Reduce Scrap for Kiefel Non-PVC

Author: Natalia Rivera Rivera
Advisor: Miriam Pabón, Ph.D., P.E.
Manufacturing Engineering

Abstract

The bag-making process is performed in different locations globally. IV Bags are used worldwide for various treatments. This project aims to reduce the scrap from the Non-PVC machine. This is the only one of ten department machines producing IV Bags. Because it is the machine with the highest scrap within the bag-making department, this project focuses on reducing the scrap from the Kiefel Non-PVC machine to contribute to the plant's scrap reduction of 2%.

Introduction

The scrap from the Kiefel Non-PVC machine is part of the manufacturing plant's most offending scrap metric. This Kiefel machine has the capacity to produce six different codes. Where each code has a different volume and port configuration. For this project, a specific code will be evaluated, as it has the highest production volume for the year. The machine manufactures the bags in 10-unit patterns for this code. However, it is capable of producing the bags in 8-unit patterns. In addition, it is the code with the highest economic impact on the machine, as it is the most expensive code produced on the machine. Therefore, the scrap from this machine directly affects the department's account. For this study, data was taken for six days in two shifts and different types of roll material. Due to the design of this study, the implementation actions apply to most of the machine codes. It is important to know that the manufacturing plant has different codes to identify discarded scrap units. Each defect has a classification, and in this way, it is possible to measure the major impact of defects for scrap. This machine represents 15% of the scrap in the department.

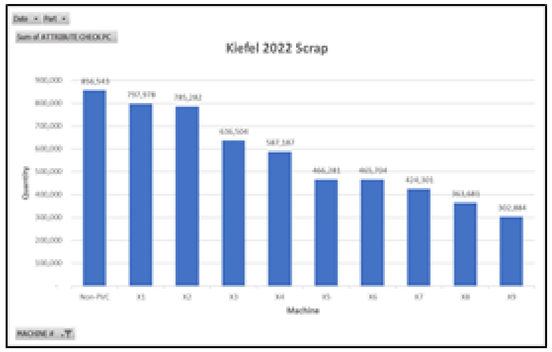
Background

Kiefel machines are used in the bag-making process in different plants globally. The machines are designed and manufactured in Germany, with automatic operation. These machines can operate to manufacture various types of bags; they can vary in size, material, and components and therefore differ in operating parameters. The plant has ten Kiefel machines; nine operate with PVC material, and one works with Non-PVC material. The Kiefel Non-PVC machine was designated for this project. The machine runs two shifts of 8 hours, Monday to Friday. The machine operates with one mechanic and three assemblers per shift. The mechanic is responsible for feeding the machine, making process tests, and solving any situation that the machine presents during the shift. The assemblers are responsible for visual inspection, defect categorization, process testing, production packaging, and documentation. The Kiefel Non-PVC machine represents 15.1% of the department's scrap by 2022.

Problem

In the Bag Making Department have one Non-PVC machine with a scrap of XX, a 33% of the scrap was of the unit with Non-defect found. With the implementation of this project, the goal is to reduce 50% of the defect Non-defect found. The actual gap is 16.5%. This project is to apport reducing 0.4% of the manufacturing plant target.

Methodology



The project methodology included data collection for 2022 to determine the focus of the project. The study was conducted over six days, with two shifts each day. It is essential to mention that every day that data was collected, the same personnel of mechanics and assemblers worked on the machine. This is intended to avoid the variable people in the study and thus consider only the machine and raw material factors. One characteristic of the material used in this machine to manufacture the bag is that the cuts of the vinyl rolls can have variations in tension. Since it is a non-PVC material, it tends to lose tension during the process. For these vinyl rolls, the manufacturer works with three roll cuts. It is very common that of the three cuts (cuts A, B and C), the most problematic is C. As part of the project, all three cuts were taken. Two-day manufacturing, two shifts each day with each roll cut. What is meant by three different vinyl roll cuts is that the vinyl fabricator is working with one giant roll that is divided into three. The center cut is cut A, and the corners are B and C. As mentioned, the cut categorized by the manufacturer as C is the problem that causes the most stress on the machine.

As part of the project methodology, a form was generated to document the data collected during the six days. Part of the project analysis was that the units discarded as scrap were to be kept for re-inspection by another assembler. This confirmed that the discard and inspection had been performed correctly. During manufacturing, assemblers are responsible for visual inspection and discarding of units with defects. Data collected over the six days included daily defect scrap, scrap caused by units automatically rejected by the machine, the number of good units produced during the shift, and a component scrap from the injection site. The re-inspection was a key part of the study analysis, as it confirmed that the defects categorized in the manufacturing process were indeed present. With the re-inspection, the factor of discarding miscategorized or non-categorized units was ruled out.

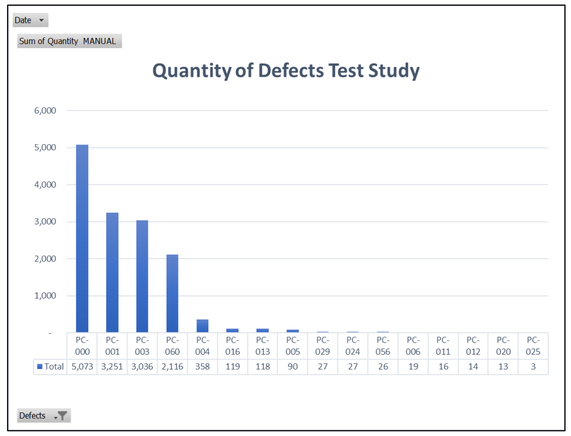
An important part of this project is that production during the six days of data collection was not halted by any consequence of the project. Instead, the machine operated normally, as usual.

Results and Discussion

After analyzing the data from the experimental runs, it was determined that the priority problem for a scrap of this Kiefel machine is the Non-defect found defect (PC-000). This means that they are units (bags) that have no defect and are being discarded and directly affecting a scrap of the machine and, therefore, the scrap of the manufacturing department.

From these results, a second offender for a scrap of this machine could also be determined. This is the excess skirt in the bag. As mentioned above, this raw material tends to cause tension problems in the different vinyl rolls. Therefore, this tension problem causes the excess skirt defect. This problem encountered under this project will be addressed under a new Project.

As a result of this project, we evaluated the possibility of working the one-up process for codes 246, 247, 248, and 249. This means that, instead of discarding a unit with no defect, under No Defect Found, this unit will be shipped and categorized to the customer as a single unit. Since the process currently in place allows units to be shipped in pairs or complete sets (eight or ten units). This will significantly reduce scrap. Because the most significant impact of this machine will be the defects not found, and, as this is declined, it will reduce scrap. As mentioned above, these units discarded as Non-defect found are the units which the unit next to it is affected by any other categorized defect. The scrap is reduced slightly by having the possibility of two-up (cutting the pattern in two and discarding the units with defects).



Each bag manufactured for this code, high runner, costs $0.4080. The production per year for this code is approximately 5,060,044 (based on 2022 data), where the machine scrap for this code was 361, 655 units, and the scrap for the Non-defect found defect is 1.91% on the year. This means that with the implementation of this project, the machine scrap for Non-defect found will be reduced by 50%. This machine ran four codes for the client in 2022. The other code has a different cost per bag. For code 246, the cost is $0.3682. For code 248, the cost is $0.5334, and for code 249, the cost is $0.5252. The projection for the 2023 year is to make 11,666,925 bags on this machine Non-PVC. For the year 2023 and its production volume with the implementation of one up to reduce 50% of Non-defect found, the estimated savings are $56,734.03. Thus, considering all codes of manufacturing previously mentioned.

Conclusions

After analyzing all the data collected for this project, it is determined that the scrap from the Kiefel Non-PVC machine directly impacts the department's scrap and, therefore, the manufacturing plant's scrap metrics. With the implementation of this project, the plant will significantly improve the scrap of this machine. It should be noted that this project will affect one machine and four manufacturing codes. Therefore, its savings will be more significant at the departmental than at the manufacturing plant level. In addition, with this project, we were able to identify a second offender for the rejection of this machine. This will be worked on in a future project: an excess skirt in the bag. This will also contribute to a percentage of the plant's metrics. As of June 2023, the one-up process will be implemented, and the savings from this project can be measured. With this savings data, we can present it as a significant scrap reduction improvement project and claim its saving as a process improvement project.

Future Work

The future work of this project is to measure the saving of the project and see the results of this implementation. Also, with this project, they can identify a second top offender. The defect of the Excess Skirt is because is the second top offender of the scrap for this machine. The team work on the new project on July 2023.

Acknowledgements

University Advisor: Miriam Pabón
Manufacturing Plant Advisor: Xaira Rolón
Reviewer: Joann Casillas

References

[1] TPM reloaded: Total productive maintenance, Joel Levitt, New York, 2010.

[2] MMP 6000: Advanced Statistics and Quality Improvement; Completely Randomized Single Factor Design, Miriam Pabón González, Ph.D., P.E., Puerto Rico, 2022.

[3] The practical application of the process capability study: evolving from product control to process control, Douglas B. Relyea, New York, 2011.