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Improving The Assembly Process of Down lighter by using Two Hand Process Chart

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Abstract: ***The objective of this research is to improve the productivity by optimizing certain operations of the manual assembly process of a product in a manufacturing industry. By creating a standard process in manual assembly line time is saved as well as energy of the worker is also saved. This leads to increased units of production and lesser fatigue. In this paper, flow process chart of assembly line of a particular product is studied. The two hand process chart of selective time consuming operations is carried out. The time saved and improvement to the operations is noted thus improving the assembly process.***

Keywords: Work flow, Two hand process, Downlighter

I. INTRODUCTION

Optimization is very important, in almost all the operations of a manufacturing industry. There is a need to produce more at low cost to sustain in market. This paper focuses on improving the process by reducing the time in the assembly process. Verma Electricals was established in 2012. They manufacture LEDs, luminaries. A total of 26 employees work at the industry. The capacity of production is 270 units per day. The various products are downlighter, pearl, savior, soft light, task light.

Flow process chart is the sequence in which the product flows through the process or the complete procedure. All the events are recorded by using symbols.

There are three types of flow process charts: Man type, Machine type, Material type:

- Flow process chart –man type: A flow process chart which records what the worker does
- Flow process chart –material type: A flow process chart which records how material is handled or treated
- Flow process chart –equipment type: A flow process chart which records how equipment is used

Two hand process chart:

The activities of hands of the workers are recorded in the two hand process chart, in relationship with one another.

The different symbols used are:

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II. FLOW PROCESS CHART

The below flow process chart is of the assembly section of product down lighter. It shows the sequence of assembly operations carried out for downlighter. It also shows the time taken by each operation to complete the assembly process.

Table I. Flow Process Chart

PRODUCT CODE:LD-30-006-XXX-WH-XX				
PRODUCT NAME:LED SQR,DOWNLIGHTER				
PROCESS CHART		MATERIAL TYPE		
CHART NO.1 SHEET NO.1		SUMMARY		
CHARTED		ACTIVITY		PRESENT
		OPERATION	○	13
ACTIVITY: ASSEMBLY		TRANSPORTATION	→	3
METHOD: PRESENT		DELAY	D	1
LOCATION: LED DEPT		INSPECTION	□	1
		STORAGE	▽	1
ESCRIPTION	DIST	TIME	YMBOL ○ → D □ ▽	REMARK
W/P ON ASSEMBLY TABLE				
RIVETING OF HEAT SINK WITH BRACKET		9 SEC		
TRANSPORT TO FITTING STATION 2				
TEMPORARY STORAGE				
EARTHING FITTING				
CONNECTOR ASSEMBLY		10 SEC		
DIFFUSOR PLACEMENT				
REFLECTOR FITTING		8 SEC		
PLACEMENT ON SIDE TABLE				
CORNER FITTING (by glue gun)				
MOUNTING CLIP ATTACHMENT		11.7 SEC		
ASSEMBLY OF LED WITH THE HOUSING		4.5 SEC		
ASSEMBLY OF LEAF FRAME WITH HEAT SINK		14 SEC		
FINAL WIREING		20.5 SEC		
FINAL INSPECTION				
LABELING				
PACKAGING				
STORAGE				
TOTAL CYCLE TIME		77.7 SEC		

III.TWO HAND PROCESS CHART

The two hand process chart of each operation is carried out.

The original process is given by giving red color to the steps and the improved process is given by giving green color to the steps.

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TABLE II: Operation of Riveting of Heat Sink with Bracket

OPERATION:
RIVETING OF HEAT SINK WITH BRACKET
LOCATION
NO OF OPERATOR:1

LEFT HAND DESCRIPTION	RIGHT HAND DESCRIPTION
TO BUSH	IDLE
PLACEMENT OF BUSH	IDLE
HOLD	TO BRACKET
HOLD	PLACEMENT OF BRACKET
TO PUNCH	HOLD
HOLD	TO HAMMER
HOLD	RIVETING
HOLD	TO HEAT SINK
HOLD	TO ASSEMBLY
TO ASSEMBLY	HOLD
HOLD	TO SCREW
HOLD	ASSEMBLYING
FIRM HOLD	TO HAMMER
HOLD	HAMMERING
PLACE IN BIN	IDLE
TO BUSH	TO BUSH
TO FIXTURE	TO FIXTURE
TO PUNCH	TO BRACKET
IDLE	PLACEMENT OF BRACKET
PLACEMENT OF PUNCH	TO HAMMER
HOLD	RIVETING
DROP PUNCH	PICK SCREW
TO ASSEMBLY	TO ASSEMBLY
TURN 180 ANGLE	TO HEAT SINK
HOLD SCREW	HAMMERING
IDLE	PLACE IN BIN

Table III: Operation of Earthing and Connector Fitting

OPERATION:
EARTHING AND CONNECTOR FITTING
LOCATION
NO OF OPERATOR:1

LEFT HAND DESCRIPTION	RIGHT HAND DESCRIPTION
HOLD BRACKET ASSEMBLY	IDLE
HOLD	TO EARTHING BRACKET
HOLD	POSITION
HOLD	TO SCREW FIT
HOLD	TIGHTENING
HOLD	TO TESTER
HOLD	TIGHTENING
HOLD	TO SCREW AND EARTHING TAP
HOLD	POSITION EARTHING TAP
HOLD	TO CONNECTOR
HOLD	TO SCREW AND NUT
HOLD	TWISTING
IDLE	PLACE IN BIN
TO EARTHING BRACKET	TO SCREW FIT AND SCREW
TO SCREW AND EARTHING TAP	TO TESTER
POSITION	SCREWING
TO CONNECTOR & NUT	SCREWING
POSITION	TO SCREW
HOLD	SCREWING
IDLE	PLACE IN BIN

Table IV: Operation of Reflector Fitting and Placement on Side Table

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TWO HAND PROCESS CHART	
CHART:3	SHEET:3
DRAWING AND PART OPERATION: Reflector fitting and placement on side table LOCATION NO OF OPERATOR:1	

LEFT HAND DESCRIPTION	RIGHT HAND DESCRIPTION
TO LEAF FRAME	TO DIFFUSOR
PLACE LEAF FRAME ON TABLE	ASSEMLE DIFFUSER ON FRAME
HOLD	TO REFLECTOR
HOLD FIRM IN PLACE	ASSEMBLE REFLECTOR
HOLD	TO GLUE GUN
HOLD	GLUING
PLACE IN BIN	IDLE

Table V: Operation of Mounting Clip Attachment

CHART:4	SHEET:4
DRAWING AND PART OPERATION: MOUNTING CLIP ATTACHMENT LOCATION NO OF OPERATOR:2	

LEFT HAND DESCRIPTION	RIGHT HAND DESCRIPTION
TO ASSEMBLED FRAME	IDLE
PLACEMENT ON FOAM TABLE	TO MOUNTING CLIP
HOLD	PLACEMENT ON ASSEMBLY
HOLD	TO RIVET
HOLD	PLACEMENT OF RIVET
HOLD	TO AIR GUN
HOLD	PLACEMENT OF AIR GUN
HOLD	AIR RIVETING
TURN 180 ANGLE	TO MOUNTING CLIP
HOLD	PLACEMENT
HOLD	TO RIVET
HOLD	PLACEMENT OF RIVET
HOLD	TO AIR GUN
HOLD	PLACEMENT OF AIR GUN
HOLD	AIR RIVETING
IDLE	TO FINISHED PART
TO MOUNTING CLIP	TO MOUNTING CLIP
TO FIXTURE	TO FIXTURE
TO RIVETS	TO FRAME
POSITION OF RIVET	TO AIR GUN
HOLD	AIR RIVETING
IDLE	PLACE IN BIN

Table VI: Operation of Led Fitting

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TWO HAND PROCESS CHART		
CHART:5	SHEET:5	
DRAWING AND PART		
OPERATION: LED FITTING LOCATION NO OF OPERATOR:2		
LEFT HAND DESCRIPTION		RIGHT HAND DESCRIPTION
TO FRAME & HEAT SINK HOLD PLACEMENTOF FRAME HOLD TO LED PLACEMENT ON HEAT SINK HOLD HOLD IDLE		IDLE TO THERMAL INSULATOR TO FRAME APPLICATION ON HEAT SINK IDLE IDLE TO SCREW DRIVER TIGHTENING PALCEMENT ON BIN
TO FRAME & HEAT SINK TO FIXTURE TO LED PLACEMENT ON HEAT SINK IDLE		TO THERMAL INSULATOR APPLICATION ON HEAT SINK TO SCREW DRIVER TIGHTENING PALCEMENT ON BIN

Table VII: Operation: Assembly of Leaf Frame and Heat Sink

CHART:6	SHEET:6	
DRAWING AND PART OPERATION: ASSEMBLY OF LEAF FRAME AND HEAT SINK LOCATION NO OF OPERATOR:2		
LEFT HAND DESCRIPTION		RIGHT HAND DESCRIPTION
TO FRAME TO TABLE TO BRACKET POSITION HOLD HOLD HOLD HOLD HOLD HOLD TURN POSITION HOLD HOLD HOLD HOLD HOLD HOLD HOLD		IDLE IDLE IDLE IDLE TO SCREWDRIVER AND SCRE PLACEMENT TIGHTEN TO SCREW PLACEMENT TIGHTEN IDLE IDLE TO SCREW PLACEMENT TIGHTEN TO SCREW PLACEMENT TIGHTEN PLACE IN BIN
TO SCREWDRIVER AND SCRE POSITION SCREWS HOLD HOLD HOLD HOLD HOLD		TO FRAME BRACKET TO FIXTURE TIGHTEN TIGHTEN TIGHTEN TIGHTEN PLACE IN BIN

Table VIII: Operation of Final Wiring

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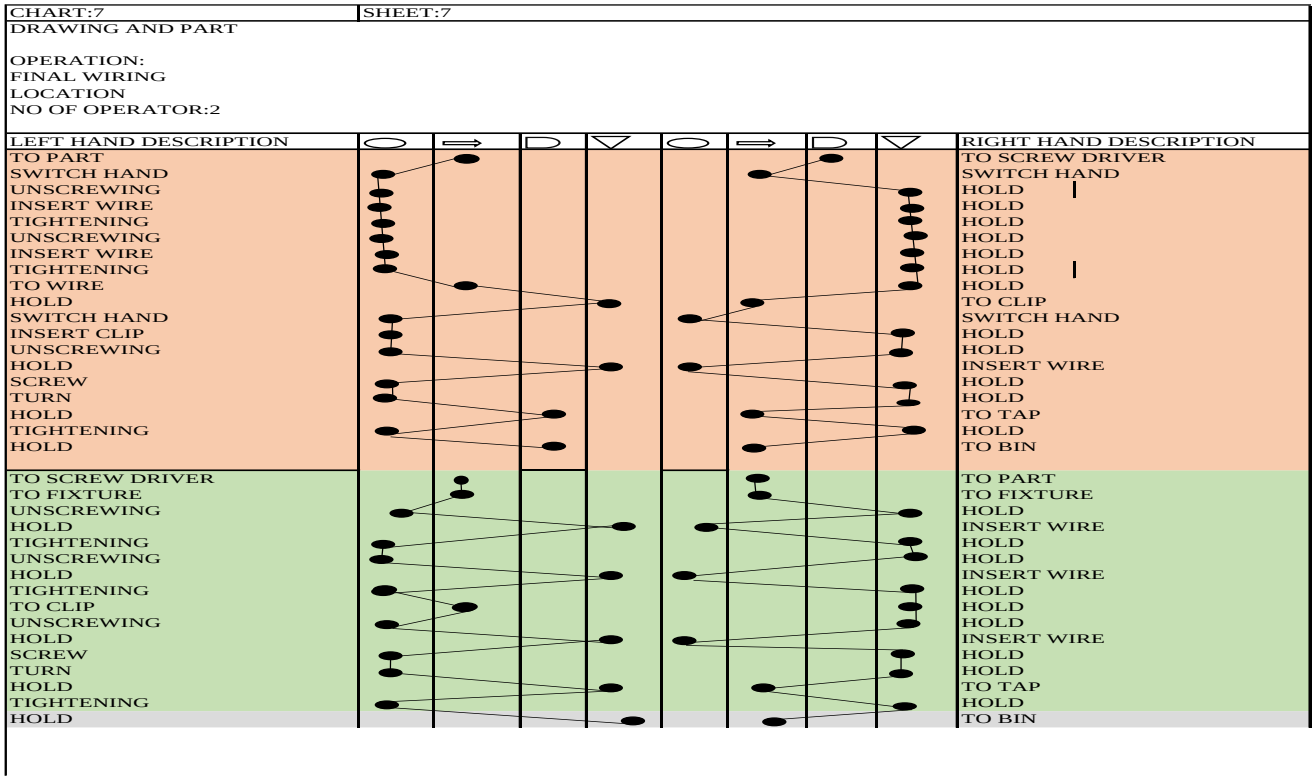

IV. RESULTS AND ANALYSIS

The changes to the process were applied and the flow process chart was recorded again.
The change in the time saved was as follows:

Table IX: Revised Flow Process Chart

PRODUCT NAME:LED SQR,DOWNLIGHTER						
PROCESS CHART		MATERIAL TYPE				
CHART NO.1	SHEET NO.1	SUMMARY				
CHARTED		ACTIVITY		PRESENT		
		OPERATION	○	13		
ACTIVITY: ASSEMBLY		TRANSPORTATION	→	3		
METHOD: PRESENT		DELAY	D	1		
LOCATION: LED DEPT		INSPECTION	□	1		
		STORAGE	▽	1		
ESCRIPTION		DIST	TIME	/MBOL ○ → D □ ▽		REMARK
W/P ON ASSEMBLY TABLE						
RIVETING OF HEAT SINK WITH BRACKET			4.8 SEC			
TRANSPORT TO FITTING STATION 2						
TEMPORARY STORAGE						
EARTHING FITTING						
CONNECTOR ASSEMBLY			6.1 SEC			
DIFFUSOR PLACEMENT						
REFLECTOR FITTING			8 SEC			
PLACEMENT ON SIDE TABLE						
CORNER FITTING (by glue gun)						
MOUNTING CLIP ATTACHMENT			7.5 SEC			
ASSEMBLY OF LED WITH THE HOUSING			2.1 SEC			
ASSEMBLY OF LEAF FRAME WITH HEAT SINK			8.6 SEC			
FINAL WIREING			16 SEC			
FINAL INSPECTION						
LABELING						
PACKAGING						
STORAGE						
TOTAL CYCLE TIME			**53.1 SEC**			

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Total cycle time for the complete assembly initially was 77.7 seconds. After suggestion and implementation of the change the time was saved by 24.6 seconds.

V. CONCLUSIONS

Form the above tables we can see that there were many steps where correct procedure was required to be applied. The two hand process chart helped to identify the critical places where optimization could be done. The process was optimized and by applying the changes 31% improvement in time was achieved.
The total cycle time was improved to 53.1 seconds.

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