ANALYSIS OF ACIERA F3 AND ACIERA F4 MILLING MACHINE CONDITIONS MEDAN STATE POLYTECHNIC MECHANICAL WORKSHOP.

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ABSTRACT Machine tools are the main machines and are indispensable for the engineering industry to producehigh-qualityy machine and equipment components. In the mechanical workshop of the Medan State Polytechnic, apart from being used for student practicum activities, machine tools are also used to produce machine components ordered by several industries and factories around the city of Medan. This study aims to determine the feasibility of the Frais Aciera F3 and F4 machines by examining the main components and measuring their geometric accuracy, whether they still comply with the recommended standards and whether they are still suitable for use. The method used is to measure each component or part that is directly related to its main movements. The result data from the measurement is processed and compared with the reference from the standard. The activity begins with preparing the machine to be tested in static conditions, standard and precise tools and measuring instruments. The results of the inspection found that the components of the F3 and F4 milling machines were lacking, incomplete, sacked and some components were missing. The accuracy of the machine was still within the permissible standard limits.

KEY WORDS Machine tools, milling machines, conditions, feasibility

INTRODUCTION

Machine tools are the main machines and are indispensable for the engineering industry to produce high-quality machine and equipment components. In the mechanical workshop of the Medan State Polytechnic, apart from being used for student practicum activities, machine tools are also used to produce machine components ordered by several industries and factories around the city of Medan. The types of precision machine tools found in mechanical workshops are Lathes, Milling, and Grinding machines, which are more than 30 years old. In such a long period of machine usage, of course, there has been a decrease in quality (accuracy and precision). Meanwhile, to produce quality machine and equipment components, the quality of these machine tools must be maintained.

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One of the machine tools found in the Polmed mechanical workshop is a milling machine, where the time to use this machine is quite long, starting from 1983 until now with an average operating time of 8 hours per day and these machines have never been used. special quality inspection. Based on observations, the current condition of the machine has experienced degradation or a decrease in quality. Some of these machines are not functioning properly, which is around 40-50% of the existing number. While the rest can still be operated with precision and accuracy which has decreased due to heavy use and workload. This kind of machine condition greatly affects the geometric quality of the product produced.

To find out how far there has been a decrease in the geometric quality of the machine tool, it is necessary to test the geometric accuracy of the machine tool and the necessary corrective actions for the milling machine. To find out the extent of accuracyowned by the machine, it is necessary to carry out a test on the machine. (Bagiasna, Komang, 1999)

The test to be carried out aims to analyze the conditions and find out the geometric accuracy deviations that occur in the Aciera F3 and Aciera F4 milling machines. The purpose of this test is not to accurately find the cause of storage that occurs but to analyze globally from the results of observations and measurements. Therefore the test methods to be carried out are interrelated with one another. The desired result of this study is to determine the condition of the machines in general and the feasibility of these machines after being used for quite a long time.

METHODOLOGY

The research begins by examining and collecting the condition of the machine by grouping machines that are still functioning for testing. Furthermore, geometric testing using equipment that has been prepared. Tests that will be carried out include, alignment of the machine base and table, alignment of the sloping motion, alignment of the motion of the head off, the deviation of the main spindle, and other major components, then proceed with data processing and analysis. The final stage is to get a conclusion.

1. Research Subjects

Based on the problems studied, the model and type of this study use a method survey in the field to get data on machine conditions at the Polmed Mechanical Engineering workshop. Next, do the inspection using the inspection form and test machines using standard inspection equipment.

2. Research Design.

This study uses a qualitative approach in the form of evaluation using a direct approach that aims to maintain the integrity of the object of research. The collected data is studied as a single unit whose purpose is to develop in depth knowledge of the object under study. The data obtained in this study is data that is directly obtained from the object of the implementation of this research, which is testing the measurement of geometric accuracy and analyzing the condition of the lathe. Observations in this study by measuring the main part of the machine.

3. Research Samples.

The research sample is 4 units of Milling Machine Aciera F3 and F4 made in Switzerland. This sampling is under the condition of the machine that has been used for quite a long time since 1983.

LITERATURE REVIEW

1. Definition of Machine Tools

Machine tools are a combination group or arrangement of various parts of machine elements, each of which has a specific function. What is meant by these machine tools are turning, milling, scrap machine or planer machine, cylindrical and flat grinders, and other machine tools whose function is to form machine component products. These machine tools also function as forming various components of industrial equipment where these components will later be assembled or assembled.

Milling Machine

A milling machine or milling machine is one of the machine tools with a rotating main motion designed for various purposes, with the working principle of rotating chisels and feeding the workpiece. Some types of milling machines are used solely for work in production, while others are used for multi-purpose purposes. (Joshi, 2007)

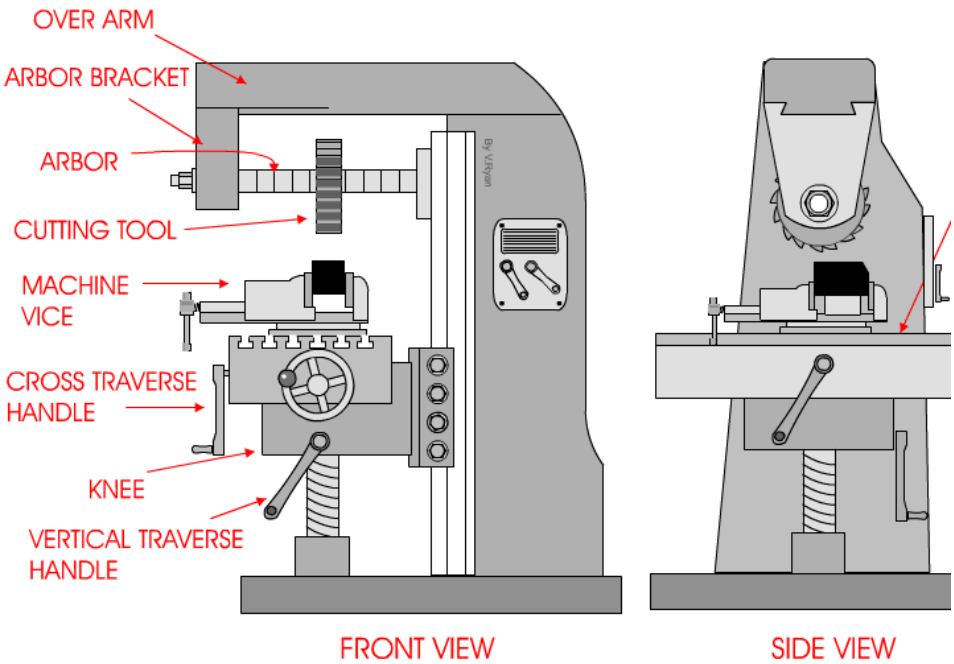

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Figure 1. Horizontal Milling Machine

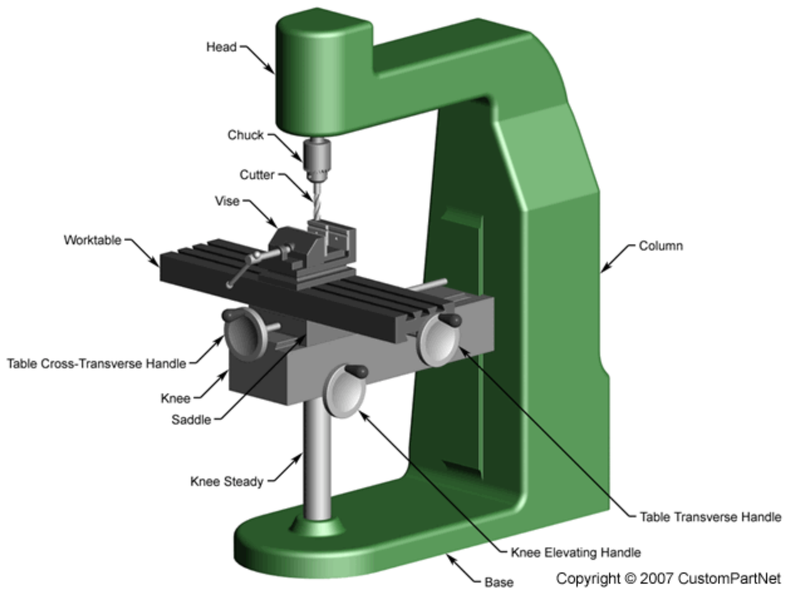

Figure 2. Verical Milling Machine

2. Machine Tool Accuracy Test

The accuracy of a machine tool is generally defined with respect to the errors involved in the movement of positioning axes. The errors are defined as the geometric deviations of actual positions from their ideal ones of a machine component along its axis of motion. (Steven Y. Liang, Albert J. Shih, 2016). The machine components produced by the machining process have certain qualities that can be seen from the accuracy of the dimensions, the accuracy of the shape, and the smoothness of the surface of the component. Accuracy deviations can cause components to be imperfect, it can be seen from the size and surface smoothness of the components that are not under the desired design. The differences in the components produced are closely related to the accuracy conditions on the machine tools that make up the components with incisions. Differences in accuracy on machine tools can be known through a true and appropriate test. The power, precision, accuracy, and speed of a machine tool largely affect the quality and cost of the produced parts and products. Designers have to consider the latitude of factors including dimensions, material, configuration, and power source of the machines in order to deliver the functionality demanded by the users. Advances in machine tool design and fabrication philosophy are quickly eliminating the differences among machine types. Fifty years ago, most machine tools had a single function such as drilling or turning, and operated alone. With the addition of automatic turrets, tool changers, and CNC systems, lathes become turning centers and milling machines become machining centers. Turning centers can also become machining centers with the addition of live or powered tool spindles in addition to the traditional single-point tools. These multiprocess centers can perform all the standard machining functions: turning, milling, boring, drilling, and even grinding. (Liang, S.Y., Shih, A.J. 2016)

This section described matters relating to the process of testing the geometric accuracy of conventional machine tools. As most machine tool users know, the concept of machine tool geometric accuracy has been around for a long time. To determine the geometric accuracy of a machine tool, it is necessary to test it according to existing procedures. Improvements to this procedure have been carried out since 1901 by Schlesinger in an attempt to produce a standard of suitability for machine tools. Various machine inspection procedures have been recognized by all users and machine manufacturers and the International Standards Organization (ISO) is the standard guide.

3. Machine Tool Precision

The precision of the machine is the accuracy of the main parts of the machine and its components. A machine is composed of several parts that have several geometric shapes, so the precision of the fundamental measurements of the machine elements is very important, for example, the flatness and straightness of the guide surfaces, the position or alignment of the gripping parts, and parallelism. from the axes to the guides, the perpendicularity of the main axis to the gripping surface on the machine table, and so on. Matching with the static accuracy of the manufacturing and assembly processes of machine parts and several points on the machine becomes the static precision of the machine. This is called geometric accuracy. The geometric accuracy of the machine is the precision of the shape and position of each part. Determination of the geometric quality of conventional machine tools can be done by testing the geometric quality of machine tools according to ISO 1708. standard

4. Machine Tool Geometric Testing

Geometric testing of machine tools is intended to test the dimensions and shape and position of machine components between one another, for example, perpendicularity between two planes, parallel between two movements, parallel between two planes, and others. Geometric testing of a machine tool can be divided into three classifications of accuracy being tested, including:

a) Machine tool geometric accuracy (manufacturing accuracy), which is how much the actual
(measured) size of the machine in an unloaded state approaches a certain standard size.

b) The geometric accuracy of dynamic machine tools (working accuracy), which is a measure that can be measured from the machine in a state of load or a working state approaching a certain standard size.

c) Geometric accuracy of the machine work (performance accuracy), namely the size of the geometric workpiece produced by the machine against a certain standard size.

Findings & Discussion

The data source obtained in this study is prima obtained directly from the research object, which is checking the condition of the main parts of the machine and testing the measurement of geometric accuracy on the Milling Machine F3 and F4 in the Polmed Mechanical Workshop. Data on the results of the lathe reliability condition are shown in the following tables 1 and 2:

Table 1. Data on the reliability conditions of Milling Machine F3

No	Nama Bagian	Nomor Mesin 362.1.··				
		01	02	03	04	Gambar dan Keteran
1	Spindle Motor	B	B	B	B	 
2	Coolant Pump	K	K	K	K	
3	Longitudinal Feedbox	B	B	K	K	
4	Horisontal Headstock	B	B	K	B	
5	Vertical Milling Head	B	B	K	B	
6	Fixed Angular Table	B	B	B	B	
7	Starting Up Machine	B	B	K	K	
8	Seection and Control Panel	K	K	B	B	
9	Manual Transfer of Head	B	B	K	K	
10	Manual Transfer of Longitudinal Slide	B	B	T	T	
11	Control of Longitudinal Power Feed	T	T	T	T	
12	Chip pan	B	B	B	B	
13	Lamp	T	T	T	T	

Remark: B: Good, K: Less, T: None, R: Damage

Table 2. Data on the percentage condition of the components and completeness of the F3 milling machine

Machine	Machine No.01		Machine No.02		Machine No.03		Machine No.04	
Condition	Number of Components	%	Number of Components	%	Number of Components	%	Number of Components	%
Good	9	69.23	9	69.23	4	30.76	6	46.15
Less	2	15.30	2	15.30	6	46.60	4	30.75
Damaged	0	0.00	0	0.00	0	0.00	0	0.00
None	2	15.30	2	15.30	3	23.0	3	23.00

1. Analysis of the Reliability Conditions of Aciera F3.

From the table and graph above for machine no.1, good components were 9 (69.23%), 2 components were less (15.30%), and 2 components were none (15.30%). For machine no.2, good components 9 (69.23%), 2 components were less (15.30%), and 2 components were none (15.30%). For Machine no.3 good components 4 (30.76 %), 6 components were less (46.60 %), and 3 components (23.14%) were none. For Machine no. 4 good component 6 (46.15%), 4 components were less (30.75%) and 3 components (23.14%) were none.

Table 3. Data on the reliability conditions of Milling Machine F4

Parts Name	**Machine No 362.1.··**				
	01	**02**	**03**	**04**	machine image
Spindle Motor	B	B	B	B	
Coolant Pump	K	K	K	K	
Over arm Support	B	B	B	B	
Spindle	B	B	B	B	
Vertical Milling Head	B	B	B	K	
Fixed Angular Table	B	B	B	B	
Starting Up Machine	B	B	B	K	
Selection and Control Panel	B	B	B	K	
Manual Transfer of Head	B	B	B	K	
Manual Transfer of Longitudinal Slide	B	B	B	B	
Manual Transfer of Vertical Slide	B	B	B	B	
Control of Longitudinal Power Feed	B	B	B	B	
Coolant Hose	B	B	B	B	
Quick Up Sadle	T	T	T	K	Milling Machine F4

Remark: B: Good, K: Less, T: None, R: Damage

Table 4. Data on the percentage condition of the components and completeness
of the F4 milling machine

Machine	Machine No.01		Machine No.02		Machine No.03		Machine No.04	
Condition	Number of Components	%	Number of Components	%	Number of Components	%	Number of Components	%
Good	12	85.71	12	85.71	12	85.71	9	64.28
Less	1	7.143	1	7.143	1	7.143	5	35.71
Damaged	0	0	0	0	0	7.143	0	0.00
None	1	7.143	1	7.143	1	7.143	0	7.143

2. Analysis of the Reliability Conditions of Aciera F4.

From the table and graph above for machine no.1, good components were 12 (85.71%), 1components was less (7.143%), and 1 component was none (7.143%). For machine no.2, good components were 12 (85.71%), 1 component was less (7.143%), and 1 component was none (7.143%). For Machine no.3 good components were 12 (85.71%), 1 component was less (7.143%), and 1 component was damaged (7.143%), For Machine no.4 good components were 9 (64.28%), 5 components was less (35.71%)

3. Geometric Test

The geometric test is carried out on surface alignment with fixed head movement and surface alignment with longitudinal movement. The data and geometric test results can be seen in the following table and graph

Figure 3. Surface alignment with longitudinal motion

Figure 4. Alignment of the moving surfaces

Table 4. Geometric test machine table F4

No	check the description of the position of the machine components	Mechine Number 362.1.··				
		01	02	03	04	Permissible
1	Surface alignment with longitudinal motion	0.02	0.02	0.015	0.025	0.02
2	The axis of the spindle rotation to the table	0.02	0.02	0.025	0.003	0.02

CONCLUSION From the results of examining the condition of the Aciera F3 and F4 milling machines some conclusions and suggestions can be drawn, namely:

1. The physical condition of the machine is still good and can be used for student practicum activities, but some of the supporting components are not functioning and are missing. Aciera F3 milling machine condition is at the level of 75% due to lack of maintenance.
2. For the Aciera F4 milling machine, the condition of the main parts of the machine is generally still good, but the supporting equipment needs to be repaired, especially the coolant pump and other equipment
3. Of the 4 units of aciera milling machines, there is 1 machine that needs to be repaired or specially equipped, namely machine no.04
4. The position (level position) of the machine needs to be reset

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