

## **Determination of Standard Working Time in the Cable Harness Production Process Using the Stopwatch Time Study Method at PT ABC**

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### **Abstract**

This study aims to determine the standard working time and evaluate daily production targets in the cable harness assembly process at PT ABC using the Stopwatch Time Study method. The research adopts a quantitative descriptive approach by directly observing operators on the production line under normal working conditions. Working time data were collected from eight work elements through 15 observation cycles for each element. The collected data were tested for uniformity and adequacy to ensure reliability before further analysis. Performance rating was determined using the Westinghouse system, while allowance factors were applied to account for fatigue, personal needs, and environmental conditions.

The results indicate that the total standard time required to complete one cable harness unit is 1,516 seconds. The standard time for each work element consists of 187 seconds for distribution, 208 seconds for sub-assembly, 188 seconds for mounting, 196 seconds for tapping, 180 seconds for ACB installation, 224 seconds for circuit testing, 163 seconds for relay insertion, and 170 seconds for the attachment process. Based on an effective working time of 8 hours per day (28,800 seconds) and a total manpower of 40 operators, the production line is capable of producing approximately 169 cable harness units per day. The findings of this study provide a practical reference for production planning, manpower allocation, and productivity improvement in cable harness manufacturing processes.

Keywords : Work Measurement; Standard Time; Stopwatch Time Study; Cable Harness; Productivity

### **INTRODUCTION**

Work productivity is one of the main indicators used to assess the success of a production process in manufacturing companies. A high level of productivity reflects a company's ability to manage its resources—particularly human resources, machinery, and working time effectively and efficiently. In an increasingly competitive industrial environment, companies are required not only to produce goods that meet quality standards but also to fulfill customer demand in the required quantity and within the specified time frame. Timely fulfillment of customer requirements is a critical factor, as delays in production can directly reduce customer satisfaction and potentially lead to a loss of customer trust, causing customers to switch to competing companies.

One of the common problems encountered in production activities is the inaccuracy in determining the working time required to complete a specific task. Poorly measured working time can result in imbalanced workloads among operators, work-in-process accumulation at certain workstations, and inaccuracies in production target planning. These conditions ultimately reduce overall productivity and efficiency in the production process. Therefore, a systematic and

measurable approach is needed to determine working time based on actual conditions in the workplace.

Work measurement is a method used to determine the amount of time required by an operator to complete a specific task at a normal working pace under optimal working conditions. Through work measurement, companies can obtain standard working time that accurately represents real working conditions. Standard working time plays an important role in production management, as it serves as a basis for setting incentive systems, planning workforce requirements, calculating production capacity, determining output targets, and developing more realistic and effective production schedules.

One of the methods commonly applied in work measurement is the Stopwatch Time Study method. This method is conducted by directly observing operator activities and recording the time required to complete each work element using a timing device. Stopwatch Time Study is considered effective because it provides detailed information on actual working time during the production process, enabling the determination of accurate standard working time. This method is particularly suitable for repetitive production processes with relatively fixed work sequences, such as cable harness production.

The cable harness production process requires a high level of accuracy, coordination, and proper management of working time. Each stage of the production process has different characteristics and levels of complexity, making it essential to establish appropriate standard working time to ensure optimal production performance. Without clearly defined standard working time, companies may face difficulties in setting daily production targets and optimizing the utilization of available labor.

Based on these conditions, this study aims to determine the standard working time in the cable harness production process using the Stopwatch Time Study method at PT ABC. This research focuses on measuring the actual working time required by operators to complete one unit of cable harness product. The results of this study are expected to serve as a reference for production planning and control, enabling the company to establish realistic production targets, improve work efficiency, and support sustainable productivity improvement.

## RESEARCH METHODS

This study applies a quantitative descriptive approach with a work measurement technique to determine standard working time in the cable harness production process. The research was conducted at PT ABC by directly observing production activities on the shop floor. The object of this study is the working time required by operators to complete one unit of cable harness product, while the research subjects are operators involved in the selected production line. Data collection was carried out under normal operating conditions to ensure that the measured working time reflects actual production performance.

The primary method used in this study is the Stopwatch Time Study method. This method involves direct observation of each work element in the cable harness production process, during which the time required to complete each activity is recorded using a stopwatch. Observations were conducted repeatedly to obtain representative time data and to minimize measurement errors caused by variations in operator performance or environmental conditions. The recorded times were then analyzed to determine the average observed time for each work element.

To obtain standard working time, the observed time data were adjusted by considering performance rating and allowance factors. Performance rating was used to account for differences between the observed working pace and the normal working pace, while allowance factors were applied to accommodate unavoidable delays such as fatigue, personal needs, and minor interruptions during the production process. The incorporation of these factors ensures that the resulting standard working time is realistic and applicable for production planning purposes.

The standard working time obtained from this analysis was subsequently used to evaluate production capacity and to determine achievable daily production targets. The results of this study

are expected to provide a reliable basis for workforce planning, production scheduling, and productivity improvement initiatives at PT ABC, particularly in the cable harness production process.

## RESULTS AND DISCUSSION

Data collection in this study was conducted in the cable harness production process at the Spacia Main line. The production process consists of several work elements, each of which was observed and measured to obtain working time data. These work elements represent the sequential activities performed by operators during the cable harness assembly process. The identification of work elements was carried out prior to the time measurement to ensure that each activity could be clearly observed and consistently recorded.

The working time measurement was performed for each identified work element using the Stopwatch Time Study method. The results of the identification of work elements in the Spacia Main line are presented in Table 1, which describes the sequence of activities involved in the cable harness production process..

Table 1. Work Elements of the Cable Harness Production Process on the Spacia Main Line

No	Elemen Kerja	Simbol Huruf
1	Distribusi	A
2	Sub Assy	B
3	Mounting	C
4	Tapping 1	D
5	Tapping 2	E
6	Tapping 3	F
7	ACB	G
8	Circuit Test	H
9	Relay Insertion	I
10	Attachment	H

Table 2. Data on the ticket time of the cable harness production process.

NO	DATA WAKTU KERJA PROSES PRODUKSI							
	A	B	C	D	E	F	G	H
1	128,4	1583,2	744,5	1510,5	548,5	467,9	125,8	348,6
2	127,6	1602,7	756,7	1525,2	465,7	457	117,1	362,9
3	139,3	1513,8	790,1	1541,6	488,2	432,8	102,9	373,6
4	146,1	1378,2	767	1477,3	479,9	437,6	115,1	338,1
5	146,4	1561,7	788,1	1471,2	470,3	419,6	102,8	381,5
6	145,7	1641,8	748,4	1556,9	491,6	422,8	106	339,3
7	136,8	1357,4	700,9	1572,4	483,6	427,9	103,6	369,6
8	127,1	1559,1	715,2	2639,7	493,8	465,8	115,1	355,5
9	142,9	1452	757,5	1516,6	494,8	403,1	112,2	355,3
10	124,5	1603,2	776,4	1493,7	544,3	443,6	110,9	346,8
11	136,7	1546,7	731,5	1442,7	561,4	436,7	109	360,3
12	127,9	1576,4	791,2	1430,1	509,5	439,1	110,4	316,1
13	136,5	1479,5	727,9	1512,1	487,7	561,6	115,5	335,7
14	135,6	1470,7	722,3	1553,2	504,4	504,3	127,2	336,7

15	136,5	1570,1	775,2	1462,5	478,6	411,6	102,6	332,8
X	2038	22896,5	11292,9	23705,7	7502,3	6731,4	1676,2	5252,8

**Data Uniformity Test**

The data uniformity test was conducted to evaluate the consistency of the observed working time data and to ensure that the data originated from the same population. This test was used to identify whether the recorded working time values were within acceptable control limits. The upper control limit (UCL) and lower control limit (LCL) were determined to establish the boundaries of data variation. Working time data that fell outside these control limits were considered non-uniform and were excluded from further analysis to maintain data reliability.

Following the data uniformity test, the average working time for each work element was calculated. This average value represents the central tendency of the observed data and serves as the basis for subsequent calculations in determining normal time and standard working time. The use of average working time ensures that the analysis reflects typical operator performance under normal working conditions

Calculate the average time of each work element.

1. Average Work Element

$$\bar{X} = \frac{\sum xi}{N}$$

$$\bar{X} = \frac{2038}{15}$$

$$\bar{X} = 135,8 \text{ (detik)}$$

2. Calculate the standard deviation of completion times.

$$\sigma = \frac{\sqrt{\sum(xi-\bar{x})^2}}{N-1}$$

$$\sigma = \frac{\sqrt{(128,4-135,8)^2+(127,6-135,8)^2+(139,3-135,8)^2+\dots+\dots+(136,5-135,8)^2}}{15-1}$$

$$\sigma = \frac{\sqrt{769,7}}{14}$$

$$\sigma = \sqrt{54,9}$$

$$\sigma = 7,4 \text{ (detik)}$$

3. Calculate the Upper Control Limit (UPC) and Lower Control Limit (LBC) values.

BKA =  $\bar{x} + k \sigma$   
 = 135,8 + 3(7,4)  
 = 158 (detik)

BKB =  $\bar{x} - k \sigma$   
 = 135,8 - 3(7,4)  
 = 113,6 (detik)

The calculation of the upper and lower control limits indicates that the working time for each process element must remain within the established control range during one production cycle. The results show that the working time should not exceed 158 seconds and should not be less than 113.6 seconds per cycle. Working time values outside this range are considered to deviate from normal process conditions and were therefore excluded from further analysis.

Table 3 presents the results of the data uniformity test, which evaluates whether the observed working time data fall within the established upper and lower control limits.

Data waktu kerja elemen A			
No	Waktu kerja	BKA	BKB
1	128,4	158	113,6
2	127,6	158	113,6
3	139,3	158	113,6
4	146,1	158	113,6
5	146,4	158	113,6
6	145,7	158	113,6
7	136,8	158	113,6
8	127,1	158	113,6
9	142,9	158	113,6
10	124,5	158	113,6
11	136,7	158	113,6
12	127,9	158	113,6
13	136,5	158	113,6
14	135,6	158	113,6
15	136,5	158	113,6

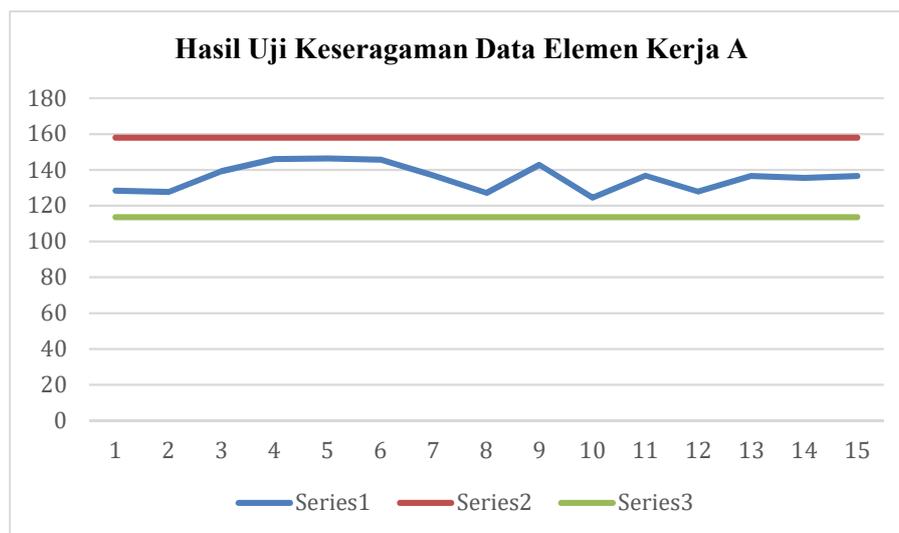


Figure 1 illustrates the results of the data uniformity test, showing the distribution of observed working time values in relation to the upper and lower control limits.

All collected data, covering work elements A through H, were found to be consistent and within the established control limits. Therefore, the data were considered suitable for further analysis to determine the standard working time of the production process.

#### Data Sufficiency Test

To perform the data adequacy test, the initial step involved processing the collected working time data using Microsoft Excel. Each observed data value was transformed by squaring it as part of the preparation for the adequacy analysis. This transformation was conducted to support the calculation required in the data adequacy test. The results of the squared data processing are presented in Table 4.

Table 4. Squared Working Time Data

NO	DATA WAKTU KERJA PROSES PRODUKSI																	
	A	A <sup>2</sup>	B	B <sup>2</sup>	C	C <sup>2</sup>	D	D <sup>2</sup>	E	E <sup>2</sup>	F	F <sup>2</sup>	G	G <sup>2</sup>	H	H <sup>2</sup>		
1	128,4	16486,56	1583,2	2506522,24	744,5	554280,3	1510,5	2281610	548,5	300852,3	467,9	218830,4	125,8	15825,64	348,6	121522		
2	127,6	16281,76	1602,7	2568647,29	756,7	572594,9	1525,2	2326235	465,7	216876,5	457	208849	117,1	13712,41	362,9	131696,4		
3	139,3	19404,49	1513,8	2291590,44	790,1	624288	1541,6	2376531	488,2	238399,2	452,8	187315,8	102,9	10580,41	373,6	139577		
4	146,1	21345,21	1378,2	1894655,24	767	588289	1477,3	2182415	479,9	230304	457,6	191493,8	115,1	13248,01	338,1	114311,6		
5	146,4	21432,96	1561,7	2438986,89	788,1	621101,6	1471,2	2164429	470,3	221321,1	419,6	176064,2	102,8	10578,84	381,5	145542,3		
6	145,7	21228,49	1641,8	2695507,24	748,4	560102,6	1556,9	2439938	491,6	241670,6	422,8	178799,8	106	11236	339,3	115124,5		
7	136,8	18712,24	1357,4	1842547,56	700,9	491260,8	1572,4	2472442	483,6	233869	427,9	183098,4	103,6	10732,96	369,6	136604,2		
8	127,1	16154,41	1559,1	2420792,81	715,2	511511	1439,7	2072736	493,8	243884,4	465,8	216899,6	115,1	13248,01	355,5	126300,3		
9	142,9	20420,41	1452	2108304	757,5	573806,3	1516,6	2300076	494,8	244827	403,1	162489,6	112,2	12588,84	355,3	126238,1		
10	124,5	15500,25	1603,2	2570250,24	776,4	602797	1493,7	2231140	544,3	296625,5	443,6	196781	110,9	12298,81	346,8	120270,2		
11	136,7	18686,89	1546,7	2392280,89	731,5	536923,3	1442,7	2081383	561,4	315170	456,7	197069	109	11881	360,3	129816,1		
12	127,9	16358,41	1576,4	2485036,96	791,2	625997,4	1430,1	2045186	509,5	259590,3	459,1	192808,8	110,4	12188,16	316,1	99919,21		
13	136,5	18632,25	1479,5	2188930,25	727,9	529838,4	1512,1	2286446	487,7	237851,3	561,6	315394,6	115,5	13340,25	335,7	112694,5		
14	135,6	18387,36	1470,7	2162958,49	722,3	521173,3	1553,2	2412430	504,4	254419,4	504,3	254318,5	127,2	16179,84	336,7	113366,9		
15	136,5	18632,25	1570,1	2465214,01	775,2	600935	1462,5	2138906	478,6	229058	411,6	169144,6	102,6	10526,76	332,8	110755,8		
$\sum x$	2038		22865		11292,9		22505,7		7302,3		6731,4		1676,2		5252,8		194831,9	
$\sum x^2$		277665,9		3504690,75		851358,2		3379590,3		3784110		3043395		188162,9		5252,8		194831,9

The working time measurement was conducted for each work element through an initial observation of 15 cycles (N = 15). As a result, each work element in every operational process consisted of 15 observed data points. This study applied a measurement accuracy level of 5% and a confidence level of 95%, corresponding to values of s = 0.05 and k = 2. These parameters indicate that the maximum allowable deviation in the collected data is limited to 5%, ensuring the reliability of the measurement results.

Furthermore, a data adequacy test based on the distribution process was performed using the specified values of k = 2 and s = 0.05. This test was conducted to determine whether the number of observations for each work element was sufficient to support further calculations. The outcome of this test serves as a basis for deciding whether the collected data can be used for subsequent analysis in determining standard working time.

$$N' = \frac{k}{s} \sqrt{\frac{N(\sum xi^2) - (\sum xi)^2}{\sum xi}}$$

$$N' = \frac{2}{0,05} \sqrt{\frac{15(277665,9) - (2038)^2}{2038}}$$

$$N' = \frac{40 \sqrt{4164989,1 - (4153444)^2}}{2038}$$

$$N' = \frac{40 \sqrt{11545,1}}{2038}$$

$$N' = \frac{40 (107,4)^2}{2038}$$

$$N' = \left(\frac{4296}{2038}\right)^2$$

$$N' = (2,10)^2$$

$$N' = 4,41$$

Based on the results of the data adequacy test, the number of observations was found to be sufficient for further analysis. This is indicated by the calculated required sample size ( $N'$ ) being smaller than the number of observations collected ( $N$ ), where  $N' = 4.41$  and  $N = 15$ . Therefore, the available data were deemed adequate to proceed with subsequent calculations.

Table 5 summarizes the results of the data adequacy test, indicating the adequacy of the observed data for further analysis.

No	Elemen Kerja	N	N'	Keterangan
1	Distribution	15	4,41	Data Cukup
2	Sub Assy	15	4,41	Data Cukup
3	Mounting	15	2,16	Data Cukup
4	Tapping	15	1,34	Data Cukup
5	ACB	15	5,01	Data Cukup
6	Circuit Test	15	11,9	Data Cukup
7	Relay Insertion	15	6,76	Data Cukup
8	Attachment	15	3,67	Data Cukup

The table above presents the results of the data uniformity test for each work element. The findings indicate that all work element data meet the required criteria and are therefore considered sufficient for further analysis.

## DATA ANALYSIS

### Finding Cycle Time

1. Cycle Time of Work Element A

$$WS = \frac{\sum xi}{N}$$

$$WS = \frac{2038}{15}$$

$$WS = 135,8 \text{ detik}$$

Table 6. Recapitulation of Cycle Time Calculations for All Work Elements

No	Elemen Kerja	WS
1	Distribusi	135,8
2	Sub Assy	1526,4
3	Mounting	752,8
4	Tapping	1500,3
5	ACB	500,15
6	Circuit Test	448,7
7	Relay Insertion	111,7
8	Attachment	350,18

**Determination of Adjustment Factors**

The Westinghouse system’s rating method incorporates four adjustment factors that influence operator performance, namely skill, effort, working conditions, and consistency. These factors are used to evaluate the operator’s performance level relative to normal working conditions. The determination of these adjustment factors should be carried out by a supervisor, senior operator, or personnel who have a thorough understanding of the operator’s job and work environment to ensure the accuracy and objectivity of the assessment.

Table 7. Operator Performance Rating Based on the Westinghouse System

No	Elemen Kegiatan	Simbol	Aspek				Jumlah
			Skill	Effort	Condition	Consistency	
1	Distribusi	A	Good (C1) + 0,06	Good (C1) + 0,05	Excellent (B) + 0,04	Good (C) + 0,01	+0,16
2	Sub Assy	B	Excellent (B1) + 0,11	Excellent (B1) + 0,10	Excellent (B) + 0,04	Good (C) + 0,01	+0,26
3	Mounting	C	Excellent (B1) + 0,11	Excellent (B1) + 0,10	Excellent (B) + 0,04	Good (C) + 0,01	+0,26
4	Tapping	D	Excellent (B1) + 0,11	Good (C1) + 0,05	Excellent (B) + 0,04	Good (C) + 0,01	+0,21
5	ACB	E	Excellent (B1) + 0,11	Good (C1) + 0,05	Excellent (B) + 0,04	Good (C) + 0,01	+0,21
6	Circuit Test	F	Excellent (B1) + 0,11	Excellent (B1) + 0,10	Good (C) + 0,02	Excellent (B) + 0,03	+0,26
7	Relay Insertion	G	Excellent (B1) + 0,11	Good (C1) + 0,05	Excellent (B) + 0,04	Excellent (B) + 0,03	+0,23
8	Attachment	H	Excellent (B1) + 0,11	Good (C1) + 0,05	Excellent (B) + 0,04	Excellent (B) + 0,03	+0,23

The data presented in the table above indicate that the skill and effort ratings were assigned by a supervisor or team leader who has a comprehensive understanding of the operators’ tasks and performance. Meanwhile, the condition and consistency ratings were determined based on direct observations conducted by the researcher during the production process. This approach was applied to ensure that each performance factor was assessed by the most appropriate and knowledgeable party.

The calculation of the adjustment factor using the Westinghouse system was performed by summing the values of the four performance factors. If the total value of these factors resulted in a positive adjustment, the performance rating (p) was obtained by adding the total adjustment value to the base rating of p = 1. Conversely, if the total adjustment value was negative, the performance rating was calculated by adding the negative value to p = 1, resulting in a performance rating of less than 1. A performance rating equal to 1 indicates that the operator is working at a normal performance level, while a performance rating lower or higher than 1 reflects performance that is below or above the normal standard.

Normal Time Determination

1. Normal Time of Distribution Process

$$\begin{aligned}
 WN &= \text{Cycle Time} \times \text{Performance Rating} \\
 &= 135,8 \times 1,16 \\
 &= 157,5
 \end{aligned}$$

Table 8. Summary of Normal Time Calculations for All Work Elements

No	Elemen Kegiatan	WN (detik)
1	Distribution	157,5
2	Sub Assy	1923,2
3	Mounting	948,5
4	Tapping	1815,3
5	ACB	605,3
6	Circuit Test	565,3
7	Relay Insertion	137,3
8	Attachment	430,7

### Determining the Grace Period

The allowance determination presented in Table 9 is based on the classification of work effort as very light, with operators performing tasks in a standing position on both feet and executing normal work movements. Visual activities are carried out almost continuously under adequate lighting conditions. The working environment is characterized by a normal temperature range of 22–28 °C, good air circulation, and a clean atmosphere. In addition to these factors, a personal needs allowance of 2% is applied. Based on these considerations, the total allowance is determined to be 19%.

Table 9. Summary of Allowance Determination for Cable Harness Assembly

Faktor	Kelonggaran	Kelonggaran (%)
<b>A. Tenaga yang Dikeluarkan</b>		
Sangat Ringan	6	0.06
<b>B. Sikap Kerja</b>		
Berdiri di atas dua kaki	1	0.01
<b>C. Gerakan Kerja</b>		
Normal	0	0
<b>D. Kelelahan Mata</b>		
Pandangan yang hampir terus menerus	5	0.05
<b>E. Keadaan Temperatur Tempat Kerja</b>		
Normal	5	0.05
<b>F. Keadaan Atmosfer</b>		
baik	0	0
<b>G. Keadaan Lingkungan yang Baik</b>		
Bersih, sehat, cerah dengan kebisingan rendah	0	0
<b>Jumlah</b>	<b>17</b>	<b>0.17</b>

### Perhitungan Waktu Baku

- Waktu baku Distribusi  
 Waktu baku = Waktu normal + (A x Waktu normal)  
 $WB = 157,5 + (0,19 \times 157,5)$   
 $WB = 187,4$
- Waktu baku *Sub Assy*  
 Waktu baku = Waktu normal + (A x Waktu normal)  
 $WB = 1923,2 + (0,19 \times 1923,2)$   
 $WB = 2288,6$
- Waktu baku *Mounting*  
 Waktu baku = Waktu normal + (A x Waktu normal)  
 $WB = 948,5 + (0,19 \times 948,5)$   
 $WB = 1128,7$
- Waktu baku *Tapping*  
 Waktu baku = Waktu normal + (A x Waktu normal)  
 $WB = 1815,3 + (0,19 \times 1815,3)$   
 $WB = 2160,2$
- Waktu baku *ACB*  
 Waktu baku = Waktu normal + (A x Waktu normal)  
 $WB = 605,3 + (0,19 \times 605,3)$   
 $WB = 720,3$
- Waktu baku *Circuit Test*  
 Waktu baku = Waktu normal + (A x Waktu normal)  
 $WB = 565,3 + (0,19 \times 565,3)$   
 $WB = 672,7$
- Waktu baku *Relay Insertion*  
 Waktu baku = Waktu normal + (A x Waktu normal)  
 $WB = 137,3 + (0,19 \times 137,3)$   
 $WB = 163,3$

8. Waktu baku *Attachment*

$$\text{Waktu baku} = \text{Waktu normal} + (A \times \text{Waktu normal})$$

$$\text{WB} = 430,7 + (0,19 \times 430,7)$$

$$\text{WB} = 512,5$$

Tabel 10 Hasil perhitungan waktu baku

No	Elemen Kegiatan	WB (detik)
1	<i>Distribusi</i>	187,4 detik
2	<i>Sub Assy</i>	2288,6 detik
3	<i>Mounting</i>	1128,7 detik
4	<i>Tapping</i>	2160,2 detik
5	<i>ACB</i>	720,3 detik
6	<i>Circuit Test</i>	672,7 detik
7	<i>Relay Insertion</i>	163,3 detik
8	<i>Attachment</i>	512,5 detik

The table above presents the standard time calculation based on a single operator, which is intended to simplify the determination of manpower requirements for each work element. Currently, the Spacia Main line employs a total of 40 operators in the cable harness assembly process, with varying manpower allocation across different work elements. To determine the actual standard time for each work element under current operating conditions, the standard time values obtained in the table were divided by the number of operators assigned to each work element. This approach allows for the estimation of effective processing time per work element and provides a basis for calculating the number of cable harness units that can be assembled daily with a total workforce of 40 operators.

Table 11. Summary of Standard Time by Work Element

No	Elemen Kegiatan	WB/man power	Waktu baku
1	<i>Distribution</i>	187,4 detik/1	187 detik
2	<i>Sub Assy</i>	2288,6 detik/ 11	208 detik
3	<i>Mounting</i>	1128,7 detik/6	188 detik
4	<i>Tapping</i>	2160,2 detik/11	196 detik
5	<i>ACB</i>	720,3 detik/4	180 detik
6	<i>Circuit Test</i>	672,7 detik/3	224 detik
7	<i>Relay Insertion</i>	163,3 detik/1	163 detik
8	<i>Attachment</i>	512,5 detik/3	170 detik
TOTAL			1516 detik

After determining the standard time for each work element, the next step was to calculate the total time required to complete one cable harness unit. Based on the standard time calculations for the eight work elements, the total standard time for one complete production cycle was obtained by summing the standard times of all processes. The results show that the total standard time required to produce one cable harness is 1,516 seconds.

The distribution of standard time across the production stages consists of 187 seconds for the distribution process, 208 seconds for sub-assembly, 188 seconds for mounting, 196 seconds for tapping, 180 seconds for ACB installation, 224 seconds for circuit testing, 163 seconds for relay insertion, and 170 seconds for the attachment process. These values represent the standard time required for each process element under normal working conditions.

The cable harness production process is carried out continuously and sequentially, starting from the distribution stage and ending with the attachment process. Since the attachment process represents the final output stage, the daily production target was determined based on the standard time of this process, which is 170 seconds and already includes allowance factors. With an effective working time of 8 hours per day, equivalent to 480 minutes or 28,800 seconds, the achievable daily output was calculated by dividing the available working time by the standard time of the attachment process. Based on this calculation, the production line is capable of producing approximately 169 cable harness sets per day with a total manpower of 40 operators..

**OPC (Operation Proses Chart)**

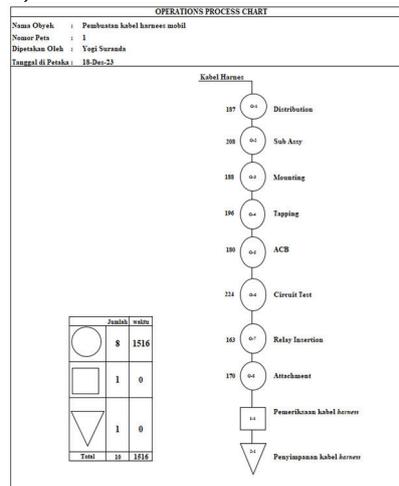


Figure 2. Operation Process Chart (OPC) for the Cable Harness Assembly Process

**Process Flow Map**

A process flow chart is a diagram that illustrates the sequence of activities occurring within a process or procedure. It describes the order of operations, inspections, transportation, waiting, and storage activities that take place throughout the entire production process. In this study, the process flow chart represents the stages involved in the cable harness assembly process, as presented below.

PETA ALIRAN PROSES			
RINGKASAN		PEKERJAAN : Perakitan Kabel Harness	
KEGIATAN	SEKARANG	NO PETA : 03	SEKARANG
OPERASI	8	1516	SEKARANG
PENYIMPANAN	3	0	DIPETAKAN OLEH : Yogi Suranda
TRANSPORTASI	3	25	TANGGAL DI PETAKAN : 18 Desember 20
MENGGALAS	1	0	
PENYIMPANAN	1	0	
JARAK TOTAL	1000		
URAIAN KEGIATAN		JARAK	WAKTU
Pengambilan wire dari gedung 05 di bawa ke gedung 200		800 m	15
Pengambilan wire di tempat penyimpanan di gedung 200 untuk di bawa ke line		100 m	5
menyebarkan wire diruang di assembly board dengan jg sebagai penyangga dan melakukan pengisian material ke box board assembly			187
menyambungkan terminal ke dalam konektor sehingga wire siap untuk dilakukan pada proses selanjutnya			208
pengalangan wire sub assy di assembly board dengan jg sebagai penyangga yang di letakkan sesuai fungsinya masing masing			188
pengalangan wire sub assy yang telah di letakkan di assembly board dengan menggunakan material tape dan material lainnya			196
Pemasangan beberapa klip ke wire harness yang sudah di tapping dengan menggunakan busuk sebagai alat bantu agar tidak ada benturan saat pemasangan klip			180
kegiatan pengecekan arus pada wire harness untuk memastikan bahwa terminal jark terhubung sesuai standar keselamatan dan fungsi			224
Pemasangan relay yang berfungsi untuk mengontrol arus listrik dari satu zona ke komponen lainnya			163
pemasangan cover penutup ECU, pemasangan klip binder dan pengecekan arus			170
Pemeriksaan			0
di bawa ke tempat penyimpanan		100 m	5
Penyimpanan			0

Figure 3. Process Flow Diagram of the Cable Harness Assembly Process

## CONCLUSION

The results of the working time measurement using the Stopwatch Time Study method indicate the standard time required for operators to complete each work element under normal working conditions. The standard times obtained were 187 seconds for the distribution process, 208 seconds for sub-assembly, 188 seconds for mounting, 196 seconds for tapping, 180 seconds for ACB installation, 224 seconds for circuit testing, 163 seconds for relay insertion, and 170 seconds for the attachment process.

Based on the standard time values of the eight work elements, the total standard time required to complete one production cycle and produce a single cable harness was determined by summing the time of each process. The calculation shows that a total of 1,516 seconds is required to complete one cable harness unit from the initial distribution stage to the final attachment process.

The cable harness production process operates in a continuous and sequential manner, with material input beginning at the distribution stage and finished output produced after the attachment stage. Therefore, the daily production target was determined based on the standard time of the attachment process, which represents the final output stage and already includes allowance factors. With an effective working time of 8 hours per day, equivalent to 28,800 seconds, the achievable daily output was calculated by dividing the available productive time by the standard time of the attachment process. The results indicate that the production line is capable of producing approximately 169 cable harness sets per day with a total manpower of 40 operators.

## SUGGESTION

Based on the results of the analysis and conclusions, several recommendations are proposed that may be beneficial for the company. First, the standard working time obtained from this study can be used as a reference for establishing production targets. In addition, it may serve as an objective benchmark for evaluating employee performance and assessing whether operators are working productively in accordance with established standards.

Second, the analysis of the standard time for the cable harness assembly process indicates that there are noticeable differences in standard time among several work elements. To prevent delays and excessive waiting time between processes, it is recommended that manpower allocation be reviewed and adjusted. Adding or redistributing operators across certain work elements can help balance the workload and ensure a continuous and smoother production flow.

Third, during the observation and analysis stages of the study, several factors were identified that may reduce work productivity. Therefore, it is recommended that the company improve supporting facilities and infrastructure to enhance operator comfort and create a more conducive working environment, which may positively impact overall productivity.

Finally, it is recommended that the company formally implement a standard time system for work completion. The adoption of such a system will enable the company to define realistic output standards for each operator and support more effective production planning, control, and performance evaluation.

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