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APPLICATION OF IMPROVEMENT OF SYNCHRONIZED MANUFACTURING SYSTEM

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ABSTRACT

Our history of development is too weird but systematic enough to make us understand many changes, which are continuously in process even today. To start with, we can recall man making fine by rubbing stone, making tools, cultivating land to produces and then making wheel to transport. This was one part of the development of man of ancient times. Then, with the passage of many decades man became more mightier, stronger, more intellectual to harness the already present and invented energy. He learnt the use of metal, he casted them, he started manufacturing; This further continues the story of development. With the growth of man's intelligence there was origin of many developments. He could think for his betterment. And, with the growth of man's quantity there originated revolutions. One such revolution started the actual process of industrial development was INDUSTRIAL REVOLUTION in 1750 the man's power to think, grow & develop himself by using nature for his betterment gave him the freedom to use anything and everything as he desired. For quite a long time this scenario continued until nature did not intervened. Man started destroying nature for its requirements and so nature showed its reciprocatory effects. Then man pondered nature & its effects and here came the changes or restrictions which became mandatory. With this thought came the theory of many wise men on the ways of manufacturing & producing in harmony with the dispositioned nature. There were notion on ways of working, processing, usage and even the quality of material produced. Man became more conscious of the quality. He started demanding durability of his manufactured products without any harm to biosphere and so he valued quality. QUALITY became the integral part of human activity. With the further growth of Industrial Revolution (1787), standards had more importance. Interchangeability of parts was given preference.

KEYWORDS: Quality, Research and Development, Maintenance

INTRODUCTION

Definition of Quality: Quality is easily the most important factors of any product, to maintain quality; an error free, smooth working product is a must. So we see it is of foremost importance to remove factors contributing towards losses and degrading quality. Generally three are many types of losses. Few of them are listed below:-

- Due to Equipment Efficiency
  - Failure loss
  - Setup / Adjustment loss
  - Cutting blade loss
  - Start up loss

  - Minor stoppage loss
  - Defect / Rework loss
- Due to Human Work Efficiency
  - Management loss
  - Motion loss
  - Line organization loss
  - Failing of automatics
  - Measuring and adjustment loss
- Due to production Resources;-
  - Yield loss
  - Energy loss
  - Die jig and tool loss
- Amongst all these losses basically six big losses are considered;-
  - Breakdowns
  - Setups and adjustments
  - Reduced speed
  - Minor stoppages
  - Defects and reworks
  - Start up loss

We came across the major types of losses that the industry faces. Research and development work carried out in this field has led to the evolution of maintenance practice for minimizing these losses. Here the word “MAINTENANCE” is concerned with the activities required to keep the facility in a built conditions and prolong its utility, with minimum cost.

OBJECTIVES OF MAINTENANCE

- Achieve stable operation by elimination equipment failure
- Prevent equipment failure by productive maintenance
- Increase mean time between failure
- Reduce mean time to repair
- Reduce maintenance cost
- Establish efficient equipment management system

- Development of advanced maintenance management techniques

ACTIVITIES OF MAINTENANCE

- Restore deterioration
- Improve equipment to lengthen maintenance interval
- Equipment condition monitoring
  - Vibration monitoring
  - Lubricants monitoring
- Establish on-line maintenance methods
- Introduction of corrective maintenance activity
- Introduction of computerized maintenance system

An Efficient Planned Maintenance program, combines Time based Maintenance; Condition based Maintenance & Breakdown Maintenance as rationally as possible. So we see there are typically four maintenance methods.

- Preventive maintenance
- Breakdown maintenance
- Corrective maintenance
- Productive maintenance

PREVENTIVE MAINTENANCE

Preventive maintenance maintains the equipment's healthy conditions. It prevents deterioration by carrying out routine maintenance, periodic inspection, equipment diagnosis and repair to restore equipment condition.

It is classified in following types:

- Periodic maintenance: Time based maintenance (TPM)
- Predictive maintenance
- Condition-based maintenance (CBM)
- Over haul: inspection and repair (IR)

Periodic Maintenance: Time Based Maintenance (TPM)

The repair period (theoretical and empirical values) is set based on parameters (production volume, pieces or number of operating days) most proportional to deterioration of equipment (productivity, number of repair etc) repair is executed unconditionally if the end of the period is reached.

Predictive Maintenance

Monitor and analyze the deterioration data regularly and constantly repair. If deterioration parameter reaches a pre determined critical value, inspection is carried out to examine the state of deterioration and to carry out repair based on inspection results.

Condition Based Management (CBM)

Equipment deterioration is recognized on an online basis on various measurement data and their analysis and repair is carried out when the deterioration value reaches the preset deterioration standards.

Overhaul: Inspection and Repair

Equipment is regularly dissembled or inspected and excellence is judged at that time (no control of deterioration trend IS executed) with defective parts replaced subsequently.

BREAKDOWN MAINTENANCE

The method of carrying out maintenance after the occurrence of breakdown to be applied to the following cases-

- Cases in which breakdown maintenance is advantageous i.e. effects and losses of breakdown are small.
- Dispersion of deteriorating trends is so great the inspection and examination is impossible.

CORRECTIVE MAINTENANCE

The method of maintenance in which steps for extension of service life and cost reduction are taken to applied to the following-

- Cases of short services life, high failure frequency and substantial maintenance expenses.
- Case of line repair time, serious affects on other and high maintenance cost.
- Cases of great dispersion of deterioration trend and difficulties in inspection and examination.

PRODUCTIVE MAINTENANCE

When breakdown and defects in machine are eliminated equipment operation rates improve, cost reduced and production rose automatically and as a consequence, labors and material productivity improves. Such maintenance is called productive maintenance.

PROBLEMS IN MAINTENANCE

- Level of skill of workers is low
- Major equipment available for maintenance only during refractory maintenance stoppages.
- Poor availability of electrical power in terms pf voltage and frequency. Thus affecting the life of the equipment.
- Difficulty in changing the attitude and work culture because of specific job description.

INDIA being a developing nation is coming up with new ideas, technologies, big brains and working hands, which are changing the image of the currently running industries. We are swinging up with the inherited ideas of the west counting are days as a single step-up each towards development.

Eicher Motors is one such example, which fits fully with the picture of developing India. The new technologies and development moves one step after the other. Eicher motors after is establishment in 1982 at Pithanpur proves to be an increment to the Indian Economy. This increment seems to be growing with years with the support and hard work of a very flexible management ready to accept and implement thoughtfully, everything, which adds to the company.

One such example of a flexible manager's bench is the recent implementation of a Managerial philosophy "TOTAL PRODUCTIVE MAINTENANCE". Its been nearly two years with the company tooling with TPM and it is still at a phase of 'implementing TPM'. Eicher has worked up with two of the eight pillars of TPM i.e.

- Individual Improvement
- Autonomous maintenance

Eicher Motors at Pithampur is an assembly unit rather than a manufacturing unit but still, the final finioshing of some assembled parts, welding, painting etc. are done at Eicher. These are some basic frame lines of the company which actually the unit has installed the technology TPM and where the relate results could be very easily studied.

The Eicher machine Shop is a unit, which is having a gradual, noticeable & profitable change since the year of establishment. This is the unit responsible to refine the powerhouse of an Eicher LCV, MCV or HCV or the latest designed busses i.e. the engine block & the engine head casting, which are brought here from the DCM foundary Chennai.

The complete machining of these cylinder heads and blocks are done in this unit to prepare the engine for the next assembling and power-transmitting unit. Initially machine shop had lathes, then gradually with the growing production these lathes were replaced by the CNC's, ATC's, APC's, etc. These machines made the worker's job easier, more precise, reduced lead-time, production time, defect rate & finally increased the production of the machine shop.

Since last year i.e. with the implementation of TPM the machine shop is undergoing further alterations. The complete shop layout is modified. Instead of a random machine arrangement, the shop has two main bay and two platforms. One bay handles the cylinder heads and the other handles the cylinder blocks. The two platforms carry out the buffing and other precise machining operations on the other parts and sub-assemblies.

The two bays consists of the CMC's but now, the CNC's are also replaced by a further advanced Japanese technology machine know's as MAZAK MACHINES. This is a heavy investment in the machine shop but with the idea of increasing the production to mare the twice the existing capacity and capability. Each MAZAK machine costs near about 2.5 crores & the unit currently owns 8 such machines.

One MAZAK replace 2 CNC, MAZAK has approximately doubles the unit's production from 1200 pieces per month to 2000 pieces per month. MAZAK has even reduced the lead-time and increased the production and profit. A comparison between the MAZAK machine and CNC machine is tabulated as under:-

Table 1

CNC MACHINE	MAZAK MACHINE
➢ Two CNC machine work as one MAZAK	➢ One MAZAK replace two CNC's
➢ CNC takes to sec per operation	➢ Mazak takes 2 see per operation
➢ It stores as much as 2-3 programs	➢ Can stores as many program as required
➢ One CNC employees more than one worker	➢ One Mazak employees only one worker
➢ Works on old CNC programming	➢ Works on new technology i.e. AUTOCAD
➢ Operations are complicated	➢ Operation are more systematized and easy
➢ Production with CNC was 1200 pieces pr month	Production with Mazak is 2000 pieces per month.
➢ Cutting time same as Mazak	➢ Cutting time same as CNC
➢ More non-cutting time	➢ Reduced non-cutting time by 40%
➢ Low productivity	➢ Increased productivity by 33%

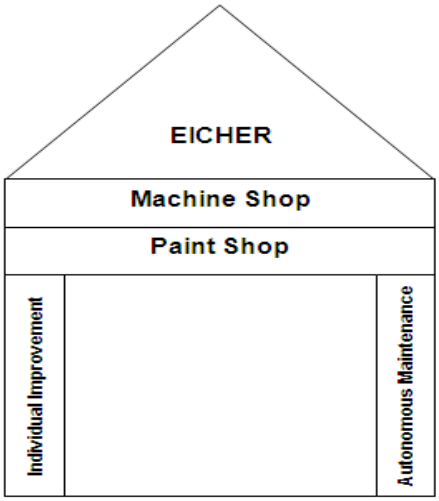

Figure 1: Implementation of TPM at Eicher Motors Pithampur

Even after such heavy investment, big machines and a new technology a company cannot flourish if -

- Its working ways are not proper & streamlined
- The machines aren't cleaned
- The machines are not oiled and maintained properly
- The workers don't love their work & machines and don't treat them well

But the best part is that Eicher carries all these responsibilities with elegance. Its workers know :-

- How to love his work and do it at his best
- How to maintain his working area and his working machine, &
- How to do his job on time

So, here is where the first pillar of TPM comes in picture – "INDIVIDUAL IMPROVEMENT".

Each worker or employee is dedicated to Eicher. They are trained for new technologies and new, working methodologies to be more efficient in less time. The whole process very gradually comes in action without hurting any mind or heart. Every Mazak just requires one worker but still Eicher has never sacked even a single worker. It has provided a total job security & a caring atmosphere for both the workers and his family. There are local health houses, entertainment days relaxing period. Hence, it is well proved that the first pillar "Individual Improvement" is very well implemented and adopted at Eicher Motors Pithampur.

A commendable point was house keeping of the complete shop. With such a heavy and continuous working there wasn't,

- Any spot of grease on the floor
- No split oil anywhere
- Machine were clean, inspite being working
- No Loose metal chip here or there
- Clean machine surfaces of blocks and head

This means that not only 'Individual Improvement' but even the second most important pillar of TPM was under a successful plan of implementation and that is- "A UTONOMOUS MAINTENANCE". Every machining needs a proper maintenance process and with the maintenance, safety of every worker is equally important. Eicher Motors gives every possible training for such maintenance and safety precautions. Now it becomes the company's responsibility to take care or the workers safety as well. Workers are being trained but some unseen mishaps do brings a sudden wave of concern.

The regular safety of every worker in Eicher Motors is taken care by providing safety means like-

- Proper uniform
- Helmet (to reduce machining noise)
- Platforms were carpeted to avoid slipping.
- Proper shelves to keep the tools, &
- Rags were provided for regular cleaning & wiping.

Eicher aim not only on plant development but its concern is the overall improvement of its 'Machine' as well as its 'Man'. There are valued instilled in every worker through different training programs and even individual motivation in terms of staring on every good job or idea is done. Every individual is trained through different training programs as to make them learn about the changes happening in the factory. Each worker, big or small, have a right to directly approach any higher official for any kind of requirement. He can put an open voice in the company to give favorable suggestion towards the improvement of the company. By this practice company's development becomes not only the managerial bench responsibility but, each and every employee feels a hand in the progress. ***Every person is responsible for his own individual jobs. A feeling of 'MY Company' stands in each heart.***

Over All Equipment Efficiency

OEE shows the capacity of any line. It checks that each and every equipment in the plant is working efficiently or not. OEE decides on the basis of various losses, which pulls back in the utilization of that particular machine efficiency. This is a Japanese process

Parameters for Oee Computation

- **Operating Hours**

  Actual Lime for Which Equipment Can Operate in a Day

- **Loading Hours**

  Operating Time - (Suspension Time in Production Plan + Suspension Time for Maintenance + Downtime)

- **Utilization Hours**

Loading Hours - (Time Related to Failure + Setting Up + Cutting Blade Exchange and Other Suspension from Loading Hours)

- **Actual Utilization Hours**

  Utilization Hours - (Minor Stoppages + Speed Loss)

- **Value Aided Hours**

  Actual Utilization Hours - (Mfg. Defect I Rework Products)

  The Above Chart Is Used in Eicher to Plot down the Results of OEE

- *OEE = Availability * Performance * Quality*

  Where,

  Availability = (Loading hours - Down time) / Loading hours

  It contains breakdown losses, setup and adjustment losses and others (e.g., tool changing)

  Performance = (Std Cycle time * Processed units) / Utilization time

  It contains minor stoppages, idling, and reduced speeds.

  Quality = (processed units - Defective units) / Processed units

  It contains defects and reworks; start up and yield losses

  We must compute OEE on a regular basis so as improve it. By this: -

  - Quality improves
  - Productivity improves
  - Breakdown decreases

TOTAL PRODUCTIVE MAINTENANCE

Quality has become the integral part of human activity. Numbers of techniques have evolved for improving quality. With the continuously growing industries the mind of entrepreneur turned towards quality control i.e. **"OPERATIONAL TECHNIQUES Used to Fulfill the Requirements of Quality".**

After this reliability, safety and maintainability got due importance. Among the latest philosophy to improve the quality given by Mr. A.V. FEIGANBAUM is known as **"TOTAL QUALITY MANAGEMENT".**

About this he argued, **"TQM is Necessary to Achieve Productivity Market Penetration & Competitive Advantage".**

Maintaining the quality is also very important in long-term basis because, increased production with declining quality, cost on the overall earning of the industry.

This picture of industry started a new terminology known as **"TOTAL PRODUCTIVE MAINTENANCE".**

TPM can be designed in following many terms:

"TPM Is To Manage Our Field & Machine in a Systematic Manner to make it Useful & Comfortable".

"Make the operator & tile production comfortable".

"Complete security, good quality, zero breakdown, less input-output cost".

"Keeping the current plant & equipment at its highest productivity level through co-operation of all areas of the organization"

WHY TPM IS USEFUL

- 24 hours working of equipment reduced of unemployment.
- Productivity improves- less production losses. Labour productivity increased by 150%.
- Quality improves- cost of defective 55% down.
- Reduced costs- maintenance inventory turn setup to 50°/.,.
- Sales people want to show plant to customers.
- Tool replacement time down 50 - 70%.
- Neat & clean, high morale of employees.

PRINCIPAL FEATURES OF TPM

The complete definition of TPM includes the following 5 elements. The word TOTAL in TPM has 3 meanings that describe the principal features of TPM.

- TPM aims at maximizing equipment effectiveness (overall effectiveness).
- TPM establishes a thorough system of productive maintenance for the entire life span of the equipment.

- All departments simultaneously viz engineering, operations & maintenance implement TPM.
- TPM involves every single employee from top to shop floor operation.
- TPM is based on promotion of productive maintenance through motivation management.

ROLE OF TPM

- Install, commission new equipment.
- Team operators in operation & maintenance of the machine equipment. Develop & hand over maintenance system to operators.
- Review & upgrade maintenance system given to operators from time to time.
- Do major maintenance works.

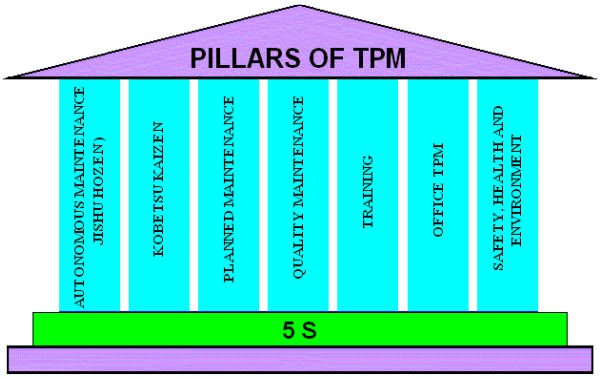

Figure 2

INDIVIDUAL IMPROVEMENT

Worker and his dedication towards his work are so much integrated with each other that one can affect the other. A worker needs to concentrate on each and every single piece on his machine, so that a perfect defect free product could be produced. A minor negligence or ignorance could be destructive and can highly affect the final quality in hand. Hence, for getting required quality and high productivity the concentration and inclination of every worker towards his individual task is very necessary. Such inclination can be provided by an individual motivation through proper training.

Eicher concentrating on every minor specification implements in its regular schedule one of the basic eight pillars of TPM that is “INDIVIDUAL IMPROVEMENT”. Any company works on- his basic workforce that is its employees and if any change or improvement in this direction has to be implemented each brain frame of every individual worker has to be changed. Individual improvement does the same. It mainly incorporates these ranges of activities.

- Every employee ISM given a similar uniform and the rank is judged by the colour of their badges
- A collage containing the photograph of every, worker with his machine is placed in every shop. This boosts the worker’s morale
- Staring and awarding system for Zero Defect and Kaizen motivated the worker to give his best.
- Time to time functions and gathering refreshes the worker and uplifts his mood

- Every employee was free to talk to any higher official regarding any subject
- A manager pays a visit to the shop every morning and talks to his subordinates regarding the daily targets, previous problems and also sometime an informal chat with the worker to lighten up his mood. Also the use of local languages of the worker helped to increase the intimacy among the two.
- Time to time training of employees to reduce monotonous working plan is quite prevalent in Eicher.
- The daily working time is same for every worker, be it C.M. or the lowest ranked employee.

AUTONOMOUS MAINTENANCE

The system is which operators carry out routine operation as well as maintenance and inspection to prevent and accelerated deterioration of the equipment. Generally the basic ideas behind autonomous maintenance are:

- Basic cleaning and inspection of machines.
- Elimination of source of dirt and dist in the machine.
- Machine easily accessible from every direction.
- Slopping leakage.
- Making check sheet and standards of autonomous maintenance.
- Recording failures

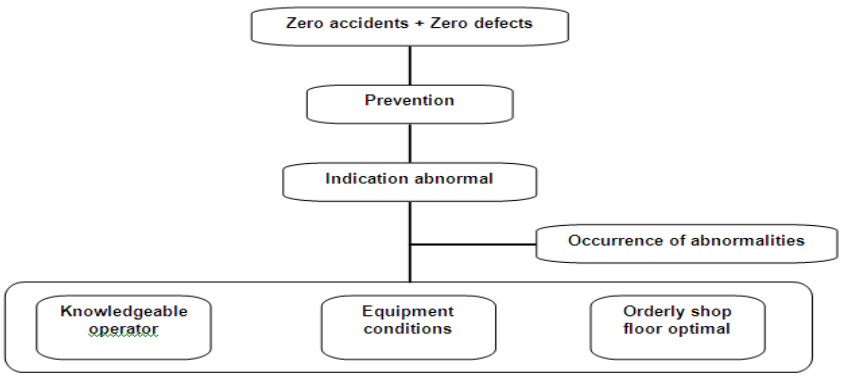

Figure 3

AUTONOMOUS MAINTENANCE

Appropriate guidance and support from the maintenance department is the key for the success of autonomous maintenance. Most important tasks are as follow

- Provide training in lubrication techniques standardize lubrication types and help operators to formulate lubrication standards.
- Deal quickly with deterioration, minor flaws in equipment conditions and deficiency in basic equipment condition.

- Contribute technical assistance in improvement activities such as eliminating contaminating sources, making areas more accessible for cleaning, lubrication, inspection and boosting equipment effectiveness.
- Organize routine activities (meeting, supervision round, etc).
- Provide instruction in inspection skill and help operators, prepare inspection standards (checklist, checking interval, and so on.).

Implementation of Autonomous Maintenance

We can see by the definition given above of autonomous maintenance that its all related to machine maintenance that on one hand make the working smooth and on the other hand keep the work place neat and clean which make the condition more enjoyable and help the workman performing without getting irritate or disturb and utilizing the full skill of the workman. Some of these thing were given special consideration in Eicher are as follows:

- Every morning at Eicher there is a practice of cleaning the machine and checking each and every part of machine like tightening loose nuts and bolts, checking machine's power unit. And cleaning any dirt or dist at working floor etc.
- At Eicher every morning head supervisor of each shop arrange a meeting with all of his workmen and show them the errors and flaws on a chart they prepare each day carrying the records of previous day. This chart helps the working scenario more effective and learning as worker can analyze their faults and loose working shown by them on previous day.
- The working arrangement in Eicher is so meticulously made so that the working burden is equally divided among workers this thing helps in exploiting the skill of each worker individually and hence creates harmony among workers.
- The workspace at Eicher is so utilities that the machine can be accessed from any side this makes cleaning and working easily. This helps in avoiding congestion and chaos while working as the workman has to move on floor quiet frequently.

"First Impression is the Last Impression"

This phrase in itself denotes the importance of external beauty. People get attracted to any vehicle first by its aesthetic values. A good design is well appreciated only when it is coated with beautiful and soothing colours. The paint shop holds the responsibility of this segment.

At Eicher motors due weight age has been given to paint shop. Various steps have been taken is this direction. And the most imp0l1ant amongst them have been the implement of TPM principles. Remarkable changes have been observed following this action. Positive results have been achieved resulting in better productivity and more profit for the company. At a glance the Paint shop give the impression of perfect and disciplined working place. The place is not overcrowded with too many workers and proper care has been taken while recruiting the present set of working personals. Presently the shop has strength of about 27 workers comprising both skilled and semi skilled men. Of this lot

- 7 Apprentice

- 15 Casual workmen
- 5 Ski lied to work at every station

The remarkable feature of this arrangement is that at any case any of the worker is not present due to any reason, worker getting ill or unable to make it on a particular day, the work does not stop and workers will be replaced. This gives a special strength to the company for incessant work thus ideal time can be evaded. Also with establishing the hydraulic conveyers the processes have gained relatively more speed and faster working rate. The trolley runs on these hydraulic conveyors carrying the cabin.

The procedural analysis of paint shop tells the whole story,

- Inspection zone where the driver cabin's skeleton coming out of the welding section is inspected before further processing like checking any sharp edges and any loose welded section, this is done for evading any hazard and make sure that the cabin is fully free from any fault and is ready for entering the paint shop.
- The cabins are processed now in pretreatment chemical tank, which are in line. The three tanks are of acid, water and alkali respectively. The main reason of feeding the cabins to tank is make the surface charged and make it ready for paint and remove any slag remain after the welding or any chemical remain in previous processes.
- Further the cabin is moved to water wash zone after the pretreatment is over. Here the water comes under high pressure and simultaneously washes over the left over chemicals.
- After that, the cabin is dried inside the hot oven to ensure that the cabin is completely dry and no water is left over. This drying process will make help in evaporating moisture from every part of cabin.
- Further primer coating is done to provide durability to the surface which helps in sustaining high loads and impacts, and preventing the shape to get distorted under any circumstances like changing weather condition viz rainstorm, High velocity wind etc and thus increasing cabins life.
- Now silver coating is done for smoother surface finish. This silver coating will help the surface to retain the paint.
- Next Sealant coating is applied at joints and points where welding has been done. While welding or cabins shape may make some points where there is an gap which is to be closed the main reason for this sealant coating is to fill the voids and eradicate chance of moisture entrapment which can be deterrent for cabins strength. For removing extra sealant a wood hammer is used which do two things:-
  - Press the sealant further for ensuring any gap left
  - For leveling the surface it’s abrade any extra sealant remains On the surface
- Now this cabin is put into hot oven for further hardening the surface.
- Now the surface is cleaned with Lenin cloth for removing any dust or any unwanted particle from the surface. Basically in the previous phases the cabin surface is very much susceptible to the dust particles, as the process doesn’t take place inside any dust free zone. Remove of dust from this station is necessary, as main paint has to put on the surface.

- Dry\wet sanding is done before delivering the cabin for final paint. By this process the cabin surface becomes ready for the next level of painting.
- Finally the cabin reaches the main painting zone where the painting is done by the Spray painting technique and the desired color is painted on the surface. After this the cabins are again put inside the hot oven for drying up.
- Now after proper drying of paint the cabin reached the inspection point where the final appraisal is to be given. Here the whole cabin is put under a high illumination zone where great amount of light is provided. This system has been designed in such a way so that every part of the cabin under test can be explored. If any fault was confronted, it was rectified then and there.
- Finally after this the dry film thickness is measured with the help of OFT-meter. This meter gives the proper indication towards the surface finish and to check the evenness of the paint over the surface

As justified above Eicher Paint Shop is a well-managed component of Eicher Motors, which faces a great competition in the market and with this increasing competency Eicher requires rapid growth in Quality. So, in 2004 in search of better quality enhancing programs, TPM has been introduced. The changes can be seen within two months of its implementation. Some of the changes seen are given below:-

- Reduction in consumption of chemicals used in pre-treatment chemical plant - where the consumption in Rs. per cabin was previously Rs 142.8/-which has gone down gradually to Rs 90/- per cabin. This shows the immediate effect of TPM.
- Damage rates have gone down, which was previously 190 and had reduced to 162.
- Non-productive rate have also gone down

A cleaner environment is now there for the worker

Above chart show the line graph depicts the amount spent on chemical consumption/cabin in past few quarters. As observed rates have fallen down in last quarter. The reason for this sharp reduction is obviously TPM.

The company has gained a lot since TPM has arrived. Ostensibly the paint shop boasts this achievement very highly as they have as they saved company's many rupees. If you look at the behavior of line, initially the cost increased a little but as TPM subjugated this cost the line has come down with a sharp fall. The company's next immediate target is to bring down this cost to Rs. 70/- within the next two months. And the target is quite achievable if they stick to TPM.

The culture at EICHER is of very high standards. By high standards we mean that due importance is given to all sectors of the company. This is very evident from the company's approach where full attention is given to the minutest of the details. Details regarding the production, individual performance, cleanliness, inventory, time management and other performance enhancing schemes are regularly dealt with.

The most important component of any company is its working hand. The company can nourish only when its workforce is in complete harmony and fully dedicated towards their job. If every worker understands his own performance value in the company then the company's fast growth is obvious. EICHER strongly believes in all these factors and has thus introduced many programs, which further increases the inclination of every individual worker towards his work. Few of them have been stated below: -

- **Safety:** The working environment of any industry established with the fact that how pleasant and safe the working conditions are. Its of great importance that proper precautions and preventions are taken for avoiding any accidents or any undesired happenings. When we talk of safety its mainly related to the nucleus of any industry is it's manual and cleric workforce, that how this force is performing and in what conditions they are performing. Suppose if a supervisor imbibes in mind of his worker that a machine they are working on is safe and very user friendly then the worker also feels free to work and is able to converse to his machine well and in that way he creates a bond with his machinery.
    - Workers wear rubber sole shoes - all the workers and supervisors wear this rubber sole shoe at EICHER as this industry basically runs on electricity. There are various junctions on the work floor where the workers are prone to get connect to these electric circuits such as motors etc. so it's for the workers safety that the rubber sole shoes are made compulsory. Other than that rubber sole has a least tendency to slip, which helps the workers in their proper movement.
    - The workers are required to wear the proper dress along with all safety accessories for there own safety.
    - All the cables and wires are underground to avoid any accidents.
    - Proper height is provided to work on every machine so that the worker working on a respective machine doesn't feel fatigued and can work tirelessly. Also all the machines are sequentially placed. So we see that there are many more factors like above ones which helps in providing the workers with a safe and comfortable environment to work on. The worker's feel free and thus improve the efficiency.
- **Facilities and Accommodation:** The Company has provided various schemes and plans for the welfare of its employees. This only indicates the prosperity of the company that it provides living accommodations and hospital facility to its employee. Proper mode of transport is there for timely service. Mobile intercom facility is there due to which the head supervisors and top officials of each shop can communicate to each other whenever required.
- **Food Culture:** The food provided by the company canteen as per their afternoon lunch service is of high quality. Hygienic and delicious, these two words simply describe the nature of the food being provided in the canteen. The most striking feature of the canteen is that at a time more than 150 people can take the meal, irrespective of there post, sit together and enjoy the food.
- **Environment Friendly:** Eicher campus exhibits a range of lush green trees and healthy environments. Proper care is taken for the maintenance of the greenery.
- **Kaizen:** A Japanese philosophy meaning "continuous improvement", was a part total implementation of TPM. This was just a awarding technique open for all the employees. It was awarded to the one giving the best and most optimum solution for a persisting problem. One such example of awarding KAIZAN occurred in the Eicher paint shop where an employee suggested reducing the size of the trolleys carrying cabins, so that they could incorporate more cabins inside the furnace. This helped in increasing the net production of the paint shop in a day. The worker was duly awarded for his small idea resulting into great performance.

- The above chart is put on board at various junctions on the shop floor to applaud the Zero defect, one, two and three star winners (the people who give ideas regarding the improvement in performance and efficiency)
- **Customer Feedback at Eicher:** Eicher believes in its customers as well as act promptly to their complements and complaints. An excellent example of this gesture is that a complaint of rusting of the inner edge of the hidden areas (where spray paint couldn't reach) was registered and to this an optimum solution was framed which was advised by a worker. The solution was a small paintbrush dipped in paint with the same thickness of the hidden area was applied. This proves two basic good habits of Eicher
  - Total customer satisfaction through proper customer feed back network
  - Each and every employee was free to give his suggestion towards improvement.
- The above chart is used at Eicher to show the suggestions put forward by the customers and the further actions taken by the company in this regard.

So we see that these factors also playa very important role and cover the whole spectrum, which implies the prosperity, customers and employees satisfaction. Minutest details do playa great role in improving quality and production of the company as shown by EICHER.

CONCLUSIONS

As time advances so advances science. Newer developments are made in the technology front. Drastic automation is being done in industries. The ramifications of this are lesser labors, lesser supervision, and lesser human control but subjugated by advanced technologies and computer operated machines. Every interval of 10 years seems enough for a complete new face of industry.

But whatever remains the medium, management principles cannot be eradicated.

There always required for perpetual running of an industry. These management principles are time tested and long lasting. The need and desire of producing gilt-edge products will always be heavily dependent on sound and ethics. TPM is one of such management principles; dealing in management during production. Its implementation results in improved productivity, fortify efficiency and more hannonized working culture. As already depicted previously the TPM has portrayed a positive impression on industry.

21st century has already seen technology advancements, improved working conditions and sound results, like EICHER MOTORS Pvt. Ltd. Pithampur, INDORE have already hit with the extra ordinary results they have received after implementing 2 pillars of TPM. Recent results show that implementation of TPM has increased the productivity by round about 60%. This just justifies if 2 pillars are so profitable then what call the whole TPM iceberg can cause! Improvement, profit and fame. Addition of TPM in their list has improved there financial position and the company is now heading toward new ventures.

"A Stitch in Time Saves Nine"

Old maxim but always true. Now its time for Indian industries to vision the future.

They should understand this fact they cannot sustain in world market without improving there quality to affront

Japanese and Korean companies which are implementing this three letter word TPM for more than 20 years. TPM principles are fully aware of relevance of the responsibility and diligence of management. TPM may be very costlier in initiation but the gambit has to play for stand in future.

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