

UNIT- Ist MAINTENANCE MANAGEMENT

Maintenance is the process to keep the equipment in the good working condition for repair it to its operational mode.

→ main objective of the maintenance is to be have increase availability of production system with increase safety and optimize cost. maintenance management involves managing the function of maintenance.

→ Maintaining equipment in the field has been a challenging task since the beginning the industrial revolution. Since then a significant of process has been made to maintain equipment effectively in the field.

Purpose of maintenance:-

1. It attence to maximize performance of production equipment efficiently and regularly.
2. It prevents break down and failure.
3. It minimize production lost from failure.
4. It increase reliability of the operation system.

Objectives of maintenance:-

The objectives of any organization is to make profit and the objectives of maintenance which is link to the overall organization objectives. Which can be extend working equipment in an acceptable condition. Performing such activities good obviously extend the useful life of the equipments. Ultimately the objective should the minimize the cost (labour cost, & material cost) as well as the loss in the revenue due to the lost of production.

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* function of maintenance management:-

For the functioning of the maintenance management the top management is responsible for negotiating and authorizing the service level agreements. another important task is creation of a master maintenance schedule, and create cut in specified period.

Any maintenance activity require resources so in order to carry out maintenance activity in a plant manner, the maintenance manager needs to organize the required resources, and all these resources need to available in the right quantity and at the right time. if the required resources are not available then the plant activity can not be perform. This will lead to degradation of the equipment performance and can also results in its failure so the maintenance manager should ensure when the equipment is restore to its normal condition as quickly as possible this way not only is the down time cost kept to the minimum but also the resources are utilized effectively.

* Quality aspects in maintenance:-

Quality is more not absolute but relative a maintenance activity can be consider to be of high quality if

1. It restores and item of equipments to its normal working state without causing any damage to the equipment and to any of its parts.
2. It is finished on the time and the equipment is restore the production at the required time.

The above mention condⁿ. can be satisfied when the maintenance organization has.

- (i) Skilled and committed superiors available to carry out the required maintenance activity at the required time.
- (ii) The required spare part for the required quantity, required tools, instruments and facilities for performing the activity.
- (iii) An appointment on the job training programme for the repair men to enhance their ability to work.
- (iv) In general the need has been a good maintenance organisation.

Maintenance Organisation:-

It concerns ~~also~~ in achieving and optimum balance and plant availability and maintenance resource utilization. The two organisation structures that are common are centralized and decentralized. And decentralized structure would probably experience a lower utilization than centralized but would be able to respond quickly break down and would achieve higher plant availability.

A maintenance organisation can be considered as being made up of three necessary interdependent components.

Resources, spares and tools

Administration:- A hierarchy of authority and responsibility for deciding what, when and how work should be carried out.

Work planning and Control system:-

Is mechanism for planning & scheduling the work and feeding back the info. that is needed for correctly directing the maintenance effort towards defined objective.

M.I.S. (Management Information System):-

It is defined as a formal method of making available to management the good accurate and timely info. necessary to facilitate the decision making process and the to enable organization to plan, control and to carry operational functions.

The system provides information on the past, present and projected future on the selected events of the departments.

Elements of good MIS:-

1. Accuracy:- It is defined as the ratio of correct info. to the total amount of info. produced over period of time. A good MIS has a very high % of accuracy.

2. Timeliness:- It is also one of the most ^{imp.} element of MIS timeliness info. help in decision making.

3. Completeness:- Info. send should be complete in all aspects.

4. Relevance:- The info. must be relevant and related to the task assigned to the unit.

5. Frequency:- The frequency of MIS may be daily, weekly and monthly and also yearly.

6. Understandable:- Info. submitted in MIS be in a form which could be understood easily. It means notation used should only be those which are common in use in the organization.

Objectives:-

1. To provide the desired info. available in the right form at the right time.
2. To supply the desired info. and at reasonable cost.
3. To keep the info. up to date.
4. To store important and confidential info. properly.

* The need for a plan maintenance system:-

Doing a maintenance is a serious business since it can constitute to three to 50% of production cost. And without a good system in place, not only can it be costly but might affect your company survival.

So the definition of plan maintenance is define as maintenance activities performed on a pre determined schedule of activities.

* Maintenance Policy:-

Any organization which an involves in machinery plant equipment must have a clear cut policy in order to ensure it well being maintenance policy procedures need to be prepared and approved by the competent authorities, this moment is containing the following concept.

1. mission statement prepared with the organizational goal and objective.
2. Organizational chart for maintenance department showing the hierarchy of person, duty responsibility etc.
3. Every all budgeting process.
4. decision for shut down planning and budgeting process.

5. work order process

6. Back log tracking.

7. daily schedule.

8. weekly schedule.

9. Preventive maintenance process

10. failure analysis.

11. Inventory monitoring, etc.

Types of maintenance:-

(i) Routine maintenance (RM):-

RM is a procedure followed regularly to ensure the machine operation smoothly. It includes activities like inspection, cleaning of m/c, lubricating system small repairs.

RM can be classified as

1. Running maintenance:-

It is the work carried out when the equipment is running.

and m/c performing some operation.

These include greasing or lubricating the bearing

and cleaning, inspection etc.

(ii) Shut down maintenance:-

Certain major maintenance activities cannot be carried out when the m/c is running and hence carried out by shutting down the m/c.

(iii) Planned / schedule / Proactive maintenance:-

Planned maintenance is the activities carried out according to the pre determined schedule and hence known as schedule maintenance.

In this type of service, the emphasis is on m/c

1. What does not manufacturer prescribed
2. It is working under normal load?
3. Is the unit utilized for two core shifts per day?
4. Characteristics of the planned maintenance:-
 - Instructions are not detailed than for routine maintenance.
 - Cost for differently time service for the same unit.

* Breakdown or corrective maintenance:-

Breakdown maintenance is the method of operating m/c to run until the fail & then repair in order to restore them to an acceptable condition. It is also defined as the maintenance which is required when an item is failed & worn out, to bring it back to working order.

* Characteristics of the breakdown maintenance:-

- No services except occasional lubrication unless failure occurs.
- No maintenance men on regular basis.
- Maintenance then done some contractors.
- No organised effort to find out reasons.

* Preventive maintenance:-

Principal of preventive maintenance is that ("Prevention is better than cure"). PM is regularly schedule maintenance activity with an objective to anticipate problems & correct them before they occur. Preventive maintenance is carried to prevent an item failing & wear out by providing systematic inspection, detection of failure.

Advantage of preventive maintenance:-

- Maintenance is planned in advance
- Reduction wear tear of m/c & increase in their life.

3. Reduction in breakdown frequency.
4. Improve productivity due to lesser breakdown.
5. Improve reliability of machinery.
6. Higher safety for the workers.
7. Labour use cost effectively.
8. Lesser segregation on better quality.
9. Less stand by equipment requirements.

Disadvantages:-

- Maintenance activity and cost increase.
- Applicable to age related deterioration.
- Unnecessary maintenance is carried out.

Difference b/w corrective maintenance & preventive maintenance:-

1. Preventive maintenance is designed to prevent at least to minimise failure and reduce the need for the corrective maintenance when as corrective maintenance is carried out to repair the equipment breakdown happens.
2. Preventive maintenance program control the repair cost as well as the over all life of the equipment where as for corrective maintenance brings back to the original life depending on the extent of the change.

Predictive maintenance:-

This maintenance is one of the modern approaches to preventive maintenance where for sensitive instruments are use to predict and anticipated failure of m/c & equipment. Sensitive equipment instrument like vibration analyser, amplitude meter sensor for pressure, temp etc. are use to predict the problem in the machinery.

A major part of the predictive maintenance involves the on going analysis to ensure wear level that damage the machine are well in the limit. A good ability to predict failure well in time to prevent breakdowns will result in

1. Maximizes the online operation
2. Minimize down time.
3. Increase plant and personal safety.

The above is achieved by continuous plant monitoring and ~~diagnosing~~ diagnosing the actual condition.

*Condition based maintenance:-

CBM relies on the fact that majority of failure do not occur instantaneously but develops over a period of time. CBM involves recording sub measurement that gives an indication of the condition. Ex- increase in vibration, level, temp. & increase leakage etc.

CBM is a continuous or periodic measurement of data to indicate a condition of item to determine the need for maintenance.

In the condition based maintenance the plant is maintained just after some problem arises there, but much before the possible breakdown. The main function of the condition monitoring is to provide the knowledge of m/c & its rate of change.

There are two method for the condⁿ monitoring

1. Trade monitoring:-

It is a continuous monitoring or regular measurement & interpretation of the data collected during m/c operation to find out variation in condition of m/c or its components.

2. Condition checking & monitoring:-

Condition checking is where a check measurement is taken with the m/c running using some

suitable indicator & use as a measure of the m/c condition at that time. CM include three stages:-

1. Detection (when) of the developing fault at an early stage.
2. Diagnosis (what) of its origin so then spare part can be ordered
3. Prognosis (forecast) subsequent measurement which will then establish the trend and enable the repair schedule to be planned.

*Implementation of condition based maintenance:-

1. Listing and numbering of machine to have identification and location details.
2. Selecting critical machine for condition monitoring.
3. Establishing program and method specifying the part to be examined.
4. Select proper examining technique.
5. Recording data.
6. Training examiner for the above jobs.

* Computerized maintenance management system:-

is a software package & maintenance a computer data base of information about and organization maintenance operation. that stores this info. intended to help maintenance work do their job more effectively (for example determining which m/c require maintenance & which store room contain the spare part they need) and to health management make informed decision.

Inspection:-

An inspection is a organised examination or formal evaluation in other word it is an out of check any an equipment for m/c or a plant for satisfactory operation. the result are usually compared to specified requirement and standard for determining whether the item or activity is in line with these target.

Generally inspection is carried for satisfactory operation it means the operation should be safe and producing the product of design quality.

Inspection objectives:-
The main objective inspection is to make sure that the produced products are of standard quality and to locate the fault if any during the operation. and the other objective as follows.

1. To ensure safe operation
2. To avoid any accidents.
3. To prevent damage of equipments.
4. To avoid miss handling.
5. To make goodwill of organisation.

Types of the inspection:-

Daily inspection:- 1. Cleaning, oiling, greasing of the m/c and its components.

- (i) Availability of proper tool
- (ii) Cleanliness of working area.
- (iii) Proper insulation of wire.

Periodic inspection:-

- (i) Oil change
- (ii) filter replacement.
- (iii) Changes of the other component of m/c.
- (iv) Check for noise, vibration & pollution of equipments.

Inspection of complaints:-

It is not plan and carried out whenever any complaint is received from the operator.

Inspection reports:- Inspection report are prepared after inspection and contains the following information.

1. Name of the m/c or equipments
2. M/c specification.

3. Manufacture or brand name.

4. Capacity of the m/c.

5. Operation of the machine.

6. Date of inspection.

7. Inspection team information.

8. Type of inspection.

9. Complete details of defects

10. Action taken to rectify the defects.

11. Oil, lubricants or any part replace information.

12. Performance after repair.

13. Time taken in inspection and eff. defects rectification.

14. Signature of the inspection with date.

* Due to maintenance

* Documentation:-

It is a key in decision making becoz it provides accurate and timely information. It is use for evolution of past history of the equipment. Also it helps in planning and organising future activity of maintenance.

A computerize maintenance system consist of the following aspect

1. Development of data base.
2. Analysis for the past resource.
3. Development of maintenance schedule.
4. Availability of maintenance material.
5. feed back control system

In large sized an industrial organisation job card system are used.

Job card system:- It is essential to prepare a job card every equipment for component to record the maintenance work carried out for work to be done. The card shows plant for code

equipment code, the start time of the job, the finish time of the job, the main ~~hours~~ ^{hours} Spindle etc. The field hours send to computer section for processing and necessary completion. The plant engineer uses the filemate provide by the computer, compiling the following information.

1. History of maintenance.
2. frequency of the maintenance operation.
3. Usage maintenance time for various job.
4. Capital required, equipment vice for the maintenance function.
5. ~~man~~ power required, categories for the maintenance function.

Maintenance cost:-

Direct cost:- Direct cost are those cost required to keep equipment operationable. These cost will include.

- (i) Periodic inspection cost.
- (ii) Preventive maintenance cost.
- (iii) Servicing cost
- (iv) Repair cost etc.

In the above cost the labour cost, material cost, oil and lubricating cost included.

Stand by cost:- When primary equipment is either under maintenance or is unoperationable then stand by equipment is need to be put for operation hence the total cost of operating & maintenance of stand by equipment is to be included as stand by cost.

Lost production cost:- Cost due to lost production because of primary equipment is down and there is no stand by equipment. In that case this loss production is to be included in maintenance cost.

Depreciation cost:- These cost relate to deterioration of the equipment over a span of time.

Optimization of maintenance cost:-

UNIT - II

Productive maintenance

Introduction:-

Today's competitive business environment and low margins, plant simply can't afford to ^{wait} for critical equipment to fail before making repair. Now ~~then~~ ^{can} the rely on time based on preventive maintenance to minimize down time. While less costly then break down maintenance or replacing components.

The gold standard for effective maintenance is a predictive approach that guide decision above production assets. it ~~meant~~ monitor each asset condition to determine the monitor its ~~finer~~ continuous operation and predicts replaced only when the m/c its self start going for him.

Predictive maintenance utilize a combination of cost effective tool to obtain operating condition of critical equipment and based on these data, maintenance is performed prior to actual time thus in predictive maintenance direct ~~monitoring~~ ^{of} critical equipment that place. So that actual time to failure are predicted rather then waiting for maintenance.

Hence we can define predictive maintenance has method of surveillance / Condition monitoring of critical equipment, to indicate the condition of equipment at any time ~~be~~ while performing its task and based upon that data to carry out predictive maintenance prior to failure.

Total predictive maintenance:-

T.P.M concept was developed in 1950 and this concept is ~~adaptable~~ ^{adopted} by Japanese & T.P.M includes Lubrication, Visual Inspection & universal use of best practices in all aspects of maintenance.

T.P.M is not just a maintenance management program, most of the activities associated with the Japanese management approaches are directed at the production function and assume that maintenance is provided the basic task require to maintain critical production asset. The benefit of T.P.M are consider in the term of capacity, product quality and total production cost.

It's a program of zero break down and zero effectives aimed at improving and eliminating the following six shop floor losses.

1. Equipment break down.
2. Setup and adjustment slow down
3. Idleing and short term stop
4. Reduce capacity
5. Quality related losses.
6. Startup / Restartup losses.

A ~~concise~~ ^{concise} definition of T.P.M is elusive. but improving equipment effectiveness comes closest. In the ~~Japanese~~ ^{Japanese} model has five pillars that help define how people work together partnership

(i) Improving equipment effectiveness.

Finding out what causes equipment to be ineffective and making improvement.

(ii) Involving in daily maintenance:-

In many successful T.P.M program, operators do not have to actively perform maintenance. They are involved in maintenance activity like in the plan, in the program and in the partnership but not necessarily in the physical act of maintaining equipment.

(iii) Improving maintenance efficiency and effectiveness:-

In most T.P.M plants the operator is directly involved in some level of maintenance. this effort involves better planning scheduling, better preventive maintenance, productive maintenance, Spare parts equipments store etc.

(iv) Educating & training personnel:-

This task is the most imp. for T.P.M. it involves every one in the company like operator are taught how to operate machine properly and maintenance personal to maintain them properly.

(v) Designing and managing equipment for maintenance prevention

Equipment is costly and should be viewed as a productive asset for its entire life. Designing equipment that is easier to operate and maintain then previous, design a fundamental part of T.P.M.

Suggestion from the operator and maintenance tech are taken for the effectiveness of the equipment and while evaluating the cost of operating and maintaining the new equipment through out its life cycle, long term value cost will be minimized.

Implementation of T.P.M:-

T.P.M has basically three goals.

(i) Zero product defect.

(ii) Zero equipment unplanned failure

(iii) Zero accidents.

These goals are achieved by gap analysis of previous historical record of product defect and accidents.

many company strugled to implement T.P.M. due to main resaults

1. Having Insufficient knowledges skills, specifically in understanding. Linkage.
the five filler activities in T.P.M

2. T.P.M require more time, resources & effort than most of these
Company believe they can not afford.

3. T.P.M identify the seven losses.

1. Setup and initial adjustment time.

2. Equipment breakdown time.

3. Ideating and minor losses.

4. Speed losses.

5. Startup quality losses.

6. In process quality losses.

7. ~~work~~ systematically to eliminate them by making improvements.