



Implementation of Corrective Maintenance on CNC Glass Milling Machine in Glass Manufacturing Company

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DOI: https://doi.org/10.56127/ju it.v4i2.1975 Abstract: Glass milling machines are used to cut, shape, or smooth glass surfaces to be used as glasses, bowls and other household appliances. This study uses a mixed method approach by combining qualitative and quantitative methods that focus on Glass milling machines. The purpose of this research is to identify machine components and find out the maintenance standards on CNC Glass Milling Machin. The results of research show that the CNC Glass Milling Machine is specially designed to process glass with high precision. The maintenance of the CNC Glass Milling machine is scheduled to be routine 6 times every Friday and every week. Standard workbench maintenance on the machine is carried out by looking at the cleanliness of dirt or dust flakes if there is dirt cleaned using a brush as a cleaning tool, standard monitor maintenance is carried out visually by looking at the condition of the monitor screen can display parameter settings, error messages, position of object coordinates or not

Keywords: Machine, Maintenance, Standard, CNC.

1. INTRODUCTION

CNC Glass Milling CNC Glass Milling Machine is used to cut, shape, or smooth glass surfaces with high precision. According to research, milling machines for glass are different from metal milling because glass is a brittle material, so special techniques and tools are needed so they do not break or crack during processing [1]. On the other case, Maintenance is required by the machine before it is operated [2]. Milling machines if not do maintained will affect the life of the machine, the quality of the work, and operational readiness [3]. If left unattended, the machine can be quickly damaged, the finished cut is not precise, and will increase costs in the production process.

Process is a step procedure or techniques used to carry out or carry out a certain activity. Meanwhile, production is an activity that converts various inputs such as raw materials, machinery, labor, capital, and information into outputs in the form of products or services, including by-products such as waste and additional information [4]. According to Assauri, maintenance is an activity carried out to maintain and maintain factory facilities or equipment through necessary repairs and replacements, with the goal of achieving optimal production operating conditions and in accordance with planning [2].

One of the companies that uses glass milling machines is a company that focuses on the glass appliances and household appliances industry, with the main products in the form of glasses, plates, and bowls. The production process running with good management in the production system [5] where the safety of machine workers must be considered for the sustainability of the production process [6] Damage to engine components can result cutting nosame, many cracks in the glass so that the machine cannot be run and the system shuts down completely [7]. This research goal to identify machine components and find out the maintenance standards on CNC Glass Milling Machine

2. STUDI LITERATURE

According to Assauri (2004), maintenance is an activity carried out to maintain or maintain factory facilities or equipment and by carrying out a necessary repair or replacement in order to obtain a satisfactory and maximum production operation state in accordance with what is planned [2]. According to Benjamin S. Blanchard, Dinesh Verma and Elmer L. Peterson (1995), maintenance is a series of policies necessary to maintain or restore an item in an effective operational state [3].

According to Sudrajat, 2011, Maintenance itself has its types in general that maintenance can be classified as preventive Maintenance, Schedule Maintenance, Predictive Meintenance, Corrective maintenance [10]. Preventive Maintenance is a maintenance that is carried out before the engine breakdown. This maintenance is good enough to prevent unplanned engine shutdown. Maintenance Schedule This maintenance aims to prevent damage and maintenance is carried out periodically within a certain period of time. Predictive Maintenance is a maintenance that is carried out before that is carried out periodically within a certain period of time. Predictive Maintenance is a maintenance that is carried out on the basis of condition (condition based maintenance) or also called machine condition of the machine by checking the engine regularly, so that reliability and guaranteed work safety can be known.

Corrective maintenance is a maintenance and maintenance activity that is carried out after damage to the machine so that the machine cannot function properly. Corrective maintenance activities include an activity to restore the system from a damaged state to being operational again. Repairs occur when damaged, although there are some repairs that can be postponed

3. RESEARCH METHOD

This study uses a mix-method approach which is a combination of quantitative and qualitative that is descriptive in nature to describe the current treatment conditions [5]. The type of research focuses on the CNC Glass Milling Machine used by a glass household appliance manufacturing company located in Pasir Nangka Village, Tigaraksa District, Tangerang, Banten. Data collection techniques include:

- 1. Interview with a technician
- 2. Direct observation by looking at the machine maintenance process
- 3. Documentation do by collecting records of machine components, machine maintenance schedules.

The data collected is then analyzed on engine components, schedules and machine maintenance standards.

4. RESULT AND DISCUSSION

CNC Glass Milling Machine is a company engaged in the Glass Household Appliances and Appliances Industry using computer programs in the manufacture of its products [6]. shape of the cnc machine used is shown in the following picture:



Picture. 1 CNC Glass Milling Machine

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CNC Glass Milling Machine is specially designed to process holes, slots, edges, or certain shapes on glass, using a diamond tool/cutter cutting process, a coolant system to prevent cracking due to heat. High-speed spindle reaches 12,000 - 24,000 rpm. It has 3 axes with X, Y, Z axes that are deprogrammed to give commands to the machine, The operator programs the cutting path using CAD/CAM software which is converted to G-Code by the machine programming language which means to be an instruction of the direction of motion, speed, depth of the process on the machine. The glass to be processed is forged in a vacuum as a special glass clamp on the worktable, where the vacuum has a flat surface coated with soft material so that the glass does not scratch with a precision level reaching the tolerance can be as small as ± 0.01 mm. The cutting path on the x, y and z axes to perform grinding, hole drilling and profiling.

Component Identification The CNC Glass Milling Machine has completeness that includes several components as shown in the following picture:



Picture. 2 Component Identification of CNC Glass Milling Machine

CNC Glass Milling Machine has components with main functions as shown in the following table

No.	Bagian Mesin	Nama Bagian	Fungsi
1.		Control Panel	Control the CNC panel machine, check the running program and Operating CNC Milling Machine.
2.		Workbenc h	Tabel to install the work object, it can move through the X and Y axes.
3.		Spinde 1	Serves to move thecutting tool
4.		Blade	Material for cutter by axial rotary shaft
5.			
		Chuc k	Align and clamp the workpiece securely, enabling the machine to perform cutting, drilling and other machining operations with a high degree of precision and stability.
6.		Coolan t hose	Work object and cutter cooler. Usually using pressurized air and coolant water flowing through a hose attached to the spindle block.

Tabel 1 Identifikasi Komponen CNC Glass Milling Machine

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No.	Bagian Mesin	Nama Bagian	Fungsi
7.		Monitor	Used to display machine data such as parameter settings, error messages, object coordinate positions, and others

The components of the CNC Glass Milling Machine consist of a control panel component that has the function of controlling, moving, and operating the CNC milling machine. The work table component that has the function of placing the work object, can move through the X and Y axes. The spindle component that has the function of moving the cutting tool. The blade component that has the function as a material cutting tool with an axial rotating axis. The chuck component that has the function of aligning and clamping the workpiece safely, allowing the machine to carry out cutting, drilling, and other work operations with a high level of precision and stability. The coolant hose component has the function of cooling the work object and cutter. Usually using pressurized air and coolant water that flows through a hose attached to the spindle block. The monitor component functions to display machine data such as parameter settings, error messages, object coordinate positions, and others.

CNC Milling Machine Maintenance is an activity carried out to maintain or guard factory machines by making repairs or replacements as needed to obtain a satisfactory and maximum production operation condition according to what is planned [2][7]. CNC milling machine maintenance uses a preventive maintenance system and corrective maintenance. By doing good maintenance, [8] CNC milling machines are ready and can work optimally when needed for short or long periods of time.

Preventive Maintenance Schedule on CNC milling machines is carried out daily, weekly, monthly, and annually by workers according to the established maintenance schedule [9]. The following is a preventive maintenance schedule on CNC milling machines.

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Keterangan															
H: Perawatan Harian															
M: Perawatan Mingguan															

Figure 3 CNC Milling Machine Maintenance Schedule

Maintenance scheduling on the CNC milling machine is carried out 6 times a month. Machine maintenance is scheduled in the brown column which shows the frequency of maintenance every Monday. The blue column shows maintenance on Friday. The maintenance carried out includes checking the components of the CNC milling machine. Each component on the CNC milling machine such as the control panel, work table, spindle and chuck is cleaned from the remaining dust flakes with a special brush, and the spindle and chuck parts are lubricated so that they do not wear out and the collant hose is checked on the hose to ensure there are no leaks and replace the fluid in the collant hose so that the machine is ready to use according to the production schedule.

Preventive Maintenance Standards on CNC Glass Milling Machines where Preventive maintenance is a routine maintenance and care activity to prevent damage to the machine[10][11][12]. CNC Milling Machine Maintenance Standards are carried out following existing machine maintenance standards as shown in Table 3 CNC Milling Machine Maintenance Standards.

No	Komponen	Method	Standar Perawatan				
1	Workbench	Visual/Touch	Checking the condition of the work table on the				
			machine and cleaning the work table from dirt or dust				
			particles using a brush or cleaning tool				
	spindel	Visual/Touch	Check the spindle condition and clean the spindle with				
2			low pressure air to remove dust and debris and ensure				
			the spindle lubricant is at the proper level.				
3 Bla	Plada	Vigual/Touch	Check the condition of the blade before and after each				
	Diade	v isuai/10uch	use and replace any worn or damaged blades.				
4	Chuck	Visual/Touch	Check the condition of the chuck grip and locking				
			mechanism and provide appropriate lubrication				
	Collant	Visual/Touch	Check the condition to ensure there are no leaks or				
5	hose		cracks and replace the coolant regularly according to				
			factory standards.				
	Control panel	Visual/Touch	Regular condition checks and cleaning of buttons and				
6			switches as well as checking connectors and cables				
			connected to the control panel.				
	Monitor	Visual/Touch	Checking the condition of the monitor and cleaning the				
7			screen as well as checking the cables and ports				
			connected to the monitor.				

Table 2 CNC Milling Machine Maintenance Standards

Each component is considered according to its respective maintenance and also its cleanliness is observed, such as cleaning leftover materials, dust and dirt so that it does not hinder machine performance and the machine can run well during the production process.

5. CONCLUSION

Based on the results of the discussion and analysis that have been carried out previously, it is concluded that :

1. CNC Glass Milling Machine CNC machines are specially designed to process holes, slots, edges, or certain shapes on glass, have the main components of the control panel,

Work table, spindle, blade, chuck, Collant hose, Monitor. Work table components for mounting work objects, Spindle components for moving cutting tools, while the Monitor components function to display parameter settings, error messages, object coordinate positions.

2. CNC Glass Milling machine maintenance is scheduled 6 times a month and 1 time a week routinely carried out every Friday. The standard workbench maintenance is carried out by looking at the cleanliness of the workbench from dirt or dust flakes if there is dirt the workbench is cleaned using a brush as a cleaning tool, the standard monitor maintenance is carried out visually by looking at the condition of the monitor screen can display parameter settings, error messages, object coordinate positions or not.

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