Stamping Tooling Preventive Maintenance Project

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Abstract

Eaton Corporation's Electrical Sector, a global leader in power management solutions, faces a critical challenge in the Stamping Department's tooling equipment maintenance. The absence of a defined Preventive Maintenance Plan (PMP) has led to frequent breakdowns, increased downtime, and production inefficiencies. This poster presents a comprehensive approach to address this challenge, incorporating insights from literature on tools and dies preventive maintenance, Lean Six Sigma principles, and a detailed affinity analysis. The data-driven selection of cost-driver tools, their prioritization, and the development of a tailored PMP are discussed. The implementation of proactive measures, such as evaluating tooling cycles, generating maintenance tags, and designating dedicated personnel, contributes to improved efficiency. The future state envisions a preventive tooling handling process, reducing troubleshooting and downtime. Achievements include projected savings of $314k/year through improved Overall Equipment Efficiency (OEE), reduced support hours, and optimized Tool Room processes. The conclusions highlight the project's success and propose further enhancements to overall production.

Introduction

Eaton Electrical Sector Stamping Department holds significant importance ensuring the production of high-quality electrical components. It utilizes specialized machinery and equipment to shape and form metal sheets into precise components used in various electrical applications. Maintenance is of utmost importance to ensure uninterrupted production, minimize downtime, and uphold product quality. By implementing regular maintenance procedures, Eaton can detect and address potential equipment failures or inefficiencies before they escalate into significant issues. This proactive approach helps prevent unexpected breakdowns, production delays, and costly repairs.

Objective

The absence of a well-defined Preventive Maintenance Plan (PMP) for the tooling equipment, as shown in Figure 1, has resulted in excessive downtime, significantly affecting production efficiency. Therefore, the objective of this project was to develop a comprehensive PMP that can effectively address the maintenance requirements of the tooling equipment.

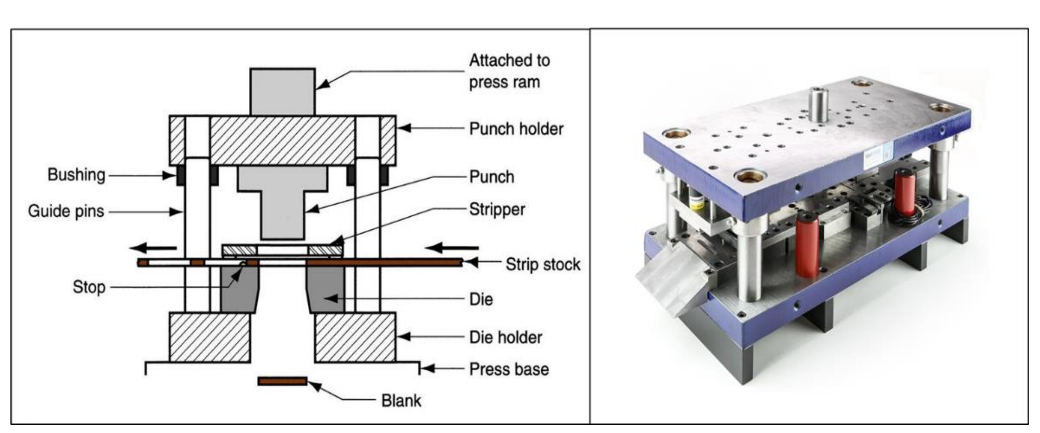


Figure 1: Tool & Die Diagram

Data Collection

Affinity Analysis

During the process of selecting and prioritizing a specific tool for the Preventive Maintenance Plan (PMP), an affinity analysis was carried out to identify the business impact tools and focus on their Preventive Maintenance (PM). Figure 2 shows potential factors to consider tool priority for the PMP. A Factor Rating Analysis was generated using the above factors to determine the top drivers within the Stamping Department. By considering these factors and by conducting a comprehensive analysis, the most suitable tools to start with the PMP were summarized in Figure 3. Note that the analysis was based on a 10-month data history collection.

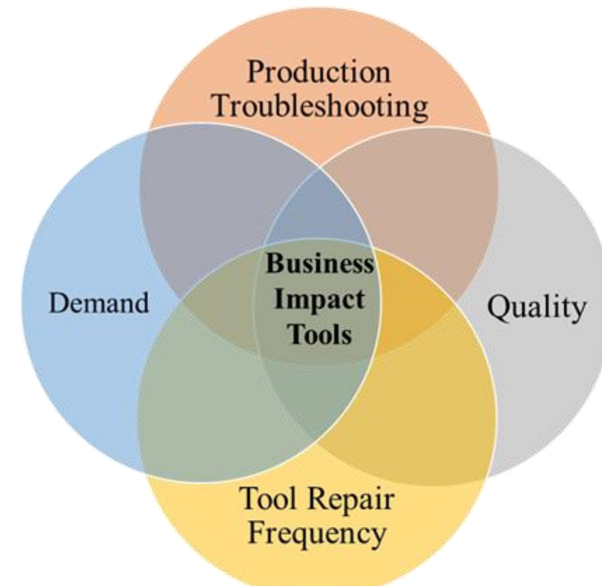


Figure 2: Business Impact Tools Factors

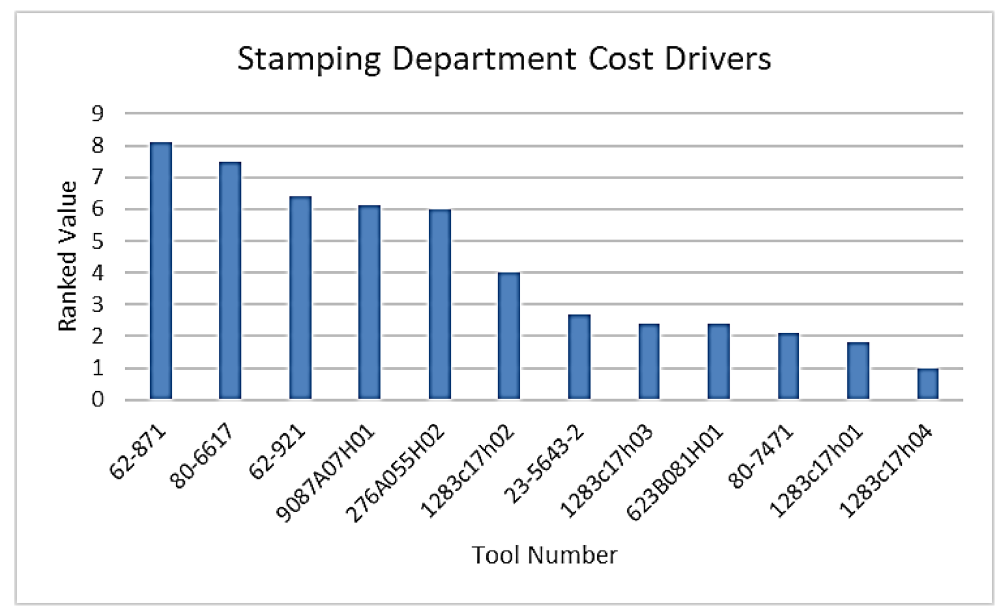


Figure 3: Cost Driver Tools Pareto Chart

Tools Used

Root Cause Analysis

In this cause-and-effect diagram, shown in Figure 4, the main cause identified is "Tool and Die Causes of Downtime" within the Stamping Department. It is further divided into five primary categories: Insufficient Lubrication, Wear and Tear, Tool/Die Breakage, Tool/Die Design Issues, and Lack of Regular Maintenance. Each category then presents specific causes related to tool and die maintenance that contribute to downtime. These causes include issues such as inadequate lubrication practices, misalignment, excessive wear, tool/die breakage, design flaws, and lack of regular maintenance activities. Identifying these causes helped the department to address the root issues to implement targeted solutions to reduce downtime and improve overall productivity.

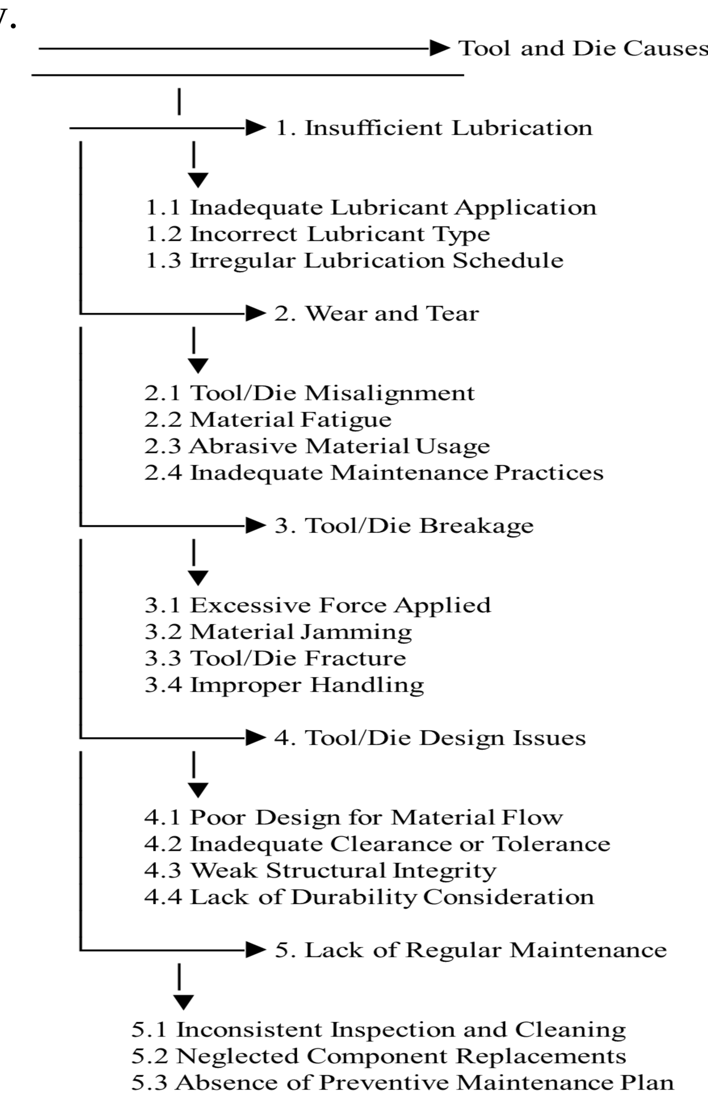


Figure 4: Tool & Dies Downtime Cause & Effect Diagram

Current State

As shown in the current state flowchart in Figure 5, the tooling handling process was a reactive one expecting troubleshooting during production. Thus, ultimately sending the tool for repair at the Tool Room causing downtime at the Stamping Department and increment in labor hours in the Tool Room.

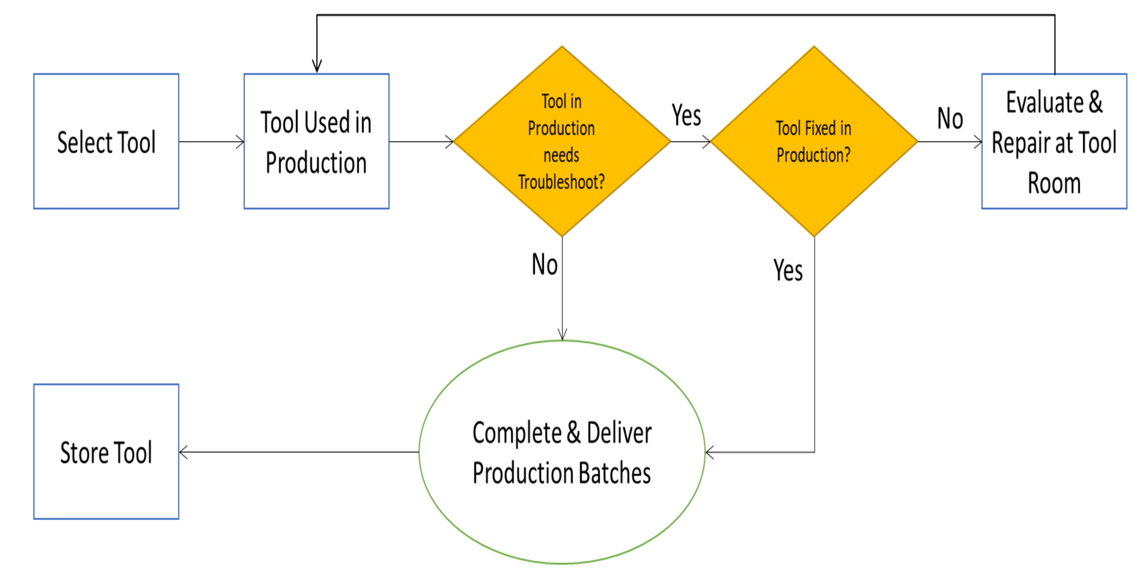


Figure 5: Tool Handling Process Current State Diagram

Improvements

Future State

As shown in the future state flowchart in Figure 6, the tooling handling process shifted to a preventive one, minimizing troubleshooting during production due to tool faults. Hence, improving downtime at the Stamping Department and ultimately a reduction in labor hours in the Tool Room. Notice that a Preventive Maintenance (PM) cycle target was incorporated to trigger preventive maintenance on the tools. The cycle target on each tool varies depending on the average cycle fault or when the tool breaks after a certain number of parts are made. Also, this model assumed no production troubleshooting and other minor tasks due to tool fault after initial preventive maintenance has been completed.

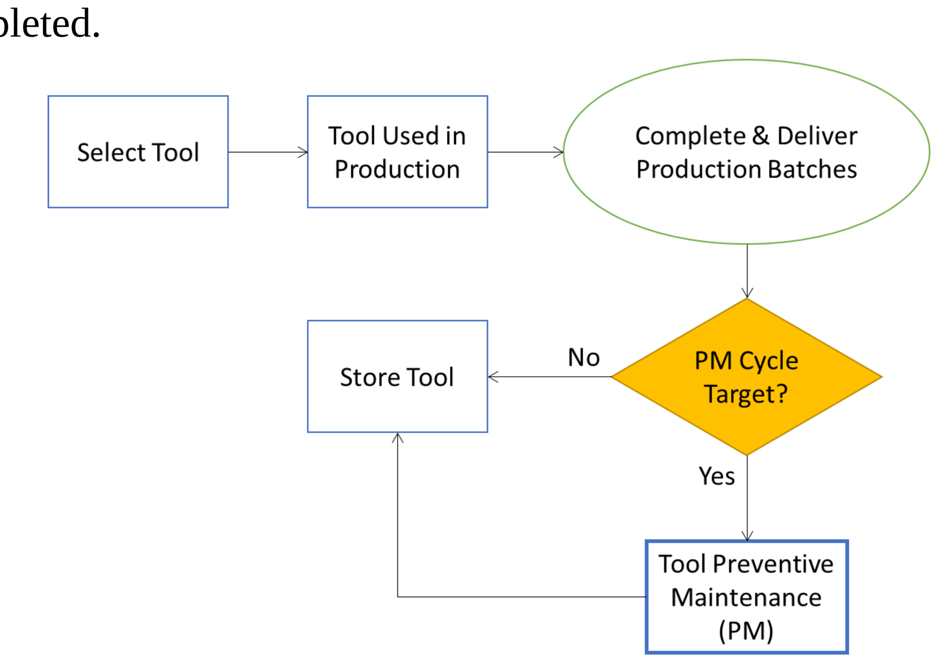


Figure 6: Tool Handling Process Future State Diagram

Solutions & Action Plan

To implement the Preventive Maintenance Plan (PMP) in the Stamping Department, a series of actions were undertaken to enhance the maintenance process and reduce downtime.

Firstly, the cost-driver tooling preventive maintenance cycle targets were evaluated by considering factors such as operator feedback, production data, and insights from the Tool Room. This analysis helped determine the optimal maintenance intervals for different tools, ensuring timely maintenance to prevent breakdowns.

In addition, to effectively schedule and track preventive maintenance, tags and/or logs, as shown in Figure 7, were generated. These tags helped identify tools due for maintenance, ensuring no tool was overlooked or neglected. Additionally, alerts were set up in the production system after a certain number of cycles, notifying the relevant personnel that preventive maintenance was due.

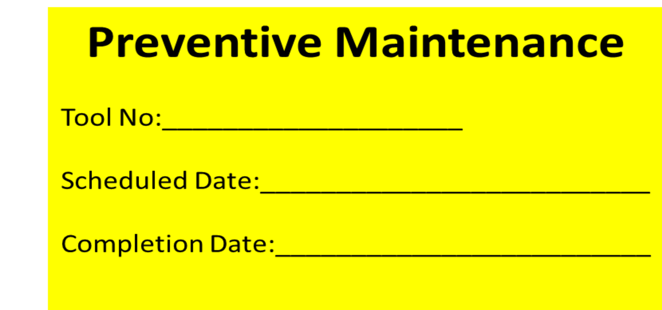
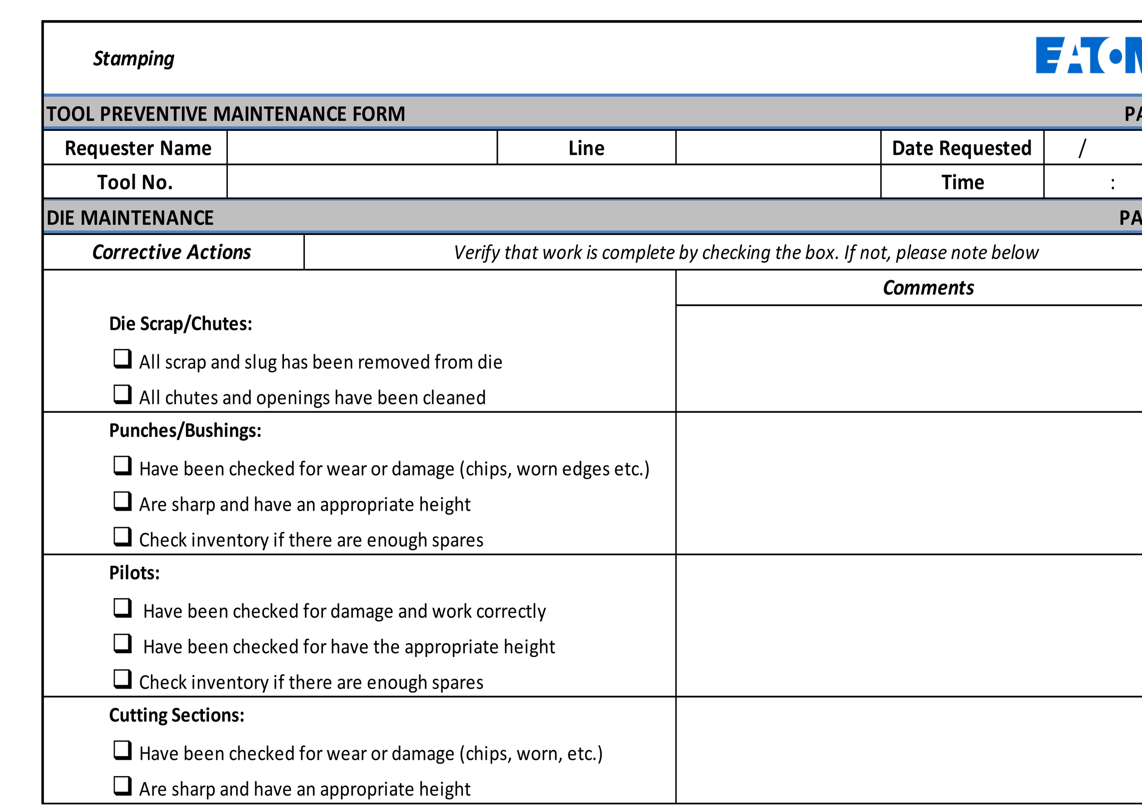


Figure 7: Tool PM Tag

Also, the stamping department and tool room layouts were evaluated, and designated tool pickup areas were established. This evaluation aimed to optimize the flow of tools between the stamping department and the tool room, ensuring that tools were readily available for maintenance and reducing the time required for tool pickup or drop-off.

Furthermore, to ensure thorough and consistent maintenance, a comprehensive PM checklist, as shown in Figure 8, was created. This checklist was developed based on research, cause and effect analysis, and feedback from experienced Tool & Die Makers, outlining the specific tasks and inspections to be performed during preventive maintenance, providing a standardized approach, and minimizing the chance of overlooking critical maintenance steps.



Stamping

TOOL PREVENTIVE MAINTENANCE FORM — PART I

Requester Name		Line		Date Requested	/ /
Tool No.				Time	:

DIE MAINTENANCE — PART II

Corrective Actions	Verify that work is complete by checking the box. If not, please note below
	Comments
Die Scrap/Chutes: ❑ All scrap and slug has been removed from die ❑ All chutes and openings have been cleaned	
Punches/Bushings: ❑ Have been checked for wear or damage (chips, worn edges etc.) ❑ Are sharp and have an appropriate height ❑ Check inventory if there are enough spares	
Pilots: ❑ Have been checked for damage and work correctly ❑ Have been checked for have the appropriate height ❑ Check inventory if there are enough spares	
Cutting Sections: ❑ Have been checked for wear or damage (chips, worn, etc.) ❑ Are sharp and have an appropriate height	

Figure 8: Tool & Die Preventive Maintenance Checklist

Achievements & Conclusions

In summary, the Preventive Maintenance Project for Tool & Dies in the Stamping Department yielded significant achievements, resulting in substantial enhancements to overall operational efficiency and cost savings. The project's successes include projected daily savings of 2.7 hours in tooling production troubleshooting, equating to a notable 6% improvement in Overall Equipment Efficiency (OEE) due to availability and an annual cost reduction of $58k. Moreover, support hours for tooling production troubleshooting were projected to decrease by an average of 1 hour per unit, translating to an annual cost saving of $31.8k.

The Tool Room Improvement aspect of the project anticipated a remarkable 61% reduction in labor hours, equivalent to the workload of one dedicated stamping employee, after the initial cycle of Preventive Maintenance on all tools. This reduction is estimated to result in an annual cost saving of $219k. Additionally, there is a projected 37.5% decrease in forklift travel time, amounting to $5.4k annually, following the implementation of a new layout. The introduction of a Spare Part Consignment Program is expected to avoid an average of one week of spare parts waiting time, leading to a weekly cost avoidance of $3.4k.

In total, these achievements culminate in an impressive $314k annual savings after full implementation. The success of the Preventive Maintenance Project sets the stage for further improvements in the Stamping Department's production processes.