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Improving Efficiency of the Process and Safety by Low Cost Automation

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Abstract--- *In the growing competition in market because of globalization, it's imperative that the product should be reach customer on time delivery. All the organization will follow to manufacture products with the standards and procedures like SAFETY, QUALITY, COST and TIME. By following the safety in our mind, we should get the quality product in time. A quality product will reduce the cost of the company. If all the chains are followed the product will be on time delivery. Therefore to increase the efficiency of the press line of 5400T (xl) and to achieve zero accidents in the sheet metal pressing and handling area it's required to minimize the manual handling with less cost. In RNAIPL currently most of operation they are using manpower to collect the inner car body panels (pressed sheet). All the panels are having sharp edges. So the processing time is being increased because safety issues. The aim of the project is to eliminate the manpower, to improve on safety and to achieve the Design Standard Time Ratio (DSTR) which reduces the usage external sources (Air, Electric power, Hydraulic) with low cost automation.*

Keywords--- *Reason for Improvement, Current situation, Analysis & Countermeasure.*

I. INTRODUCTION

During panel production, panels stacking & palletizing is found difficult from the end conveyor. The next process area required manpower to modify the panel position for the assembly. All the actions are lead to accident. In order to reduce the manual handling & NVA decided to collect the panels by means of AUTO PALLETIZING by "LOW COST AUTOMATION".[1]

There is more number of critical panels handling in 5400T press. For the project, HOOD INR panel is taken. This panel only produced in more quantity and handling also is more risk. It involves secondary handling (panel tilting) for the next assembly operation called hemming.

And so the objective is to provide a robust process for unloading the panel and tilting of panel to avoid accident and to eliminate the manpower.

II. ANALYSIS PHASE

Process Flow

The process flow for the various steps in the implementation is given below in the flowchart.

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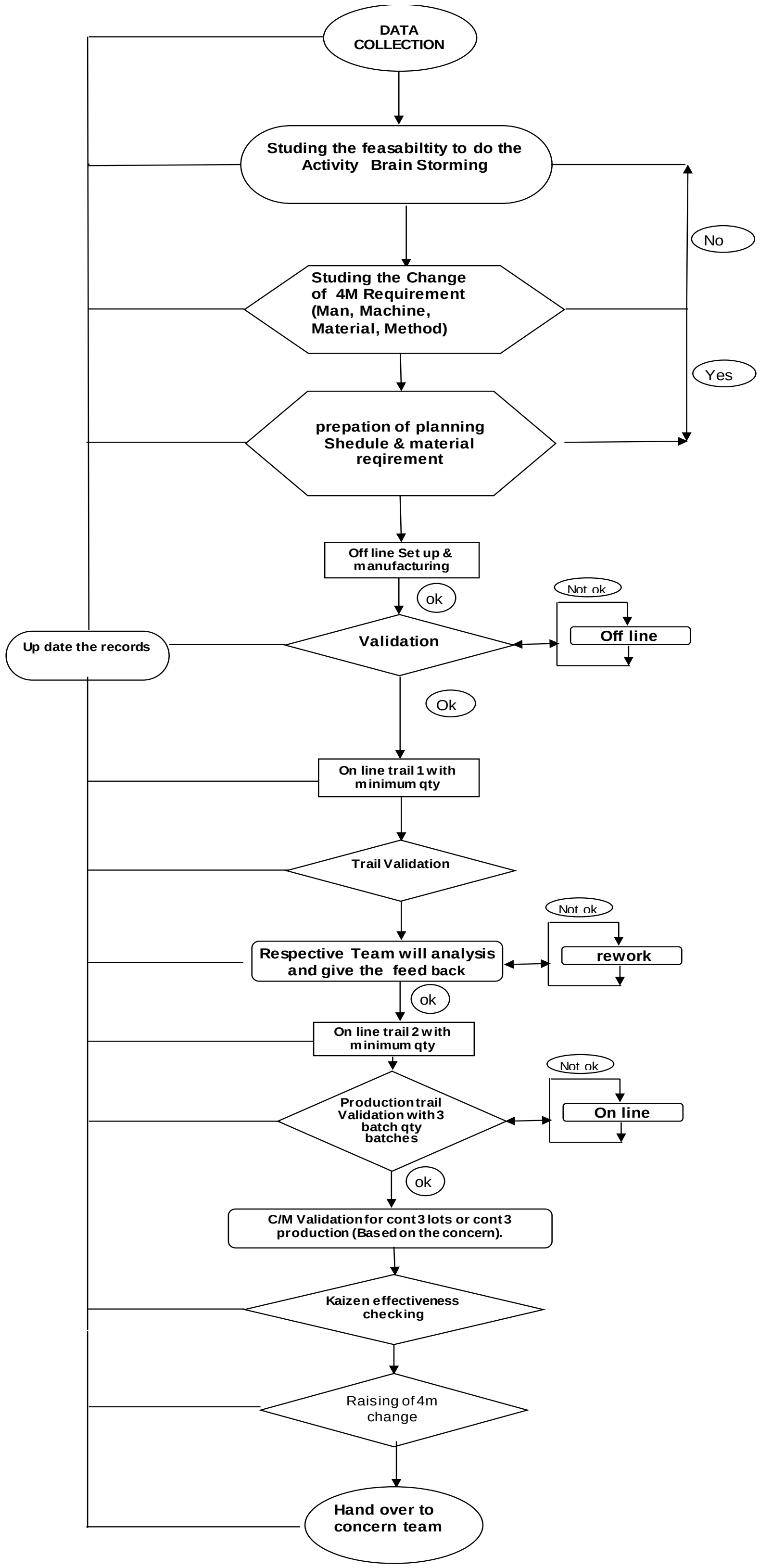

Fig. 1: Process Flow

Cause and Effect Diagram

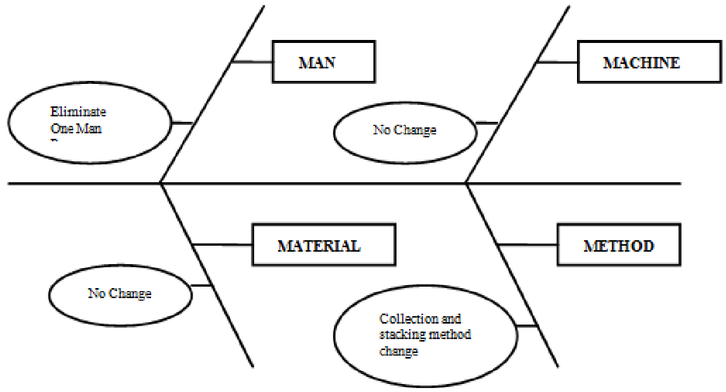

Fig. 2: Cause and Effect Diagram

III. Measure Phase

The dimensions of various parts were measured and given in the following.

Table 1: Dimension of Parts

S.NO	*DIMENSIONS CRITERIA*	*SIZE (mm)*
1	Total conveyor table size	3800x10000
2	Panel size	850x1210
3	Conveyor table width	1800
4	Pallet size to store the panels	1500x2000
5	Conveyor table max pitch movement	2020
6	Conveyor table Drive end height max	1050
7	Conveyor table tail end height max	1420

End Conveyor ADC Data for the Part

Table 2: End Conveyor ADC Data for the Part

Die No.	Die Name	Lifting Height Tail End RH (mm)	Lifting Height Tail End LH (mm)	Lifting Height Drive End RH (mm)	Lifting Height Drive End LH (mm)
122-1	HOOD INR	1280	1420	1010	1050

Time Analysis for before Condition

The time series analysis is carried out before modification and recorded as follows.

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Table 3: Time Analysis before Condition

S.No	*Operation Name*	*Sequence Line*	*Time (sec)*	*Method*
1	ADC Start	Past Die Out	30	Automatic
2	Last Pallet Clear	End Conveyor	30	Manual
3	Conveyor Table Preparation	EC Table Layout Change	105	Manual
4	Next Pallet Arrange	EC Area	35	Manual
5	ADC End	Next Die IN	30	Automatic
6	Total Time	Total ADC	60	Automatic
7	Total Time	Total ADC	160	Automatic
8	Over All Time		220	

IV. MANUFACTURING PHASE

Raw Material Requirement

Table 4: Raw Material Requirement

No	*Material Name*	*Spec*	*Size (mm)*	*Qty*	*Remarks*
1	Square Tube	MS	50x50x5000	1	
2	Square Tube	MS	75x75x250	2	
3	Plate	MS	10x500x500	2	
4	Sheet	MS	5x500x1500	1	
5	Rollers	Plastic	Dia 20x1300	5	Pitch = 32mm
6	Grouting Bolt	For Floor Drill	Dia 20x250	9	
7	Steel Rod	Stainless Steel	Dia 10x750	2	
8	Soft Sphere	Plastic	Dia 25	2	With hole of 10mm

Bill of Materials

Table 5: Bill of Materials

S. No	*Element Name*	*Fabrication Method*	*Keypoints*
1	Panel Guider	Welding & Assembly	As Per Trail Varnishing
2	Pallet Setup	Bending & Foam fixing	As Per Panel Profile to be Bend
3	Panel Tilter	Bending, Welding & Assembly	Sting to be Fixed as per Panel Distance
4	Panel Stopper	Bending	As Per Pallet Stacking Method

Elements of the Fixture

Panel Tilter

- This is the most important element in the auto palletizing method.
- In this, panel setting is tilted at 180 degree and dropped in the conveyor table.

- The panel tilter is made by material of MS & stainless steel. [3]
- This will be fixed in the machine end conveyor door.
- The main function of the panel tilter is when the panel coming from normal position based on the conveyor speed the panel is hanged in the tilting lever and the panel is getting tilted.

Fig. 3: Panel Tilter

Panel Guider

- It is the element in which the panels can be guided and the panel can be traveled with the support of rollers. [2]
- The panel which is coming from the conveyor is automatically aligned by means of the panel guider.
- Then the panel can be stacked automatically in the set pallet.
- It is fabricated as per the conveyor drive end height i.e. 1050mm
- The guider width = panel width + clearance (10mm/side).

Fig. 4: Panel Guider

Panel Stopper

- It is the element in which the panels are stacked in the correct location in the pallet.
- Due to the traveling speed of the panel passes through the panel guider, it cannot able to stack properly in the pallet.

- So we induced a panel stopper at the end of the pallet.
- It is designed & fabricated as per the panel shape.

Fig. 5: Panel Stopper

V. FUNCTION OF AUTO PALLETIZING

Setup Preparation

During the ADC time the preparation will be made up by following steps.

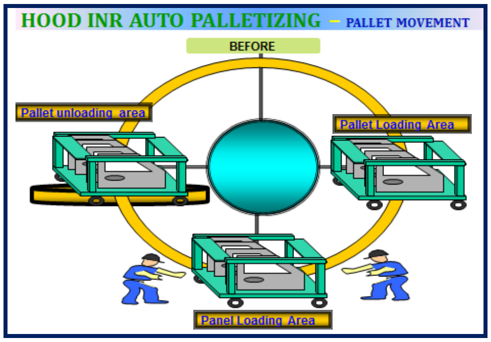
- At the first end conveyor table size will be minimized by use of closing the side walls of the table.
- Then the panel guider will be fixed near to the conveyor drive end at designated location.
- Required column a pallet will be placed in the palletizing area.[4,5]
- The pallet stopper will be fixed in the pallet itself
- The panel tilter is fixed at the press 4 end doors by using fasteners.

Working Procedure of Auto Palletizing

- The finished panel is dropped in the end conveyor table by beam robot#5
- Then the signal is passed to the data base to start the conveyor to run.
- When the conveyor start to run first the panel is touch the panel tilter and it's tilting the panel up to 140 degree.
- Due to the gravitational movement the remaining angle will be tilted.[7-10]
- The panel is traveled by the panel guider and it's getting aligned to the palletizing position.
- Finally the panel is stacked in the pallet automatically.
- By the continual process the production will be completed.

VI. RESULTS AND DISCUSSIONS

Change of Layout and Manpower



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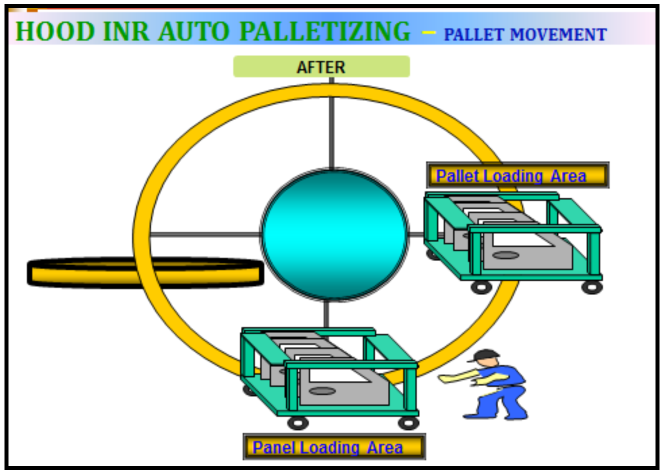

Fig. 6: Change of Layout and Man Power

Graph Trend

Accident Trend

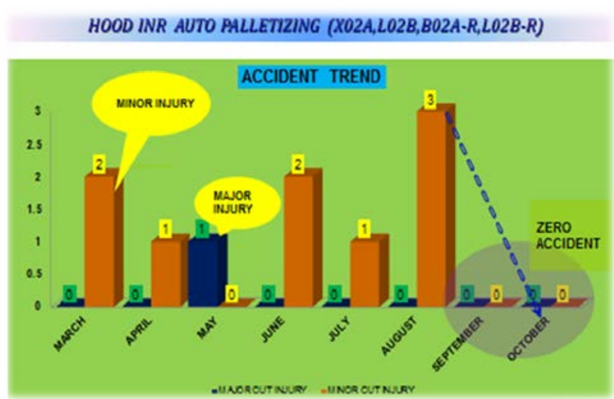

Fig. 7: Accident Trend

Quality Improvement Trend

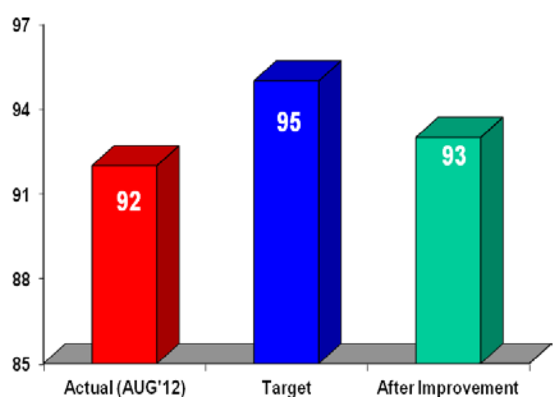

Fig. 8: Quality Improvement Trend

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Production & SPM Trend

Fig. 9: Production & SPM Trend

Man Hours Reduction Trend

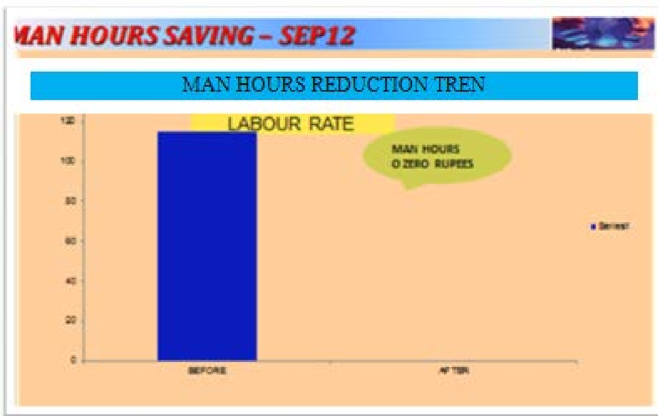

Fig. 10: Man Hours Reduction Trend

Cost Saving

Table 6: Cost Saving

	Before (Rs.)	**After (Rs.)**
No. of cars produced	18719	18719
No. of HOOD INR panels produced	20542	19514
Design SPM	9	11
No. of min for Production	2282.444	1774
No. of hrs for Production	38.04074	29.56667
Allowance	114.1222	8.87
Total hrs reqd. for Production	152.163	38.43667
Labor rate/hr.	115	0
Total Cost	17498.74	0
Cost/Car	**Rs. 0.934812**	**0**

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Direct and Indirect Benefits

- Achieved zero accident.
- Elimination of manual handling of critical panels.
- Reduce ergonomics concerns.
- Reduced man power via low cost automation.
- Design SPM is achieved.
- Achieved company DSTR.
- New concept is developed.[11-13]
- Cost saving done Rs 93paise/car.
- Resource depletion is reduced.
- Formation of the
- Horizontal deployment concept is improved.

VII. CONCLUSION

Trends in the technological development and human tendencies make the people to look for perfection of safety and quality in all things. So broadly speaking not only today's every where safety giving first preference. Quality standard for a particular product may not match tomorrow's quality standard for a particular product since the technological is getting updated in day by day.

This project, optimization of the process constrains (by slight modification in the production process to lead to drastic reduction of the accidents and improve in the production system.

Hence FTT trend has been improved significantly there by improving immediate customer satisfaction. We have monitored the accident trend & production trend on daily basis and found great satisfaction since the accident & manpower constrains has been totally eliminated

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