

# How to Perform a Time Study

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Since the emergence of Taylorism in the 1880's (a system of scientific management developed by Frederick W. Taylor), industrial production has been broken down into its most basic elements to obtain the greatest efficiency. To obtain this level of efficiency, one must analyze all of these basic elements to develop the most effect production method. One of the most essential elements is the standard assembly time of the assembly line being developed. There are several methods to obtain a standard time, each more accurate than the others depending on some factors of the assembly (time to assemble, cyclical v. asynchronous assembly, complexity of motions, etc.). A time study is the most common method to obtain a standard time and is accurate for most assemblies, being very accurate for any cyclical assembly. A cyclical assembly is an assembly that repeats the same cycle each time the assembly is completed.

Performing a time study consists of 3 main tasks. The first task involves observing and setting up. To do this, you will observe the assembly to break it down into steps (elements). Using this information, you will set up the time study form (one is provided with this instruction set), and gather all the materials needed to begin the study. The second task involves gathering the data. You will observe the task again, simply recording the times it takes to perform each step of the assembly. The third task is the analysis of the data. The analysis involves using the data you gather to determine the standard time for the assembly.

## **WARNING! READ BEFORE ATTEMPTING**

This instruction set is assuming you are observing an assembly in a factory setting. While there are no dangers involved in the time study itself, **FACTORIES ARE EXTREMELY DANGEROUS AREAS**. Please become informed of the potential safety hazards of the factory you are in and **FOLLOW ALL OF THE SAFETY PROCEDURES**. Serious injury or death can occur in a factory, so do not ignore this warning.

## **Required Materials**

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- Time Study Form (*provided on next page*)
- Timing Device (*must have a lap timing setting*)
- Pen/Pencil
- Safety Equipment (*as required by factory, e.g. safety goggles*)
- Clipboard

# Time Study Observation Form

Study No.:	Date:	Page of
Operation:	Operator:	Observer:

Element No. and Description	Note	Cycle	1				2				3				4				5				
			R	W	OT	NT																	
		1																					
		2																					
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					
		9																					
		10																					
		11																					
		12																					
		13																					
		14																					
		15																					
		16																					
		17																					
		18																					

Summary	
Total OT	
Rating	
Total NT	
No. Observations	
Average NT	
% Allowance	
Elemental	
No. Occurences	
Standard Time	

**Total Standard Time (sum standard time for all elements):**

Foreign Elements				Time Check			Allowance Summary	
Sym	W1	W2	OT	Description	Finishing Time	Starting Time	Personal Needs	
A							Basic Fatigue	
B					Elapsed Time		Variable Fatigue	
C					TEBS		Special	
D					TEAF		Total Allowance %	
E					Total Check Time		Remarks:	
F					Effective Time			
G					Ineffective Time			
<b>Rating Check</b>					Total Recorded Time			
Synthetic Time				%	Unaccounted Time			
Observed Time					Recording Error %			

# Procedure

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This section breaks down each of the three tasks (observe/set-up, gather data, analyze) into basic steps. To ease your understanding, it will also follow the assembly of a pen as a basic example to describe how to complete the time study from beginning to end. Follow the procedure in sequence to complete the study.

## Task 1: Observe/Set-up

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**Step 1:** Watch the assembly until you feel familiar with the process.

**Step 2:** Define a clear beginning/end point of the complete assembly.

**Note:** *This cannot be ambiguous. You will need to define the exact point that the assembly ends, not the step. In the example, this is when the operator (person performing the assembly) releases the completely assembled pen from his hand. Notice that if this point was defined as “assembly complete”, one may record the time when the cap is finally placed on the pen during one cycle then the point when the pen is set down during the next cycle. This will cause inconsistency in the study.*



Beginning/end point for pen assembly

**Step 3:** Break the rest of the assembly down into clear steps. Define a clear end point for each step.

**Note:** *Just as in step 2, the end point must be a clear, consistent point. The end point of each step is the point where you will click the “lap” button on your timing device.*

**Step 4:** Record each step you have defined in the top row, directly adjacent of the corner labeled “Element No. and Description”, numbering each element in the top-left corner in the order they occur.

Element No. and Description	1				2				3			
	R	W	OT	NT	R	W	OT	NT	R	W	OT	NT
	Pick up cap and bottom				Combine components				Set down pen			

The red labels are the steps for the pen assembly

**Note:** Label the steps (elements) from left to right in the order they occur. This will be important when you retrieve the times from your timing device.

**Step 5:** Gather a timing device, pencil, clipboard, and the time study form. Attach the form to the clipboard. Proceed to the area where you can observe the assembly. Set the timing device to the lap timing setting.

**Note:** Be sure to have a place where you can clearly observe each step of the assembly so that you do not miss any of the steps.

## Task 2: Gather Data

In this section you will need to decide how you will record the times gathered. Most commonly seconds are used. Some will use hundredths of a minute.

**Step 1:** Observe the assembly until the operator reaches the beginning/end point of the assembly. Start the timer when this point occurs.

**Step 2:** Click the lap button on the timer when the end point of each element occurs. Record the rating you determine at the end each step. Continue this process until you observe 18 cycles (18 complete assemblies).

Cycle	R	W	OT	NT	R	W	OT	NT	R	W	OT	NT
1	100				110				90			
2	100				90				110			

The red numbers are the ratings that have been recorded for the pen assembly

**Note:** Do not record the times during the observation, you will do this later. *The rating is a value describing the speed at which the operator is working relative to an average operator. A 100 rating means that the operator is working at the standard pace. Below a 100 means the operator is working slower than the standard pace, and above 100 means the operator is working faster.*

**Step 3:** Use the recall function on your timing device to view the time recorded for the first step of the first cycle. Record this time on the time study form under the column labeled W. Continue to record sequential times in the corresponding box until all times have been recorded.

Cycle	R	W	OT	NT	R	W	OT	NT	R	W	OT	NT
1	100	0.8			110	1.9			90	2.2		
2	100	2.9			90	3.7			110	4.0		

The times in the “W” column are the times recorded from the stop watch

**Note:** You should be recording the total time in the column labeled W, because this is how most timing devices will read (i.e. if the first step took 10 seconds and the second step took 5 seconds, it should read 10 then 15).

### Task 3: Analyze

This section will describe how to fill out the time study observation form and determine the standard assembly time. The “Time Check”, “Foreign Elements”, and “Rating Check” sections will not be filled out, for most time studies will not take this into consideration.

**Step 1:** Record the actual time it took to perform each individual step under the column labeled OT (observed time). To get this time, subtract the time under the W column for the previous step from the time under W for the step you are calculating the observed time for.

Element No. and Description		1 Pick up Cap and Bottom				2 Combine components				3 Set down pen					
		Note	Cycle	R	W	OT	NT	R	W	OT	NT	R	W	OT	NT
	1		100	0.8	0.8			110	1.9	1.1			90	2.2	0.3
	2		100	2.9	0.7			90	3.7	0.8			110	4.0	0.3

The numbers in the “OT” column are the observed times for the pen assembly. As you can see, this was calculated by subtracting preceding “W” values.

**Step 2:** Multiply the observed time (OT) for each step by the rating (as a percentage; refer to the equation below). Record this number in the column labeled NT (normal time).

$$NT = (OT) * (Rating / 100)$$

Element No. and Description		1 Pick up Cap and Bottom				2 Combine components				3 Set down pen						
		Note	Cycle	R	W	OT	NT	R	W	OT	NT	R	W	OT	NT	
	1		100	0.8	0.8	0.8		110	1.9	1.1	1.21		90	2.2	0.3	0.27
	2		100	2.9	0.7	0.7		90	3.7	0.8	0.72		110	4.0	0.3	0.33

The numbers in the “NT” column are the normal times calculated using the formula to the left.

**Step 3:** Refer to the Allowance section at the bottom right-hand side of the page. Record the allowances, determined by several factors of the assembly, in the corresponding boxes. Sum these values and record in the box labeled "Total Allowances %".

Allowance Summary	
Personal Needs	5
Basic Fatigue	4
Variable Fatigue	0
Special	0
Total Allowance %	9

**Note:** The different allowance values can be found in many sources. The allowance is determined by the company. So, to get this number, you will have to consult your company.

These allowances were determined using the ILO Recommended Allowances. If your company does not provide allowances, this table may be used.

**Step 4:** Sum the observed times (OT column) for each step in the assembly individually. Record these values in the "Summary Section" in the box labeled "Total OT" corresponding to the step.

	18			
<b>Summary</b>				
Total OT	1.5	1.9	0.6	
Rating				
Total NT				
No. Observations				
Average NT				
% Allowance				
Elemental				
No. Occurrences				
Standard Time				
Total Standard Time (sum st				

**Step 5:** Sum the normal times (NT column) for each step in the assembly individually. Record these values in the "Summary Section" in the box labeled "Total NT" corresponding to the step.

<b>Summary</b>				
Total OT	1.5	1.9	0.6	
Rating				
Total NT	1.5	1.93	0.6	
No. Observations				
Average NT				
% Allowance				
Elemental				
No. Occurrences				
Standard Time				
Total Standard Time (sum st				

**Step 6:** Divide the total normal time by the total observed time for each step to calculate the rating. Record this number in the box labeled "Rating" corresponding to the step.

<b>Summary</b>				
Total OT	1.5	1.9	0.6	
Rating	100	101.6	100	
Total NT	1.5	1.93	0.6	
No. Observations				
Average NT				
% Allowance				
Elemental				
No. Occurrences				
Standard Time				
Total Standard Time (sum				

$1.5/1.5 = 100$

**Step 7:** Record the number of cycles observed in the box labeled “No. Observations”.

Summary			
Total OT	1.5	1.9	0.6
Rating	100	101.6	100
Total NT	1.5	1.93	0.6
No. Observations	2	2	2
Average NT			
% Allowance			
Elemental			
No. Occurrences			
Standard Time			
Total Standard Time (sum)			

**Step 8:** Divide the total normal time for each step by the number of occurrences. Record this value in the box labeled “Average NT” corresponding to the step.

Summary			
Total OT	1.5	1.9	0.6
Rating	100	101.6	100
Total NT	1.5	1.93	0.6
No. Observations	2	2	2
Average NT	0.75	0.965	0.3
% Allowance			
Elemental			
No. Occurrences			
Standard Time			
Total Standard Time (sum)			

$1.5/2 = 0.75$

**Step 9:** Record the % allowance you determined in step 3 in the box labeled “% allowance”. Use the below formula to calculate the standard time for each step. Record this value in the box labeled “Standard Time” corresponding to the step.

Standard Time =  $NT * (1 + \% \text{ allowance}/100)$

**Note:** The % allowance should be a whole number. Ignore the boxes labeled “Elemental” and “No. Occurrences”.

Summary			
Total OT	1.5	1.9	0.6
Rating	100	101.6	100
Total NT	1.5	1.93	0.6
No. Observations	2	2	2
Average NT	0.75	0.965	0.3
% Allowance	9	9	9
Elemental			
No. Occurrences			
Standard Time	0.8175	1.0519	0.327
Total Standard Time (sum)			

$0.75 * (1 + 9/100) = 0.8175$

**Step 10:** Sum the standard times you have calculated for each step and record it in the box labeled “Total Standard Time”. This is the standard time for the assembly.

Total Standard Time (sum standard time for all elements):	2.1964
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As you can see, the red number (2.1964) is the standard assembly time for the pen. Note that this is the sum of the standard times from the three steps in the image from step 9.

# Glossary

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- **Observed Time:** The exact amount of time that was observed to complete the assembly or step
- **Normal Time:** The adjusted observed time for the assembly or step. The adjustment is calculated by determining if the operator was moving at a fast or slow pace.
- **Standard Time:** The adjusted normal time for the assembly or step. The adjustment is calculated by determining the % allowance for the assembly.
- **Rating:** A value describing the rate at which an operator is performing. A value of 100 is given for a standard rate, with the number increasing for a faster rate and decreasing for a slower rate.
- **% Allowance:** A value describing how the normal time will change, based on fatigue and personal needs of the operator.

# Troubleshooting

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<b>Problem</b>	<b>Solution</b>
The assembly consists of more than six steps/elements.	Use a second form, recording the additional steps on this sheet. Perform the "analyze" task as you would for a single sheet.
A step occurs more than once during each assembly.	Make this step a separate step for each time it occurs. (e.g. combine components 1, combine components 2)
A step occurs too quickly to accurately time	Combine this step with the preceding or following step.