Continual Improvement Using Jishu Hozen Pillar of Total Productive Maintenance in Manufacturing Organization

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Abstract: For any industrial firm, the most important thing is Safety, Quality & Productivity. Everyday tasks are aimed at sustaining and increasing it. After all, it determines the profit of the firm. It is also crucial for the economic progress of the country. High productivity refers to doing the job in the shortest possible time with minimum inputs and wastage but without sacrificing safety & quality. This is where Japanese improvement tool "Total Productive Maintenance" comes into the picture. This thesis aims to implement JH pillar of TPM in manufacturing company which will help in determining the improved methods to perform the required activities.

Keywords: Total Productive Maintenance, Jishu Hozen pillar, JH step 1-3 implementation, Kaizens

1. Introduction

1.1 TPM

Total Productive Maintenance (TPM) is a process or technique. This technique was first introduced by Japanese in 1952. This is an extension to TQM. TPM is a well-defined and organized program which eliminate the losses caused by break-down of machines and equipment's by identifying and attacking all causes of equipment break downs and system down time. TPM is a cost-effective technique through this technique it is possible to maintain the plant, machinery/equipment and tools in productive state in least cost. Well maintained machines leads to productivity. There is relation between cost of maintenance and cost of quality. We can't think quality outputs without quality inputs and one of the important input is TPM.

1.2 Definition TPM

TPM is a Japanese tool/methodology which is used to get excellence aiming Zero accident, zero defect, zero breakdown and Employee motivation through TPM culture at all levels of organization and Bringing customer satisfaction through customer rating and competitive prices. TPM is a system of maintaining and improving the integrity of production, safety and quality systems through the machines, equipment, processes, and employees that add business value to an organization.

1.3 Why to do TPM?

Zero Accident, Zero Defect, Zero Breakdown



2. JH Pillar/ Jishu Hozen/ Autonomous Maintenance

2.1 Introduction to JH Pillar

Workplace Ownership: "I operate the machine; I will maintain it also." Jishu Hozen, which means autonomous or self-maintenance, promotes development of production operators to be able to take care of small maintenance tasks, such as cleaning, inspecting, and lubricating their equipment, thus freeing the maintenance associates to spend time on more value-added activities and technical repairs. The operators are responsible for upkeep of their equipment to prevent it from deteriorating.

2.2 CLIT Inspection in JH Pillar

Through autonomous maintenance initiatives, production operators are expected to perform the TPM Activities of Cleaning, Lubrication, Inspection & Tightening on a Daily basis.

2.3 Seven steps of JH Pillar

1.4 Pillars of TPM

Step	Name	Activity
1	Clean and inspec	Eliminate all dirt and grime on the machine,

Volume 9 Issue 12, December 2020

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International Journal of Science and Research (IJSR) ISSN: 2319-7064 SJIF (2019): 7.583

		lubricate, tighten bolts, and find and correct problems.				
2	Eliminate problem sources and inaccessible areas	Correct sources of dirt and grime; prevent spattering and improve accessibility for cleaning and lubrication. Shorten the time it takes to clean and lubricate.				
3	Draw up cleaning and lubricating standards	Write standards that will ensure that cleaning, lubricating, and tightening can b done efficiently. (Make a schedule for periodic tasks.)				
4	Conduct general inspections	Conduct skills training with inspection manuals and use general inspections to fin and correct slight abnormalities in the equipment.				
5	Conduct autonomous inspections	Prepare standard check sheets for autonomous inspections. Carry out the inspections.				
6	Standardize through visual workplace management	Standardize and visually manage all work processes.				
7	Implement autonomous equipment management	Develop company policies and objectives; make improvement activities part of everyday practice; keep reliable MTBF (mean time between failures) data, analyse it, and use it to improve equipment.				

3. Problem Formulation & Methodology

3.1 Problem Statement

For any industrial firm, the most important thing is Safety, Quality & Productivity. Everyday tasks are aimed at sustaining and increasing it.

3.2 Motivation / Need for Research

In this research work, I will implement Jishu Hozen pillar which is called Autonomous Maintenance also. In production there is misconception among production operators "I run the machine, Maintenance maintain my machine" They think that their responsibility is to run machine & do production only. They are not responsible for maintaining the machine. Machine will be maintained by Maintenance department of company. Due to this misconception, they regularly neglect many abnormalities in daily routine. These abnormalities if neglected for long time can lead to accident, defected part production, machine breakdown. Using JH pillar this misconception is changed into "I run the machine, I am responsible to maintain the machine". Operator starts capturing all abnormalities which can lead to any accident, defect & breakdown. These abnormalities are timely removed.

3.3 Methodology

- Use JH step 0 methodology.
- Use JH step 1 methodology.
- Use JH step 2 methodology.
- Use JH step 3 methodology.
- Use JH step 4 methodology

3.4 Tools

There is a requirement of several equipment and machines for this research work. Some of they are stated below

- Moulding section machines
- Power press section machines
- CNC section machines
- Fibro moulding section machines
- Die casting section machines
- Assembly section machines

4. Experimentation & Analysis

4.1 Outline

4.1.1 Background



Fig. 4.1 Background

4.1.2 Aim

The aim of JH pillar is to change the mind set of operator from "I operate you maintain" to "I operate I maintain".

4.1.3 Objective

To achieve Zero Accident, Zero Defect, Zero Breakdown and Zero Waste due to weak JH.

4.1.4 Benchmark & Targets

SN.	кмі	КРІ	иом	BM FY 16-17	Target FY 17-18	Target FY 18-19	Target FY 19-20	Target FY 20-21
1.	Safety	Accidents due to weak JH	Nos	1	0	0	0	0
2.	Customer Rating	Defects due to weak JH		1.1	< 0.55	< 0.30	< 0.17	< 0.11
з.		Breakdown hrs due to weak JH	Hrs	130	90	65	39	0
4.	Manufacturing Cost	CLIT time reduction	Min	20	15	10	8	5
5.		Minor Stoppage	Nos	3047	2400	1800	1200	600

Table 4.1 Benchmark & Targets

4.2 Key Points of Activity

4.2.1 Master Plan

Table 4.2: Master Plan

Volume 9 Issue 12, December 2020

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DOI: 10.21275/SR201122152147

International Journal of Science and Research (IJSR) ISSN: 2319-7064 SJIF (2019): 7.583



4.2.2 Pillar Structure

For implementing the JH practice across the plant, we formed a team who gives training and monitor the JH activities.

4.3 Audit Methodology





4.4.1.2 Training: Knowledge about abnormalities



Fig. 4.5 Knowledge about Abnormalities

4.4.1.3 Training: Red Tags & White Tags



1S Sorting

4.4.1.1 Training: Knowledge about machine

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DOI: 10.21275/SR201122152147

International Journal of Science and Research (IJSR) ISSN: 2319-7064 SJIF (2019): 7.583



4.4.1.6 JH step 0: 1S, 2S Audit sheet

	Auditor Name Mgoy			abute of	Crineria for	32	0
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	Marka Alburation		47.		10	2.5	2.9
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	Not documents are pointed on well's multimes. (Communities like packing material "Adhesive tapes having company loger are used intensed.	20	1		10		1
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	25 Systematic Arrangement		0%	25%	50%	75%	100%

Fig. 4.10 - 1S,2S Audit check sheet

4.4.1.7 JH Step 0: 1S, 2S Overall plant benefits

	REVENUE GENERATED										
SN.	Item Removed	UOM	Actual	Money Generated INR (Lacs)							
1	Plastic Bin	KG	3730	0.75							
2	Drum/Container	Nos	261	0.78							
3	Carton Box & Wooden Waste	KG	20275	1.01							
4	Molding Machine	Nos	3	1.75							
	Total Money Generate	d in INR (Lacs)		4.29							
	AREA SAVED										
SN.	Item Removed	Area(M ²)	Spare Area Allocation								
1	Conveyor Oven	225	Space allotted for keeping robot cell								
2	Chip Conveyor	160	Space allotted for new CNC machine								
3	Assembly Table	32	Space in spare								
4	Molding Machine	56	Space allotted for WIP material								
5	Adhesive coating Station	11	Space allotted fo	radhesive SPM							
6	Sheet dry table	8	Space allotted for rolling machine								
7	Drill cum reamer machine	4	Space allotted for oven								
Total	area Saved	496									

Table 4.4 - 1S.2S Overall Plant Benefits

4.4.1.8 JH step 0: 1S, 2S Results



80	STEP 2
	1.4 Three Layer audits 1.3 Identification of SOC & HTA
1.2 Pre	paration of Fugai matrix & Tag stratification nspection & tagging of abnormalities
Step 0 : Complete	

4.4.2.1 Cleaning with inspection & Tagging of



Fig. 4.11 - Tagging **IDENTIFIED TAG STATUS- MOULDING MACHINE**



List Of Abnormalities 'Fugai'- Moulding Machine

We prepared the list of abnormalities and we identified total 24 tags as under.

Eq	uipment N	ame: MP-(01				Shop	o Name: Mo	oulding						
	Date of	Detector	Eq	uipment N	ame: MP-0	1		Shop Name: Moulding							
214	detection	Delector	SN	Date of	Detector	Eq	uipment N	ame: MP-01	1		Shop Name: Mould	ling	_	-	
1	05.02.18	Raj		detection	Jeneral I		Date of			why is it a Fugai (what will	Why did it become	Contents of the	"EFU"		Planne
		Prakash	9	05.02.18	Raj Prakash	SN	detection	Detector	Fugai item	happen if it is left as it is?)	so ? (what is the cause)	countermeasures	Classificati on	Executor	Date
2	05.02.18	Raj Prakas	10	05.02.18	Bhupendra	17	06.02.18	Sarvesh	Pillar Lubrication not done	Lubrication not done	Unfulfilled the basic condition	Gland to be provided	Red	ABHISHEK	10.02.1
3	05.02.18	Sone lal	11	05.02.18	Sone Ial	18	06.02.18	Raj Prakash	Earthing wir dressing nol done	t Loose	Unsafe	Proper dressing to be done	Red	ABHISHEK	10.02.
4	05.02.18	Sarvesh	12	05.02.18	Banti	19	06.02.18	Sone lal	Limit switch loose	Loose	Unsafe	To be tighten	Red	ABHISHEK	10.02.
5	05.02.18	Bhupendra	13	05.02.18	Banti	20	06.02.18	Bhupendra	Oil leakage from pressu gauge	re Oil leakage	Source of contaminations	To be tighten	Red	ABHISHEK	14.02.
6	06.02.18	Sarvesh	14	06.02.18	Sarvesh	21	06.02.18	Bhupendra	Hydraulic tank cover bolt missing	Bolt missing	Unfulfilled the basic condition	Bolt to be provided	Red	ABHISHEK	11.02.1
7	06.02.18	Raj Prakas	┝				05 02 10	Count	Conduit pipe	es Loose wire	Verefe	Conduit pipe to be		ADUTCUEN	
8	06.02.18	02.18 Sonu 15 06.0	06.02.18	Banti	22	05.02.18	Servesn	available		Unsale	provided	Red	NOUTOUCK	10.02.1	
			16	06.02.18	Hemant	23	06.02.18	Sone lal	Heater wire not clean	Wire dirty	Unsafe	Wire to clean	Red	ABHISHEK	08.02.1
						24	06.02.18	Sone lal	Oil leakage from joint	Oil leakage	Source of contaminations	Welding to be done	Red	ABHISHEK	10.02.1
						_		-							-

Figure 4.12: List of Abnormalities

4.4.2.2 Fugai matrix & Tag stratification – Moulding machine

Volume 9 Issue 12, December 2020

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FUGAI MATRIX



Table 4.5 Fugai Matrix TAG STRATIFICATION



4.4.2.3 List of SOC & HTA – Moulding machine SOURCE OF CONTAMINATION FUGAI



HARD TO ACCESS FUGAI



4.4.2.4 Three layer of audit step 1 – Moulding machine

After completing Step 1 activity, Machine passed 3 level of Step 1 audits.



4.4.3 JH Step 2 Activity METHODOLOGY



4.4.3.1 Countermeasure of Source of Contamination (SOC)

asures has been taken against all source of contamination and one example is shown Counter below





4.4.3.3 CLIT time reduction activity – Moulding m/c 1 CLIT time of Moulding machine 1 reduced as described below in activity chart.



4.4.3.4 Three layers of audit Step 2 – Moulding



After completion of step 2, Step 3 has been started.

4.4.4 JH Step 3 Activity METHODOLOGY

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4.4.4.1 Preparation & Implementation of Machine tentative standard – Moulding

Based on our learnings from step1 and step 2 and abnormalities found, we have prepared machine tentative standard for operators to carry out daily <u>CLL</u>I,T. Below one sample is shown.

मत्तीन	(here)		(Classification)			तानु करने की किंधि	उपकरणों का	search 1	(Time)
enga Baeve Machin (Description) t Side)		₩. ₩. (S.N)	8-W	eteres.	HIVER (Criteria)	(Method of Implementation	अपकोग (Use of Tools)	duran (Daily)	को मह यो
	मसीन	Δ 💿	सफाई	फ्रंट साइड	साफ़ होनी चाहिए	करके कपडे द्वारा सफाई करे	783	•	
	इसरजेंसी बटन		द्रस्प्रेक्शान	फ्रंट साइठ	काम करना चाहिए	दया के देखे	Q	•	
फ्रेट साइउ	स्टार्ट बहन मिन्द्र प्रायक		इस्प्रेक्शन	फ्रंट साइड	काम करना चाहिए	दया के देखे	Q	•	
	सेसर 📲 🔂		इस्पेक्शन	सेफटी कार्टन	काम करना धाहेप	सेपटी कार्टन के बीच हैंड पास करके	AN	•	T
	प्रेगर		इस्पेक्शन	फ्रंट साइठ	प्रेशर _{80:55} kg/cm2 होना चाहिप	देख कर	۲	•	
	सांक विसित्र	7	ন্ত্রক্লিক মান	.L.IT सोकेश	. त्विकेमान होना चाहिप	देख कर	۲	•	

Fig. 4.15 Tentative Standard

4.4.4 Visual aids displayed on machine

VISUAL FREQUENCY

Following common visual frequencies added in JH machine check sheets across the plant.



VISUAL STANDARDS

Following is a sample of visual displayed on machines to simplify & minimize CLIT activity time.



VISUAL STANDARDS DISPLAYED ON MACHINE We have added visual controls on the machines for making them self-speaking machine as shown below.



Fig. 4.17 Visuals

4.4.4.3 Checkpoints added in JH checksheet

We added visual controls on machine. Based on past breakdowns, past defect analysis & actions, "PM" and "Q" points were added in JH check sheet.



4.4.4 Three layers of audit Step 3 – Moulding machine

After completing step 3 activity, Machine passed 3 level of step 3 audits.



 Self-Audit Marks
 Section Manager Audit Marks
 Plant Head Audit Marks

 92
 86
 82

 After completion of Step 3, Step 4 started.
 80
 82

5. Results & Conclusion

5.1 KPI Results

SN	KPI	иом	BM FY 16-17	Target FY 17-18	Actual FY 17-18	Target FY 18-19	Actual FY 18-19	Target FY 19-20	Actual FY 19-20	Target FY 20-21
1.	Accidents due to weak JH	Nos	1	0	0	0	o	0	0	0
2.	Defects due to weak JH	%	1.1	< 0.55	0.37	< 0.30	0.20	< 0.17	0.15	< 0.11
3.	Breakdown hrs due to weak JH	Hrs	130	90	95	65	53	39	31	0
4.	CLIT time reduction	Min	34	25	22	15	14	8	8	5
5.	Minor Stoppage	Nos	3047	2400	2210	1800	1720	1200	800	600
				Table	5.1 KPI R	esults				

5.2 KAI Results

		KAI	UOM	BM FY	FY 1	7-18	FY 18-19		FY 19-20		Target
SN	KPI			FY 16-17	Target	Actual	Target	Actual	Target	Actual	FY 20-21
1	Accident	Unsafe Condition	Nos	352	0	264	0	124	0	49	0
2	Defects due to poor JH	Q points maintained by JH	Nos	16	75	90	135	132	200	219	250
3		Tagging & removal of abnormalities	Ratio	100	100	100	100	100	100	100	100
4	Breakdown	M/C tentative standard check sheet preparation/ updation	Nos /year	160	300	340	550	542	750	751	1000
5		No of one point lesson	Nos	44	100	110	200	188	270	259	400

Table 5.2 KAI Results

5.3 Intangible Benefits (Qualitative)

	1) Presentation skill improved
	2) Analysis knowledge improved
Jishu Hozen / JH /	3) Brain storming skill improved
Autonomous	4) Communication skill improved
Maintenance	5) 5S improved
	6) Self-confidence improved
	7) Morale improved & innovative consciousness
	Table 5.3 Intangible Benefits

5.3 Future Scope

	itale scope					
SN	OBJECTIVE	ACTIVITY				
1	Sustenance & Monitoring	Step 1, 2, 3 sustenance in all the departments ar monitoring all the results.				
2	JH Step 4-7	Training and implementation of JH steps				

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