Importance of adopting a balanced plant maintenance strategy

A purely reactive approach to service should be replaced by the one that properly balances reactive and proactive behavior. Adopting balanced maintenance practices helps ensure the facilities are constantly up and running

Today there is no general method to use when deciding about maintenance strategies with a starting point in the actual condition of a technical system. Existing methods have their main focus on separate equipment and are not able give a macro perspective on the actual condition of the system and how different maintenance strategies will affect if over a long period of time.

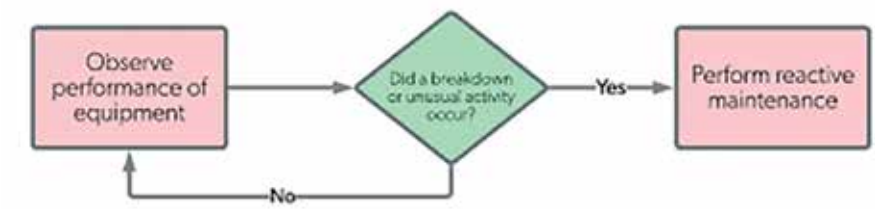
Plant maintenance or Industrial maintenance practices ensures equipment operating reliability, increase equipment uptime and equipment life in the manufacturing environment. Maintenance is basically the management control, and execution activity designed to meet predefined business objectives by ensuring uninterrupted availability of machine, achieve optimum machine performance and ideal machine life.

Nowadays, the industrial test equipment has been more advanced and automated, also the troubleshooting and diagnostic tools have become easily available, with high level of accuracy and large storages for in-depth analysis with optimized cost. This overall helps to design the optimized maintenance strategies as per the individual need of the industry or individual assets.

The right maintenance strategy can save plants both cost and downtime, thereby improving efficiency and allowing industries to keep their operations running smoothly.

Evolution of Maintenance Strategies

Reactive Maintenance



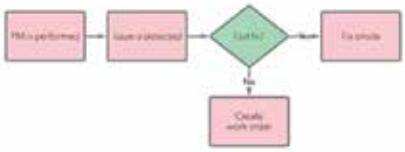
The reactive maintenance or breakdown maintenance is carried out when the equipment has already broken down, the reactive maintenance tries to restore the normal operation of the machine.

When a machine fails without warning, it creates downtime within the plant, which can get quite expensive. This also drives up labour costs to get the apparatus back up and running, especially if a worker has to do overtime. Many plants still use some level of reactive maintenance strategies since the equipment are absolute or very old systems and its repair or maintenance is also not feasible. Sometimes the maintenance cost of the equipment is much higher than the purchase cost of new equipment. Hence after study and analyzing all the facts of the equipment appropriate maintenance strategy has been selected.

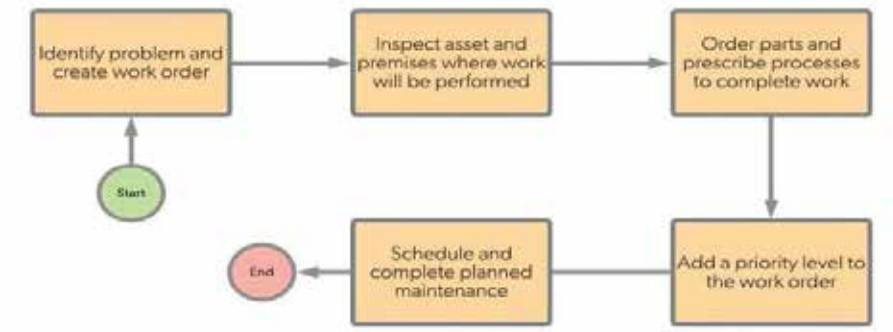
Planned Maintenance

When the maintenance activity is planned with desired action plan and scheduled then it is planned maintenance. The planned maintenance ensures minimize the downtime and maximize the availability of the machines.

Corrective Maintenance

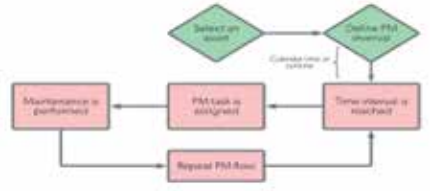


Corrective maintenance is a planned maintenance in this the machines are still running however with degradable performance or not in a normal state. Thus, with the corrective actions the equipment can be restored so that it works in normal state with optimum pos-



sible performance.

Preventive Maintenance



The Preventive Maintenance requires more on-going effort, but once tuned and executed properly, it can reduce overall costs in both the short and long term. It involves maintaining machines by tending to them at specified time intervals so that the machine healthy condition can be maintained. Preventing equipment failure can help users avoid unnecessary production losses as well as health and safety violations. Preventive Maintenance services provide greater operational control to users and help prevent known problems in the future.

The primary advantage of a Preventive Maintenance plan is cost effectiveness when it comes to the most expensive maintenance processes. It can save energy as well, because the machines will be operating at their most efficient. Preventive Maintenance can extend the life cycle of a machine and prevent having to purchase larger and more expensive replacement parts. Overall, such an approach generates an estimated 12 to 18% in savings over Reactive Maintenance strategies

a. Scheduled Maintenance

When the maintenance activity is schedule for a particular time it is said to be schedule maintenance. It provides details such that when will be the given maintenance tasks are performed and by whom. Scheduled maintenance may occur at repeating intervals or in response to a work request.

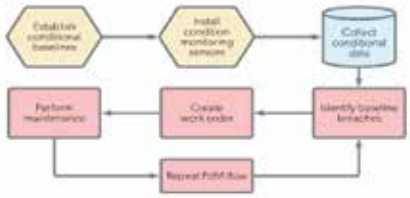
b. Responsive Maintenance

Responsive maintenance is day-to-day maintenance or repair works that are carried out in response to requests for such works, to restore an item or component to its working condition. This maintenance relies on direct observation of equipment conditions.

Predictive Maintenance

The predictive maintenance will help machine, operators save costs by reducing unplanned downtimes, it will allow machine manufacturers to improve their business as well. For example, knowing about machine failures helps manufacturers plan and offer new maintenance strategies based on guaranteed uptime or optimize warehousing costs by having spare parts only on stock when they are actually needed. Moreover, it will help to increase product quality and shorten release cycles.

Predictive maintenance has been widely used in various industries helping to improve the overall efficiency of numerous operations.

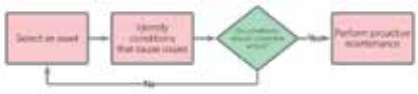


Proactive Maintenance

Proactive maintenance identifies and fix the root causes of equipment failures through preventive and predictive strategies so that overall assets life can be increased.

The immediate goal of the proactive maintenance is to find and fix problems before there's a breakdown. The long-term goal is to reduce unplanned outages and extend asset life.

There is a variety of techniques that are used to enact a proactive maintenance solution. For instance, making



sure to train workers in the best practices for machine operation or using a chain of reliable suppliers for machine elements like lubrication and parts are great ways to help improve maintenance systems.

Prescriptive Maintenance

Prescriptive maintenance evolved from predictive. Prescriptive maintenance detects assets degradation and prescribes a solution to mitigate that problem.

Prescriptive maintenance adds the ability to give advice to the technician on what to do and how to do the repair by taking advantage of artificial intelligence and machine learning. We can get the advanced suggestions for improving production, supporting workflow, reducing downtime, and much more

The Balanced Approach

Some may be tempted to sacrifice maintenance expenditures for an immediate improvement in profitability, but this strategy can adversely affect longer-term profitability: Spending less on maintenance degrades equipment, which leads to poorer performance and, ultimately, to reduced productivity and product quality. The inverse strategy yields the inverse result: increased production and improved quality. A purely reactive approach to service should be replaced by one that properly balances reactive and proactive behavior.

Adopting a balanced maintenance practices helps to achieve the goal of a maintenance program i.e to ensure the facilities are constantly up and running.

For achieving the targets, we need

to tune the maintenance strategy time to time. For example, One can create maintenance plane which involves different strategies working together in one plan such that less than 10% reactive, between 25 and 35% preventive and between 45 and 55% predictive.

Findings on OEE

Maintenance Strategy	Best Applicable	OEE
Reactive	Fix when broken	< 50%
Planned	Schedule maintenance activities	50% - 70%
Proactive	Defect elimination to improve performance	75% - 90%
Predictive	Analytics and sensing data to predict machine reliability	Up to 90%
Prescriptive	Advance analytics and Machine learning	Can Achieve as Expected OEE

Why Remote Maintenance

Remote services provide expertise to the customer in a cost-effective and efficient way. Having these services available 24/7 is very beneficial to customers who are facing the dual challenge of a lack of expertise and rapidly advancing technology.

Remote Maintenance: Three Step approach

Diagnose: Identify existing system reliability issues. Implement: Deliver identified improvement services. Sustain: Manage and continue the improvement process

Role of AR & VR in Plant Maintenance

AR technology can also facilitate the training of maintenance workers by an equipment vendor, or even by other more experienced workers. The training concept involves presenting a cyber-representation that demonstrates how to perform the maintenance.

Virtual reality (VR) can be also used for training purposes in a similar context, based on pre-recorded visual presentations of the task at hand.

AR for training and remote maintenance is currently an emerging trend, which is likely to expand in the coming years. This is mainly due to the rising complexity of industrial equipment and machinery, which makes it increasingly difficult and more expensive to detect, troubleshoot and repair failures.

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