

International Journal of Education and Science Research

Review

Volume-2, Issue-1 www.ijesrr.org E-ISSN 2348-6457 February- 2015 Email- editor@ijesrr.org

Overall Equipment Efficiency Improvement

Mradula Sharma, Madan Kumar, Dhowmya Bhatt Assistant Professor Department of Information Technology SRM University NCR Campus Modinagar

ABSTRACT:

Overall Equipment Efficiency OEE is a powerful metric to measure any Machine/Process/Plant performance. OEE consist of Availability Rate , Quality Rate , Production Rate. We need to measure OEE to monitor and analyze our equipment performance and to make continuous improvement. Earlier scenario Selling price = Manufacturing Cost + Profit which was decided by manufacture but Now a day selling price is decided by the competitor or by Market and manufacturing cost is increasing which results reduction in profit. So to sustain in this global competitive world continuous improvement required. This can be achieved by optimization of resources and reduction in wastages. We have six resources Man, Machine, Material, Energy, Environment, and Time. OEE is used to optimization of Machine performance which is the very important resource of any industry. Standard calculation of OEE is given below:

 $OEE(\%) = AR \times PR \times QR \times X100$

Operating time

AR(Availability rate) =

Loading time

Loading time = Available time - Planned downtime Operating time = Loading time - Breakdown time

Good quality prod. = Total production - Rejection

Actual achieve production

KEYWORDS: Lean, OEE, IMR Chart, Regression Analysis Pareto Chart, Why-Why Analysis, Kaizen, Gant Chart

INTRODUCTION:

I did this project at Uniproduct India Ltd under vendor up gradation activity through Maruti production System or Lean Manufacturing technique. Uniproduct is the Teir-1 supplier of the Maruti Suzuki India Ltd and manufacture of Carpet, Headliner etc for automobiles. To identify the project first we collected the machine wise OEE data to identify the bottleneck machine for OEE improvement. We analysis all the moulding press OEE from Apr'11 to Jul'11 and find out that the average OEE of moulding press-18 is 70% against the management target of 85% and this machine also have lowest OEE among all moulding presses. This machine demand was also increasing in future. So Press-18 machine selected for the improvement. After that a team was formed to implement the decided Kaizen and carrying out required

International Journal of Education and Science Research Review

Volume-2, Issue-1 www.ijesrr.org February- 2015

E- ISSN 2348-6457

Email- editor@ijesrr.org

activity as per activity plan. We plotted IMR (Individual Moving Range Chart) to see the consistency in OEE ,AR,PR,QR and regression analysis to see relationship among the factors by which OEE is actually effecting. In Our case OEE is mainly affected by AR. R-Sq coefficient of relationship is coming 50.8% hence we concluded that OEE is varying because of AR. Then we collected reasons for low AR and made Pareto chart reason wise to prioritize the problem and did Why- Why analysis to find out the root cause and decided counter measure for the same. We also did brainstorming among the team to overcome potential failure in future and identified 8 Nos of Kaizen (Kai + Zen= Change for Better). After implementation of Kaizen we monitor the effectiveness and compare the results by using reason wise Pareto comparison and IMR chart for OEE and AR. After comparison we observed significant improvement in OEE. After improvement OEE of Press-18 is consistently maintained more than 90% against the management target of 85%. This action standardised using preventive maintenance check list and time base maintenance check list. Learning has been Horizontally deployed on the other machines.

MACHINE SELECTION:



Inference: Moulding Press-18 having lowest OEE 70% selected for Improvement. PRESS -18 OEE TREND (APR'11 ~ JULY'11):



- I. TEAM MEMBER
- 1. Mr. Himanshu Sharma- Sr. Counselor
- 2. Mr. Pavinder Kumar Team Leader
- 3. Mr. Vikash Member
- 4. Mr. Vinod Member
- 5. Mr. Rakesh Member







JCL=106.

(=62.1

Inference: In consistency in OEE and Xbar: 62.1%,MR bar:16.83%

IMR CHART AR % (JUNE'11 ~ JULY'11)



Inference: Inconsistency in AR% Xbar: 82.7% and MRbar: 21.3%

FITTED LINE PLOT: OEE VS AR



Inference: R-Sq is 52.5% so OEE is affected by AR.

IMR CHART: OEE VS PR:



Inference: Inconsistency in PR. Xbar:75.5% and MRbar:14%.

FITTED LINE PLOT: OEE VS PR:



Inference: R-Sq is 34.6% so OEE is not affected by PR.

FITTED LINE PLOT: OEE VS QR



Inference: QR is consistent.Xbar:99.83% and MRbar:0.34%

International Journal of Education and Science Research Review

Volume-2, Issue-1 www.ijesrr.org REASON FOR LOW AR:

February- 2015

E- ISSN 2348-6457 Email- editor@ijesrr.org

S. no.	Problem	Total Loss(Min.)	Total Loss (Hrs)
1	Low pressure problem	440	7.2
2	PLC/ Control Panel problem	400	6.3
3	Main cylinder seal leakage	360	6
4	Safety lock problem	280	4.3
5	Pressure switch problem	240	4
6	Oil leakage	150	2.5
7	Vacuum Pump problem	110	1.8
8	Low oil level	60	1

PARETO CHART: REASON WISE



WHY WHY ANALYSIS-1:

Problem	Low Hydraulic pressure problem
Why-1	Why Low Hydraulic pressure Problem?
Answer-1	Because High temp. of hydraulic oil.
Why-2	Why high temp. of hydraulic oil ?
Answer-2	Because no proper cooling of hydraulic oil.
Why-3	Why no proper cooling of hydraulic oil ?
Answer-3	Because low capacity of heat exchanger.
Why-4	Why low capacity of heat exchanger?
Answer-4	Because m/c design defect as it is an Imported m/c from Australia so designed as per their environment condition
Root cause	Less Hydraulic pressure problem because No proper cooling of hydraulic oil
C.Measu	one extra heat exchanger provided on m/c

WHY WHY ANALYSIS-2:

Problem	PLC /Control panel problem again & again	
Why-1	Why PLC/control panel problem ?	
Answer	Because lot of unnecessary interlocking in panel	
Why-2	Why lot of unnecessary interlocking in panel ?	
Answer	Because m/c panel design with oven application also.	
Why-3	hy m/c panel design with oven application?	
Answer	As it was design with electric heating with moulding process but here we are using it as only moulding process	
Root	Extra application interlocking in control panel	
cause		
C,Measure	Panel design modified as per our present requirement .	

WHY WHY ANALYSIS-3

Problem	Main cylinder seal damage
Why-1	Why main cylinder seal damage ?
Answer	Because high temp. of hydraulic oil
Why-2	Why high temp. of hydraulic oil ?
Answer	Because no proper cooling of hydraulic oil
Why-3	Why no proper cooling of hydraulic oil ?
Answer	Because low capacity of heat exchanger
Why-4	Why low capacity of heat exchanger ?
Answer	Because m/c design defect as it is an Imported m/c from Australia so designed as per there environment condition
Root cause	No proper cooling of hydraulic oil
C,Measure	One extra heat exchanger provided on m/c

KAIZEN SHEET

.N.	Kaizen	Benefit	Status
1	Extra heat exchanger provided	Main cylinder oil leakage problem solved	Completed
2	PLC panel modification	PLC / control ckt related problem solved	Completed
3	Interlocked the hydraulic temp. of oil tank to control off the main. Motor	Pressure as well as main cylinder seal leakage problem solved	Completed
4	Pressure relief valve provided	Extra pressure problem resolved	completed
5	Filter provided in vacuum blower	Blower impeller damage problem solved	Completed
6	Flexible hydraulic hose pipe to be replaced by solid seamless pipe	Frequent oil leakage to be prevented.	Completed
7	Steam Condensate recovery line provided	Steam in parts (Quality N.G) problem resolved	Completed
8	Hydraulic pressure gauge provided for checking pump pressure	Mean Time to Repair (MTTR)reduced	Completed

July 2011

KAIZEN -1

Company: Uniproducts(I) Ltd.	Deptt.: Maintenance	Result: Implemented	Month of Repo	ort Jui 201
Subject: Extra Heat exchanger is provid	led	Process: Carpet Moulding		
Before		After	Productivity	Yes
	and the second se		Quality	Yes
Only and heat exchanger present with		2	Cost	
out insulation	1		Delivery	
			Safety	
	1 1		Morale	
Comments: No proper cooling results	Comments: Ex	tra Heat exchanger	Environment	
cycle time	maintained.		Others	Breakdow Reduction
Why-Why Analysis	Hor	izontal Deployment	Cost saving/Year	
Lower capacity heat exchanger was there	Heat exchan	ger is provided on M.press- 19,20 &21	Date of Imple.	22/8/201
Benefits: Break down reduced & produ	ctivity Improved.		Suggested by	Vikas
			Approved by	Mr. Pavind
				Kumar

KAIZEN -2

Company: Uniproducts(I) Ltd.	Deptt.: Maintenance	Result: Implemented	Month of Rep	ort Aug 201
Subject: Filter is provided on vaccu	m blower	Process: Carpet Molulding		
Before		After	Productivity	Yes
			Quality	
				YES
A COLOR			Delivery	
		HTT A	Safety	
CALL STREET, SALES			Morale	
Comments: No filter in suction result	Comments: Filt	Comments: Filter provided on suction result no damage of impeller		Yes
Impeller damage repeatedly due to contaminations sucked inside.	damage of imp			
Why-Why Analysis	Но	rizontal Deployment	Cost saving/Year	
No filter on blower suction	Filter is p	provided on M.press-19,20	Date of Imple.	25/9/2011
Benefits: Productivity Improved.			Suggested by	Somdutt
			Approved by	Vikas

KAIZEN -3

Company: Uniproducts(I) Ltd.	Deptt.: Maintenance	Result: Implemented	Month of Repo	Sep 2011
Subject: Panel modification		Process: Carpet Molulding		
Before		After	Productivity	Yes
	() (provide and the second		Quality	
	Car Landerson	The second	Cost	
			Delivery	
		· · · · · · · · · · · · · · · · · · ·		Yes
		YAYA MANAGANA ANA ANA ANA ANA ANA ANA ANA ANA	Morale	
Comments: Complicated control circuit	Comments: New	panel designed with simplified	Environment	
results repeated electrical break down	logic result electr	ic break down reduced	Others	Break down Reduction
Why-Why Analysis	Horiz	ontal Deployment	Cost saving/Year	
Common (Oven + Press) operation was performed with a single panel.		NO	Date of Imple.	20/1/2012
Benefits: Increase in MTBF and reduction	on in MTTR.		Suggested by	Vinod Sharma
			Approved by	Mr. Pavinder

KAIZEN -4

Company: Uniproducts(I) Ltd.	Deptt.: Maintenance	Result: Implemented	Month of Repo	rt Sep 2011
Subject: Panel modification		Process: Carpet Molulding		
Before		After	Productivity	Yes
Reference in the second s			Quality	
	The second s		Cost	
	- 738		Delivery	
			Safety	Yes
	-		Morale	
Comments: Complicated control circuit	Comments: New	panel designed with simplified	Environment	
results repeated electrical break down	logic result electi	ic break down reduced	Others	Break down Reduction
Why-Why Analysis	Horiz	zontal Deployment	Cost saving/Year	
Common (Oven + Press) operation was performed with a single panel.		No	Date of Imple.	20/1/2012
Benefits: Increase in productivity by inc	rease in MTBF		Suggested by	Vinod Sharma
			Approved by	Mr. Pavinder

KAIZEN -5



Deptt. Mainte Month of Report

Quality Cost Delivery Safety Morale Environm

Cost saving/Ye Date of Im

Sugge Appro Nov. 2011

MTTR

12/11/201

ompan<mark>y:</mark> Uniproducts(I) Ltd

Subject: Pressure gauge is p

Comments: No pressure gauge at ou et of main hydraulic pump results

Why-Why Analys

Pressure was measured by using auxiliaries as no gauge was there.

efits: MTTR reduced & productivity

KAIZEN -6



Company: Uniproducts(I) Ltd.	Deptt.: Maintenance	Result: Implemented	Month of Rep	ort Nov. 2011
Subject: Pressure relief valve is prov	ided	Process: Carpet Moulding	3	
Before		After	Productivity	Yes
the second se				
C				
	1			Yes
			Morale	
Comments: No Pressure relief valve	Comments: Pr	Comments: Pressure relief valve provided resulting tool safety improved		
resulting tool damage repeatedly.	resulting tool s			Breakdown Reduction
Why-Why Analysis	Ho	rizontal Deployment	Cost saving/Year	
Excess Pressure is exerted by pump	p. PRV is	provided on M.press-19	Date of Imple.	12/112011
Benefits: Tool safety Improved.			Suggested by	Dinesh
			Approved by	Mr. Pavinde

Pressure gauge is provided on all M

ROTATION OF PDCA



Inference: Low pressure problem reduced significantly and others are eliminated.

OEE : BEFORE VS AFTER



Inference: X bar (Avg. OEE) Improved from 62.1% to 82.%.MR Bar (Avg. Range) Reduced from 16.83 to 8.29.

Overall Consistency in OEE improved.

AR : BEFORE VS AFTER



Inference : X bar (Avg AR) improved from 82.7% to 95.6%. MR bar (Avg Range) reduced 21.34% to 6.24%.

Consistency in Availability ratio.

OEE: TARGET VS RESULT



OEE: TARGET VS ACHIEVEMENT



STANDARDIZATION & HORIZONTAL DEPLOYMENT:

The entire document standardized like preventive maintenance sheet, time base maintenance sheet daily maintenance sheet. List of critical spares revised. Scope of horizontal deployment found and plan made for the same on 5Nos moulding press.

II. SUMMARY OF BENEFITS

Before Breakdown Time= 17.3% = 0.173 X 24 X 25 x 12= 1245 Hours

After Breakdown Time= $4.4\% = .044 \times 24 \times 25 \times 12 = 316$ Hours

Time Saved = 1245 - 316 = 929 Hours

Machine Hour Rate =1234 / Hour

Total cost Saving=1234*929=Rs 11.46 Lacs /Year

CONCLUSIONS:

This concept can be deployed in any industry like Manufacturing, IT, Food processing etc. To know our equipment performance OEE is the strongest measuring metric which can give us cumulative information about Quality, Availability, and Productivity

Acknowledgment

We would like to thank Dr. K Kumar who guided us throughout the study and Uniproduct India Ltd team and their management provided good support. We had a wonderful team. They are smart, curious & disciplined.

International Journal of Education and Science Research Review

Volume-2, Issue-1 www.ijesrr.org

February- 2015

E- ISSN 2348-6457 Email- editor@ijesrr.org

REFERENCES

- 1. Lean: www.lean-manufacturing-japan.com
- 2. OEE: www.oee.com
- 3. IMR CHART: www.six-sigma-material.com/I-MR.html.
- 4. Regression: en.wikipedia.org/wiki/Regression_analysis
- 5. Pareto Chart: en.wikipedia.org/wiki/Pareto_chart
- 6. Why Why Analysis: www.isixsigma.com
 7. Gant Chart: en.wikipedia.org/wiki/Gantt_chart
 8. Values
- 8. Kaizen: en.wikipedia.org/wiki/Kaizen
- 9. PDCA: en.wikipedia.org/wiki/PDCA