4B machine is the process of roughing and grooving . Roughing process is performed to reduce the outer diameter of the part BD D80N. While grooving process is a process to form a groove on the part BD D80N. Groove / grooving is shown with a red mark on the image of a good result of OP 4B above. In the process of machining, this machine uses two tools mounted on the turret machine. This turret works as a tool that used in the machining process at the OP 4B and can perform a tool change according to the program. Both of tool that mounted on the turret has a different function, namely for turning and grooving process according to OP 4B machining process that has been described previously. Below is a picture of the turret on the Goodway GV - 500 machine.

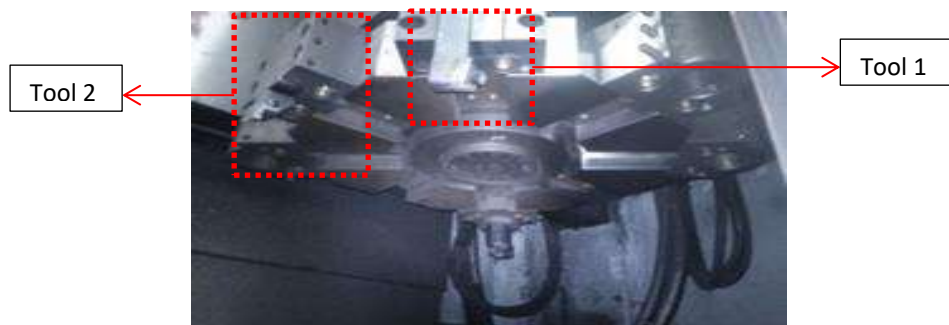


Fig. 2: Position turret in the Goodway GV-500 machine

In the picture above, there are two tools mounted on the turret machine. Tool 1 is doing the process of turning to reduce the outer dimensions BD D80N while tool 2 doing the process grooving for making grooves in the part BD80N.

3. Analystist and design

3.1. Analysis of Concepts in Goodway GV - 500 Machine

After observation of the condition of the Goodway GV 500 machine then there are two concept design for automatic unloading tool that will be installed on the machine. Here are two options automatic unloading tool concepts that will be installed of Goodway GV – 500 machine

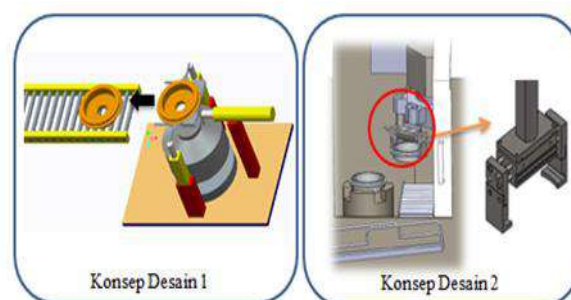


Fig. 3: Selection concepts of automatic unloading equipment

Of these two options it was decided to use the second design concept that using the gripper. The concept of the second design have been more effective and efficient than using 3 pistons. In addition to the two concepts do not need to install additional poles for mounting the piston as the gripper can be mounted on a turret, so only need to add the holder and the mounting for the gripper.

3.2. Automatic Unloading Equipment Design

Before starting the process of making the automatic unloading tool, the thing to do is do the design process. The design process is intended to facilitate the execution part and the ordering of goods. All parts are designed using Solidwork for initial design. This drawing concept is the basis in the design dimensions, the suitability of the placement of parts, and mechanical system design further. The design concept for automated unloading apparatus is shown in the following figure.

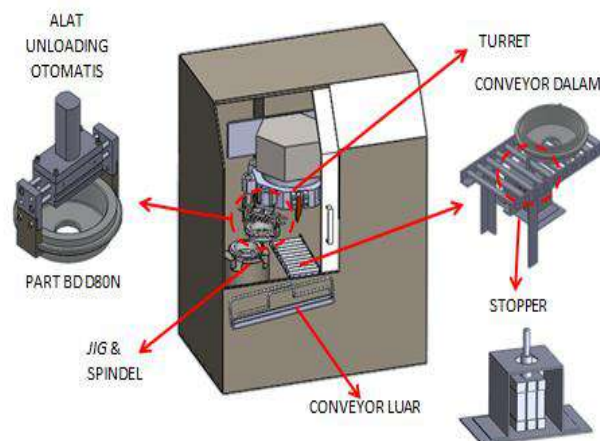


Fig. 4: Concept Design Tool Automatic Unloading

The design concept using the gripper to take part that have been fully processed. The gripper is mounted in the turret so that the movement of the gripper utilize turret movement that can move in two axes, namely X and Z. With this gripper can be closer to spare and after being right in the middle of the spindle gripper can take part and then placed on the conveyor. Before the parts can come out of the machine there is a stopper cylinder under the conveyor. This stopper works to hold the part that came out after the door was opened.

Design of the control system is divided by two: program design and wiring for installation gripper design. In designing the program, the addition of a program for automatic unloading process. Automatic unloading process will use the addition of M20 and M21 code. As for the stopper up and down the reed switch is integrated in the cylinder for auto door. To determine the improvement programs is added automatically unloading the following is a flow chart drawing program of automatic unloading process.

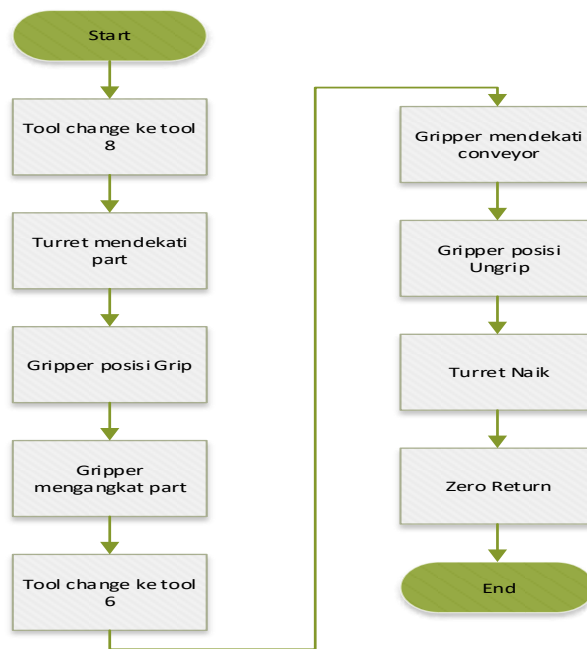


Fig. 5: Concept Design Tool Automatic Unloading

Furthermore, the design of wiring for mounting the gripper on the machine that can be activated using the program. In designing the wiring for the installation gripper done by connecting an external relay on the relay board configured with the program. For more details, here is a picture of the electrical wiring diagram for the installation of an external relay on the relay board and solenoid gripper.

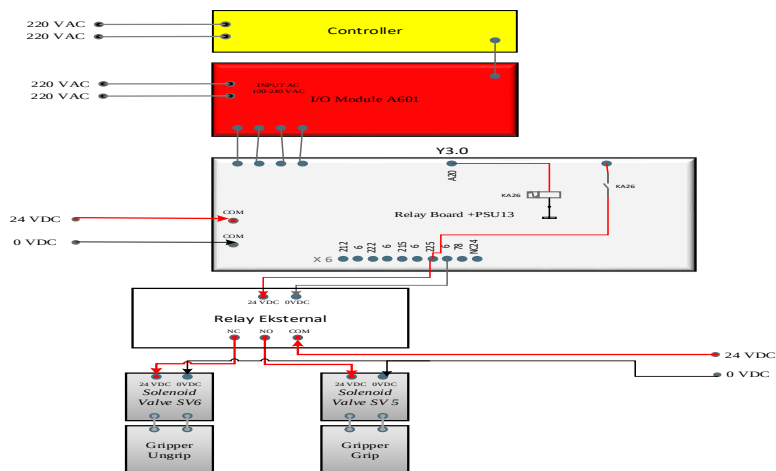


Fig. 6: Wiring diagram of external relays installation

As for the pneumatic circuit can be seen in the picture below.

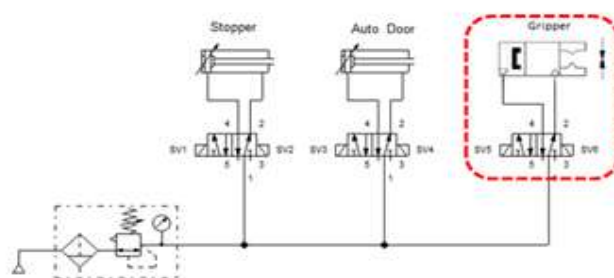


Fig. 7: Pneumatic circuit of Goodway GV -500 achine

4. Making of Control System

The control system of Goodway GV – 500 machine is Fanuc Oi TD. In making the control system is divided into two parts, that is programming and manufacturing of wiring for installation gripper. Making the program means that is making programs for automatic unloading tool is added to the machine. The program for the machining process on the machine does not change. For a detailed explanation of the program described below.

```
T0899;
T0803;
G98
G00 X0.0 Z80.0;
G00 Z30.0;
G01 Z0.0 F500;
M20;
G04 P1500;
G00 Z1500;
G28 W0.0;
G04 P3000;
T0600;
T0604;
G00 X-50.0 Z30.0;
G01 Z0.0 F500;
M21;
G00 Z1000;
G00 Z1500;
```

TOOL CHANGEKE TOOL 8
RETURN TO INTIAL LEVEL
PROSES TURRET MENDEKATI PART BRAKE DRUM
GRIPPER POSISI GRIP
PROSES GRIPPER MENGANGKAT PART BRAKE DRUM
TOOL CHANGEKE TOOL 6
PROSES GRIPPER MENDEKATI KONVEYOR
GRIPPER POSISI UNGRIP
TURRET NAK

Fig. 8: Example program automatic unloading tools in Fanuc Oi TD

Making of wiring for installation gripper performed on the relay board that exist on the machine. However, before to mounting the gripper on the relay board the installation of an external relay prior to the relay board configured with M20 and M21 program. The socket is connected to an external relay. From the external relay then connected to the gripper solenoid so that the gripper can be activated and deactivated with M20 and M21 program. Actually schematic wiring with the installation of solenoid gripper as shown in the following figure.

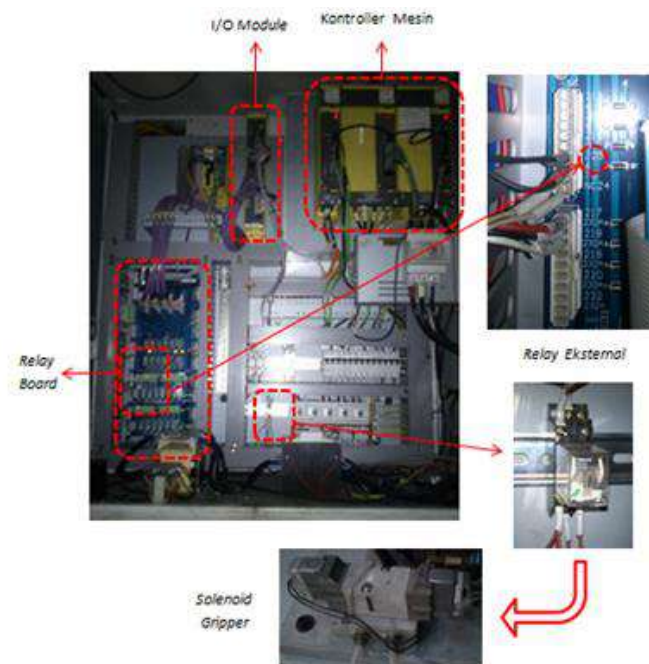


Fig. 9: Installation solenoid gripper to Fanuc Oi TD controller

5. Result of Decreased of Handling Time

The main purpose of the the automatic unloading tool is to reduce the handling time operator on the machine of Goodway GV - 500 according to the improvement plan is 6 seconds. With the automatic unloading tool operator's handling time to 4 seconds with a machining time 86 seconds. Before improvement operator handling time on this machine is 12 seconds with the machining time by 80 seconds. The following chart comparison operator handling time before and after improvement.

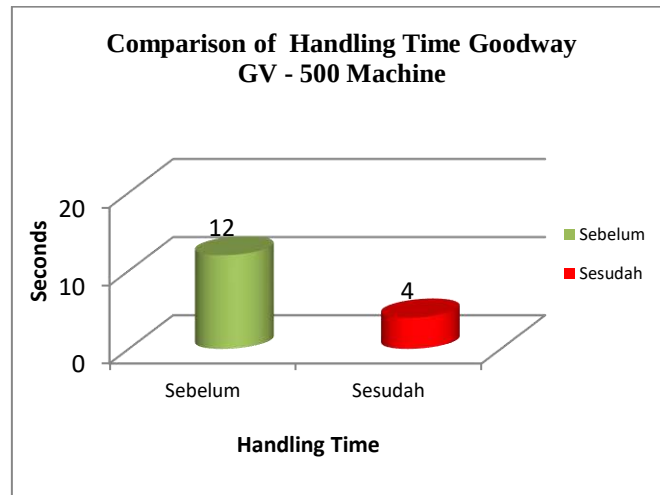


Fig. 10: Comparison of handling time Goodway GV - 500 machine

With reduced handling time of Goodway GV - 500 machine causes the cycle time of Goodway GV – 500 machine to 90 seconds from 92 seconds. The reduced cycle time, causes the number of parts produced increases of 39 pcs / hour to 40 pcs / hour.

6. Conclusion

Based on research conducted it can be concluded that in order to reduce handling time operator on the Goodway GV – 500 machine can be done by removing the elements of the operator is taking part. To eliminate the element of the work carried out improvement by making automatic unloading tool, so that part can come out automatically. The concept of automatic unloading tool is made by adding a gripper in turret machine. With the automatic unloading tool the handling time operator Goodway GV – 500 machine can be reduced from 12 seconds to 4 seconds.

7. References

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