RELIABLEPLANT

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Lean Maintenance — Reduce Costs, Improve Quality & Increase Market Share

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Many companies have failed in their attempt to implement Lean Maintenance. They took the concepts of Lean Manufacturing, applied them to Lean Maintenance and failed when, in fact, their approach was flawed from the beginning.

Dr. W. Edwards Deming once stated, "We have learned to live in a world of mistakes and defective products as if they were necessary to life."

Mistakes and defects can be controlled and driven out of the maintenance process through the successful implementation of a Lean Maintenance Initiative. The very foundation of Lean Maintenance is Total Productive Maintenance (TPM). TPM is an initiative for optimizing the reliability and effectiveness of manufacturing equipment. TPM is team-based, proactive maintenance and involves every level and function in the organization, from top executives to the shop floor. TPM addresses the entire production system life cycle and builds a solid, shop-floor-based system to prevent all losses.

TPM objectives include the elimination of all accidents, defects and breakdowns.

TPM is not a short-lived, problem-solving, maintenance-cost-reduction program. It is a process that changes corporate culture and permanently improves and maintains the overall effectiveness of equipment through the active involvement of operators and all other members of the organization. TPM requires sponsorship and commitment from top management to be effective.

Most organizations that implement TPM fail to achieve the results that were anticipated. This is often because TPM was seen as a cost-cutting venture and was never sponsored or committed to by upper management.

The investment required to successfully implement TPM is very high, but so is the return. Over time, the cooperative effort creates job enrichment and pride, dramatically increasing productivity and quality, optimizing equipment life cycle cost and broadening the base of every employee's knowledge and skillset. To understand the return on investment, one must understand the losses incurred. These losses must be measured. "You cannot manage what you do not measure."

TPM activities should focus on results. There are Eleven Major Losses that must be measured in TPM. These losses are used to measure the effectiveness of TPM or your Lean Maintenance Initiative. The first focus of TPM should be on major equipment effectiveness losses because this is where the largest gains can be realized in the shortest time. These major areas of loss fall within four broad categories:

Planned-shutdown losses

1. No production, breaks and/or shift changes
2. Planned maintenance

Downtime losses

4. Equipment failure or breakdowns
5. Setups and changeovers
6. Tooling or part changes
7. Start-up and adjustment

Performance efficiency losses

7. Minor stops (less than six minutes)
8. Reduced speed or cycle time

Quality losses

9. Scrap product/output
10. Defects or rework
11. Yield or process transition losses

Planned Shutdown Losses

Valuable operating time is lost when no production is planned. However, there are reasons that this is not often considered a "loss." It is best stated as a "hidden capacity to produce."

Loss #1: Production is not scheduled. The facility may be a three-shift operation where the third shift is the maintenance shift. It may be a plant that doesn't run on Saturdays and Sundays. Employee shift changes, breaks or mealtimes also fall into this category. During breaks, some equipment gets shut down. If an operation is a continuous process, that obviously doesn't happen. But in plants making piece parts, there are assembly lines and processes that shut down for breaks and shift changes.

Loss #2: Planned maintenance includes periodic shutdowns of equipment, processes and utilities for major maintenance. These shutdowns represent a period when no production occurs. Typically, Overall Equipment Effectiveness (OEE) calculations factor planned maintenance out of the equation. It is assumed that it's planned maintenance — you have to do it, you can't reduce it, you can't eliminate it, so leave it in. Well, auto racing represents a different story about planned maintenance. A planned maintenance stop or "pit stop" on the NASCAR circuit in 1950 was typically nearly four minutes long. Now, pit crews perform the same pit stops in 17.5 to 22.5 seconds. What's happening in that less-than-20-second period are the same things that were happening in 1950 in four minutes: change tour tires, dispense 22 gallons of fuel, make chassis adjustments, wipe off the windshield, give the driver some water and wipe the rubber dust off the radiator. In about 20 seconds, the car is back on the track. At some point, somebody said, "We can do these pit stops in less than four minutes, can't we?" Planned maintenance is a pit stop. TPM advocates must ask, "How much time are we spending in the pits?"

A walk-through of almost any plant uncovers ways that the same amount of maintenance can be done in less time or that more maintenance can be done in the same amount of time. And those things can be accomplished not with more contractors and not with more work hours, but just by doing things differently and working smarter, not working harder.

Downtime Losses

Downtime is the second category of major equipment losses. This category includes the following:

Loss #3: Typically, when a company's personnel consider losses, they think of equipment failures or breakdowns. But there are other unplanned downtime losses.

Loss #4: This loss includes how long it takes to set up for production processing and how long it takes to shift from one product or lot to another. Determining these losses should take into account how long it takes to start up after a changeover and run a new product. In auto racing, this type of loss includes the preparation and setup for qualifying and racing.

Loss #5: This loss includes the time it takes to make tool changes and production-part changes. Industry in which certain tooling, machine devices or parts must be changed can learn from an auto racing pit stop. The techniques are the same. In an actual pit stop, every single action is considered.

Loss #6: This loss occurs when equipment or processes are started up. It includes the warm-up time and the run-in time that must be set aside to get everything in the process ready to produce quality output. Pit stops are, in part, successful if the driver optimizes the car's speed on the slowdown lap before the pit stop and the speed-up lap after the pit stop. If the driver brings the car up to speed too quickly, the drivetrain and tires may be damaged. A race car handles poorly until the new tires are properly conditioned on the track.

Performance Efficiency Losses

The third category of major equipment losses is performance loss when machines operate at less than the designed speed, capacity or output.

Loss #7: These types of loss — minor stops or "machine hiccups" — are the little things that companies usually don't track. Quite often, equipment downtime lasting less than six minutes is not tracked. However, consider the impact if this six-minute downtime occurs during each shift in a three-shift, five-day operation. That all adds up to 1 ½ hours of downtime per workweek or 75 hours of lost production per 50-week year. Little losses add up.

Loss #8: Equipment and processes running at less than design speeds and cycle times result in lower output. As machines age and components wear, they tend to run slower. At times, machines are run at

lower speeds because the people who operate and maintain them have compensated for problems and believe that running them slower is better and results in fewer breakdowns.

Quality Losses

The final category of major equipment losses is loss of quality. One of the fundamental truths of TPM is this: ***If equipment is available 24 hours a day, seven days a week, and if it's performing at its highest design cycle rate, then if it's not producing the highest level of quality, it's just producing scrap at full capacity.***

So, quality is a very important element among the major losses.

Loss #9: Scrap loss is fairly straightforward. When equipment runs and produces unusable products or outputs, valuable operating time is lost.

Loss # 10: Defective output, even if it can be reworked or recycled, is considered a major loss to be eliminated. As with scrap, when equipment runs and produces unusable products or outputs, valuable operating time is lost.

Loss #11: Yield or transition losses often occur when equipment and processes require a warm-up or run-in time. During that time, they often produce an off-quality output. This type of loss also includes the lost output that results from transitioning from one chemical product to another in a process. Equipment running and wasting raw materials create yield and transition losses.

One of the fundamental measures used in TPM is OEE.
OEE = Equipment Availability x Performance Efficiency x Rate of Quality

World-class levels of OEE start at 85% based on the following values:
90% (Equipment Availability) x
95% (Performance Efficiency) x
99% (Rate of Quality) = 84.6% OEE

The OEE calculation factors in the major losses that TPM seeks to eliminate.

TPM can yield results in two months — sometimes two weeks — when activities are focused on results, and there is regular monitoring, recording and trending of OEE data. It is not as important to focus on OEE percentage as it is to focus on each of the factors of OEE and perform root-cause failure analysis on the major losses of each — equipment availability, performance efficiency and rate of quality. Use the OEE data to communicate how well the equipment is performing and how well the TPM activities are working.

Applied Best Practices of Lean Maintenance

Best Practices of Lean Maintenance are proven practices that, when applied, will result in reduced cost, increased capacity, a more satisfied workforce, etc. These best practices are not designed to be selected individually but together to receive results.

- Workflow processes are mapped (eliminates wasted tasks, time and defects) — many organizations do have mapped processes for maintenance and reliability. This is a must, beginning with how a company defines critical assets to how critical assets follow up on reported corrective action.
- Planning and scheduling must be applied as a discipline (maximize the use of labor and time).
- Develop a reliability strategy and scorecard on critical assets. The use of RCM methodology is a must on critical assets with the engagement of the TPM Team (reduction of cost, increase in capacity, increased involvement of all, reduction in defects and errors).
- Managing Reliability of Assets must be a joint effort by all, with leadership at the top-level accepting responsibility (reduction of defects and cost).
- Manage using Key Performance Indicators (KPIs) with capacity and reliability scorecards posted by operators at their stations and in the maintenance shops. KPIs at the lowest levels (manage as teams).

Causes of Lean Maintenance Failure

Lean Maintenance has failed in more places than it has succeeded. In fact, the places that brag about success may need to re-evaluate themselves. A company cannot truly operate under a Lean Maintenance environment without a **true** OEE of 85% or better, meeting the known "**world-class reliability benchmarks**," and having the following:

- True continuous improvement process for maintenance and reliability
- Not reducing maintenance staff to decrease costs

- Management is committed, from senior level down (no lip service)
- Employees are committed and making decisions based on metrics
- Production works daily with maintenance on reliability issues, just like it is part of their job, and takes responsibility for these issues
- All data is collected and used to its full potential, from condition-based maintenance to CMMS data (Is this data mapped in your processes and followed?)
- Culture is sustained in a totally proactive, bottom-driven environment
- Everyone understands the plant's reliability and maintenance processes and believes it is "world-class”

Lean Maintenance does work and does provide results when applied properly. Companies that attempt this journey must develop a business plan first and always develop a master plan with targets and goals defined on a timeline. Many of these targets and goals are defined as maintenance and reliability metrics. Last but not least, never go it alone; find a great (NOT GOOD) consultant to help you with this journey. This is money well spent.

About the Author

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Ricky has over 30 years' experience working as Maintenance and Reliability Professional for companies such as Exxon Company USA, Alumax Mt Holly, Kendall Company and the US Army. In additi... Read More

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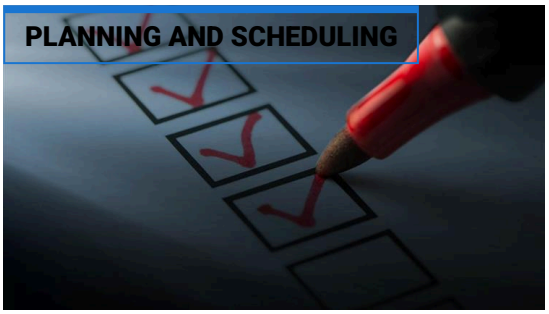

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