

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

Akash Kumar

¹Bahra Institute Of Management and Technology, V.P.O. Chidana, Gohana -131301, India
promise4akash[at]gmail.com

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.

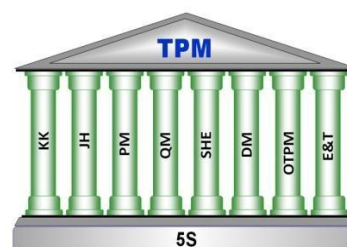
1.2 Definition TPM

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

1.4 Pillars of TPM



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

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

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		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 be done efficiently. (Make a schedule for periodic tasks.)
4	Conduct general inspections	Conduct skills training with inspection manuals and use general inspections to find 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

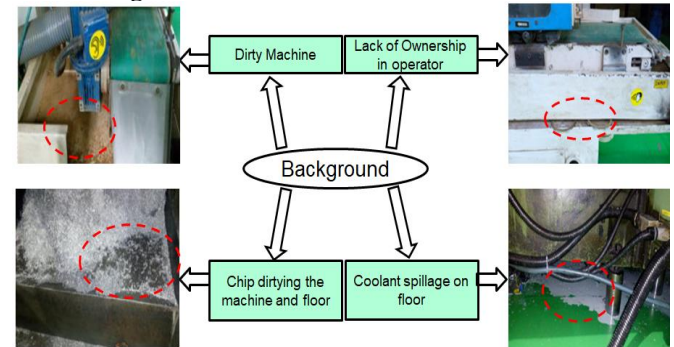


Fig. 4.1 Background

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

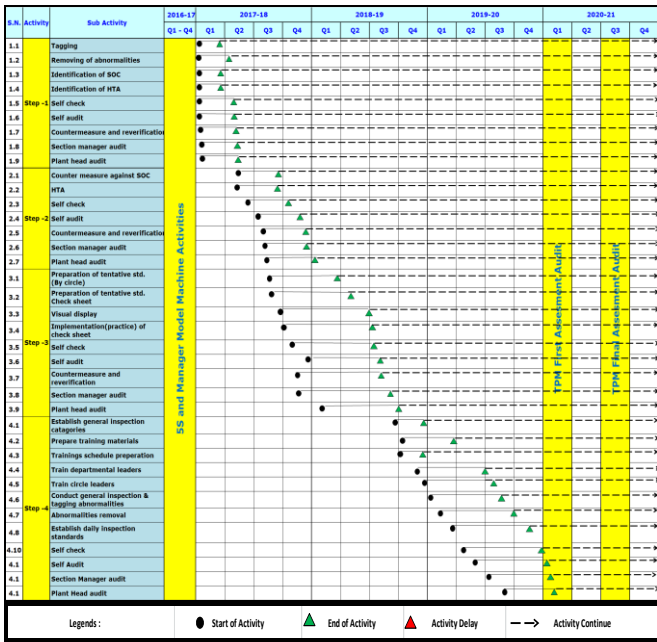
SN.	KMI	KPI	UOM	BM FY 16-17	Target FY 17-18	Target FY 18-19	Target FY 19-20	Target FY 20-21
1.	Safety	Accidents due to weak JH	Nos	1	0	0	0	0
2.	Customer Rating	Defects due to weak JH	%	1.1	< 0.55	< 0.30	< 0.17	< 0.11
3.		Breakdown hrs due to weak JH	Hrs	130	90	65	39	0
4.	Manufacturing Cost	CLIT time 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



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

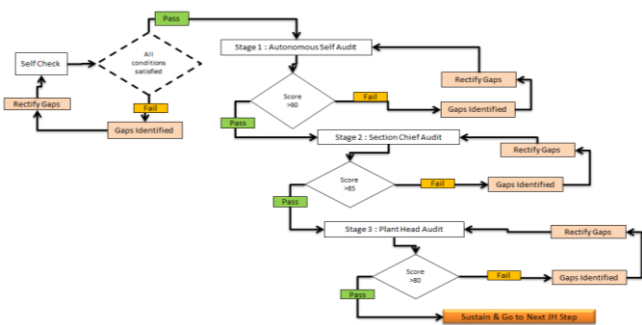


Figure 4.3: Audit Methodology

4.4 Activity Status of Each Step

4.4.1 JH Step 0 Activity

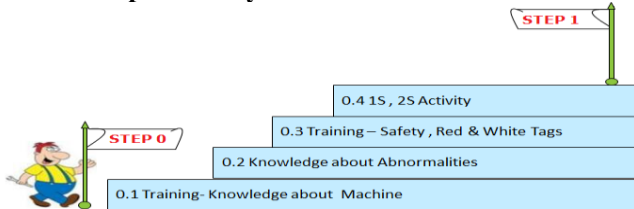


Figure 4.3: Step 0 Activity

4.4.1.1 Training: Knowledge about machine

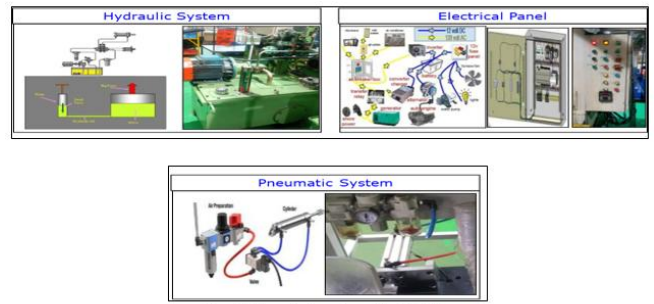


Fig. 4.4 Knowledge about the Machine

4.4.1.2 Training: Knowledge about abnormalities

TYPES OF ABNORMALITIES

1. Minor Flaws	Cleaning	Machine construction, Covers, Level, Height, Space
2. Unfulfilled Basic Conditions	Checking	Construction, Covers, Level, Orientation, Operation, Instrument position and accuracy
3. Inaccessible places	Lubricating	Position of lubrication, construction, height, footholds, lubricant outlets, etc.
4. Contamination sources	Tightening	Construction, Layout size, Space
5. Quality Defect Sources	Operation	Construction, layout, Position of valves, switches and levers, etc.
6. Unnecessary and non-urgent items	Adjustment	Position of pressure gauges, thermometers, flow meters, viscosity gauges, vacuum gauges, etc.
7. Unsafe places	Floors	Unevenness, cracked, holes, projections, peeling, wear of steel chucker plates, slipping
	Steps	Too steep, irregular, slipping, handrails, etc.
	Lights	Dim, out of position, broken covers, no explosion proofing, etc.
	Oil level gauges	Dirty, Damaged, indication of correct level
	Rotating machinery	Displacement, broken covers, not safe for emergency stop devices
	Tightening	Looseness, Missing, Cross-threaded, Corroded, Unsuitable washers, wing nuts, etc.
	Lifting Devices	Crane brakes and other parts of cranes and hoists etc.
	Others	Flammable substances, solvents, toxic gases, insulating materials, danger signs, protective clothing etc.

Fig. 4.5 Knowledge about Abnormalities

4.4.1.3 Training: Red Tags & White Tags



Fig. 4.6 White Tag

यह टैग मशीन की उन असामान्य चीजों पे लगाया जाता है जिनको आप सुद या सुपरवाइजर की सहायता से 24 घंटो के अंदर सही कर सकते है

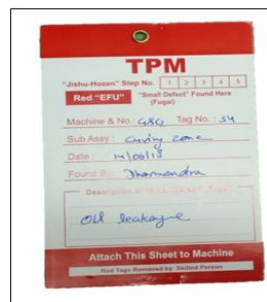


Fig. 4.7 Red Tag

यह टैग मशीन की उन असामान्य चीजों पे लगाया जाता है जिनको केवल मैटेनंस अथवा अन्य डिपार्टमेंट की सहायता से ही 72 घंटो के अन्दर सही किया जा सके

4.4.1.4 JH Step 0: 1S Implementation 1S Sorting

4.4.4.1 Preparation & Implementation of Machine tentative standard – Moulding

Based on our learnings from step 1 and step 2 and abnormalities found, we have prepared machine tentative standard for operators to carry out daily C.L.I.T. Below one sample is shown.

मशीन का हिस्सा (Machine Part)	चित्र (Description)	क्र. सं. (S.N)	वर्णन (Classification)	CLIT	कारण (Cause)	संशोधन का विवरण (Method of Investigation)	संशोधन का उपाय (Use of Tools)	समय (Time)
समीकन		1	सजाई	प्रोड सजाई	साइज से नीचे चलाने	साइज से नीचे चलाने	हाथ से ठीक करके चलाने	5 मिनट
दूरदर्शी कटन		2	दुरुस्ति	प्रोड सजाई	कमस कमस चलाने	कमस कमस चलाने	दबा के देखे	5 मिनट
साइड बदन		3	दुरुस्ति	प्रोड सजाई	कमस कमस चलाने	कमस कमस चलाने	दबा के देखे	5 मिनट
सौर		4	दुरुस्ति	सेवागी कटन	कमस कमस चलाने	कमस कमस चलाने	साइड साइड के बीच से दबा करके	5 मिनट
दिएर		5	दुरुस्ति	प्रोड सजाई	दोनों 8000 kg/घंटा चलाने	दोनों 8000 kg/घंटा चलाने	देख कर	5 मिनट
सौर विस्तर		6	सुविक्रम	LIT चोकेस	सुविक्रम सौर चलाने	सुविक्रम सौर चलाने	देख कर	5 मिनट

Fig. 4.15 Tentative Standard

4.4.4.2 Visual aids displayed on machine

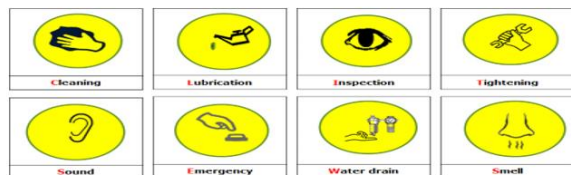
VISUAL FREQUENCY

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

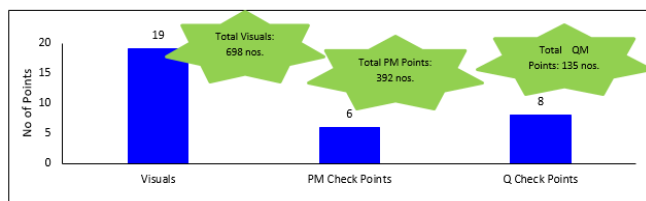
We have added visual controls on the machines for making them self-speaking machine as shown below.



Fig. 4.17 Visuals

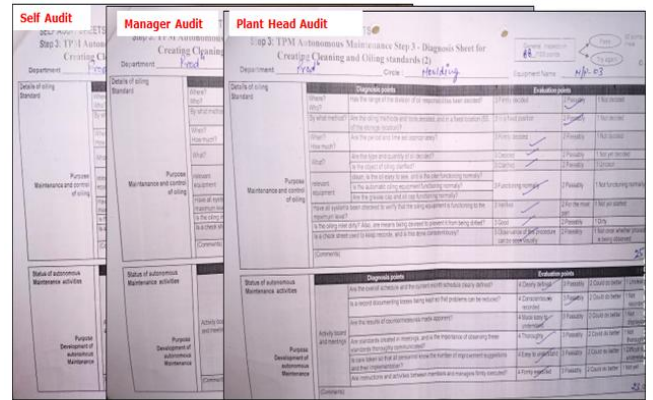
4.4.4.3 Checkpoints added in JH checksheet

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



4.4.4.4 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.

5. Results & Conclusion

5.1 KPI Results

SN	KPI	UOM	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	0	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 Results

5.2 KAI Results

SN	KPI	KAI	UOM	BM FY 16-17	FY 17-18		FY 18-19		FY 19-20		Target FY 20-21
					Target	Actual	Target	Actual	Target	Actual	
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/ update	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)

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

Table 5.3 Intangible Benefits

5.3 Future Scope

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

References

- [1] Seiichi Nakajima "Introduction to TPM: total productive maintenance" Productivity Press, Cambridge, 01-Oct1988.
- [2] Osama Taisir R.Almeanazel,"Total Productive Maintenance Review and Overall Equipment Effectiveness Measurement", Volume 4, Number 4, Pages 517 - 522,2010.
- [3] Veronika I.D. Buech, Alexandra Michel, Karlheinz Sonntag, "Suggestion systems I organizations :what motivates employees to submit suggestions?", European Journal of Innovation Management, Vol. 13 Iss: 4 pp. 507 - 525, 2010.
- [4] Ranteshwar Singh, Ashish M Gohil, Dhaval B Shah, Sanjay Desai ,2013 "Total Productive Maintenance (TPM) Implementation in a Machine Shop: A Case Study" Procedia Engineering 51 (2013) 592 – 599
- [5] J. Venkatesh, "An Introduction to Total Productive Maintenance (TPM)", 2007.
- [6] Faisal Talib1, Zillur Rahman, M.N. Qureshi, "Pareto Analysis of Total Quality Management Factors Critical To Success for Service Industries. International Journal for Quality research,Vol.4, No. 2, 2010.
- [7] Jose Arturo Garza-Reyes, Steve Eldridge, Kevin D. Barber, Horacio SorianoMeier, "Overall equipment effectiveness (OEE) and process capability (PC) measures: A relationship analysis", International Journal of Quality & Reliability Management, Vol. 27 Iss: 1 pp. 48 - 62, 2010.
- [8] Bulent Dal, Phil Tugwell, Richard Greatbanks, "Overall equipment effectiveness as a measure of operational improvement - A practical analysis", International Journal of Operations & Production Management, Vol. 20 Iss: 12 pp.1488 - 1502, 2000.
- [9] Ahmed, S., Hassan, M.H. and Taha, Z. (2004), "State of implementation of TPM in SMIs: a survey study in Malaysia", Journal of Quality in Maintenance Engineering, Vol. 10 No. 2, pp. 93-106.
- [10] Ahmed, S., Hassan, M.H. and Taha, Z. (2005), "TPM can go beyond maintenance: excerpt from a case implementation", Journal of Quality in Maintenance Engineering, Vol.11 No. 1, pp. 19-42.
- [11] Ahuja, I.P.S. and Khamba, J.S. (2007), "An evaluation of TPM initiatives in Indian industry for enhanced manufacturing performance", International Journal of Quality & Reliability Management, Vol. 25 No. 2, pp. 147-172.
- [12] Ahuja, I.P.S. and Khamba, J.S. (2008a), "Total productive maintenance: literature review and directions", International Journal of Quality & Reliability Management, Vol. 25 No. 7, pp. 709-756