

LEAN CONCEPT IN THE MAINTENANCE

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SUMMARY

LEAN manufacturing concept is part of business strategy at the enterprise level in order to increase market share and simultaneously reduced operational costs. At the core of this strategy is a series of related processes in order to continuously reduce the consumption of resources without affecting the value of the product. LEAN concept of the production process can not be implemented without the use of LEAN strategy in the area of equipment maintenance. One of the most important tools in the LEAN concept of maintaining the "5 S". It is a technique that results in a well-organized workplace (clean, regulated, safe and organized), which connects people and processes

Keywords: *Lean production concept, lean maintenance, tool "5 S".*

1. LEAN CONCEPT PRODUCTION

LEAN manufacturing concept has its beginning with Henry Ford and his conveyor belts, which later became the model on which bases its Toyota Production System 40's of the last century.

Henry Ford had a vision of building "a car for the great multitude," which price and time and cost of construction had to be as low as possible.

It could be argued that the LEAN adaptation of Eastern philosophy to the Western way of thinking.

Many authors emphasize that the purpose of LEAN tools increase productivity, which can sometimes lose the focal role of the people, which is more pronounced in the TPS.

LEAN as the TPS is described which consists of the many techniques that are designed to reduce production costs, above all in the decrease in the decrease in cost and the elimination of waste, that is, all the unnecessary expense, the two basic methods:

- JUST IN TIME - "just in time" which is a technique of supplying the correct quantity, at the right time at a precise location.
- JIDOKA - includes a variety of cultural and technical issues related to the integrated use of machinery and labor.

LEAN philosophy recognizes seven major types of "waste":

1. Excess: Parts that are manufactured without any new cause or require the buyer
2. Hold: The time is not used efficiently, which increases all utilities.
3. Transport: Moving elements of work from place to place in the process, even if it is only a short distance
4. Waste in the process: The work on producing more than is needed during the production cycle of the waste
5. Excess inventory: Excess raw materials or finished products
6. Unnecessary movement: All unnecessary surgery, movement and steps are waste
7. Errors: Everything is out of zero defects is a waste.

2. LEAN MAINTENANCE

The production process can not be considered independently without LEAN maintenance strategy.

In the book "LEAN maintenance: reduce costs, improve quality and increase its market share " Authors Ricky Smith and Bruce Hawkins claims that manufacturers can achieve maximum results without the use of proper maintenance.

The objectives of the maintenance process must support the strategy of production plans and objectives. The main goal of any organization is to maintain the reliability and availability of equipment, or system effectiveness individually and as a whole.

If the equipment is not reliable when an operation does not meet the production and subsequent steps also not satisfactory. When this happens the maintenance must intervene as soon as possible.

Equipment reliability is a prerequisite for the implementation of LEAN manufacturing concept

The production plant that has accepted all the doctrines of lean manufacturing, it is not ready to implement them in practice, without LEAN concept in maintenance

LEAN concept is realized by applying LEAN tools: Visual controls, "5 S" - Simplify, Scrub, Straighten, Stabilize, Sustain, Eliminate seven wastes , SMED (Single Minute Exchange of Dies), Poka Yoke.

3. "5 S" AS A TOOL LEAN CONCEPT IN THE MAINTENANCE

"5 S" is one of the basic tools of LEAN concept in maintaining

Elements " 5 S " are japanese words that begin with the letter S: Seir Seiton, Seiso, Seiketsu and Shitsuke (Table 2).[2], [3],

Table 2: Meaning "5 S"

Japanese "S"	Anglicized Version	Meaning
Seiri	Sort (Tidiness)	Remove all items from the workplace that are not immediately required for the work
Seiton	Set in Order (Orderliness)	Set everything you need at the right place, for quick retrieval and storage
Seiso	Sweep, Straighten (CLEANliness)	.Ensure that the work area clean, free of contaminants, dirt and foreign matter unnecessary for the process.
Seiketsu	Standardize (Standardization)	Standardize, import rules, the way of cleaning
Shitsuke	Sustain (Discipline)	Define a way of maintaining order and cleanliness of the workplace and identify specific tasks

LEAN maintenance plays a key role in increasing the reliability of production equipment to the required level. Since the production process is becoming increasingly dependent on automation, good maintenance becomes increasingly important, which means that it requires continuous inspection, evaluation and improvement.

LEAN maintenance operations, which results in a reduction in costs and an increase in production, the first step in the overall LEAN transformation of organizations - businesses, in which a special role is played by tools "5S".

"5 S" is a system for reducing all types of waste and optimizicaiju productivity by eliminating noise in the workplace, in the current configuration without disturbing the normal production process.

"5 S" can be used in any environment, including workshops, factories, warehouses, construction sites, offices and others.

3.1 Measuring the "5 S" level

Implementation of the "5 S" should be checked regularly. "5 S" is as good as good as its weakest link and, regardless of the level of the state of other elements "5S"

One example of measurement "S 5" level is shown in Table 3

Table 3:Measuring the "5S" levels of maintenance

Object: Workshop maintenance of an enterprise							
Category "5S"	Topic control	The rating level					Remark
		5	4	3	2	1	
Sort	Distinguish between what is necessary and unnecessary to be in the environment		<input type="checkbox"/>		+		There are recommendations that do not comply
	The presence of unnecessary equipment, tools, furniture and other in the workshop.		<input type="checkbox"/>		+		It was observed a delay in the removal of unnecessary materials.
	The presence of unnecessary articles on the walls and bulletin boards				<input type="checkbox"/>	+	No inscriptions
	Various objects are present in the aisles, stairways, corners and other places			<input type="checkbox"/>	+		It is necessary to remove all the unnecessary material - waste
	Present unnecessary inventory, supplies, and other materials			<input type="checkbox"/>	+		Partially
	Present danger to the security (water, oil, chemical substances, equipment, supplies)				<input type="checkbox"/>	+	The danger of landslides
Set in Order (Orderliness)	Everything is in its place			<input type="checkbox"/>	+		Partially
	They are clearly marked place for every item		<input type="checkbox"/>	+			Partially labeled tool
	Items not in place			<input type="checkbox"/>	+		Items for use partly in place
	Passes, workstations, equipment locations are not defined				<input type="checkbox"/>	+	In most cases, defined
	Items can not go to their place immediately after use				+		Frequently immediately after use
	They define the limits of necessary tools, materials and other items			<input type="checkbox"/>	+		Are defined but are not consistently observed
Shine (CLEAN liness)	Cleaning and defined way to keep it clean and organized			<input type="checkbox"/>	+		Partially
	Floors, walls, stairs and surfaces soiled from dirt, oil, grease and other materials			<input type="checkbox"/>	+		There are cases where impurities
	The equipment is unclean from dirt, oil and grease				<input type="checkbox"/>	+	Equipment in proper relation to the operating conditions
	Cleaning supplies are not readily available				<input type="checkbox"/>	+	Get a plan and periodically
	Labels and signs are not clear and legible			<input type="checkbox"/>	+		Visible under the terms
	Other cleaning problems of any kind are present				<input type="checkbox"/>	+	Basically there are no other significant problems
Standardize (Adherence)	Maintain and monitor the previous three categories			<input type="checkbox"/>	+		Not systematically monitored
	The required information is not visible				<input type="checkbox"/>	+	Included in routine reports
	Standards are not known and applied			<input type="checkbox"/>	+		Partially
	Control regulations do not exist for the cleaning and maintenance jobs				<input type="checkbox"/>	+	There are in most cases
	All amounts and limits are not easily recognizable				<input type="checkbox"/>	+	Applicable documents
	How to monitor and implement the recommendations and standards			<input type="checkbox"/>	+		From the point of order at the secondary level
Sustain (Self-discipline)	Is responsible to the facility rules apply "5S"?			<input type="checkbox"/>	+		Partially
	Do workers have a regular "5 S" training?	<input type="checkbox"/>		+			They have no "5S" training
	How many times a week to conduct "5 S"?	<input type="checkbox"/>	+				Not implemented
	How long objects are disordered?			<input type="checkbox"/>	+		Often longer than the prescribed
	How many times do business in accordance with the recommendations of the "5S" is not completed by a certain date?		<input type="checkbox"/>		+		That's what it does not pay enough attention
	How often do you "5 S" inspections were not undertaken as planned?	<input type="checkbox"/>			+		There is no plan daily inspections
TOTAL <input type="checkbox"/>		3	4	14	9	0	
TOTAL +		0	1	12	15	2	

- The first measurement of "5S" performed at the beginning of the measurement month, "
- Other measurements "5S" performed at the end of the measurement month "+"

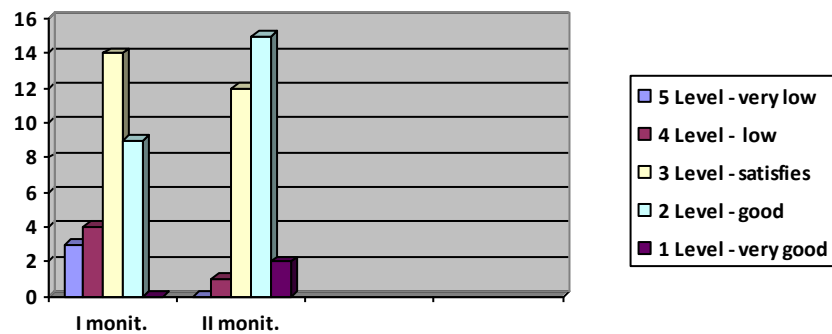


Fig. 2

From the diagram it can be concluded that during the measurement the month there was a significant improvement of the workshop in terms of "5S" (fig.2).

The fifth level (very low) is eliminated, the fourth level (low) was reduced by about 70%, the third level (meets) was also reduced by 20%, the second level (right) is increased by about 40%, while the first level (very good) to get the value zero.

4. ADVANTAGE - BENEFIT "5 S"

- Implementation of the "5 S" LEAN methods concept in maintenance, storage, as well as other elements of the business system, resulting primarily in the area of obtaining, significant reduction in size of the space needed for existing operations.
- It will also result in better organization of the use of tools, materials, equipment, and proper positioning of the rational movement of people.
- In addition, many companies begin their transformation just using the "5 S", which reveal some "invisible" examples of various types of waste, ie, unnecessary costs, which is a precondition for the establishment of discipline necessary to continue the successful initiatives of continuous improvement
- In the daily work of the company, "5 S" reflects the organization and transparency that are essential for the smooth flow and performance of work activities
- Successful application of LEAN method improves working conditions and encourages workers to improve productivity, reduce waste, reduce failures - and other equipment downtime

5. CONCLUSIONS

- LEAN maintenance is the basis for the reliability of the process which reduces the need to address the problem of maintenance and repairs.
- LEAN Maintenance is the protection of the causes of equipment downtime - not just their symptoms
- Many world-class companies argue that improvements can not occur without the use of "5 S" method LEAN concept
- "5 S" must be carried out through team work and the results need to ensure everyone can "tell at a glance" what is right and what is not in place
- The typical "5 S" implementation results in a significant reduction in materials and space required for existing activities and operations.

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