



Comparison of Auto Cutting and Semi Auto Cutting Work Systems on Wire Quality Achievement

Final Project

By:
Maria Oktaviani C.P (3221901013)

**Electronics Manufacturing Engineering Study Program
Electrical Engineering Department
Polytechnic Negeri Batam
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Statement Of Originality Of Final Project

I, the undersigned, declare that the contents of part or all of my Final Project entitled: "Comparison of Auto Cutting and Semi Auto Cutting Work Systems on Wire Quality Achievements" is the result of my own work, completed without using unauthorized materials, and is not a the work of another party that I acknowledge as my own work. All references cited or referenced have been written in full in the bibliography. If it turns out that my statement is not true, I am willing to accept sanctions in accordance with applicable regulations.

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Maria Oktaviani Christina. P

NIM: 3221901013

Approval

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By :

Maria Oktaviani C.P (3221901013)

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approved by :

Diono., S. Tr. T., M. Tr.T
NIK:

Muhammad Arifin, S. Si., M.Si
NIK: 116161



Budiana., S.Si., M.Si
NIK:



Comparison of Auto Cutting and Semi Auto Cutting Work Systems on Wire Quality Achievement

Maria Oktaviani Christina. P

* Batam Polytechnics

Electrical Engineering study Program

Parkway Street, Batam Centre, Batam 29461, Indonesia

E-mail: bppm@polibatam.ac.id

Batam Polytechnics

Informatics Study Program

Parkway Street, Batam Centre, Batam 29461, Indonesia

E-mail: jurnalintegrasi@yahoo.com

Abstract

Cutting process is the process of cutting cables accompanied by inner or not inner, which this process must be in accordance with the drawing guidelines that have been determined by the company. In the cutting process, there are 2 cutting machines, namely an auto cutting machine and a semi auto cutting machine. This study aims to compare the results of the performance of auto and semi auto cutting on the achievement of wire quality in wire harness production.

The statistical tests used were the F test and the Gage Repeatability and Reproducibility (GR & R) test to see the significance of the work performance of the Auto Cutting Machine and the Semi Auto Cutting Machine. The results of the efforts made by the author regarding the analysis carried out can be explained that it is the cutting machine that gets better cutting results while the semi-auto cutting machine still needs improvement.

Keywords: Cutting Auto, Wire, GR&R, Uji F

1. Introduction

Chapter 1. Production

1.1. Background

Companies operating in the field of electronics manufacturing, especially wire harness assembly, carry out production using one of the processes, namely the cutting process. The cutting process is the process of cutting the cable. In this process, 2 machines are used, namely an auto cutting machine and a semi-auto cutting machine. [6][7]

An auto cutting machine is a wire (cable) cutting machine according to specifications, where on this machine the wire (cable) is cut then stripped after that it will be crimped automatically, namely providing the terminal directly [1]. while a semi-auto cutting machine is a wire (cable) cutting machine which is only for cable cutting and stripping, it does not include providing terminals or the crimping process therein [1].

The machine used has advantages and disadvantages in the cable cutting process. The auto cutting machine has the advantage that after cutting, the cable will automatically be given a terminal. Meanwhile, the disadvantage of this machine is that it rejects the terminal. And semi-auto cutting machines have advantages and disadvantages in the cable cutting process. Semi-auto cutting machines do not have any advantages because this machine has many disadvantages, namely cable overlengths often occur.[1]

To provide recommendations and determine the continued existence of the use of an auto cutting machine in terms of work performance and effectiveness of machine operation, in this research a comparison of the performance results of auto and semi auto cutting will be carried out on the wire quality achievements in wire harness production.

1.2. Formulation of the problem

Based on the description of the background above, the author formulates and examines the problems that occur as follows:

1. What are the results of the comparison of the work performance of auto cutting and semi auto cutting on the quality of the wire produced?

1.3. Objective

The aim of this final project is to compare cutting performance results

auto and semi auto to achieve wire quality in wire harness production

1.4. Benefit

General Instructions

CHAPTER 2. Literature Review

Companies operating in the field of electronics manufacturing, especially wire harness assembly, carry out production using one of the processes, namely the cutting process. The cutting process is the process of cutting the cable. In this process, 2 machines are used, namely an auto cutting machine and a semi-auto cutting machine. [6][7]

1.1. Process Cable Cutting

The process of cutting cables with inner or no inner, this process must be in accordance with the

2.2 The tools used

1.1.1. Machine Cutting Auto

An auto cutting machine is a wire (cable) cutting machine according to specifications, where on this machine the wire (cable) is cut then stripped after that it will be crimped automatically, namely providing the terminal directly [1]. Auto cutting machine is shown in figure 2.2 [6]

1.1.2. Machine Cutting Semi auto

A semi-auto cutting machine is a wire (cable) cutting machine figure 2.3 [7]

The system that the author will create will have several benefits. The author explains the benefits of the project that will be created:

1. As an initial evaluation that can provide recommendations for the continued existence of machine use.

1.5. Limitation

The problem limitations that exist in this system are as follows:

1. Research using auto cutting and semi auto cutting machines
2. The research only uses samples with AWG 18 type cable

drawing guidelines determined by the company [1][8]. In this company there are 2 cutting machines, namely a semi-auto cutting machine and an auto cutting machine. The cable cutting process is shown in figure 2.1.

Figure 2.1 cable cutting process



The tools used to carry out the cable cutting process are:



figure 2.2 machine cutting auto machine which is only for cable cutting and stripping, not including terminals or the crimping process therein [1]. Semi auto cutting machine is shown in



Gambar 2.3 Machine Cutting Semi Auto

1.2. Types of cables

Cables are a tool used to transmit signals from one place to another [2]. There are various types of cables in companies, such as the following.

1.2.1. Cable type 22-001138-89

One type of cable used in companies, this cable has a size of 18 AWG. Where AWG is the abbreviation for American Wire Guide, which is the standard cable size which is measured in mm (millimeters) [3]. This cable is

1.2.2. Cable type 22-01138-164

One type of cable used in companies, this cable also has a size of 18 AWG. This cable is also usually used for the assembly process and then sent to the subcont. Different from the previous cable type, cable 22-01138-164 has a blue color. An example of a cable drawing 22-01138-164 is shown in figure 2.5.

1.3. Standard wire quality parameters

There are standard parameters for wire, where these standards have tolerances. However, in this case it

1.3.1. Cable Over Length

This is a defect in the cable, namely a condition where the cable length exceeds the provisions stated in the drawing [1]. An example of the results of cutting cable over length is shown in figure 2.6.

1.3.2. Cable Short Length

It is a defect in the cable, namely a condition where the cable length is less than the required provisions stated in the drawing [1]. An example of the results of cutting a short length cable is shown in figure 2.7.

1.4. test

The F test is a statistical test method used to compare two or more data objects, where each object or data is tested repeatedly to determine the size of the variance. [4][9]

usually used for the assembly process and then sent to the subcont. This cable is characterized by a white color. An example image of cable 22-01138-89 is shown in figure 2.4.

Figure 2.4 cable 22-01138-89



Figure 2.5 Cable 22-01138-164



can occur outside of tolerance, resulting in defects in the cable such as:



figure 2.6 cable over length



Figure 2.7 cable short length

- F Test data collection: Collect 30 samples.
- Choose 3 different operators
- Each operator takes measurements 3 times using the same method

In this study, measurements were carried out using a meter and a ruler, the units of measurement were centimeters.

In determining the f test, there is a formula which is as follows:

$$F = \frac{R^2 / (n-1)}{(1-R^2) / (n-k)}$$

Notes :

R2 = Coefficient of determination

n = Number of data

k = Number of independent variable

2.5. Gage R&R

It is a statistical test method used to determine the magnitude of variation in measurement data due to the measurement system. It then compares the measurement variation with the total observed variability, consequently determining the capability of the measurement system. [5][10] Measurement variation consists of two important factors, namely repeatability and reproducibility. Repeatability due to equipment variations and reproducibility due to operator variations.

Gage R&R can be known:

1. The number of measurement system variations compared to process variations.

2. The amount of variation in the measurement system caused by operator influence.

3. The ability of the measurement system to distinguish between different parts.

Gr&R data collection:

1. Collect 30 samples.

2. Choose 3 different operators

3. Each operator takes measurements 3 times using the same method.

4. In this study, measurements were carried out using a tape measure and ruler, the units of measurement were centimeter

2.5.1. Formula from Gr&R

1. Determine the average range using the equation

$$R = \frac{R_1 + R_2 + \dots + R_R}{n}$$

2. Determine the difference between the maximum and minimum averages using the equation

$$\bar{X}_{diff} = \bar{X}_{max} - \bar{X}_{min}$$

3. Notes :

R = Distance

\bar{R} = Average range X = Average range

\bar{X} = Average of averages

Variations in measurement systems can be calculated. There are three that need to be calculated:

Repetition (Equipment Variation)

Repeatability is a variation of repeating measurements on the same part and the same characteristics, and carrying out measurements 3 times. The calculations are given below:

$$r = K_1 \times$$

Where K1 is a constant that depends on the number

1. Reproducibility (Rater Variation)

Variation between operators is called reproducibility.

Reproducibility can be achieved by averaging

$$R = \sqrt{(\bar{X}_{diff} \times K_2)} - \left(\frac{r^2}{n \times t} \right)$$

Where K2 is a constant that depends on the number

of trial

measurements made by several different operators when measuring the same samples and parts. Below is the formula for measuring reproducibility:

of evaluators

$$GRR = \sqrt{r^2 + R^2}$$

<10% = Capable

10-30% = Conditionally Capable

30% = Unacceptable and needs to be corrected

2. Combine the two to determine GRR

This research examines data in receiving measurement results as well as variations caused by operators or measuring devices. The standard percentage of total Gr&R received is as follows:

3. Style Guidelines and Topics

Chapter 3. Implementation Method

The design of this system is as follows:

1. Study literature.

Literature study is looking for theoretical references that are relevant to the cases or problems found.

2. Machine operation by adjusting parameters according to the drawing

Before starting the process, production must adjust the parameters according to the specifications in the drawing.

3. Measurement & Inspection

Carry out measurements and inspections according to drawing references

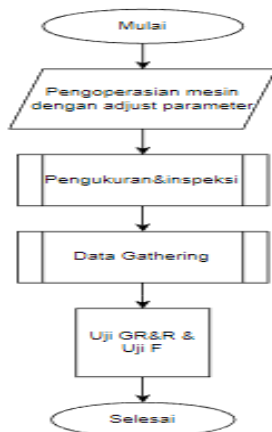
4. use a meter.

5. Data gathering

Collect data from measurement and inspection results.

6. Statistical tests use the GR and R tests & F tests

Using GR&R to see working OEE.



3.1.1. Working Steps on an Auto Cutting Machine

An auto cutting machine is a wire (cable) cutting machine according to specifications, where on this machine the wire (cable) is cut then stripped after that it will be crimped automatically, namely providing the

3.1.2. Working Steps on a Semi Auto Cutting Machine

It is a wire (cable) cutting machine which is only for cable cutting and stripping, does not include providing terminals or the crimping process therein [1]. In contrast to auto cutting machines, this machine does not have any advantages so that production

terminal directly [1]. This machine has the advantage that it is equipped with a terminal for the crimping process, the number of cable production is greater, because of these advantages the production results from the auto cutting machine are better and the reject results can be minimized, because of these advantages I would recommend that in the future the cable cutting process uses a machine auto cutting.

The following includes the working steps on an auto cutting machine as follow

1. Turn on the machine that is connected to a socket or electric current source in the company.
2. After that, set the machine starting from the length of the cable to be cut, the inner length of the cable and the terminal that will be used based on the drawing reference.
3. Cut the cable and inner parts based on the drawing in 5 quantities as samples for checking first by the company's quality control.
4. After being declared to meet the requirements by quality control, the cable cutting process continues.
5. An example of an image of the cable cutting process on an auto cutting machine is shown in figure 3.2



Figure 3.2 Cable cutting process on an auto cutting machine

results and rejects are high. The following includes the working steps on a semi-auto cutting machine:

1. Turn on the machine that is connected to a socket or current source
2. After that, set the machine starting from the length of the cable to be cut, the inner length of the cable based on the drawing. There is a difference in the way

this machine works with an auto cutting machine, namely that this machine only carries out the cable cutting process, excluding the process of providing terminals (crimping).

3. Cut the cable and inner parts based on the drawing, 5 pieces as samples for checking first by the company's quality control.

4. After being declared to meet the requirements by quality control, the cable cutting process continues.

3.2. Testing

There are several testing techniques carried out, namely as follows:

1. Number of samples taken.
2. This research will take 30 samples each
3. Parameters to be measured.

In the research, there are parameters that will be

Chapter 4. Results and Discussion

This research is quantitative in nature where the data produced will be in the form of numbers. From the data obtained, analysis was carried out using the F test and GR&R test. This research aims to compare the performance results of auto and semi-auto cutting

4.1. Analysis Results

4.1.1. GR&R Test

It is a statistical test method used to determine the magnitude of variation in measurement data due to the measurement system. It then compares the measurement variation with the total observed variability, consequently determining the capability of the measurement system. [5][10] Measurement variation consists of two important factors, namely repeatability and reproducibility. Repeatability due to equipment variations and reproducibility due to operator variations. Gage R&R can be known:

3. Each operator takes measurements 3 times using
- In this study, measurements were carried out using a tape measure and ruler, the units of measurement were centimeters.

Formula from GR&R

- Determine the average reach using the equation:

An example of a cable cutting process on a semi-auto cutting machine is shown in figure 3.3.



Figure 3.3 The process of cutting cables on a semi-auto cutting machine

measured, namely as follows:

- Cable length: namely the length of the cable that will be cut according to the drawing provisions
- Inner length: namely the length of the inside of the cable that has been stripped according to the drawing provisions.

From the information above, the data will be analyzed using the Minitab

on wire quality achievements in wire harness production. . With objectives based on this, 30 data were collected according to what was carried out by the company's production. This research uses the F Test and GR&R Test which consists of several data, tables and diagrams.

The number of measurement system variations is compared with process variations.

The large variations in the measurement system caused by operator influence.

The ability of the measurement system to distinguish between different parts.

Gr&R data collection:

1. Collect 30 samples.
2. Choose 3 different operators

the same method

$$R = \frac{R_1 + R_2 + \dots + R_R}{n}$$

- Determine the difference between the maximum and minimum averages using the equation

Note :

30 samples were taken with a cutting target of $4020 \pm 5\text{cm}$ in 2 trials carried out by 3 operators

and the following results were obtained. Cables can be cut with conditions less than zero and not more than 5

Tabel 4.1 Sample Cutting Auto Machine Data (GR&R)

QUANTITY SAMPLE	OPERATOR A			OPERATOR B			OPERATOR C		
	WIRE LENGTH CONDITION RESULTS								
	1 TRIAL	2 TRIAL	RANGE	1 TRIAL	2 TRIAL	RANGE	1 TRIAL	2 TRIAL	RANGE
1	4022 cm	4020 cm	2 cm	4020 cm	4023 cm	3 cm	4024 cm	4020 cm	4 cm
2	4024 cm	4022 cm	2 cm	4022 cm	4020 cm	2 cm	4021 cm	4022 cm	1 cm
3	4020 cm	4021 cm	1 cm	4025 cm	4024 cm	1 cm	4023 cm	4021 cm	2 cm
4	4023 cm	4024 cm	1 cm	4023 cm	4022 cm	1 cm	4021 cm	4020 cm	1 cm
5	4020 cm	4024 cm	4 cm	4021 cm	4024 cm	3 cm	4023 cm	4025 cm	2 cm
6	4021 cm	4024 cm	3 cm	4025 cm	4023 cm	2 cm	4020 cm	4021 cm	1 cm
7	4025 cm	4021 cm	4 cm	4021 cm	4024 cm	3 cm	4022 cm	4021 cm	1 cm
8	4022 cm	4020 cm	2 cm	4022 cm	4020 cm	2 cm	4024 cm	4021 cm	3 cm
9	4020 cm	4021 cm	1 cm	4021 cm	4025 cm	4 cm	4025 cm	4020 cm	5 cm
10	4025 cm	4022 cm	3 cm	4024 cm	4020 cm	4 cm	4023 cm	4021 cm	2 cm
11	4023 cm	4020 cm	3 cm	4022 cm	4023 cm	1 cm	4022 cm	4023 cm	1 cm
12	4021 cm	4025 cm	4 cm	4023 cm	4024 cm	1 cm	4021 cm	4023 cm	2 cm
13	4020 cm	4024 cm	4 cm	4022 cm	4024 cm	2 cm	4020 cm	4024 cm	4 cm
14	4025 cm	4023 cm	2 cm	4021 cm	4025 cm	4 cm	4021 cm	4022 cm	1 cm
15	4022 cm	4025 cm	3 cm	4025 cm	4024 cm	1 cm	4023 cm	4020 cm	3 cm
16	4024 cm	4022 cm	2 cm cm	4022 cm	4020 cm cm	2	4021 cm	4024 cm	3 cm
17	4024 cm	4020 cm	4 cm	4023 cm	4020 cm	3 cm	4024 cm	4022 cm	2 cm
18	4020 cm	4019 cm	1 cm	4024 cm	4025 cm	1 cm	4023 cm	4025 cm	2 cm
19	4023 cm	4022 cm	1 cm	4022 cm	4025 cm	3 cm	4021 cm	4023 cm	2 cm
20	4020 cm	4022 cm	2 cm	4023 cm	4023 cm	1 cm	4023 cm	4022 cm	1 cm
21	4024 cm	4023 cm	1 cm	4023 cm	4025 cm	2 cm	4020 cm	4022 cm	2 cm

22	4022 cm	4022 cm	0 cm	4023 cm	4020 cm	3 cm	4023 cm	4020 cm	3 cm
23	4025 cm	4020 cm	5 cm	4022 cm	4024 cm	2 cm	4021 cm	4025 cm	4 cm
24	4024 cm	4020 cm	4 cm	4020 cm	4022 cm	2 cm	4020 cm	4021 cm	1 cm
25	4022 cm	4021 cm	1 cm	4021 cm	4022 cm	1 cm	4024 cm	4021 cm	3 cm
26	4025 cm	4023 cm	2 cm	4024 cm	4023 cm	1 cm	4025 cm	4021 cm	4 cm
27	4024 cm	4023 cm	1 cm	4022 cm	4025 cm	3 cm	4022 cm	4021 cm	1 cm
28	4021 cm	4024 cm	3 cm	4024 cm	4023 cm	1 cm	4025 cm	4020 cm	5 cm
29	4023 cm	4025 cm	2 cm	4021 cm	4024 cm	3 cm	4024 cm	4021 cm	3 cm
30	4022 cm	4025 cm	3 cm	4023 cm	4021 cm	2 cm	4020 cm	4022 cm	2 cm

Table 4.2 Sample Semi Auto Machine Data (GR&R)

QUANTITY SAMPLE	OPERATOR A			OPERATOR B			OPERATOR C		
	WIRE LENGTH CONDITION RESULTS								
	1 TRIAL	2 TRIAL	RANGE	1 TRIAL	2 TRIAL	RANGE	1 TRIAL	2 TRIAL	RANGE
1	4020 cm	4027 cm	7 cm	4015 cm	4021 cm	6 cm	4018 cm	4025 cm	7 cm
2	4020 cm	4030 cm	10 cm	4019 cm	4023 cm	4 cm	4022 cm	4027 cm	5 cm
3	4022 cm	4027 cm	5 cm	4020 cm	4029 cm	9 cm	4017 cm	4021 cm	4 cm
4	4029 cm	4025 cm	4 cm	4023 cm	4017 cm	6 cm	4021 cm	4027 cm	6 cm
5	4021 cm	4028 cm	7 cm	4025 cm	4018 cm	7 cm	4019 cm	4024 cm	5 cm
6	4020 cm	4026 cm	6 cm	4013 cm	4018 cm	5 cm	4020 cm	4026 cm	6 cm
7	4028 cm	4022 cm	6 cm	4022 cm	4026 cm	4 cm	4018 cm	4022 cm	4 cm
8	4022 cm	4029 cm	7 cm	4012 cm	4019 cm	7 cm	4016 cm	4021 cm	5 cm
9	4023 cm	4028 cm	5 cm	4027 cm	4030 cm	3 cm	4023 cm	4029 cm	6 cm
10	4029 cm	4025 cm	4 cm	4015 cm	4022 cm	7 cm	4017 cm	4024 cm	7 cm
11	4027 cm	4021 cm	6 cm	4019 cm	4024 cm	5 cm	4018 cm	4026 cm	8 cm
12	4023 cm	4026 cm	3 cm	4027 cm	4021 cm	6 cm	4022 cm	4027 cm	5 cm
13	4024 cm	4028 cm	4 cm	4022 cm	4029 cm	7 cm	4026 cm	4030 cm	4 cm
14	4021 cm	4030 cm	1 cm	4012 cm	4016 cm	4 cm	4021 cm	4028 cm	7 cm

15	4026 cm	4022 cm	4 cm	4017 cm	4024 cm	3 cm	4020 cm	4026 cm	6 cm
16	4023 cm	4029 cm	6 cm	4014 cm	4020 cm	6 cm	4019 cm	4022 cm	3 cm
17	4029 cm	4020 cm	9 cm	4026 cm	4030 cm	4 cm	4024 cm	4029 cm	5 cm
18	4030 cm	4024 cm	6 cm	4021 cm	4017 cm	4 cm	4018 cm	4025 cm	7 cm
19	4017 cm	4021 cm	4 cm	4011 cm	4016 cm	5 cm	4024 cm	4029 cm	5 cm
20	4015 cm	4020 cm	5 cm	4023 cm	4016 cm	7 cm	4022 cm	4028 cm	6 cm
21	4025 cm	4018 cm	7 cm	4019 cm	4027 cm	8 cm	4017 cm	4022 cm	5 cm
22	4021 cm	4016 cm	6 cm	4023 cm	4027 cm	4 cm	4023 cm	4030 cm	7 cm
23	4021 cm	4030 cm	9 cm	4011 cm	4013 cm	3 cm	4026 cm	4018 cm	8 cm
24	4014 cm	4020 cm	6 cm	4021 cm	4013 cm	8 cm	4025 cm	4019 cm	6 cm
25	4019 cm	4027 cm	8 cm	4013 cm	4018 cm	5 cm	4018 cm	4027 cm	9 cm
26	4017 cm	4021 cm	4 cm	4028 cm	4024 cm	4 cm	4022 cm	4029 cm	7 cm
27	4025 cm	4032 cm	7 cm	4021 cm	4029 cm	8 cm	4020 cm	4017 cm	3 cm
28	4017 cm	4020 cm	8 cm	4027 cm	4029 cm	2 cm	4021 cm	4028 cm	7 cm
29	4018 cm	4022 cm	4 cm	4012 cm cm	4018 cm	6 cm	4021 cm	4025 cm	4 cm
30	4019 cm	4027 cm	8 cm	4023 cm	4016 cm	7 cm	4017 cm	4023 cm	6 cm

Two-Way ANOVA Table

Source	DF	SS	MS	F	P
MESIN	1	680,56	680,556	133,080	0,000
OPERATOR	2	6,40	3,200	0,626	0,536
Repeatability	176	900,04	5,114		
Total	179	1587,00			

Based on the table above, the results of the Two-Way ANOVA Table test in the table above can be explained as follows.

- In the machine variable, a significance value of 0.000 is obtained, meaning it is smaller than 0.05, so it can be concluded that there is a significant difference between the wire length range value on a semi-auto cutting machine and the wire length range value on an auto cutting machine.

- In the operator variable, a significance value of 0.536 is obtained, meaning it is greater than 0.05, so it can be concluded that there is no significant difference between the wire length range values for each operator A, B and C for each wire length range value on the semi cutting machine. auto and auto cutting machines.

Gage R&R

Variance Components

Source	VarComp	%Contribution (of VarComp)
Total Gage R&R	5,1139	40,53

Repeatability	5,1139	40,53
Reproducibility	0,0000	0,00
OPERATOR	0,0000	0,00
Part-To-Part	7,5049	59,47
Total Variation	12,6188	100,00

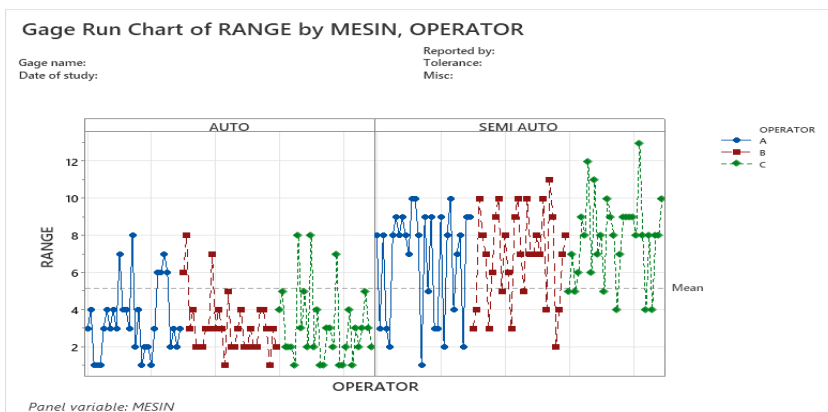
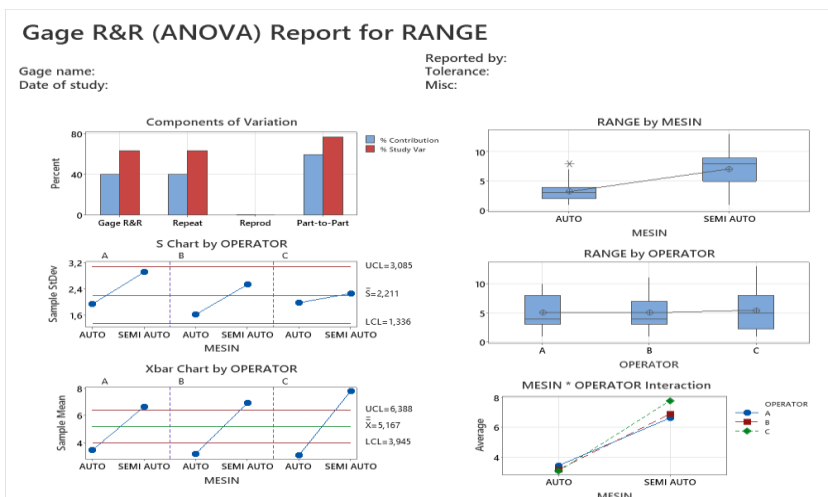
Part-To-Part	2,7395	16,4371	77,12
		1	
Total Variation	3,5522	21,3138	100,00
		9	

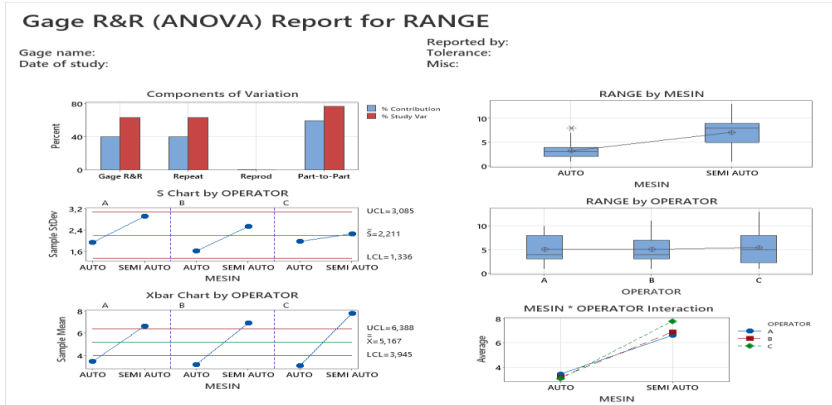
Number of Distinct Categories = 1
Based on the Variance Components Gage R&R in the output above it can be explained as follows:

- Total Gage R&R is the variability of the measurement system which includes several operators using the same gauge, namely with a total Gage R&R of 40.53%.
- Repeatability is variability in measurements when the same operator measures the same part several times, namely with a contribution percentage of 40.53%.
- Part-to-Part is measurement variability due to different parts, namely with a contribution percentage of 59.47%.

Gage Evaluation

Source	StdDev (SD)	Study Va r (6 × SD)	%Study Va r (%SV)
Total Gage R&R	2,26139	13,5683	63,66
Repeatability	2,26139	13,5683	63,66
Reproducibility	0,00000	0,0000	0,00
OPERATOR	0,00000	0,0000	0,00





4.1.2. F Test

It is a statistical test method used to compare two or more data objects, where each object or data is tested repeatedly to determine the size of the variance. [4][9]

F Test data collection:

It is a statistical test method used to compare two or more data objects, where each object or data is tested repeatedly to determine the size of the variance. [4][9]

F Test data collection:

1. Collect 30 samples.
2. Choose 3 different operators
3. Each operator takes measurements 3 times using the same method.

In this study, measurements were carried out using a

Note :

30 samples were taken with a cutting target of $4020 \pm 5\text{cm}$ in 2 trials carried out by 3 operators

meter and a ruler, the units of measurement were centimeters.

In determining the f test, there is a formula which is as follows:

Notes :

$$F = \frac{R^2 / (n-1)}{(1-R^2) / (n-k)}$$

R^2 = Coefficient of determination

n = Number of data

k = Number of independent variable

and the following results were obtained. Cables can be cut with conditions less than zero and not more than 5

Table 4.3 Sample data for Auto Cutting Machine (F Test)

QUAN TITY SAMP LE	OPERATOR A			OPERATOR B			OPERATOR C		
	WIRE LENGTH CONDITION RESULTS								
	1 TRIAL	2 TRIAL	RANGE	1 TRIAL	2 TRIAL	RANGE	1 TRIAL	2 TRIAL	RANGE
1	4022 cm	4020 cm	2 cm	4020 cm	4023 cm	3 cm	4024 cm	4020 cm	4 cm
2	4024 cm	4022 cm	2 cm	4022 cm	4020 cm	2 cm	4021 cm	4022 cm	1 cm
3	4020 cm	4021 cm	1 cm	4025 cm	4024 cm	1 cm	4023 cm	4021 cm	2 cm
4	4023 cm	4024 cm	1 cm	4023 cm	4022 cm	1 cm	4021 cm	4020 cm	1 cm
5	4020 cm	4024 cm	4 cm	4021 cm	4024 cm	3 cm	4023 cm	4025 cm	2 cm
6	4021 cm	4024 cm	3 cm	4025 cm	4023 cm	2 cm	4020 cm	4021 cm	1 cm
7	4025 cm	4021 cm	4 cm	4021 cm	4024 cm	3 cm	4022 cm	4021 cm	1 cm

8	4022 cm	4020 cm	2 cm	4022 cm	4020 cm	2 cm	4024 cm	4021 cm	3 cm
9	4020 cm	4021 cm	1 cm	4021 cm	4025 cm	4 cm	4025 cm	4020 cm	5 cm
10	4025 cm	4022 cm	3 cm	4024 cm	4020 cm	4 cm	4023 cm	4021 cm	2 cm
11	4023 cm	4020 cm	3 cm	4022 cm	4023 cm	1 cm	4022 cm	4023 cm	1 cm
12	4021 cm	4025 cm	4 cm	4023 cm	4024 cm	1 cm	4021 cm	4023 cm	2 cm
13	4020 cm	4024 cm	4 cm	4022 cm	40 24 cm	2 cm	4020 cm	4024 cm	4 cm
14	4025 cm	4023 cm	2 cm	4021 cm	4025 cm	4 cm	4021 cm	4022 cm	1 cm
15	4022 cm	4025 cm	3 cm	4025 cm	4024 cm	1 cm	4023 cm	4020 cm	3 cm
16	4024 cm	4022 cm	2 cm cm	4022 cm	4020 cm cm	2	4021 cm	4024 cm	3 cm
17	4024 cm	4020 cm	4 cm	4023 cm	4020 cm	3 cm	4024 cm	4022 cm	2 cm
18	4020 cm	4019 cm	1 cm	4024 cm	4025 cm	1 cm	4023 cm	4025 cm	2 cm
19	4023 cm	4022 cm	1 cm	4022 cm	4025 cm	3 cm	4021 cm	4023 cm	2 cm
20	4020 cm	4022 cm	2 cm	4023 cm	4023 cm	1 cm	4023 cm	4022 cm	1 cm
21	4024 cm	4023 cm	1 cm	4023 cm	4025 cm	2 cm	4020 cm	4022 cm	2 cm
22	4022 cm	4022 cm	0 cm	4023 cm	4020 cm	3 cm	4023 cm	4020 cm	3 cm
23	4025 cm	4020 cm	5 cm	4022 cm	4024 cm	2 cm	4021 cm	4025 cm	4 cm
24	4024 cm	4020 cm	4 cm	4020 cm	4022 cm	2 cm	4020 cm	4021 cm	1 cm
25	4022 cm	4021 cm	1 cm	4021 cm	4022 cm	1 cm	4024 cm	4021 cm	3 cm
26	4025 cm	4023 cm	2 cm	4024 cm	4023 cm	1 cm	4025 cm	4021 cm	4 cm
27	4024 cm	4023 cm	1 cm	4022 cm	4025 cm	3 cm	4022 cm	4021 cm	1 cm
28	4021 cm	4024 cm	3 cm	4024 cm	4023 cm	1 cm	4025 cm	4020 cm	5 cm
29	4023 cm	4025 cm	2 cm	4021 cm	4024 cm	3 cm	4024 cm	4021 cm	3 cm
30	4022 cm	4025 cm	3 cm	4023	4021	2 cm	4020 cm	4022 cm	2 cm

Table 4.4 Sample data for Semi Auto Cutting Machine (F Test)

QUANTITY SAMPLE	OPERATOR A			OPERATOR B			OPERATOR C		
	WIRE LENGTH CONDITION RESULTS								
	1 TRIAL	2 TRIAL	RANGE	1 TRIAL	2 TRIAL	RANGE	1 TRIAL	2 TRIAL	RANGE

1	4020 cm	4027 cm	7 cm	4015 cm	4021 cm	6 cm	4018 cm	4025 cm	7 cm
2	4020 cm	4030 cm	10 cm	4019 cm	4023 cm	4 cm	4022 cm	4027 cm	5 cm
3	4022 cm	4027 cm	5 cm	4020 cm	4029 cm	9 cm	4017 cm	4021 cm	4 cm
4	4029 cm	4025 cm	4 cm	4023 cm	4017 cm	6 cm	4021 cm	4027 cm	6 cm
5	4021 cm	4028	7	4025 cm	4018 cm	7 cm	4019 cm	4024 cm	5 cm
6	40 20 cm	4026 cm	6 cm	4013 cm	4018 cm	5 cm	4020 cm	4026 cm	6 cm
7	4028 cm	4022 cm	6 cm	4022 cm	4026 cm	4 cm	4018 cm	4022 cm	4 cm
8	4022 cm	4029 cm	7 cm	4012 cm	4019 cm	7 cm	4016 cm	4021 cm	5 cm
9	4023 cm	4028 cm	5 cm	4027 cm	4030 cm	3 cm	4023 cm	4029 cm	6 cm
10	4029 cm	4025 cm	4 cm	4015 cm	4022 cm	7 cm	4017 cm	4024 cm	7 cm
11	4027 cm	4021 cm	6 cm	4019 cm	4024 cm	5 cm cm	4018 cm	4026 cm	8 cm
12	4023 cm	4026 cm	3 cm	4027 cm	4021 cm	6 cm	4022 cm	4027 cm	5 cm
13	4024 cm	4028 cm	4 cm	4022 cm	4029 cm	7 cm	4026 cm	4030 cm	4 cm
14	4021 cm	4030 cm	1 cm	4012 cm	4016 cm	4 cm	4021 cm	4028 cm	7 cm
15	4026 cm	4022 cm	4 cm	4017 cm	4024 cm	3 cm	4020 cm	4026 cm	6 cm
16	4023 cm	4029 cm	6 cm	4014 cm	4020 cm	6 cm	4019 cm	4022 cm	3 cm
17	4029 cm	4020 cm	9 cm	4026 cm	4030 cm	4 cm	4024 cm	4029 cm	5 cm
18	4030 cm	4024 cm	6 cm	4021 cm	4017 cm	4 cm	4018 cm	4025 cm	7 cm
19	4017 cm	4021 cm	4 cm	4011 cm	4016 cm	5 cm	4024 cm	4029 cm	5 cm
20	4015 cm	4020 cm	5 cm	4023 cm	4016 cm	7 cm	4022 cm	4028 cm	6 cm
21	4025 cm	4018 cm	7 cm	4019 cm	4027 cm	8 cm	4017 cm	4022 cm	5 cm
22	4021 cm	4016 cm	6 cm	4023 cm	4027 cm	4 cm	4023 cm	4030 cm	7 cm
23	4021 cm	4030 cm	9 cm	4011 cm	4013 cm	3 cm	4026 cm	4018 cm	8 cm
24	4014 cm	4020 cm	6 cm	4021 cm	4013 cm	8 cm	4025 cm	4019 cm	6 cm
25	4019 cm	4027 cm	8 cm	4013 cm	4018 cm	5 cm	4018 cm	4027 cm	9 cm
26	4017 cm	4021 cm	4 cm	4028 cm	4024 cm	4 cm	4022 cm	4029 cm	7 cm
27	4025 cm	4032 cm	7 cm	4021 cm	4029 cm	8 cm	4020 cm	4017 cm	3 cm
28	4017 cm	4020 cm	8 cm	4027 cm	4029 cm	2 cm	4021 cm	4028 cm	7 cm
29	4018 cm	4022 cm	4 cm	4012 cm	4018 cm	6 cm	4021 cm	4025 cm	4 cm
30	4019 cm	4027 cm	8 cm	4023 cm	4016 cm	7 cm	4017 cm	4023 cm	6 cm

The aim to be achieved in this research is to see the difference between the average wire length range on semi-auto cutting machines and on auto cutting machines. The following F test results are shown in the following table.

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
MESIN	1	680,6	680,556	133,64	0,000
Error	178	906,4	5,092		
Total	179	1587,0			

Based on the results of the F test on the average wire length range value, the probability value is 0.000 because the probability is <0.05 so it can be concluded that the average wire length range value has a different variant or there is a significant difference between the wire length range values on the machine. semi-auto cutting with wire length range values on an auto cutting machine. To see the average difference between the two cutting machines, see the

Conclusions

5.1 Conclusion

Based on the results of the analysis and discussion, it can be concluded that from the f and GR&R tests the semi-auto cutting machine has poor performance but can still be used with the risk that there are still some cable cuts outside of specifications. Meanwhile, the auto cutting machine has good enough performance to be used in companies, because the auto cutting machine has minimal rejects when cutting the cable

5.2 Sugestion

Based on the results of the research that has been carried out, suggestions are proposed, namely:

In the future, the company will pay more attention to the semi-auto cutting work system because this machine has many problems which can be detrimental to the company or complaints from the company's customers. And I, as the author, suggest that companies expand their work system using auto cutting machines, on the grounds that these machines have better work performance than semi-auto cutting.

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Foreword

Praise and gratitude to God Almighty for His blessings so that the author can complete this final report.

following table.

MESIN	N	Means		
		Mean	StDev	95% CI
AUTO	90	3,222	1,841	(2,753; 3,692)
SEMI AUTO	90	7,111	2,607	(6,642; 7,581)
<i>Pooled StDev = 2,25663</i>				

The data used in this research amounted to 90 samples on auto cutting machines and 90 on semi-auto cutting machines. Based on the statistical descriptive table, the average wire length range on auto cutting machines is 3.222, while the average wire length range on semi-auto cutting machines is 7.111, meaning that the average wire length range on semi-auto cutting machines is higher than average wire length range on auto cutting machines. So it can be concluded that the wire length range results on an auto cutting machine are better than the wire length range results on a semi-auto cutting machine with an average difference in wire length range of 3.8889

The title of the Final Assignment (TA) that the author has prepared is "**Comparison of auto cutting and semi auto cutting work systems on wire quality achievements**". The author hopes that by completing this final assignment he can fulfill the requirements to obtain the title of Associate Expert in Engineering (AMd.T.). With this, the author would like to express his deepest gratitude to those who have helped and supported in completing this final assignment, namely:

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FORMULIR LOGBOOK BIMBINGAN DAN PENGAJUAN SIDANG TUGAS AKHIR

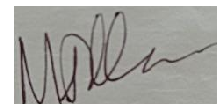
Nama : Maria Oktaviani Christina .P
NIM : 3221901013
Pembimbing I : Budiana.,S.Si.,M.Si
Judul : Perbandingan Sistem Kerja Cutting Auto Dan Cutting Semi Auto Terhadap Capaian Kualitas Wire

No	Hari/Tgl	Rincian Kegiatan	TTD Pembimbing I
2	26 Januari 2024	Revisi Tugas Akhir	
3	16 Februari 2024	Revisi Tugas Akhir	
4	23 Februari 2024	Revisi Tugas Akhir	
5	08 Maret 2024	Revisi Tugas Akhir	
6	05 April 2024	Revisi Tugas Akhir	
7	25 April 2024	Revisi Tugas Akhir	
8	10 Mei 2024	Revisi Tugas Akhir	
9	24 Mei 2024	Revisi Tugas Akhir	
10	30 Mei 2024	Revisi Tugas Akhir	

Berdasarkan hasil bimbingan yang telah dilaksanakan selama 5 bulan dan telah disetujui oleh dosen pembimbing, maka dengan ini saya mengajukan diri sebagai peserta Sidang Tugas Akhir.

Batam, 30 Mei 2024

Peserta



Maria Oktaviani Christina.P
NIM: 3221901013

**Hapus yang tidak perlu.*

Jumlah bimbingan minimal 10 kali. Dalam satu minggu maksimal bimbingan yang dihitung adalah 2 kali.