TOPIC: ENGINEERING

AUTONOMOUS MAINTENANCE: THE POWER OF AUTONOMY IN KEEPING THINGS RUNNING SMOOTHLY

8 min read

A proven strategy to improve equipment reliability, operational efficiency, and product quality.

Across industries, maintenance is typically considered a service organization, rather than an integrated part of production. There are often inconsistencies between a maintenance system's goals and how people, processes, and tools are organized. To reduce downtime and extend the life of the equipment, breweries need to make their maintenance function proactive instead of reactive. This, in turn, will reduce their annual expenses and parts inventories without compromising safety or quality. [1]

Implementing autonomous maintenance in a brewery involves empowering the frontline team to take ownership of equipment maintenance tasks, fostering a culture of continuous improvement, and implementing learning and development plans. Initially teams should conduct thorough equipment assessments to identify maintenance needs and develop standardized (one best way) cleaning and inspection routines. These routines facilitate consistent execution of maintenance tasks. Additionally, routine monitoring and review of maintenance activities help refine processes and identify opportunities for optimization. By empowering front line employees with the knowledge and tools to maintain equipment autonomously, breweries can enhance operational efficiency, minimize downtime, and ensure product quality and safety.

Below are seven steps of implementing autonomous maintenance. [2]

Step 1: Increase Operator Knowledge

The initial step involves completing the selection of equipment and setting up the base conditions for its operation, which includes schedules for cleaning, inspection, and maintenance. An interdisciplinary team comprising managers, operators, and technicians should be assembled to carry out the transformation of the equipment. This will ensure that operators develop a deep understanding of the equipment's functionality and recognize both its normal and abnormal conditions.

Choosing the right equipment is crucial and should be based on an evaluation of downtime and associated losses; one should avoid selecting equipment based only on focused losses rather than dispersed ones. Effective autonomous maintenance of the chosen equipment can lead to rapid improvements in performance.

Below are good examples of specific equipment contrasted with overly general categories:

- Bottle Line Labeler vs. Entire Bottle Line
- Ammonia Compressor vs. Entire Cooling System
- Malt Mill vs. Warm Block Process
- Yeast Centrifuge vs. Cold Block Process

It's critical to assess the equipment's capabilities and operational efficiency to establish fundamental conditions. Additionally, it is advisable to reassess the workplace organization (5S) and standard operating procedures (SOPs) related to the equipment.

Step 2: Perform Initial Inspection and Cleaning

The initial inspection requires equipment downtime so that the team can conduct an initial thorough inspection and cleaning of the equipment to identify any abnormalities. The goal is to identify dirty points, wear points, failure and stress points, leaks, loss parts, jams, wear points, and sources of contamination.

This initial inspection and cleaning will expose abnormalities that are difficult to clean and inspect. Another goal of the initial inspection and cleaning is to remove parts that are no longer needed.

The team should tag each identified abnormality to methodically resolve the abnormality and remove the tag. When the inspection and cleaning event is complete, the tags will be categorized for proper root cause analysis.

Inspection and Cleaning events should be repeated to ensure the entire team has participated. As a result, the equipment should be restored to a "like new" condition.

Step 3: Eliminate Causes of Contamination

The focus here is on identifying and eliminating sources of contamination that could lead to equipment malfunction or deterioration. There may be numerous tags per equipment area that are generated in the inspection and cleaning events. Ensure that there is an organized process and visualization to manage the tags generated and root cause analysis. Failure to address the abnormalities from the cleaning and inspection events will result in team disengagement and delays in achieving results.

Below are examples of identified contamination or defects:

- Machine Defects (worn parts, etc.)
- Dirty (leaks, etc.)
- Dangerous (unsafe conditions such as pinch points, guarding deficiencies, etc.)
- Difficult (accessibility, visibility, etc.)

Step 4: Define Standards for Cleaning, Lubrication, and Inspection

Defining standards for cleaning, lubrication, and inspection is a crucial step in implementing autonomous maintenance in a brewery. Standards ensure that the equipment is maintained in a consistent and effective way, preventing breakdowns, defects, and waste. Standards also help operators to identify and eliminate sources of contamination, improve equipment performance, and extend equipment life. Defining standards should be documented in SOPs (standard operating procedures) that are accessible and easy to follow for all operators. SOPs can be in digital or video format, depending on the preference and convenience of the operators. It is crucial to maintain the management of SOPs in a manner that prevents outdated versions from being accessed. It is important to note that standards for cleaning, lubrication, and inspection should be set after a series of inspection and cleaning events.

Below are examples of standards put in place:

- Visualization on lube levels and gauge ranges to indicate correct operating ranges
- Color coded lubrication points to match lubricant type
- Transparent guarding vs opaque for increased visibility

Step 5: Execute Inspection and Monitoring

To execute inspection and monitoring in implementing autonomous maintenance in a brewery, operators need to follow the SOPs and use the appropriate tools and instruments to check the equipment condition and performance. Operators should report any abnormalities or deviations from the standards to the maintenance team or the supervisor and record the inspection results in a logbook or a digital system. Operators should also use visualization techniques such as charts, graphs, or dashboards to display the inspection data and track the equipment's status and trends over time.

Step 6: Standardize Visual Maintenance

Standardized visual maintenance is a key element of autonomous maintenance in a brewery, as it helps operators to quickly identify and resolve any issues that may affect the equipment or the product quality. By using visual cues such as labels, signs, and indicators, operators can easily see the equipment's condition, performance, and operating parameters, and compare them with the established standards. This enables them to spot any deviations or abnormalities and take corrective actions promptly. Standardized visual maintenance also supports adherence to maintenance standards, as it guides operators on how to perform the inspection and monitoring tasks correctly and consistently.

Step 7: Establish Continuous Improvement

The final step in implementing autonomous maintenance is to establish a culture of continuous improvement, where operators and technicians are constantly seeking ways to enhance equipment reliability and efficiency over time, based on feedback and data collected during the maintenance process. This involves conducting regular reviews of the maintenance standards, updating the visual cues and checklists, and applying the PDCA (plan-do-check-act) cycle to solve problems and implement improvements. To ensure the sustainability of autonomous maintenance, operators and technicians also need to undergo periodic training refreshers and audits to verify their skills and adherence to the standards. Additionally, employee recognition and rewards should be provided to motivate and appreciate the team members for their efforts and achievements in autonomous maintenance.

One of the goals of autonomous maintenance is to foster a culture of continuous improvement among the operators and technicians. Some of the continuous improvement items that need to be completed are creating detailed standard operating procedures for cleaning, inspection, and lubrication; checking the lubrication level or executing lubrication tasks; recognizing that cleaning is a form of inspection; developing skills to improve the process through clean and tag events and operator upskilling; implementing 5S area improvements; and ensuring the availability of correct tools and equipment.

Learning and Development

One of the key steps in implementing autonomous maintenance is to provide learning and development opportunities for operators and technicians. This involves conducting root cause analysis on the tags generated during the clean and tag exercise, which identifies equipment abnormalities and improvement areas. Operators and technicians also need to acquire advanced technical skills, both theoretical and practical, on the unit operations (motors, valves, etc.), processes (filling process, yeast centrifuge, etc), and equipment they are responsible for. On the job training, guided by maintenance technicians, is essential to ensure operators can perform routine maintenance tasks such as cleaning, lubrication, and inspection. Furthermore, a long-term training plan or academy should be developed and implemented to ensure continuous improvement and knowledge transfer among team members.

Summary

Autonomous maintenance is not just a fancy term for operators doing the cleaning and lubrication of their equipment. It is a powerful approach that gives operators the skills and responsibility to take care of their equipment and prevent failures. By doing so, they can achieve remarkable results, such as:

- Enhancing their performance and quality by increasing their ownership and knowledge of their equipment.
- Improving equipment reliability and reducing downtime by preventing deterioration and detecting problems early.
- Freeing up maintenance technicians to focus on more advanced and value-added tasks, such as technical improvements, planned maintenance, and failure analysis.

Autonomous maintenance is a key step in your journey to excellence. It can help you increase your productivity and profitability, while delivering consistent and high-quality products to your customers. [3] To start your autonomous maintenance journey, choose a single piece of equipment and follow the best practices. Celebrate your successes and learn from your challenges. You will soon see the benefits of autonomous maintenance for your brewery.

Resources

1. Boston Consulting Group. (2017). How World-Class Maintenance Can Boost Global Manufacturing. [Online] Available at: https://www.bcg.com/publications/2017/lean-operations-how-world-class-maintenance-can-boost-global-manufacturing .
2. The Lean Suite. (2023). The 7 Steps of Autonomous Maintenance. [Online] Available at: https://theleansuite.com/the-7-steps-of-autonomous-maintenance/ .
3. Vorne Industries. TPM (TOTAL PRODUCTIVE MAINTENANCE). [Online] Available at: https://www.leanproduction.com/tpm/ .