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# Lowering Lost Glass with the PDCA Method at PT XYZ

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**Abstract**
PT XYZ is a glass manufacturing company with a production efficiency target of 83%. However, the high level of glass loss, especially in the IS Forming process in the C2.4 production line, hindered the achievement of this target. By using the PDCA (Plan, Do, Check, Action) method, this study aims to reduce glass loss caused by the Invert-Revert Center Line Problem. Remedial measures include root cause analysis, resetting technical parameters, and implementing specific solutions such as dummy settings, plunger timing settings, and cooling pressure optimization. From this PDCA approach, there was a significant decrease in glass loss from 173.37 tons to 71.05 tons, or by 59%. This implementation not only improves production efficiency but also provides cost savings. This study shows that the PDCA approach is effective in identifying and solving production problems, so that it can be applied to similar cases in other industrial sectors.

**Keywords:** Loss Glass, PDCA, Invert-Revert Center Line Problem

## Introduction

Production efficiency is one of the key factors in the manufacturing industry to remain competitive, especially in the face of increasingly fierce global competition. PT XYZ, a company engaged in glass manufacturing, faces challenges in achieving the production efficiency target of 83% that has been set by the management. One of the main obstacles is the high level of glass loss that occurs in the C2.4 production line in the Forming IS process. Loss glass not only reduces production efficiency, but also has an impact on operational costs and the accuracy of delivery to customers. This problem is mainly caused by the Invert-Revert Center Line Problem, which triggers various types of product defects such as slug neck, check under ring, and short parison.

This study aims to reduce the level of glass loss through the application of the PDCA (Plan, Do, Check, Action) method. With this approach, it is hoped that a systematic solution can be found to improve the stability of the production process, reduce the level of glass loss, and ultimately improve operational efficiency at PT XYZ.

### PDCA (Plan, Do, Check, Action) Approach

PDCA is a management method introduced by W. Edwards Deming and is often known as the "Deming Cycle." This methodology is designed to improve quality and efficiency through a cyclical approach that includes planning, implementing, assessing, and implementing corrective actions. The four phases in PDCA are:

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1. Plan:
   Detect problems and determine their root causes by utilizing tools such as fishbone diagrams and historical data analysis.
2. Do:
   Implement solutions based on analysis results from the planning stage, including conducting small-scale trials to reduce risk.
3. Check:
   Observe and assess the effects of the implemented solutions by measuring performance parameters and conducting statistical analysis.
4. Action:
   Integrate successful improvements into operational procedures or work policies to ensure continuity of implementation. This method has proven effective in various industrial sectors, including in manufacturing, thanks to its systematic and repetitive nature in overcoming problems (Kondo & Nakanishi, 2019; Mulyadi & Lestari, 2021).

**Loss of Glass in the Glass Manufacturing Sector**

Glass losses are an important indicator that indicates the presence of inefficiencies in the glassmaking industry. Some of the causative factors include:

1. Errors in the technical process, such as incorrect parameter settings on the IS Forming machine.
2. Material factors, including the non-conformity of glass raw materials with established technical specifications.
3. Environmental conditions, e.g. unstable temperatures or pressures during the production stage.
   Research by Akao (2020) shows that glass loss reduction can be achieved by optimizing technical processes through a data-driven approach, such as applied in the PDCA method.

**Quality Approach in Manufacturing Process**

In the context of quality improvement in the glass industry, the Lean Manufacturing approach is often combined with the PDCA method to reduce waste and improve stability in the process (Hines & Rich, 2020). This strategy includes:

1. Process standardization: Ensuring consistent production results through clear operational guidelines.
2. Continuous monitoring: Implement a real-time monitoring system for early detection of anomalies in the process.

The success of this approach is evidenced in a study by Satria et al. (2024), where the reduction of waste has significantly succeeded in reducing production costs.

## Method

**Research Approach**

This study applies a descriptive quantitative approach by using the PDCA (Plan, Do, Check, Action) method as the main structure to identify, analyze, and overcome the problem of glass loss in the production process at PT XYZ. Data sources were obtained from daily production reports, interviews with operators, and direct observation during the study.

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**Stages of PDCA in Research**

1. Plan:
   a) Identify the root cause of glass loss using data analysis from the daily production report (March–May 2023).
   b) The main causes found include:
      - Absence of invert/revert center line setting parameters.
      - There is no standard plunger up time with a settle time.
      - Irregularity of the schedule of changing plungers and thimbles.
      - Plunger cooling pressure is not optimal.

2. Do:
   1. Implementation of designed solutions, such as:
      - Dummy neck ring arm fabrication to ensure proper level.
      - Setting of standard parameters of plunger timing.
      - Preparation of a routine change schedule for plungers and thimbles.
      - Plunger cooling pressure related settings and training.

3. Check:
   a) Monitoring and evaluation of improvement results based on daily production reports (July–August 2023).
   b) Data analysis was carried out by comparing the level of glass loss before and after the improvement using pareto charts and other statistics.

4. Action:
   a) Documentation of improvement results in the form of standard operating procedures (SOPs) to ensure the sustainability of implementation.
   b) Socialization of SOPs to all production teams and related operators.

**Data and Tools**

- Data Sources: Daily reports of production, live observations, and interviews with the operator team.
- Tools Used: Fishbone diagrams, pareto charts, scatter analysis, as well as tools such as dummy neck rings and pressure gauges.

**Location and Period of the Study**

The research was carried out on the C2.4 production line, PT XYZ, during the May–August 2023 period.

## Result and Discussion

**PDCA Implementation Results**

After the implementation of the designed improvement measures, there was a significant decrease in the level of glass loss that occurred in the IS Forming process in the C2.4 production line. Based on the daily production report, the loss of glass in the engine area fell

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from 173.38 tons (before repairs) to 71.05 tons (after repairs), which shows a decrease of about 59%. The details of the reduction of glass loss based on the type of defect are as follows:

- Slug Neck: Decreased from 63.83 tons to 10.25 tons.
- Check Under Ring: Decreased from 60.04 tons to 28.24 tons.
- Check Ring: Decreased from 28.44 tons to 21.99 tons.
- Short Parison: Decreased from 21.06 tons to 10.57 tons.

**Discussion**

This significant decline can be explained by the evaluation of the implementation of the solution carried out at each stage of the PDCA:

1. Plan:
   Careful root cause identification through data analysis makes it easy to design the right solution. Resetting the invert/revert center line and more precise timing setting of the plunger successfully reduce product defects caused by slug neck and short parison.
2. Do:
   The implementation of improvement measures, such as the manufacture of a dummy neck ring arm to ensure proper leveling and resetting of plunger cooling pressure, resulted in significant improvements. This solution successfully keeps the plunger temperature and pressure in optimal condition, which reduces the risk of slug neck.
3. Check:
   Monitoring carried out through daily data shows that the implemented solutions have an immediate positive impact. The evaluation of the data showed that all the parameters set successfully reduced glass loss, with more consistent results in each production cycle.
4. Action:
   Based on the evaluation carried out, the steps implemented are considered successful and have been documented in standard operating procedures (SOPs) to ensure the sustainability of future improvements. Thus, the results achieved show that the PDCA method is effective in overcoming the problem of glass loss and can be used as a model to increase efficiency in other production lines.

**Cost Savings**

In addition to increased efficiency, the implementation of these improvements also resulted in significant cost savings. With a decrease in glass loss of 102.32 tons, the company managed to save costs of IDR 90,686,000 in a two-month period. This shows that improvements not only have an impact on product quality, but also provide great economic benefits for the company.

## Conclusion

This study shows that the application of the PDCA (Plan, Do, Check, Action) method in PT XYZ has succeeded in reducing the level of glass loss that occurs in the IS Forming process in the C2.4 production line. With a careful analysis of the root cause of the problem, the implementation of structured remedial measures, and regular monitoring and evaluation, the company managed to reduce glass loss from 173.38 tons to 71.05 tons, or about 59%.

These results show that a systematic approach using PDCA can significantly improve production efficiency. In addition, this improvement also resulted in substantial cost savings, amounting to Rp90,686,000 for two months, which had a positive impact both in terms of quality and economy. The successful implementation of PDCA at PT XYZ also emphasizes the importance of documentation and standardization of procedures to ensure the continuity of future improvements. Therefore, this method can be used as an improvement model that can be applied to other production lines in the company or even to similar industries.

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