

Production Improvement by Reducing Down Time Using Root Cause Analysis

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Abstract: -- :- Now a days manufacturing industries are facing a greater competition in the market. Because of this, they try to improve and increase both quality and productivity continuously. One way to increase the productivity is to increase the availability of existing machines. The manufacturing companies are facing the problem of loss of productivity due to break downs in assembly lines. Reduction in idle time is direct way to increase the productivity and profit. The main objective of the project is to increase the availability of a machine and to reduce the down time of a machine, to maximize production capacity and to improve new preventive maintenance schedule. The reason for the break down has been analyzed and inspected by the method of Fish bone diagram and why-why analysis, this in turn helped to develop and improve a new preventive maintenance checklist for the machine. This project work is aiming at reducing idle time that is breakdown by increasing availability and maintenance. This has been achieved by optimal utilization of time maintenance, inspection frequency by considering manufacturer recommendation and previous experience. By all these procedures the availability of the machine will increase to a certain extent and also increases the production capacity, minimizes the maintenance cost and reduces the downtime.

I. INTRODUCTION

The demand placed for an organization in today's environment is to satisfy the customer needs and satisfaction. Assembly is the place where key equipments in the manufacturing process will be operated. Production, Productivity of assembly line is vitally determining the output of the plant. Each and every down hours of assembly line leads to heavy production loss. So, the project had taken Reduction of down hours of the equipments. Bath tub curve analysis describes the variation of failure rate of components during their life time.

The item population after having been built in reaches its lowest failure rate levels, which is normally characterized by a relatively constant failure rate, accompanied by negligible or gradual changes due to wear. This period is characterized mainly by occurrence of stress related failures during its normal operation.

Types of maintenance:

Generally maintenance is of following types,

- A. Preventive maintenance
- B. Breakdown maintenance
- C. Corrective maintenance
- D. Fixed time maintenance
- E. Condition based maintenance
- F. Maintenance fore casting

A. Preventive maintenance:

Preventive maintenance is taking of equipment at planned intervals. These intervals are decided mainly keeping in view the complexity of the machine and its load condition. In this Preventive maintenance, duly time scheduled and replacement of overly worn out parts on the part of machine, the preventive maintenance is also called planned maintenance or scheduled maintenance. It is extremely important function for reduction of maintenance cost and to keep the good operational condition of the equipment amiability, preventive maintenance aims to locate the sources of problem or troubles and to remove them before breakdown occurs .it is based on the idea of "prevention is better than cure".

B. Breakdown maintenance:

In break down maintenance, defects are rectified only when the machine cannot perform its function any longer .After the repairing of equipment the maintenance engineer do not attend the equipment Until another failure occurs. There is no element of planning for this type of maintenance. Till the break down comes maintenance becomes no one's job, but once it occurs its becomes everyone job.

C. Corrective maintenance:

Corrective maintenance arises not only when the equipment fails but also when indicated condition based criteria. The basic task is establishment of the most economical way of restoring the equipment to an acceptable condition. Because

of the probabilistic nature of failure and uncertainty surrounding corrective maintenance cannot be programmed. However for critical if the equipment failure it is essential that corrective maintenance guidelines are formulated for maintenance corrective action after failure.

D. Fixed time maintenance:

This is only effective where the failure mechanism of the item is clearly time dependent, the item being expected to wear out within the life of unit, where the total cost of such replacement are substantially less than those of failure replacement repair i.e. the time could be classified as simply replaceable.

E. Condition based maintenance:

An alternative concept is that proper time for performing correct time maintenance to be determinable by monitoring the condition or performance. The probabilistic element in failure prediction is therefore reduced or indeed almost eliminated the item life maximized and effects of failure minimized. Condition based maintenance can however be costly in time and instrumentation. The desirability of the policy, monitoring techniques used and its periodicity will depend on the determination of characteristic of the equipment studied and the cost involved.

F. Maintenance forecasting:

Forecasting is the first major activity in the maintenance planning. It involves careful study of past data and present scenario. The main purpose of forecasting is to estimate the occurrence, timing or magnitude of failure events, Once the reliable forecast for the maintenance is available, good planning of activities is needed to meet the future demand. Forecasting thus provides the input to the planning and scheduling process.

Benefits of forecasting:

1. Effective handling of uncertainty.
2. Better labour relations
3. Balanced work –load
4. Minimization in the fluctuations in maintenance
5. Better Material Management,

Based on condition technology, usage and application, maintenance will be forecasted. Generally forecasting will be done yearly, half yearly and quarterly.

Scope of the Work

This project is to reduce the down hours of the assembly line by 30%. Maintenance system for the organization.

Objectives in doing this project:

- A. Data collection,
- B. Analyzation,
- C. Designing a new system,
- D. Implementation,
- E. Result.

A).DATA COLLECTION:

The data available with the Mechanics, Electricians and Production Operators was collected and furnished here with. The Equipments Electrical Break Downs, Mechanical Break Downs, Total down Hours and availability month wise calculated.

The data collected should be of breakdown hours. Break down hours:

Break down is one of the major processes that lead to less output from the line. Each and every breakdown in the line will be recorded and cause for the breakdown also will be analyzed. The following are the cause for the break down hours.

1. Lack of Training
2. No Infrastructure
3. No Methodology

1. Lack of training;

Generally the lack of training occurred of unskilled worker, in some cases the new plant, new machinery and new assembly lines have, no adequate training provided for the mechanics on

- Electrical,
- Wiring(power&controle),
- Pneumatics,
- hydraulics,
- Problem Solving Techniques,
- Inventory Planning,
- Maintenance forecasting and Planning,
- History Record Maintenance,
- Preventive maintenance,
- Shut down maintenance,
- Corrective maintenance,
- Trouble shooting guide lines.

2. No infrastructure;

Infrastructure is the main input to the maintenance section, without proper infrastructure maintenance equipment too difficult. Sufficient man power available in the maintenance section, Manufacturer Manuals, Catalogues and Specialized tools etc not maintained. Critical Maintenance Spares are also not maintained.

3. No methodology;

No Proper System available for

- 1) Record the breakdown,
- 2) Analyze the break down,
- 3) Types of action to be taken for rectification of Problem.

B. ANALYZATION

Each Every break down has to be analyzed for Excessive Break down and More down Hours.

Cause and Effect Relationship;

Generally Single cause can give Multiple Effect and Some Multiple Causes will result in Single Effect. The causes for every problem have to be analyzed properly.

Doing maintenance without proper investigation on break down or failures, the service output is damaged Equipment.

Better Understanding about the effect Problem and Cause will help full in decreasing the Repair time.

Improper maintenance system result the following effects.

<i>Cause</i>	<i>Problem</i>	<i>Effect</i>
Spare parts not available in stores	Delay in Repair	More Down Hours
Tools not available	Delay in Repair	More Down Hours
Trained man power Not Available	Delay in Repair	More Down Hours
PM Schedule not defined and Carried out	Repeated Break Down	More Down Hours
TPM Concept not adopted	Repeated Break Down	More Down Hours

Criticality of the problem:

The Excessive down Hours in Assembly line leads to

- 1) Low Production
- 2) Low Productivity
- 3) Less Employee Morale
- 4) Less Availability of equipment
- 5) High Maintenance Cost
- 6) Unsafe condition
- 7) Low uptime

1. Bath tub analysis:

Bath tub curve analysis describes the variation of failure rate of components during their life time.

2. Initial failure period:

Initially the components of new equipment exhibit a high failure rate. This failure rate decreases rapidly after the initial period and stabilizes. These failures could be attributed to

higher cost in maintenance, due to faulty workmanship in manufacturing of the components, during transportation, damages due to installation errors.

3. Running life period:

The item population after having been built in reaches its lowest failure rate levels, which is normally characterized by a relatively constant failure rate, accompanied by negligible or gradual changes due to wear. This period is characterized mainly by occurrence of stress related failures during its normal operation.

4. Wear out period:

The equipment reaches the point where the failure rate is increased due to its age and utilization. More attention has to be given on the equipment's which are in the final period i.e. Wear out period. Frequent monitoring is required, because possibility of break down is more.

5. Control activities:

Controlling is the one of important activity for efficient and smooth running of equipment. It includes the following

- 1) Main power control
- 2) Material control
- 3) Money control

Process of data for analysis

1. Brainstorming,
2. Why why analysis,
3. Cause and effect diagram.

1. Brainstorming:

Brainstorming is a group creativity technique by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its members, in assembly lines in production plant break down hours are more. In order find the break down hours reasons and problems cum solution, through brain storming non - availability of machines and equipment's are listed their also ideas and reasons are gathered spontaneously by team members to keep up time of machinery and equipment's.

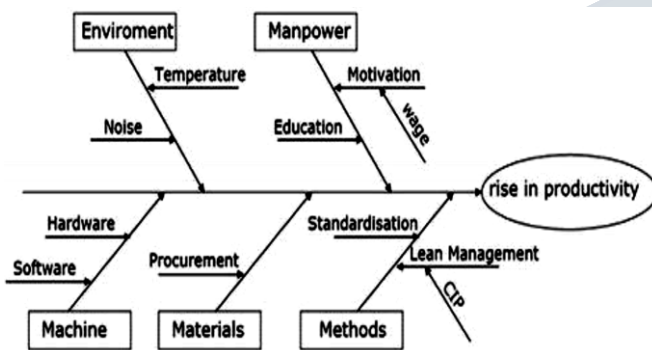
2) Why Why Analysis

5 Whys is an iterative interrogative technique used to explore the effect relationships underlying a particular problem. The primary goal of the technique is to determine the cause of a defect or problem by repeating the question "Why?" Each question forms the basis of the next question. The "5" in the name derives from an empirical observation on the number of iterations typically required to resolve the problem. Brainstorming is a group creativity technique by which efforts are made to find a conclusion for a specific

problem by gathering a list of ideas spontaneously contributed by its members after brainstorming as part through why why analysis reasons and causes for breakdown of machinery and equipment are analysed and grouped major categories of break down in machine major breakdown due to failure of particular make sensor as for design issues, failures frequently as input power high and instant variations fault output due variation load details.

3) Cause and effect diagram:

Ishikawa diagrams (also called fishbone diagrams, herringbone diagrams, cause-and-effect diagrams, or Fishikawa) are causal diagrams created by Kaoru Ishikawa (1968) that show the causes of a specific event Common uses of the Ishikawa diagram are product design and quality defect prevention to identify potential factors causing an overall effect. Each cause or reason for imperfection is a source of variation. Causes are usually grouped into major categories to identify these sources of variation. The categories typically include.



Fishbone diagram

- People: Anyone involved with the process
- Methods: How the process is performed and the specific requirements for doing it, such as policies, procedures, rules, regulations and laws
- Machines: Any equipment, computers, tools, etc. required to accomplish the job
- Materials: Raw materials, parts, pens, paper, etc. used to produce the final product
- Measurements: Data generated from the process that are used to evaluate its quality
- Environment: The conditions, such as location, time, temperature, and culture in which the process operate

Through the cause and effect diagram problem and causes major contributed is focused as in assembly line as for machine the major reason of break down occurred due the part chosen as it comes machine and design selection as failure. As it effect of more hours of break down find out as part focus on issue is clear and easy and specific so availability of machine is increase discharge make of sensor so that avoided failure of machinery.

C. Designing a new system

The data collection made during the Period after analyzing it perfectly, proposed the new system to management for approval and Implementation.

The following approaches are planned to implement in the New System.

- 1) Creating of best infrastructure,
- 2) Training to Mechanics , Electricians and Operators,
- 3) Pm scheduling and Schedule Compliance,
- 4) Introduction of CIMS,
- 5) Prologues of TPM Concept,
- 6) Action plan to reduce repeated problems.

Creating of best infrastructure;

Suggest the best infrastructure in the plant by analyzing the data and to recruit the required man power for PM and Break Downs Works and plan for required training Program.

Training to Mechanics, Electricians and Operators;

Training is used to increase the Efficiency of the Operators, Mechanics and Electricians and to improve the effectiveness. Efficiency means “Doing Things Rightly”. Effectiveness Means “Doing Right Things”

Training proposed to give on the following,

- 1) Equipment Working Principles
- 2) Trouble Shooting Guidelines
- 3) Pneumatics
- 4) Hydraulics
- 5) PLC's Etc

Maintenance policy;

The maintenance policy of equipment is “providing timely service, maintaining at less break down, running at low cost per battery making better availability of equipment.

Principles of maintenance:

There are some principles involved in maintenance like availability and maintainability. They are also performance key indicator of maintenance.

Availability:

Availability is defined as the average percentage of time that a device is available to give satisfactory performance during its required operation period.

Availability = Effective Utilization/ No. of hour's equipment can run without any problem.

Availability always should be close to 100%:

More is availability better is performance of equipment.

Maintainability:

It is defined as the percentage ratio of the average time that particular device take to repair after the failure occurred, to the total operating time before the occurrence of the preceding failure.

Maintainability= Time to repair/ Total run hours before failure Maintainability trend should be towards 0 %(zero breaks down maintenance).

Less is the maintainability better is the performance of the equipment.

D. Implementation

Suggested scheme of implementation, Suggested improvements on the following for implementation

- 1) Resources Planning
- 2) Maintenance Budgeting
- 3) Maintenance Planning
- 4) Maintenance Scheduling
- 5) Inventory Management
- 6) Tools management
- 7) Usage of Problem solving tools
- 8) Analyzation of Problem creator
- 9) Usage Of Bath Tub Analysis for Maintenance Planning
- 10) Implementation of Cost Reduction Techniques
- 11) Key maintenance Metrics
- 12) Training

Display of maintenance posture;

Maintenance displays in the maintenance section which will help in reduction repair time.

Following displays generally should be available in the section

- Critical Spares List
- Specification of Each Spares
- Consumables List
- Electrical wiring diagram
- Maintenance parameters
- Maintenance process flow diagram

Application study of maintenance;

Application study helps the maintenance person to forecast the type of maintenance required for the equipment over a period. In the process of application study, the following information was gathered

1. Specification of the equipment.
2. Age of the equipment
3. Loading capacity of the equipment
4. Schedule compliance
5. Nature of work
6. Working condition
7. Nature of work
8. Working condition
9. Number of start and stop during a particular period.
10. Planning for maintenance
11. Preparation maintenance budget for equipment.

Optimizations;

Approaches adopted in reduction of equipment's running cost.

- Optimum Utilisation of the Equipment
- In house Manufacturing of Equipment Components
- Indigenisation of Equipment Spare Parts
- Speed reduction for best performance of the equipment by VFD
- Reduction in idle running time
- Economic loading pattern
- Optimum utilization of man power
- Method study technique can be adopted to find out some other way for doing the work efficiently
- Work measurement technique can be adopted to find out effective utilization of time and eliminate the idle time.

E.RESULT

Project had been taken to reduce the break down hours in the Assembly Line of the production plant by doing various Improvements in Mechanical, Electrical Instruments, New Systems and Procedures also developed.

Overall Results of the projects:

As the Out Come of the Project the

- 1) Line availability increased
- 2) Average Break down hours reduced
- 3) Maintenance Expenses Reduced
- 4) Customer Satisfaction Improved

Over all Expected Benefits:

As a result of this project, by reducing the break down time apart from production and productivity increase the following also got increased

- 1) Individual Machine Productivity
- 2) Energy Productivity
- 3) Men Productivity
- 4) Material Productivity

The following got reduced;

- 1) Specific Energy Consumption
- 2) Manufacturing Cost.

Overall expected time, coast and efforts;

As long as the improvements also getting maintained, Suggestions are getting implemented and Procedures are getting followed, no doubt the results will be continued. Frequent monitoring about the adherence of the New Maintenance System required so as getting the fruitfull outcome of the project continuously.

PRECAUTIONS;

All the Improvements carried out during the execution of the project should need to be recorded in the equipment's History Record which will help to know who has done the modification, When the Modification done, Why the modification done, How the Modification done and what is the Modification Done. It will ensure the sustenance of the benefit from the project in the industry.

CONCLUSION

By the applying of the Analyzation, Designing a new system, And Implementation it causes the reduction of equipment down time, Equipment productivity increased and Maintenance cost reduced measurably.

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