

Industrial Wash Six Sigma

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 Client: Parker Hannifin Accumulator and Cooler Division

Mechanical Engineering



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Abstract

The team is working with Parker Hannifin Accumulator to perform statistical analysis and experimentation on the client's parts wash system to identify variation and sources of defects. Parker Hannifin has a large planned capital expenditure, an automated paint robot, being installed on the paint line in April 2021. To validate this expenditure, the client needs the parts wash station, which precedes the paint line, to contribute a minimal amount of variation and defects to the post-fabrication process, so that statistical analysis can be done on the paint line without other factors being variable.

Introduction

Parker Hannifin Accumulator and Cooler division is a subsection of Parker Hannifin,. The team was tasked with designing experiments to isolate variables in the system to find the sources of variation in the system and analyze that data to drive continuous improvement solutions that brings control to the process and maintains the optimum specifications to ensure a proper paint application.

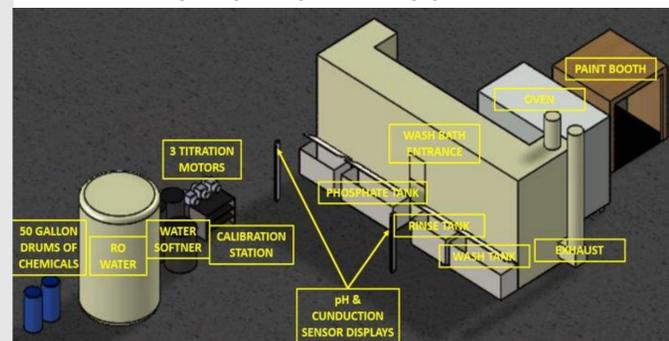


Figure 1: CAD layout of wash system

Design of Experiments

The wash system consists of an industrial detergent bath, a phosphate bath, and two rinse bathes.



Figure 2: Test Plate experimental setup

Experiment #1: Optimal Bath Concentrations:

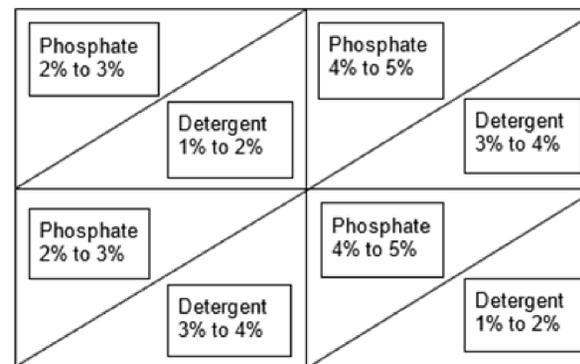


Figure 3: 2x2 Experimentation used in Experiment #1 to alter concentration

Experiment #2: Effects of Line Stoppages

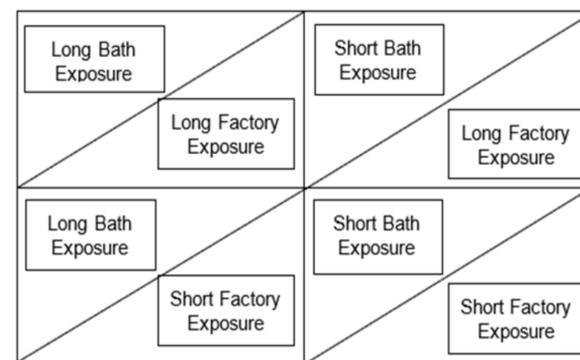


Figure 4: 2x2 Experimentation used in Experiment #2 to alter exposure times

Results

Determination of Root Causes through Minitab.

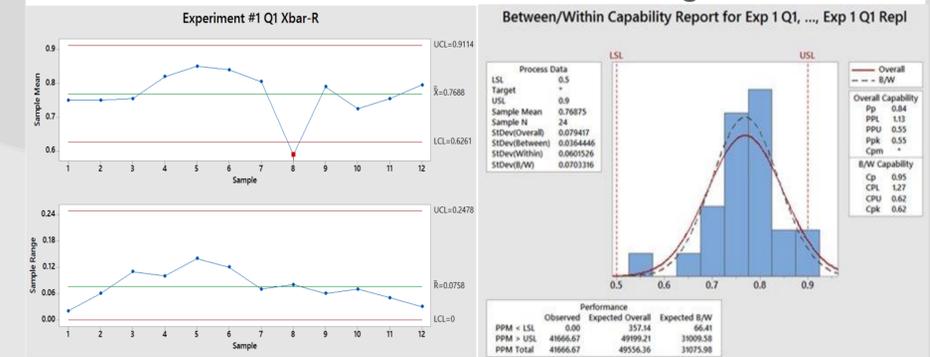


Figure 5: Example Xbar-R Chart and Capability Analysis

Conclusions

From the experimental results and a PFMEA analysis, the team identified the paint, aged soap bath, nozzles, line stoppages, and oven temperatures as root causes. Evaluating the paint, adjusting the concentration level of the detergent bath, adding/unclogging nozzles, preventing unnecessary line stoppages, and further testing the oven will ensure system stability.

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