

IMPLEMENTATION OF 5S AND KOBETSU KAIZEN (TPM PILLAR) IN A MANUFACTURING ORGANIZATION

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Abstract - Total Productive Maintenance (TPM) is a procedure that intends to build the accessibility of existing equipment subsequently diminishing the requirement for assist capital venture. Total Productive Maintenance (TPM) is an arrangement which focuses on add up to association of everybody from top administration to all employee to actualize a far reaching maintenance program for all equipment for the duration of its life. This arrangement brings about most extreme adequacy of equipment, tidier, slick and clean work place and ethically supported representatives. The aim is to decide execution elements and qualities in industrial associations and recognizing the viability of 5S implementation and Kobetsu Kaizen (TPM Pillar) on organizational performance as well. The consequences of this exploration got from a relative estimation of organizational performance before and after 5S implementation.

Key Words: Total Productive Maintenance, Overall Equipment Effectiveness, 5S.

1.INTRODUCTION

Total Productive Maintenance (TPM) is an upholding program which includes a recently characterized idea for keeping up plants and machinery. The purpose of the TPM program is to especially enlarge production while, in the meantime, expanding worker pledge and occupation completion. The TPM program nearly takes after the well known Total Quality Management (TQM) program.

TPM is an extraordinary Japanese arrangement of support, which has created by the Japan Institute of Plant Maintenance (JIPM). It has been very important for gear serious assembling segments; it is a key means for expanding machine accessibility. The benefit of sending TPM is generally perceived, especially in current market situation where economy is in retreat, introduced limit is more prominent than request, quality is fundamental, developing rivalry, and offering cost is managed by the market, various equipment unified control and few operators in the plant.

1.1 Pillars of TPM

There are three ultimate goal of TPM: zero defects, zero accident and zero breakdowns. TPM has been imagined as a complete assembling procedure to enhance gear profitability. TPM implementation requires a long haul sense of duty regarding accomplish the advantages of enhanced OEE through training, management support and teamwork. The essential practices of TPM are often called the pillar or elements of TPM.



Fig -1: Pillars of TPM

1.2 5S

5S is a framework to diminish squander and advancing profitability through keeping up a sorted out workplace and using visual signs to fulfill more dependable operational outcomes. Usage of this technique "tidy up" and deals with the workplace essentially in its present course of action, and it is commonly the primary lean strategies which affiliation's implement. TPM starts with 5S. 5S process is generally perceived as a foundation step to continuous improvement techniques.

5S Japanese Version	5S English Version	5C English Adaption	CANDO American Adaption	Basic Meaning
Seiri	Sort	Clear out	Clearing up	Separating the essential from the non-essential
Seiton	Staighthen (or simplify)	Configure	Arranging	A place for everything and everything in its place
Seiso	Scrub (or Shine or Sweep)	Clean & Check	Neatness	Keep things clean and in good working order
Seiketsu	Standardise	Conformity	Discipline	Set the 5S / 5C standard and sustain
Shitsuke	Self Discipline	Custom & Practice	On-going improvement	Consistent application, training, everyday routine and advancing the 5S / 5C standard

Fig -2: 5S

1.3 Overall Equipment Effectiveness

Overall Equipment Effectiveness (OEE) is the key metric of Total Productive Manufacturing (TPW). OEE monitors the actual performance of a tool relative to its performance capabilities under optimal manufacturing conditions. OEE looks at the entire manufacturing environment measuring, not only the equipment availability, but also, the production efficiency while the equipment is available to run product, as well as the efficiency misfortune that outcomes from scrap, revamp, and yield misfortunes. The OEE is probably the most important tool in the TPM improvement program. OEE is simple and practical

$$OEE = (A) * (PE) * (RQ)$$

Where

A=Availability, PE=Performance Efficiency and RQ=Rate of Quality

OEE before TPM Implementation

Shift Time (General): 8 hours = 480 min.

Planned Downtime: 70 min. Running

Time Loss: 55

Min. Output: 120

Nos. Rejection: 18

Nos.

Running Time = Shift Time – Planned down Time

= 480 -70

= 410 min.

Operating time = Running Time – Running Time Loss

= 410-55

= 355 min.

Availability = (Operating Time / Running Time) x 100

= (355 / 410) x 100

= 86.59 %

Machine Speed (No. of components/ min) = 0 .50

Expected Output = Machine Speed x Operating Time

= 0.50 x 355

= 177.5 Nos.

Performance / Efficiency = (Output/ Expected output) x 100
 = 120 /177.5
 = 67.61

Quality = (Good Piece / Total Piece) x 100
 = (102/120) x 100
 = 85 %

OEE = Availability x Performance / Efficiency x Quality
 = (.8659X .6761 X .85) X 100
 = 49.76%

OEE after TPM Implementation

Shift Time (General):8 hours = 480 min.

Planned Downtime: 70 min. Running

Time Loss: 35 min

Output: 150

Nos. Rejection: 8 Nos.

Running Time = Shift Time – Planned down Time

=480-70

=410 min.

Operating time = Running Time – Running Time Loss

= 410 - 35 min.

= 375 min.

Availability = (Operating Time / Running Time) x 100

= (375/410) x 100

=91.46 %

Machine Speed (No. of components/ min) = 0.50

Expected Output = Machine Speed x Operating Time

= 0.50 x 375

=187.5Nos.

Performance / Efficiency = (Output/ Expected output) x 100

= (150 / 187.5) x 100

= 80 %

Quality = (Good Piece / Total Piece) x 100

= (142 /150) x 100

= 94.67 %

OEE = Availability x Performance / Efficiency x Quality

= (.9146 X.80 X .9467) X 100

= 69.27 %

From the above calculation it is clear that OEE of the machine have been improved with approximately 19 %. i.e. from 49.76 % to 69.27 %.

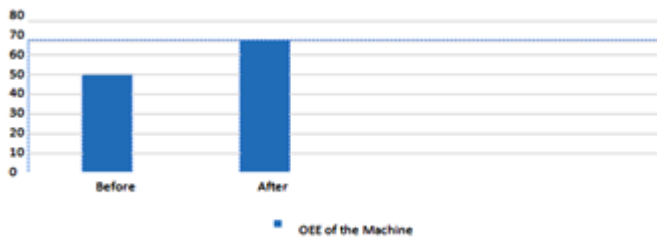


Fig -3: Comparison of OEE before and after 5S & TPM

2. CASE STUDY

2.1 About Company

Majestic Auto Limited, Greater Noida was established in 1973 to manufacturing various bicycle components for M/S Hero Cycles Pvt. Ltd. The company manufactures various types of mufflers, blanking component, seat recliner of cars, gear sector, back plate, rim link and other access Equipment's

2.2. 5S Audit Sheet before Implementation

0=Very Bad 1=Bad 2= Average 3=Good 4=Very Good

Table -1: 1s before Implementation

1S	No.	Check item	Description	Score				
				0	1	2	3	4
SORT	1	Materials or parts	Does the inventory or in process inventory included and unneeded materials or parts?			2		
	2	Machines or equipment	Are there any unused machines or other equipment around?		1			
	3	Jigs,tools or dies	Are there any unused Jigs, tools or dies or similar around?			2		
	4	Visual control	Is it obvious which items have been marked as unnecessary?			2		
	5	Written standards	Has establishing the 5S left behind any useless standards?			2		
Sub Total					1	8		

Category Subtotal

9

Table -2: 2s before Implementation

2S	No.	Check item	Description	Score				
				0	1	2	3	4
SET IN ORDER	6	location Indicators	Are shelves and other storage areas marked with location indicators					

		and addresses?					
7	Item Indicators	Do the shelves have signboards showing which items go where?		1	2		
8	Quantity Indicators	Are the maximum and minimum allowable quantities indicated?			2		
9	Demarcation of walkways and in-process inventory areas	Are white lines or other markers used to clearly indicate walkways and storage areas?				2	
10	Jigs and tools	Are jigs and tools arranged more rationally to facilities picking them up and returning them?				2	
Sub Total				1	8		

Category Subtotal

9

Table -3: 3s before Implementation

3S	No.	Check item	Description	Score				
				0	1	2	3	4
SHINE	11	Floor	Are floors kept shiny clean and free of waste, water and oil?			2		
	12	Machines	Are the machines wiped clean often and kept free of shaving, chips and oil?		1			
	13	Cleaning and checking	Is equipment inspection combined with equipment maintenance?			2	3	
	14	Cleaning responsibilities	Is there a person responsible for overseeing cleaning operations?					
	15	Habitual cleanliness	Do operators habitually sweep floors and wipe equipment without being told?			2		
Sub Total					1	6	3	

Category Subtotal

1

Table -4: 4s before Implementation

4S	No.	Check item	Description	Score				
				0	1	2	3	4
STANDARDIZE	16	Improvement memos	Are improvement memos regularly being generated?			2		
	17	Improvement ideas	Are improvement ideas being acted on?			2		
	18	Key procedure	Are standards procedure clear, documented and actively used?		1			
	19	Improvement plan	Are the future standards being considered with a clear improvement plan for the area?			2		
	20	The first 3Ss	Are the first 3 Ss (sort, set locations and shine) being maintained?			2		
Sub Total					1	8		

Category Subtotal

9

Table -5: 5s before Implementation

5S	No.	Check item	Description	Score					
				0	1	2	3	4	
SUSTANE	21	Training	Is everyone adequately trained in standard procedure?		1				
	22	Tools and parts	Are tools and parts being stored correctly?			2			
	23	Stock controls	Are stock controls being adhered to?				3		
	24	Procedure	Are procedures up-to-date and regularly reviewed?			2			
	25	Activity boards	Are activity boards up-to-date and regularly reviewed?			2			
			Sub Total		1	6	3		

Category Subtotal
10

			Score				
			0	1	2	3	4
7	Item Indicators	and addresses? Do the shelves have signboards showing which items go where?			2		
8	Quantity Indicators	Are the maximum and minimum allowable quantities indicated?			2		
9	Demarcation of walkways and in-process inventory areas	Are white lines or other markers used to clearly indicate walkways and storage areas?				3	
10	Jigs and tools	Are jigs and tools arranged more rationally to facilities picking them up and returning them?					4
		Sub Total		1	4	3	4

Category Subtotal
12

2.3. 5S Audit Sheet after Implementation

0=Very Bad 1=Bad 2= Average 3=Good 4=Very Good

Table -6: 1s after Implementation

1S	No.	Check item	Description	Score				
				0	1	2	3	4
SORT	1	Materials or parts	Does the inventory or in process inventory included and unneeded materials or parts?				3	
	2	Machines or equipment	Are there any unused machines or other equipment around?			2		
	3	Jigs, tools or dies	Are there any unused jigs, tools or dies or similar around?				3	
	4	Visual control	Is it obvious which items have been marked as unnecessary?				3	
	5	Written standards	Has establishing the 5S left behind any useless standards?			2		
			Sub Total		4	9		

Category Subtotal
13

Table -7: 2s after Implementation

5S	No.	Check item	Description	Score				
				0	1	2	3	4
SET IN ORDER	6	location Indicators	Are shelves and other storage areas marked with location indicators		1			

Table -8: 3s after Implementation

3S	No.	Check item	Description	Score				
				0	1	2	3	4
SHINE	11	Floor	Are floors kept shiny clean and free of waste, water and oil?				3	
	12	Machines	Are the machines wiped clean often and kept free of shaving, chips and oil?				3	
	13	Cleaning and checking	Is equipment inspection combined with equipment maintenance?			2		
	14	Cleaning responsibilities	Is there a person responsible for overseeing cleaning operations?				3	
	15	Habitual cleanliness	Do operators habitually sweep floors and wipe equipment without being told?				3	
			Sub Total			2	1	2

Category Subtotal
14

Table -9: 4s after Implementation

4S	No.	Check item	Description	Score				
				0	1	2	3	4
STANDARDIZE	16	Improvement memos	Are improvement memos regularly being generated?				3	
	17	Improvement ideas	Are improvement ideas being acted on?				3	
	18	Key procedure	Are standards procedure clear, documented and actively used?			2		
	19	Improvement plan	Are the future standards being considered with a clear improvement plan for the area?			2		
	20	The first 3Ss	Are the first 3 Ss (sort, set locations and shine) being maintained?				3	

Category Subtotal
13

			Sub Total			4	9
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Table -10: 5s after Implementation

S	S	No.	Check item	Description	Score				
					0	1	2	3	4
SUSTANE	2	1	Training	Is everyone adequately trained in standard procedure?			2		
	2	2	Tools and parts	Are tools and parts being stored correctly?				3	
	2	3	Stock controls	Are stock controls being adhered to?				3	
	2	4	Procedure	Are procedures up-to-date and regularly reviewed?				3	
	2	5	Activity boards	Are activity boards up-to-date and regularly reviewed?					
				Sub Total			2	1	2

Category Subtotal
14

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REFERENCES

[1] Moubray,J.(2003), Twenty-first century maintenance organization: Part I – The asset management model, Maintenance Technology, Applied Technology Publications, Barrington, IL.

[2] Johnson, P. and Lesshammar, M., (1999), –Evaluation and improvement of manufacturing performance measurement systems—the role of OEE||, International Journal of Operations and Production Management, Vol. 19, No.1, pp 55-78.

[3] Sharma, R.K., Kumar, D. and Kumar, P. (2005), –FLM to select suitable maintenance strategy in process industries using MISO model||, Journal of Quality in Maintenance Engineering, Vol. 11, No. 4, pp. 359-374.

[4] Nakajima, S. (1988), TPM – An Introduction to Total Productive Maintenance, Productivity Press, Cambridge, MA.

[5] Majumdar,N. (1998), –TPM: the philosophy of the zero||, Business Today, pp. 60-73.

[6] Ahuja, I.P.S. and Khamba, J.S. (2008b), –Total productive maintenance: literature review and directions||, International Journal of Quality & Reliability Management, Vol. 25, No. 7, pp.709-756

[7] Jeong, K-Y. and Phillips, D.T. (2001), –Operational efficiency and effectiveness measurement, International Journal of Operations and Production Management, Vol. 21, No.11, pp. 1404-1416.

[8] Nakajima, S. (1997), –Introduction to TPM: Total Productive Maintenance||, 2nd Edition, pp. 1-129, Productivity Press (India), Pvt. Limited, Chennai.

[9] Ramayah. T, Muhammad Jantan & Mohd Mustapha Hassan "Change Management and Implementation of Total Productive Maintenance: An Exploratory Study of Malaysian Manufacturing Companies", 2002, vol. 3.

[10] Raouf, A. "Improving Capital Productivity through Maintenance", International Journal of Operations & Production Management, 1994, vo114, issue7, 44-52.

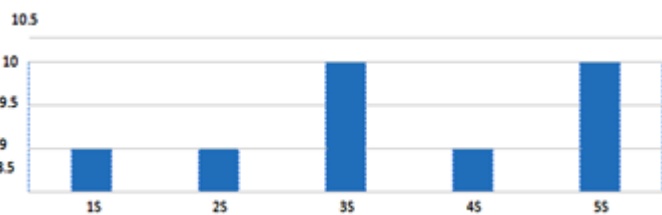


Fig 4: Implementation before 5S

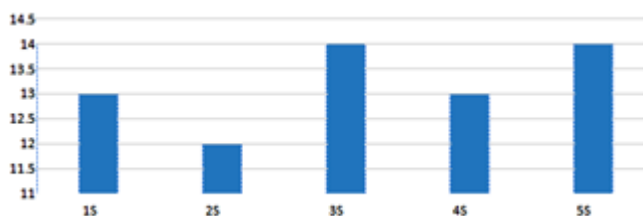


Fig -5: Implementation after 5S

3. CONCLUSIONS

The work present is focus on the implementation TPM with the additions of Kaizen. The conclusion is derived from implementation of TPM in the machine shop of automotive company. Success of TPM depends on various pillars like 5-S, Jishu Hozen, Planned Maintenance, Quality maintenance, Kaizen, Office TPM and Safety, Health & Environment. Overall Equipment Effectiveness has improved from 49.76% to 67.27 % indicating the improvement in productivity and improvement in quality of product.