Implementing TPM At Sewing Machine Shop And Estimating Equipment Effectiveness

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Abstract- *This paper represents a novel design and control architecture of the continuous stirred tank reactor (CSTR) based on its mathematical equivalent modeling of the physical system. The plant is formed analytically for the normal operating condition of CSTR. Then the transfer function model is obtained from the process. The analysis is made for the given process for the design of controller with Convectional PID (trial and error method), Ziegler Nichols method, Fuzzy logic method and Model Reference Adaptive method. The simulation is done using MATLAB software and the output of above four different methods was compared so that the Model Reference Adaptive Controller has given better result. This thesis also compares the various time domain specifications of different controllers.*

Keywords- TPM, Machine downtime, Preventive maintenance

I. INTRODUCTION

In its simplest definitions, the time it takes to solve the trouble shoot is known as corrective measurement. It encompasses the period from when an operator begins a procedure and when the task is ready to be handed on to the maintenance person. Preventive maintenance activities are done in an effective manner (only 30% of target achieved) Machine downtime calculations are infeasible. Unclear data regarding machine corrective duration & intervals leading to process bottlenecks.

At present the major problem industry faces are ineffective equipment monitoring, usages and management in manufacturing line, so more time is required for solving thetroubleshoot. Implementing TPM (Total Productive Maintenance) will be helpful to improve the equipment effectiveness in the manufacturing line and hence the productivity and quality also increased, led to a higher level of customer satisfaction.

II. LITERATURE SURVEY

1) M.Ilangkumaran and S. Kumanan. (2009) .Their findings tells about a multi criteria decision making technique to find out the optimum maintenance policy by the use of Analytic hierarchy process (AHP).
2) Damjan Maletic et al., (2014) talks about the potential advantages of a maintenance strategy for output, quality and profitability. Also, his study talks about the profit increased by 3% for one weaving machine.
3) Iftikar Ali Hussein et al., (2006) discussing about the average of reliability and maintenance of the sewing machines by exponential distributions. This study accounts the equipment effectiveness by the models (90 to 93 %).
4) Jorge M.Simoeset al., (2011) According to the study's findings, it is suggested that systematic research is needed in the field of maintenance performance and management, and that more practical applications should be encouraged.
5) Evonne Lucille and Mei Schke. (2008) Discuss the factors affecting sewing care & maintenance. This will enhance me design of the checklist for the regular maintenance practices.
6) Janak Priyantha (2021) He enhances the knowledge about the types of maintenance culture &problem-solving strategies. It clearly explains the eight maintenance factors which involve organizational culture.

III. OBJECTIVES AND FINDINGS

The objective of this Research paper lies in calculating the Overall equipment effectiveness in sewing line without affecting the quality of the product. To implement TPM concepts effectively. To estimate and reduce machine down-time. To better corrective duration timings. To optimize PM tasks

Maintenance Team Practices:

1.Preventive Maintenance
2. Corrective Maintenance
3. Predictive Maintenance

Alternatives for Maintenance Practices in Garments Segment

Here we have made changes and alternatives to the existing maintenance practices.

Checklist for Preventive Maintenance – Will be distributed to every individual operator and train them to do the basic preventive things for their operating machine. This gradually reduces the time as well as improve the preventive maintenance practices.

MONTHLY CHECK LIST - FOR ..... MONTH																														
M/C MAKE :	M/C TYPE :																			M/C NO :										
DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
M/C BED & BUSH																														
PEDAL MATE																														
EYE/FINGER GUARD																														
PULLEY COVER/BELT CHECKING																														
PRESSURE FOOT SHAKE																														
NEEDLE BAR HEIGHT																														
THREAD TENSION																														
OIL LEVEL / LEAKAGE																														
LOOSEN SCREWS																														
MOTOR NOISE																														
MECHANIC SIGN :																														

Table 1. Preventive Maintenance Checklist

Checklist for Corrective Maintenance – This list will provide the data regarding trouble shoot. Also, we can easily analyze the machines downtime.

MACHINE BREAKDOWN CARD												
DATE	M/C NO	LINE ID	BREAKDOWN DETAILS					BREAKDOWN TIME	RECTIFIED TIME	MECHANIC SIGN	REMARKS	

Table 2. Corrective Maintenance Checklist

Checklist for Predictive Maintenance – This will enhance the risk and condition-based maintenance. It will provide details regarding services and calibration about the machines.

MONTHLY HISTORY CARD						
M/C MAKE :		M/C TYPE :		M/C NO :		
SERIVCE		MACHINE BREAKDOWN				MECHANIC SIGN
OIL SERVICE DATE	NEXT SERVICE DATE	M/C PROBLEM 1	M/C PROBLEM 2	M/C PROBLEM 3	SPARES REPLACED	

Table 3. Predictive Maintenance Checklist

Types of Machines Used in Sewing Industry:

Here we figured out the most used machines in garment manufacturing industry. And we are enhancing TPM for these particular machines.

Fig 1. Overlock Machine

Fig 2. Single Needle Machine

Fig 3. Flat Seam Machine

Fig 4. Flatlock Machine

Fig 5. Flatlock Machine

Overall Equipment Effectiveness

OEE is the benchmark for assessing manufacturing productivity.

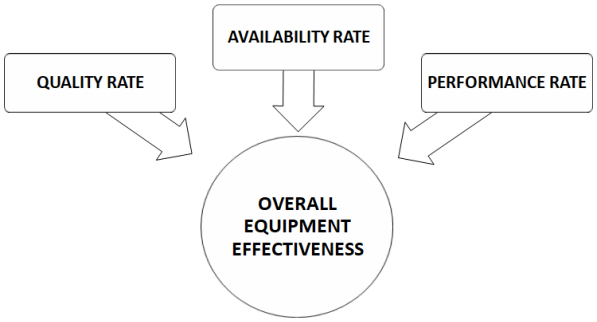


Fig 6. OEE Chart

a. Availability Rate

$$\text{Availability Rate} = \frac{Actual Running Time}{Scheduled Running Time}$$

=360min / 480min

= 75 %

Availability rates help us to find the deviation between actual and scheduled running time of the equipment.

b.Performance Rate

$$\text{Performance Rate} = \frac{PROCESSED\ AMOUNT * IDEAL\ CYCLE\ TIME}{OPERATION\ TIME}$$

= 1500*2 / 35

= 86 %

Performance rates help us to find the performance of the production and operations.

c.Quality Rate

$$\text{Quality Rate} = \frac{TOTAL\ PRODUCTION - DEFECT\ AMOUNT}{TOTAL\ PRODUCTION}$$

= 1500 – 80 / 1500

= 95 %

Quality rate help us to find the rate of good products produced.

OEE Calculation

By calculating and enhancing equipment effectiveness, overall equipment effectiveness plays a significant role in the implementation of TPM.

OEE = (Availability Rate) * (Performance Rate) * (Quality Rate) * 100 %

OEE = (0.75) * (0.86) * (0.95) * 100

OEE = 61 %

Observed Machine Down Time:

By observing machines deeply, we can able to analyse not only the downtime of that particular machine also we can able get the perfect utilization for particular machines.

S.NO	MONTH	No of Cell Observed	Avg output pieces/day	No of working hrs/month (Per Machine)	Total Losses in Hrs/ Month(Per Machine)
1.	APRIL	5	10000	250	14 hrs
2.	MAY	5	12000	294	16 hrs

Table 4. Machine Downtime in hours

Stoppages and its classification

In Sewing machines, we will find lots of minor and major stoppages. According to some long-time analysis we have found some classification of stoppages.

a. Unplanned Stoppages - Machine Breakdown, Malfunctioning, Quality Issues, Spare changeover and it will account for **30%**
b. Planned Stoppages - Daily cleaning process, Preliminary Maintenance, Oil Services and it will account for **10%**

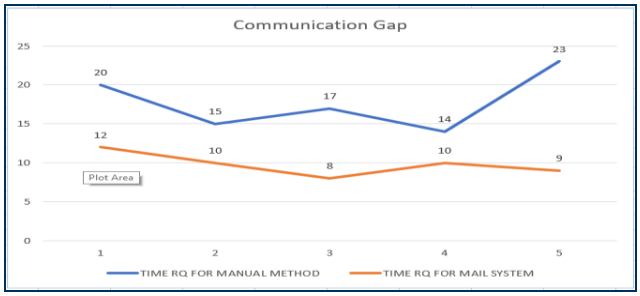
c. Short Stoppages – Needle broken down, Thread cut, Cone change over, uneven stitches, Folding clip adjustment. Also, it will account for **60%.**

Breakdown Communication Process

Now they are following the old notebook for machine breakdown communication. So, we are initiated the mail system for better communication and also time taken for the process is gradually reduced.

STUDY NO	TIME RQ FOR MANUAL METHOD	TIME RQ FOR MAIL SYSTEM
1	20	12
2	15	10
3	17	8
4	14	10
5	23	9

Table 5. Machine Breakdown Communication Process



Graph 1. Machine Breakdown Communication Process

IV. ADVANTAGES

While implementing TPM we have followed advantages

1. Decrease the down and repair time.
2. Helping to improve production process
3. To perform periodic planned replacement
4. To record process quality rate
5. Analysing of equipment failure cause and effect
6. Improving skills of operators and maintenance staff
7. To provide Computerized maintenance management system (CMMS)
8. To monitor the production equipment status.

V. CONCLUSION AS PER STUDY

The above implementation and initiation will really be helpful to improve the equipment effectiveness. The way in which the equipment's are monitored and used effectively will lead to the efficient production. The equipment availability, performance and quality will really be helpful to manufacture more good products.

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