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Analysis of Standard Time Calculations Using the Direct Stopwatch Time Study Method on Line Deburing Pt. Mikuni Indonesia

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Abstract:- Measuring working time is an attempt to determine the length of working time required by a trained employee to complete a job at a normal speed level. To increase work efficiency for employees, both time and energy, research was carried out to determine time Standard ds, time allowances and output Standard ds for the company, so that the production process runs better. In this research, the time for each process will be measured with a stopwatch, which will then be used to calculate cross-production balance. The results of the work measurement research on the deburing line show that the ideal planning that should be set by management for each product is 07K for 8 working hours, namely 987 pcs and 1233 for 10 working hours, 3DM for 8 working hours, namely 764 pcs and 955 for 10 Working hours, 01Y for 8 working hours, namely 868 pcs and 1085 pcs for 10 working hours, 01D for 8 working hours, namely 810 and 1012 pcs for 10 working hours, 01S for 8 working hours, namely 820 pcs and 1025 pcs for 10 working hours, 5SM for 8 working hours, namely 849 pcs and 1061 pcs for 10 working hours, 457 for 8 working hours, namely 294 pcs and 368 pcs for 10 working hours, 874 for 8 working hours, namely 784 pcs and 980 pcs for 10 working hours, and 908 1-C for 8 working hours, namely 634 pcs and 792 pcs for 10 working hours.

Keywords:- *Pengukuran Waktu Kerja, Direct Stopwatch Time Study.*

I. INTRODUCTION

Measuring working time is a job of observing and recording working time on a phase or cycle scale using predetermined methods and instruments. Work measurement is an application of techniques that have been included in the plan and functions to help the company determine results that meet demand that can be provided by human resources carrying out the manufacturing stage. Measurements with accurate data can become work Standard ds that can be used by a company to determine the minimum targets that must be achieved by workers. However, problems often arise in the work measurement process, such as: varying work periods, inaccurate data collection and also a lack of understanding about work measurement itself(Arianie & Puspitasari, 2017).

PT. Mikuni Indonesia is a company that operates in the automotive industry, both two-wheeled and four-wheeled, with the final product being a Trothle Body. PT. Mikuni Indonesia is located in the MM2100 area, Jl. Irian Block QQ-1, West Cikarang, Bekasi. Trothel Body produced by PT. Mikuni Indonesia has ADC12 series aluminum material. All products produced by PT. Mikuni Indonesia has 19 Trothel Body Types. In the production process there are two work stations, namely the Die Casting machine and Deburing. where based on the results carried out by the author, it was found that there was a quite significant increase in daily production planning in the deburing process in the last three months. The increase in daily planning occurred due to the change in Die Casting management at the beginning of 2024 who wanted to increase productivity in the Die Casting Department, but the work measurement was carried out by management only once, precisely in February 2024. However, management continued to increase the daily production planning every month without carry out work measurements again(Latief et al., 2021).

The purpose of measuring working time is to obtain the Standard d time that must be achieved by workers to complete a job. To determine incentives, plans, placement of the required number of workers, production schedules, to calculate output and input, you can use the Standard d Time basis. The most important factor in ensuring the smooth production process is labor, but other important factors also have a significant influence on the production process such as equipment, machines and so on(Nur Rahmanti Ratih et al., 2022).

- *Product tivitas*

In general, productivity is defined as the relationship between real or physical results in the form of goods or services and actual input. Productivity also means a comparison between the results achieved and the total resources used (input), which are related to a productive mental attitude, including: regarding attitude, spirit, motivation, discipline, creativity, innovation, dynamic and professionalism. Robbins and DeCenzo explain that productivity is the entire output of goods and services produced divided by the input required to produce that output. Productivity is a combination of people and operating variables. Therefore, an effective organization will maximize productivity by successfully integrating people into the entire operating system(Cut Ita Erliana, ST, 2015).

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➢ *Measuring Working Time*

Work measurement is a science that studies the principles and techniques to obtain the best work system design. This science is one of the sciences in the industrial engineering discipline, even judging from its history, work measurement is the forerunner of this discipline. In its application, work measurement will interact with various other sciences within the industrial engineering discipline to simultaneously achieve the optimal state of a production system in the broadest sense of the word, namely a system consisting of human components, materials, machines, equipment and money. As a science, work measurement has its own framework with parts that are together integrated to achieve the above goals. This work measurement was developed by F.W. Taylor and F.B. Gilbreth. Based on research from F.W. Taylor and F.B. Gilbreth, although the research was not carried out together, was later known as a unit and was known as Work Design or Methods Engineering. This design is carried out by paying attention to technological, psychological and sociological aspects of work so that a work system is obtained that is more in line with human abilities and limitations(Prayuda, 2020).

➢ *Direct Stopwatch Time Study*

In the context of work measurement, the direct stop-watch Time Study method is a work measurement technique using a stop-watch as a tool for measuring time shown in the completion of an observed activity (actual time). The time that is successfully measured and recorded is then modified by considering the operator's work tempo and adding an allowance. To facilitate future measurement and analysis activities, in addition to the stop-watch as a timing device, a Time Study form is needed to record the measured time data. Apart from recording time, you must also record all information related to the activity being measured, such as sketches of work area layouts, working conditions (machine working speed, product images, operator names, etc.) and descriptions related to elemental breakdown. Measurement and recording usually use a continuous method (the stopwatch does not need to be stopped every time an element or work cycle has finished being measured). The work activities to be measured must first be divided into detailed work elements. By observing the activities to be measured, then measuring the time needed to complete each work element is measured and recorded. The time read from the stopwatch (which moves continuously) is then recorded in the "record" column (R). For each work element of each work cycle that is recorded, calculations are carried out at the end of the study. The actual time for each work element is then recorded in the "Time" column (T)(Cut Ita Erliana, ST, 2015).

➢ *Operation Process Chart*

Operation Process Chart (OPC) is a diagram that describes the process steps that raw materials will undergo regarding the sequence of operations and inspections from the beginning until it becomes a complete finished product or as a component, and also contains the information needed for further analysis. carry on. So in an Operation Process Chart (OPC), only operational and inspection activities are recorded, sometimes at the end of the process a record is recorded regarding the storage of the Operation Process Chart (OPC). This is used to analyze the flow of material operations that occur in the production process. This map depicts the most complete graphical picture of the entire process. The formation of a flow process map according to Wignjosoebroto (2009) is the operational process of the process being studied, a general process map of each component is obtained, the operational process map is drawn again on the line corresponding to the component, and all the desired data is entered on the side of the symbol, such as the description. , distance, quantity, time, costs, and so on, are studied on the resulting map to enable improvements to the entire process, linkages between activities, independent processes, and so on(Wahyudi et al., 2023).

➢ *Flow Proses Chart*

Process Flow Map is a diagram that shows the sequence of operations, inspection, transportation, waiting and storage that occur during a process, and it also contains the information needed for analysis such as the time required and distance of movement (Teknik et al., 2024)

II. RESEARCH METHODOLOGY

The type of research used by researchers is quantitative. Quantitative research methods are usually used when researchers want to obtain accurate data, based on empirical and measurable phenomena. By using this type of quantitative research, the researcher will present data in the form of numbers in the form of the duration of working time for each product work activity. In this research, researchers carried out the deburing process at PT. Mikuni Indonesia as a research object. The deburing process is the process of removing part lines in a product(Purbasari, 2020).

A. Normality and Uniformity of Data

The data uniformity test aims to ensure that the data taken does not contain extreme data, all data falls within the upper control limits (BKA) and lower control limits (BKB).

➢ *Formula to find Upper Control Limit (BKA) and Lower Control Limit (BKB) values*

- BKA = Average Observation Time + (Z x Standard d Deviation)
- BKB = Average Observation Time – (Z x Standard d Deviation)

➢ *Desired Confidence Level 95%, jadi Z = 1.96*

Table 1 *Desired Confidence Level*

Desired Confidence Level	Z Value
90%	1.65
95%	1.96
95.4%	2.00
99%	2.58
99.7%	3.00

➢ *Source:*

If the Upper Control Limit (BKA) and Lower Control Limit (BKB) values have been determined then the work measurement value which is not more than BKA and more

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than BKB can be said to be the work measurement value which meets Data Uniformity.

B. Data Sufficiency Test

A data adequacy test is needed to ensure that the data that has been collected and presented in the measurement report is objectively sufficient. The following is the formula used to test the level of data adequacy.

$$.n' = \frac{\left[\frac{k}{s}\sqrt{n(\sum xi^2)-(\sum xi)2}\right]^2}{\sum xi}$$

Equation Formula 1

Where

n' = Number of theoretical data

k = Constant level of confidence in observations

s = Degree of accuracy

xi = Observation data

n = Number of observation data

If n' ≤ n then the data is considered sufficient, but if n` ≥ n the data is considered insufficient (insufficient) and additional data needs to be added.

C. Performance Rating

Performance Rating aims to determine operator performance with the aim of normalizing working time. There are four factors that influence the Performance rating, namely: Skill, Effort, Condition and Consistency. The following is the value of each factor that influences the Performance Rating calculated based on the Westinghouse system(Asarela & Sari, 2023).

Table 2 Performance Rating Dengan Sistem Westinghouse

Skill	Effort	Conditions	Consistency
Superskill +0.15	Excessive +0.13	Ideal +0.06	Perfect +0.03
Superskill +0.13	Escessive +0.12	Excellent +0.04	Excellent +0.03
Excellent +0.11	Excellent +0.10	Good +0.02	Good +0.02
Excellent +0.8	Excellent +0.8	Average +0.0	Average +0.0
Good +0.6	Good +0.5	Fair - 0.03	Fair - 0.03
Average +0.0	Average +0.0	Poor - 0.07	Poor - 0.04
Fair - 0.5	Fair - 0.4		
Fair - 0.10	Fair - 0.8		
Poor - 0.16	Poor - 0.12		
Poor - 0.22	Poor - 0.17		

➢ *Source:*

Operator ratings are based on normal performance with the following concepts:
Normal PR =1 *Better* PR < 1 *Worse* PR > 1

Using the Westing House System's rating method, there are four assessments of adjustment factors that can influence operator performance, namely ability, effort, condition and consistency. Determining these adjustment factors should be done by a supervisor or someone who really understands the employee's job(Prahadita et al., 2021).

D. Allowance

Allowance is a factor or percentage of allowance given to workers so that they can work comfortably, because every worker will always have fatigue factors, both personal and delay(*Buku Product tivitas Kerja Dr. Candra Wijaya, M.Pd*, n.d.). The following are the allowance factors needed by workers:

- Personal needs (drinking, going to the toilet etc.)
- Fatigue/Fatigue
- Delays (Unavoidable & Avoidable)

A reasonable amount of allowance is around 10 – 15%

E. Standard d Time

Standard d Time is the time required for a trained worker to complete a particular task, working at a continuous rate and using certain methods, machines, equipment and work arrangements(Bloom & Reenen, 2013).

➢ *The following are Calculations to Determine Standard d Time:*

$$w_s = w_{Nx}\left(\frac{100\%}{100\% - allowance\%}\right)$$

So the result is Standard d Time (AWS) in Seconds per unit.

F. Output Standard d

Output Standard d is the number of units that can be produced in a specified time unit (seconds, minutes, hours). Here's how to determine Standard d Output:

$$Os = \left(\frac{1}{\bar{x}w_s}\right): 20\ x\ 3600$$

Then the value (Standard d Output) Is in units per hour

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III. RESULTS AND DISCUSSION

A. Data Collection

Data collection was carried out at the Deburing Line of the Die Casting Department of PT. Mikuni Indonesia on 13-18 May 2024 with measurements carried out 10 times using a stopwatch on superior products produced by PT Mikuni Indonesia.

Table 3 Jenis Product

No.	Stations	Kode Produk
1	DC1	07K
2		3DM
3	DC2	01Y
4		01D
5	DC3	01S
6		5SM
7	DC4	457
8		05A
9	SAV	908 1-C
10		874

Source: Company Data, 2024

The measurement process is carried out by notifying the operator so that working time samples are taken under normal conditions, not accelerated or slowed down.

Table 4 Working Time Data Table

PENGUKURAN KERJA	LINE DEBURING									
	DC1		DC2		DC3		DC4		SAV	
	07K	3DM	01Y	01D	01S	5SM	457	05A	874	908 1-C
1	24,5	31,8	27,3	29,7	28,6	27,7	82,5	75,8	30,2	37,5
2	24	31	27,8	29,9	29	28,2	83	76	30	37,8
3	24,8	32	27,2	30	28,8	27,8	82,7	76,3	30,5	37,8
4	24,8	31,7	28,2	29,8	28,7	27,8	83	75,7	30,2	37,6
5	24,5	31,6	27,9	29,8	28,8	28,2	82,9	75,8	30,6	38
6	24,7	31,8	28,6	29,7	28,9	28,2	83,2	75,7	30,3	37,8
7	24,5	31,9	27,6	29,9	29,3	27,8	82,8	75,9	30,9	37,5
8	24,6	31,7	27,8	30,2	29,2	27,8	82,8	76	30,5	37,9
9	24,7	31,9	27,8	29,7	29	27,9	82,9	75,8	30,6	38
10	24,8	31,8	27,7	30,2	28,9	28	83,3	76,2	30,3	37,8
Rata-rata	24,59	31,72	27,79	29,89	28,92	27,94	82,91	75,92	30,41	37,77
Std. Deviasi	0,24	0,28	0,40	0,19	0,21	0,20	0,23	0,20	0,26	0,18
Z Value	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65
BKA	24,99	32,18	28,46	30,21	29,27	28,26	83,29	76,26	30,84	38,07
BKB	24,19	31,26	27,12	29,57	28,57	27,62	82,53	75,58	29,98	37,47
Uji Ksrgmn	Seragam	Seragam	Seragam	Seragam	Seragam	Seragam	Seragam	Seragam	Seragam	Seragam
Uji kecukupan	0,0026	0,0018	0,0035	0,0014	0,0017	0,0017	0,0002	0,0002	0,0019	0,0008

Source: Data Processed, 2024

B. Data Adequacy Test

The results of measurements of the work elements in the throttle body production process will first be analyzed to fulfill the data adequacy check. Data adequacy checks are necessary because the data obtained when measuring working time is not always consistent. The high diversity of data in initial observations (n) will also influence the observations that must be taken (n') which are also high. Measurement of working time has been carried out on each work element with n = 10 initial observations carried out on each work element, so that each work element of each operational process each has 10 data. This time measurement research uses an accuracy level of 10% and a confidence level of 90%, so the values s = 0.1 and k = 1.6, meaning that in collecting this data the maximum deviation is only 10%. From the calculation of the data adequacy test using the formula in equation (3.1), the data is sufficient for further calculations because the value n' < n is 00.2 < 10. The specific calculation can be seen in the attached sheet.

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C. Data Uniformity Test

Data uniformity testing is intended to identify data and eliminate extreme data in working time measurements. Existing extreme data makes the results obtained invalid, so if it is proven that there are results with extreme data then the data must be discarded. The use of individual control charts is used for individual observations where n = 1. Measurement of working time for each work element is included as individual observation. The following are the results of analysis using individual control charts in the Minitab application.

D. Determination of Adjustment Factors

Working time measurements have met the adequacy assumptions and data uniformity assumptions. The next step is to determine the adjustment factor. The objective obtained from determining the adjustment factor is that by determining the adjustment factor, the reasonableness of the work demonstrated by the operator will be known, meaning whether the operator of each operating process has worked under normal conditions or not. Using the Westing House System's rating method, there are four assessments of adjustment factors that can influence operator performance, namely ability, effort, condition and consistency. Determining this adjustment factor should be done by a supervisor or someone who really understands the employee's work. The following is the adjustment factor value for each operator.

Table 5 Performance Rating with System Westinghouse

Nama	*Jobdesk*	Aspek				Jumlah
		Skills	*Efforts*	*Conditions*	*Concistency*	
Rheynata	07K/3DM	Good +0.06	Good +0.06	Good +0.06	Fair -0.03	0,15
Devita	07K/3DM	Excellent +0.08	Good +0.06	Good +0.06	Average 0.0	0,2
Melda	01Y/01D	Good +0.06	Good +0.06	Good +0.06	Good +0.06	0,24
Selvi	01Y/01D	Good +0.06	Good +0.06	Fair -0.03	Average 0.0	0,09
Ranti	01S/5SM	Good +0.06	Average 0.0	Fair -0.03	Average 0.0	0,03
Aulia	01S/5SM	Good +0.06	Average 0.0	Fair -0.03	Average 0.0	0,03
Agnes	457/05A	Excellent +0.08	Good +0.06	Good +0.06	Good +0.06	0,98
Melia	457/05A	Excellent +0.08	Good +0.06	Good +0.06	Good +0.06	0,98
Balqis	874/908 1-C	Good +0.06	Average 0.0	Fair -0.03	Good +0.06	0.9
Novi	874/908 1-C	Good +0.06	Average 0.0	Fair -0.03	Good +0.06	0.9

The data listed in the table for skill and effort was provided by the Die Casting Supervisor who knows very well how his employees work and perform, while for condition and consistency it was obtained from the researcher's observations.

The way to calculate the adjustment factor using this system is to add up the four factors with the value of each factor in the table, after that if the total for each factor still shows a positive value then the performance rating value will be added to p = 1 and if the total for each -each factor shows a negative value, then p = 1 will be added to the negative value. So the performance rating value will be less than 1. If the performance rating is equal to 1 then the worker is working in good condition but if the performance rating is less or more than 1 then the worker is working in poor condition

E. Allowance

PT. Mikuni Indonesia determines that the Overall Equipment Effectiveness (OEE) time for each department is 85%, meaning that 15% of the total working time is used as allowance time, assuming the following calculations:

Total Working Time = 10 Hours or 600 Minutes

600 Minutes x 85% = 510 Minutes

Total Time Allowance = 90 Minutes

Assuming 40 minutes for personal needs, 30 minutes for fatigue and 20 minutes for easing other obstacles.

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F. Cycle Time

$Ws = \frac{\sum xi}{n}$

Table 6 Cycle Time Product 07K and 3DM

DC 1			
07K		3DM	
Rheynata	Devita	Rheynata	Devita
24,5	24,3	31,8	31,8
24	24,2	31,4	31
24,8	24,5	31,8	32
24,8	24,7	31,8	31,7
24,5	24,5	31,7	31,6
24,7	24,6	31,9	31,8
24,5	24,6	31,7	31,9
24,6	24,7	32	31,7
24,7	24,6	31,8	31,9
24,8	24,7	31,7	31,8
∑xi	∑xi	∑xi	∑xi
245,9	245,4	317,6	317,2
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
24,59	24,54	31,76	31,72

Source: Data Processed, 2024

Table 7 Cycle Time Product 01Y and 01D

DC 2			
01Y		01D	
Melda	Selvi	Melda	Selvi
27,3	27,4	29,5	29,7
27,8	27,8	29,7	29,9
27,2	27,4	29,8	30
28,2	28,2	29,7	29,8
27,9	27,9	29,8	29,8
28,6	28,6	29,9	29,7
27,6	27,8	30	29,9
27,8	27,8	30	30,2
27,8	27,9	29,8	29,7
27,7	28	29,9	30,2
∑xi	∑xi	∑xi	∑xi
277,9	278,8	298,1	298,9
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
27,79	27,88	29,81	29,89

Source: Data Processed, 2024

Table 8 Cycle Time Product 01S and 5SM

DC 3			
01S		5SM	
Ranti	Aulia	Ranti	Aulia
28,6	28,9	27,7	27,7
29	28,8	28,2	28,2
28,8	29,2	27,5	27,8
28,7	28,8	27,8	27,8
28,8	28,8	28,2	28,2
28,9	29,3	28,2	28,2
29,3	28,6	27,6	27,8
29,2	28,7	27,8	27,8
29	29,1	27,9	27,9
28,9	28,8	28	28
∑xi	∑xi	∑xi	∑xi
289,2	289	278,9	279,4
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
28,92	28,9	27,89	27,94

Source: Data Processed, 2024

Table 9 Cycle Time Product 457 and 05A

DC 4			
457		05A	
Agnes	Melia	Agnes	Melia
82,5		75,8	
83		76	
82,7		76,3	
83		75,7	
82,9		75,8	
83,2		75,7	
82,8		75,9	
82,8		76	
82,9		75,8	
83,3		76,2	
∑xi		∑xi	
829,1		759,2	
$Ws = \frac{\sum xi}{n}$		$Ws = \frac{\sum xi}{n}$	
82,91		75,92	

Source: Data Processed, 2024

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Table 10 Cycle Time Product 874 and 908 1-C

SAV			
874		908 1-C	
Tuti	Siti	Tuti	Siti
30,2	30,7	37,5	37,5
30	30,6	37,7	37,8
30,5	30,5	37,8	37,8
30,2	30,8	37,6	37,6
30,6	30,7	37,8	38
30,3	30,4	37,9	37,8
30,9	30,4	38	37,5
30,5	30,8	37,6	37,9
30,6	30,7	37,7	38
30,3	30,7	37,8	37,8
∑xi	∑xi	∑xi	∑xi
304,1	306,3	377,4	377,7
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
30,41	30,63	37,74	37,77

Source: Data Processed, 2024

G. Normal Time

- Wn = Ws x Performance Rating

Table 11 Normal Time Product 07K and 3DM

∑xi	∑xi	∑xi	∑xi
245,9	245,4	317,6	317,2
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
24,59	24,54	31,76	31,72
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1,02	1	1,02	1
Wn	Wn	Wn	Wn
25,0818	24,54	32,3952	31,72
Ws	Ws	Ws	Ws
29,51	28,87	38,11	37,32

Source: Data Processed, 2024

Table 12 Normal Time Product 01Y and 01D

∑xi	∑xi	∑xi	∑xi
277,9	278,8	298,1	298,9
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
27,79	27,88	29,81	29,89
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1	1,02	1	1,02
Wn	Wn	Wn	Wn
27,79	28,4376	29,81	30,4878
Ws	Ws	Ws	Ws
32,79	33,56	35,18	35,98

Source: Data Processed, 2024

Table 13 Normal Time Product 01S and 5SM

∑xi	∑xi	∑xi	∑xi
289,2	289	278,9	279,4
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
28,92	28,9	27,89	27,94
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1,03	1,03	1,03	1,03
Wn	Wn	Wn	Wn
29,7876	29,767	28,7267	28,7782
Ws	Ws	Ws	Ws
35,15	35,13	33,90	33,96

Source: Data Processed, 2024

Table 14 Normal Time Product 457 and 05A

∑xi	∑xi
829,1	759,2
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
82,91	75,92
PR=1+PR	PR=1+PR
1	1
Wn	Wn
82,91	75,92
Ws	Ws

Source: Data Processed, 2024

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Table 15 Normal Time Product 874 and 908 1-C

∑xi	∑xi	∑xi	∑xi
304,1	306,3	377,4	377,7
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
30,41	30,63	37,74	37,77
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1,02	1,02	1,02	1,02
Wn	Wn	Wn	Wn
31,0182	31,2426	38,4948	38,5254
Ws	Ws	Ws	Ws
36,60	36,87	45,42	45,46

Source: Data Processed, 2024

H. Standard d Time

Ws = $wn \frac{100\%}{100\%-15\%}$

Table 16 Standard d Time 07K and 3DM

∑xi	∑xi	∑xi	∑xi
245,9	245,4	317,6	317,2
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
24,59	24,54	31,76	31,72
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1,02	1	1,02	1
Wn	Wn	Wn	Wn
25,0818	24,54	32,3952	31,72
Ws	Ws	Ws	Ws
29,51	28,87	38,11	37,32

Source: Data Processed, 2024

Table 17 Standard Time 01Y and 01D

∑xi	∑xi	∑xi	∑xi
277,9	278,8	298,1	298,9
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
27,79	27,88	29,81	29,89
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1	1,02	1	1,02
Wn	Wn	Wn	Wn
27,79	28,4376	29,81	30,4878
Ws	Ws	Ws	Ws
32,79	33,56	35,18	35,98

Source: Data Processed, 2024

Table 18 Standard Time 01S and 5SM

∑xi	∑xi	∑xi	∑xi
289,2	289	278,9	279,4
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
28,92	28,9	27,89	27,94
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1,03	1,03	1,03	1,03
Wn	Wn	Wn	Wn
29,7876	29,767	28,7267	28,7782
Ws	Ws	Ws	Ws
35,15	35,13	33,90	33,96

Source: Data Processed, 2024

Table 19 Standard Time 457 and 05A

∑xi	∑xi
829,1	759,2
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
82,91	75,92
PR=1+PR	PR=1+PR
1	1
Wn	Wn
82,91	75,92
Ws	Ws

Source: Data Processed, 2024

Table 20 Standard Time 874 and 908 1-C

∑xi	∑xi	∑xi	∑xi
304,1	306,3	377,4	377,7
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
30,41	30,63	37,74	37,77
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1,02	1,02	1,02	1,02
Wn	Wn	Wn	Wn
31,0182	31,2426	38,4948	38,5254
Ws	Ws	Ws	Ws
36,60	36,87	45,42	45,46

Source: Data Processed, 2024

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I. Output Standard

Os = 3600 / Ws (perJam)

Table 21 Output Standard Time 07K and 3DM

∑xi	∑xi	∑xi	∑xi
245,9	245,4	317,6	317,2
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
24,59	24,54	31,76	31,72
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1,02	1	1,02	1
Wn	Wn	Wn	Wn
25,0818	24,54	32,3952	31,72
Ws	Ws	Ws	Ws
29,51	28,87	38,11	37,32
Os	Os	Os	Os
122	125	94	96

Source: Data Processed, 2024

Table 22 Output Standard Time 01Y and 01D

∑xi	∑xi	∑xi	∑xi
277,9	278,8	298,1	298,9
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
27,79	27,88	29,81	29,89
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1	1,02	1	1,02
Wn	Wn	Wn	Wn
27,79	28,4376	29,81	30,4878
Ws	Ws	Ws	Ws
32,79	33,56	35,18	35,98
Os	Os	Os	Os
110	107	102	100

Source: Data Processed, 2024

Table 23 Output Standard Time 01S and 5SM

∑xi	∑xi	∑xi	∑xi
289,2	289	278,9	279,4
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
28,92	28,9	27,89	27,94
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1,03	1,03	1,03	1,03
Wn	Wn	Wn	Wn
29,7876	29,767	28,7267	28,7782
Ws	Ws	Ws	Ws
35,15	35,13	33,90	33,96
Os	Os	Os	Os
102	102	106	106

Source: Data Processed, 2024

Table 24 Output Standard Time 457 and 05A

∑xi	∑xi
829,1	759,2
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
82,91	75,92
PR=1+PR	PR=1+PR
1	1
Wn	Wn
82,91	75,92
Ws	Ws
97,83	89,59
Os	Os
37	40

Source: Data Processed, 2024

Table 25 Output Standard Time 874 and 908 1-C

∑xi	∑xi	∑xi	∑xi
304,1	306,3	377,4	377,7
$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$	$Ws = \frac{\sum xi}{n}$
30,41	30,63	37,74	37,77
PR=1+PR	PR=1+PR	PR=1+PR	PR=1+PR
1,02	1,02	1,02	1,02
Wn	Wn	Wn	Wn
31,0182	31,2426	38,4948	38,5254
Ws	Ws	Ws	Ws
36,60	36,87	45,42	45,46
Os	Os	Os	Os
98	98	79	79

Source: Data Processed, 2024

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Table 26 Calculation of Standard d Output Based on Working Hours

OUTPUT STANDAR *DEBURING*									
DC1		DC2		DC3		DC4		SAV	
07K	3DM	01Y	01D	01S	5SM	457	05A	874	908 1-C
8 Jam		8 Jam		8 Jam		8 Jam		8 Jam	
987	764	868	810	820	849	294	321	784	634
10 Jam		10 Jam		10 Jam		10 Jam		10 Jam	
1233	955	1085	1012	1025	1061	368	402	980	792

Source: Data Processed, 2024

IV. CONCLUSIONS AND SUGGESTIONS

A. Conclusions

The conclusion from the research results of measuring working time using the Time Study stopwatch method on the Deburing line for cycle time, normal time and Standard d time respectively is cycle time 24.56 seconds, normal time 24.81 seconds and Standard d time 29.18 seconds for product 07K, cycle time 31.74 seconds, normal time 32.05 seconds and Standard d time 37.71 seconds for 3DM products, cycle time 27.83 seconds, normal time 28.11 seconds and Standard d time 33.17 seconds for product 01Y, cycle time 29.85 seconds, normal time 30.14 seconds and Standard d time 35.57 seconds for product 01D, time cycle 28.91 seconds, normal time 29.77 seconds and Standard d time 35.13 seconds for product 01S, cycle time 227.91 seconds, normal time 28.75 seconds and Standard d time 33.92 seconds for product 5SM, cycle time 82.91 seconds, normal time 82.91 seconds and Standard d time 97.83 seconds for product 457, cycle time 75.92 seconds, normal time 75.92 seconds and Standard d time 89.59 seconds for product 05A, cycle time 30.52 seconds, normal time 31.13 seconds and Standard d time 36.72 seconds for product 874, cycle time 37.75 seconds, normal time 38.51 seconds and time Standard d 45.44 Seconds for product 908 1-C.

Meanwhile, the Standard d Output in one hour is 123 pcs for 07K products, 95 pcs for 3DM products, 109 for 01Y products, 101 pcs for 01D products, 102 pcs for 01S products, 106 pcs for 5SM products, 37 pcs for 457 products. 40 pcs for product 05A, 98 pcs for product 874 and 79 pcs for product 908 1-C.

Thus, the ideal planning that should be set by management for each product is 07K for 8 working hours, namely 987 pcs and 1233 for 10 working hours, 3DM for 8 working hours, namely 764 pcs and 955 for 10 working hours, 01Y for 8 working hours. namely 868 pcs and 1085 pcs for 10 working hours, 01D for 8 working hours, namely 810 and 1012 pcs for 10 working hours, 01S for 8 working hours, namely 820 pcs and 1025 pcs for 10 working hours, 5SM for 8 working hours, namely 849 pcs and 1061 pcs for 10 working hours, 457 for 8 working hours, namely 294 pcs and 368 pcs for 10 working hours, 874 for 8 working hours, namely 784 pcs and 980 pcs for 10 working hours, and 908 1-C for 8 working hours, namely 634 pcs and 792 pcs for 10 working hours.

B. Suggestions

➢ *Based on the Research Benefits Identified, here are some Suggestions:*

- *For Researchers*

✓ It is necessary to improve the ability to implement knowledge from lectures in real situations and try other relevant methods to take into consideration for work measurement in order to obtain efficient working time.
✓ Continuing more in-depth research into various work measurement methods and how these methods can be adapted to specific needs and conditions in various types of industry.

- *For Companies*

✓ Use the results of this research as a guide to improve the work measurement process in the future.
✓ Periodically evaluate the advantages and disadvantages of the current work process. Use the results of this evaluation to make continuous improvements and ensure that work processes are always at an optimal level in accorandce with operational needs.

- *For Universities*

✓ Make the results of this research additional material for literature discourse, both at the faculty and university level.
✓ Using this research as additional material for research and learning references at Pelita Bangsa University.

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