# Reducing Overhaul Time of Coating Equipment with Seven Tools Method in PT XYZ

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## ABSTRACT

This study aims to improve the overhaul time efficiency of coating equipment at PT XYZ, which is a crucial part of the steel sheet galvanizing process. Inefficient overhaul processes can lead to significant downtime, affecting the company's productivity and profitability. The study identifies factors contributing to prolonged overhaul times and provides solutions to enhance time efficiency through the application of the Seven Tools method. The research employs a qualitative approach with a case study methodology. Data were collected from the Maintenance Department of PT XYZ from February to May 2024, through interviews with technicians and maintenance managers, as well as historical data on overhaul times and maintenance frequency. Analysis was conducted using cause-and-effect diagrams (fishbone), Pareto charts, and process flow analysis. The results indicate that the frame cleaning process using a burner takes the longest time, specifically 17 hours. The primary causes are insufficient burner operation training for workers and the use of only one burner. Proposed solutions include operator training and the addition of burners to expedite the frame cleaning process simultaneously on both sides. Implementing these solutions successfully reduced the overhaul time from 60 hours to 50 hours, a 17% reduction. This research contributes to improving maintenance process efficiency in the manufacturing industry, offering practical solutions to enhance productivity and competitiveness.

**Keywords:** Seven Tools, Coating Equipment, Overhaul, Time Efficiency.

## INTRODUCTION

In the era of globalization, rapid technological advancements are compelling various industrial sectors to optimize their systems and maintain competitiveness. Productivity, a key indicator of performance, heavily relies on the efficient use of available resources. This is particularly crucial in the manufacturing industry, where maintaining the effectiveness of production processes and equipment plays a vital role. PT XYZ, a company specializing in producing galvanized steel sheets for the automotive industry, faces significant challenges in maintaining production efficiency. One critical stage in their production process is the overhaul of Coating Equipment, which is essential for ensuring a uniform zinc coating on steel sheets. However, the overhaul process has proven to be time-consuming, negatively impacting overall production efficiency.

The inefficiencies in the overhaul process can lead to substantial downtime, which not only affects productivity but also increases operational costs. Identifying the factors contributing to prolonged overhaul durations is essential for developing effective solutions. Preliminary analyses have indicated that the frame cleaning process, primarily conducted using a burner, is a significant bottleneck, requiring up to 17 hours to complete. Contributing factors include a lack of operator training and the reliance on a single burner for cleaning operations. This situation is consistent with findings by Widodo and Fathimah hayati (2019), who emphasized that inadequate training can lead to inefficiencies in maintenance tasks, ultimately affecting production timelines.

To address these challenges, this study aims to enhance efficiency in the overhaul process by applying the Seven Tools method, a structured approach that allows for systematic identification and analysis of the root causes of inefficiencies. The Seven Tools method includes techniques such as cause-and-effect diagrams (fishbone), Pareto analysis, and process flow analysis, which have been shown to effectively identify and categorize potential causes of delays (Hamdani, 2022). By implementing targeted improvements, such as operator training and the addition of another burner, the research seeks to reduce the overhaul duration from 60 hours to 50 hours, representing a 17% reduction in time.

This research not only contributes to improving maintenance processes in the manufacturing sector but also offers practical solutions for enhancing productivity and competitiveness in similar industrial contexts. The findings are expected to serve as a reference for other companies facing similar challenges, demonstrating the practical application of structured problem-solving methodologies in optimizing maintenance processes. By integrating proven theories and methods, this study aims to provide valuable insights into the optimization of overhaul times, ultimately contributing to increased operational efficiency and reduced costs in the manufacturing industry.

## LITERATURE REVIEW

Efficiency and equipment maintenance are crucial aspects of the manufacturing industry, particularly in optimizing productivity and minimizing operational costs. Achieving this efficiency requires structured analysis methods, such as the Seven Tools, which allow companies to systematically identify and analyze the root causes of problems. According to Setiawan (2017), this method includes tools like fishbone diagrams, which are effective in categorizing potential causes into groups such as workforce, methods, and materials. One of the primary tools within the Seven Tools method is the fishbone diagram, which visually identifies the root causes of problems. Pratama et al. (2023) noted that fishbone diagrams are highly effective in grouping causes into relevant categories, such as human factors, methods, materials, and the environment. In this study, the fishbone diagram was applied to analyze the cleaning frame process, identified as the primary cause of prolonged overhaul durations for Coating Equipment. This approach enables companies to map problems systematically and establish priorities for solutions.

Efforts to reduce overhaul time do not only rely on identifying problems but also on implementing data-driven solutions. A study by Widodo and Fathimahhayati (2019) demonstrated that operator training could enhance workforce competency, thereby reducing task completion times. In this context, operator training is combined with a strategic intervention: adding burners to simultaneously accelerate the cleaning frame process on both sides. This combined approach is expected to effectively address the key bottlenecks in the overhaul process. Furthermore, other studies emphasize that time optimization significantly impacts productivity. Hamdani (2022) highlighted that time efficiency in maintenance processes can considerably reduce downtime, ultimately increasing production capacity. This research builds on these concepts by developing Seven Tools-based solutions focused on optimizing overhaul time, providing practical applications to improve overall efficiency.

Additionally, methods like the Priority Quadrant have proven effective in identifying and prioritizing improvements within the manufacturing sector. Sunirno et al. (2018) found that this method helps organizations focus resources on areas that yield the most significant performance improvements. In this study, the Priority Quadrant was utilized to identify the cleaning frame process as the priority area requiring immediate improvement. By integrating these proven theories and methods, this study aims not only to reduce overhaul time but also to provide practical contributions to enhancing the efficiency of maintenance processes in the manufacturing industry. This structured approach is expected to serve as a reference for other companies facing similar challenges.

## RESEARCH METHODOLOGY

To solve a problem in research, a research stage is needed in solving a problem, so that the problems that arise can be described clearly. The steps used are as follows:

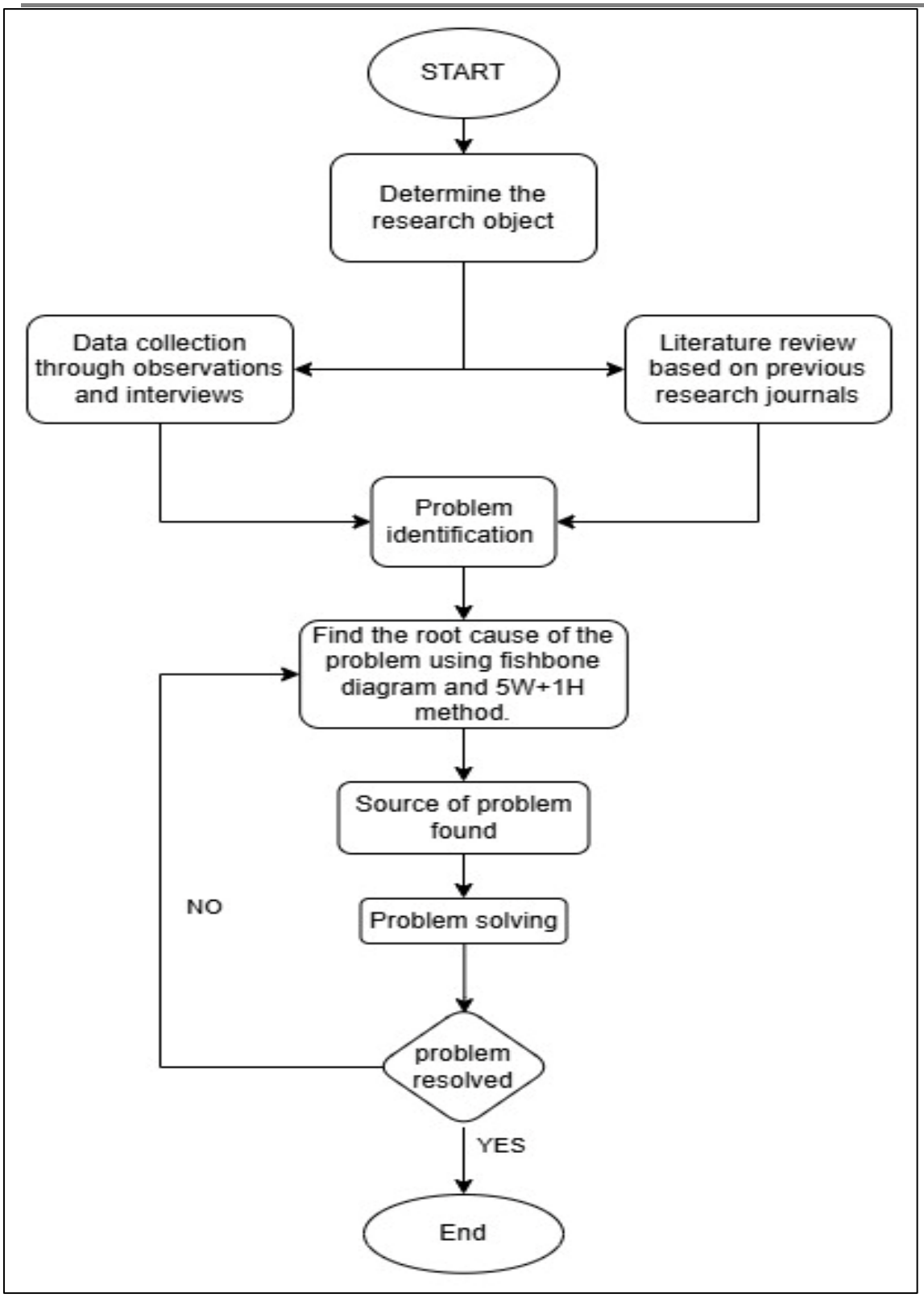


**Figure 1.** Step of Research

The flowchart outlines a systematic approach to the research process detailed in the journal. It begins with the Start phase, where the research initiative is launched. The first critical step is to Determine the Research Object, which involves defining the specific focus of the study. This foundational decision sets the direction for the entire research effort, ensuring that all subsequent activities align with the identified objectives. Following this, the researchers engage in Data Collection through Observations and Interviews. This phase is essential for gathering qualitative data, as it allows the researchers to observe the processes in real-time and conduct interviews with personnel directly involved in the operations. This firsthand information is crucial for understanding the context and identifying specific issues that may not be apparent through secondary data alone.

Next, a Literature Review Based on Previous Research Journals is conducted. This step involves a thorough examination of existing literature to understand previous findings and methodologies related to the research topic. By situating the current study within the broader context of existing knowledge, the researchers can identify gaps in the literature and justify the need for their investigation. Once the data is collected and the literature reviewed, the researchers proceed to Problem Identification. This phase involves analyzing the gathered data to pinpoint specific problems that require attention. Identifying these issues is critical for developing effective solutions. To delve deeper into the identified problems, the researchers utilize the Fishbone Diagram and the 5W+1H Method. The fishbone diagram serves as a visual tool to map out potential causes of the problems, categorizing them into relevant groups. Simultaneously, the 5W+1H method (What, Why, Where, When, Who, and How) is employed to explore the issues comprehensively, ensuring that all aspects are considered.

After these analyses, the researchers assess whether the Source of the Problem is Found. If the root cause is identified, the process moves forward to Problem Solving. In this phase, targeted solutions are developed and implemented to address the identified issues effectively. The next step involves evaluating whether the Problem is Resolved. This critical assessment determines if the implemented solutions have had the desired impact. If the problem is resolved, the research process concludes, if not, the cycle may repeat, indicating a need for further investigation and refinement of solutions. In summary, this structured approach ensures a comprehensive analysis of the issues at hand, leading to effective solutions and improvements in the maintenance processes within the manufacturing context. By following this systematic methodology, the research aims to enhance operational efficiency and productivity in the industry.

## RESULT AND DISCUSSION

To overcome these problems, a solution will be carried out based on existing research steps, where each stage will be explained as follows:

### Identification of Problems

In this company there is Coating equipment that plays a very important role in the galvanizing process, where this tool is used to remove excess zinc coating on steel sheets. An inefficient overhaul process can result in significant downtime, impacting the company's productivity and profitability. Therefore, this study was conducted to identify factors that cause the length of overhaul time and provide recommendations for improvements that can be implemented. The method used in this research is qualitative with a case study approach. Data was collected from the Maintenance Department of PT XYZ during the period from February to May 2024. The steps taken include data collection through interviews with technicians and maintenance managers to understand the overhaul process, as well as historical data collection regarding overhaul time and maintenance frequency. Furthermore, the seven tools method was applied to analyze the factors affecting the overhaul time, which included a cause-and-effect diagram (fishbone) and process flow analysis. The Coating Equipment overhaul activities are based on the use of equipment that has processed 15,000 tons of strips. The Coating Equipment overhaul process consists of several stages, including the replacement of rolls, namely the Sink Roll and Support Roll. Many parts must be removed to replace the old roll with a new one. The part removal process in the Coating Equipment utilizes more burner processes to clean the zinc attached to the parts and a gouging process to remove the welding points on the part connections. The table below will show the replacement steps along with the time for each job:

**Table 1.** Changeover Step And Time Required

| No. | Work Step | Time (Hours) | Total Work Time (Hours) |
|---|---|---|---|
| 1 | Preparation Tools | 1 | 60 |
| 2 | Cleaning Frame from Zinc | 17 | |
| 3 | Gouging Process | 8 | |

| | | | |
|---|---|---|---|
| 4 | Take Out Support Roll | 5 | |
| 5 | Take Out Sink Roll | 5 | |
| 6 | Install Support Roll | 4 | |
| 7 | Install Sink Roll | 8 | |
| 8 | Welding Process | 8 | |
| 9 | Install Cover Sink Roll | 4 | |

From the table above, it can be concluded that the process of cleaning the frame from zinc using a burner is the work that takes the longest time. The frame cleaning process takes 17 hours, which is the longest process compared to other processes. Therefore, the author decided to focus on analyzing and solving the problem.

**Analysis of Problem Causal Factors**

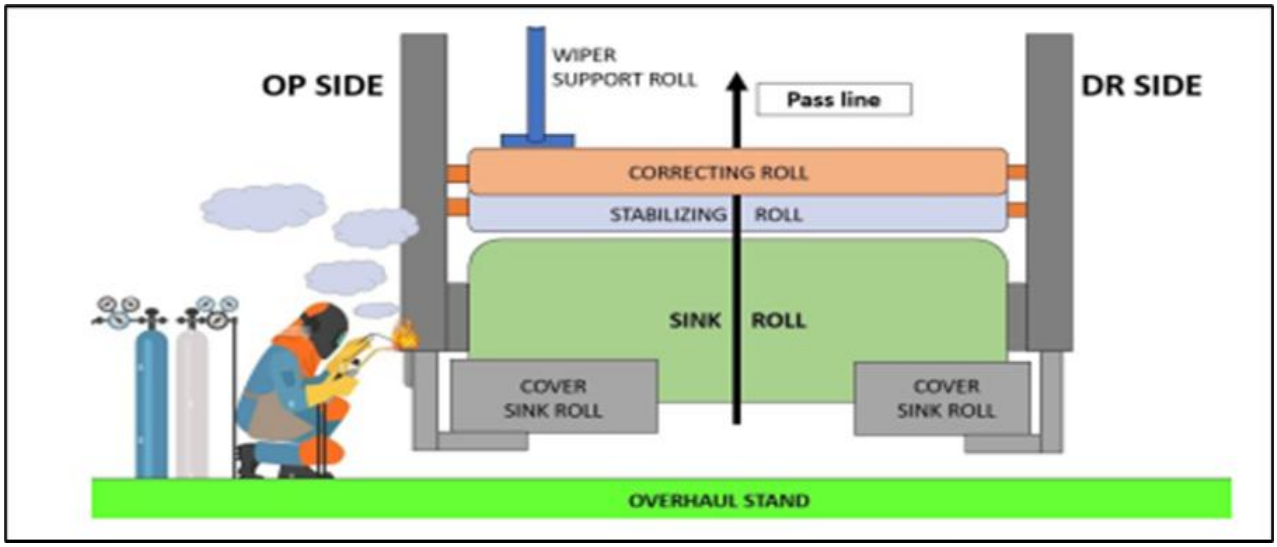


**Figure 2.** Simulation of the Frame Cleaning Process

After making observations, in this process there are problems that occur. The process of cleaning the frame using a burner is only carried out by 1 manpower, while the area that must be cleaned is on two sides, namely OP Side and DR side. As a result, the part removal process becomes quite long for both sides of the frame. The above problems are summarized using a cause-and-effect diagram to make it easier to analyze and draw conclusions. The cause-and-effect diagram can be seen in the figure below:

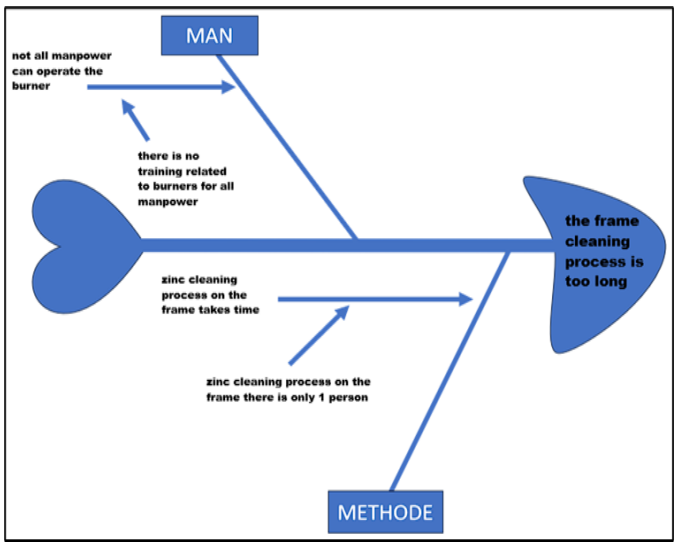


**Figure 3.** Fishbone the Frame Cleaning Process is too Long

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Based on the cause-and-effect diagram above, we can conclude that the cause of the frame cleaning process taking too long is:

**Table 2.** Conclusion Of The Results Of The Fishbone Diagram

| Category | Cause |
|---|---|
| Man | there is no training related to burners for all manpower |
| Methode | zinc cleaning process on the frame there is only 1 person |

After identifying the causes of why the frame cleaning process takes too long, the author will develop an improvement proposal using the 5W+1H method. This method presents a table containing key questions, namely What, Why, Who, When, Where, and How, relating to each of the causes of the problem that have been found. Each problem identified will be described in the table, and on the How line, the author will formulate a specific improvement plan to address each cause of the problem. With this approach, it is expected that the proposed improvement plan can increase the efficiency of the frame cleaning process and reduce the time required in the overhaul process as shown in the table below:

**Table 3.** Table Of Proposed Improvements Using The 5w+1h Method

| **5W + 1H** | **Man** | **Methode** |
|---|---|---|
| What | Not all manpower can operate a burner | Zinc cleaning process on the frame takes a long time |
| Why | No burner operation training for all manpower. | Zinc cleaning process on the frame is only done 1 burner |
| Who | Operator maintenance coating section | Operator maintenance coating section |
| When | Plan as of June 2024 | Plan as of June 2024 |
| Where | Coating section area | Coating section area |
| How | Conducted burner operation training on all manpower | 1 more burner is added for the zinc cleaning process on the frame. |

**Problem Solving**

Based on the table above, the author proposes an improvement plan from the man side by conducting burner operation training for all manpower in the hope that manpower can operate the burner without having to be done by 1 skill manpower only, from the method side, namely by adding 1 burner for the zinc cleaning process on the frame with the aim that the frame cleaning process from zinc can be done partially on both sides, namely the OP side and the DR side. By making the improvement plan, two problems in terms of people and methods should be solved. Following is an illustration after the addition of the burner and training.

After implementation, the overhaul time was reduced from 60 hours to 50 hours, with a 17% increase in efficiency. This time reduction shows that the corrective measures implemented, such as operator training and the addition of burners, were successful in increasing the speed and effectiveness of the cleaning process. With shorter overhaul times, the company was not only able to reduce operational costs associated with downtime, but also increase overall production capacity. The 17% increase in efficiency means that the company can utilize the previously wasted time to perform other production activities, potentially increasing output and profitability.

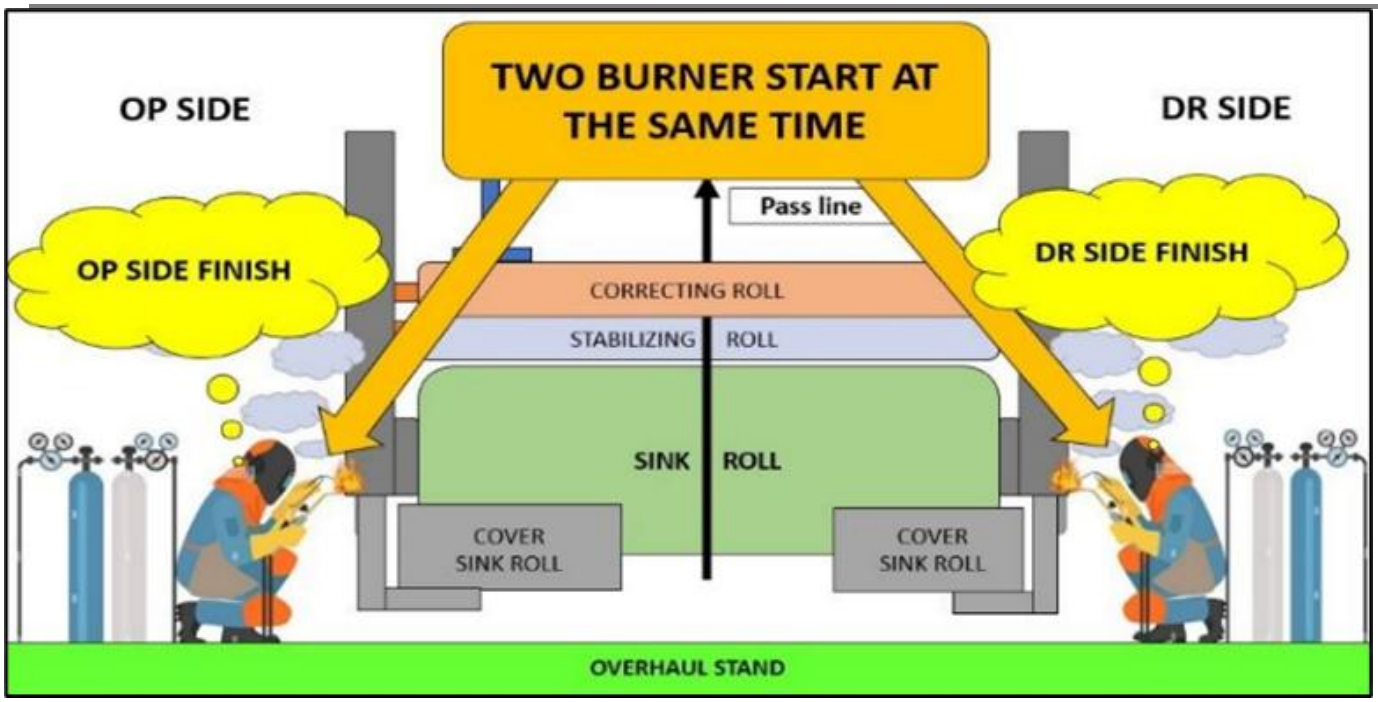


Figure 4. Illustration After The Addition of Burners and Training

## CONCLUSIONS

This study concludes that the overhaul process of Coating Equipment at PT XYZ can be significantly improved through the application of structured problem-solving methodologies. The research identified key inefficiencies, particularly in the frame cleaning process, which were primarily attributed to inadequate operator training and the use of a single burner. By implementing targeted solutions, including enhanced training programs and the addition of a second burner, the overhaul time was successfully reduced from 60 hours to 50 hours, representing a 17% increase in efficiency. The findings highlight the effectiveness of the Seven Tools method, particularly the fishbone diagram and the 5W+1H approach, in diagnosing and addressing operational challenges. This structured approach not only facilitated the identification of root causes but also provided a clear framework for developing actionable solutions. Overall, the research demonstrates that continuous improvement practices, when systematically applied, can lead to substantial enhancements in operational efficiency and productivity. The successful implementation of these solutions at PT XYZ serves as a valuable case study for other manufacturing organizations facing similar challenges, reinforcing the importance of investing in employee training and process optimization to maintain competitiveness in the industry.

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