QUALIFICATION OF A NEW GLASS BOTTLE WITH E&J GALLO WINERY

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Abstract

Qualification of a new glass bottle with E&J Gallo Winery
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This paper will further examine the procedures involved in transitioning to a new bottle type made by Glass Company B, on a specific bottling line within E&J Gallo's bottling facility. For this project Bottling Line X will require thorough testing as well as the creation of a changeover choreography plan. The testing procedure will follow a 3 phase process utilizing project management and statistical skills to ensure quality standards are upheld with the transition. Since Bottling Line X is not familiar with transitioning between bottle types, lean manufacturing techniques will be required to create a changeover document ensuring operators are able to successfully change between bottle types with little inconvenience or assistance from mechanics.

The completion of this project proved Bottling Line X to be partially capable of upholding quality standards while running the new bottle design. Of the two label types tested with the new bottle one is now qualified to run on Bottling Line X. The label type unable to run on Line X will be transitioned to Bottling Line Y, which currently runs the new bottle design with this label type. While conducting tests, procedures and settings were documented and altered to generate a step by step changeover procedure. With the conclusion of testing and changeover documentation the original estimate of two hours for a changeover was reduced to a forty-five minute requiring no additional assistance from mechanics.

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Introduction

Being one of the largest beverage distributors, E&J Gallo created Gallo Glass with the purpose of monopolizing on a major contributor to their industry. Over the past few years Gallo has substantially increased to the point where Gallo Glass can no longer support their full needs. To add to this Gallo Glass will be undergoing a reconstruction of one of their furnaces, forcing Gallo to outsource a specific bottle design to another company.

The purpose of this report is to convey the process taken in bringing in a new glass type to the Gallo bottling facility. This process includes the qualification of the new glass type on all bottling line equipment and the creation and design of a new changeover process for the operating team on Bottling Line X. The success of this project will require the use of the overlapping roles of a Project Manager and a Packaging Engineer. Using key project management techniques, tasks will be completed through the effective communication between any parties involved. Punch list items will be created, assigned, and completed through the collaboration of all team members and stakeholders. The Packaging Engineering role will ensure a reasonably smooth transition for the machinery and operators involved in moving the new glass to the Bottling Line X.

The following sections include further details into the process of implementing a new glass change to Bottling Line X, as well as creating a changeover document. These sections will elaborate on the choices, practices, and outcomes resulting from this project.

Background

Early last year Gallo Glass became aware of a growing concern relating to their glass supply. With the reconstruction of a furnace Gallo Glass would not be able to meet the demands of E&J Gallo's production facility for a certain bottle type. In order to resolve this problem, Gallo decided to outsource the soon to be scarce bottle type. Glass Company B was chosen as a client due to their current production of a bottle similar to Gallo Glass' bottle design. Line X only runs the glass bottle being transitioned out, therefore it is important to verify the functionality of the new glass on this production line

Since Gallo has been using Gallo Glass for so long many processes have been put in place in regards to how the glass is handled. These standards range from how glass is brought into the facility to how glass runs through the different machines on the bottling line. Two specific challenges created in the transition from Gallo Glass to Glass Company B are specifically related to these two types of standards. Since both glass types are being provided by different companies, the way in which the bottles are brought into the facility differs greatly. Also, the dimensions of Glass Company B's bottle are slightly different than what is currently run on the bottling line in the Gallo production facility. With these differences the implementation must be examined carefully in order for a successful change.

Specific processes needing to be examined include; mechanical adjustments, updating of settings on bottling machines, and changeover choreography for line operators. In order to create and implement a solution to these potential changes, coordination between all

stakeholders must occur. Most of the processes needing alteration will require the support of all employees directly related to the bottling line; this includes working with Team Leads, Operators, Mechanics, and Contractors. Coinciding with the support needed by these team members this project will also require coordination with those involved in the production planning and quality assurance aspect of the business.

Dimensional Differences

Since Gallo could not have their current bottle designs replicated the bottle chosen resembled many dimensions found in a current bottle produced by Gallo Glass. In regards to bottle design the absence of a label panel created the major difference separating Gallo Glass and Glass Company B. Gallo Glass created a label panel to account for the large amounts of backup pressure on the bottling lines within Gallo's bottling facility. The label panel provides a slight curve to the main portion on the body of the bottle. This curve allows for protection of the label as bottles move down the conveyers as well as when they are transported in cases. With the absence of a label panel not only will the diameter of the bottle be different but production must be checked throughout all steps in the packaging process to ensure quality is upheld.

Problem Statements and Deliverables

This paper will address two difficulties in achieving a successful transition from Gallo Glass to Glass Company B. First, quality cannot be ensured when using the current machinery and settings on Bottling Line X with the new glass model made by Glass Company B. Second, operators on Bottling Line X have no experience or instruction in completing a changeover process between bottle types for this line.

A major concern in proceeding with this project is that Line X will prove to be incapable of meeting the quality standards while running the new bottle. Currently bottling Line Y is capable of running the new bottle design with one specific label type. If Bottling Line X is unable to transition to the new glass, packages being transitioned to Glass Company B's bottle design will need to transition to Bottling Line Y. As a result further testing must be completed to ensure a second label type can be used with the new bottle design on Bottling Line Y.

The deliverables of this project are broken up based on the two types of problems being addressed.

Qualification of Glass Company B's new Bottle Design

In order to bring a new bottle design into Gallo's bottling facility a qualification process must take place. Within this process machine settings must be tested in order to gain specific settings relating to the new bottle design. Once these settings are collected, tests must be run to ensure quality of the products being produced meet standards set throughout the bottling room. If needed a justification must be made in regards to the purchasing of new parts. This decision is analyzed when documenting the capabilities of the current machines on the bottling line.

Creating a Changeover Process

The second deliverable needed due to the new partnership between Gallo and Glass Company B, is a changeover process to be followed by the operating team on Bottling Line X. This document must also be prepared in a way allowing for the possibility of its implementation on

other lines with other operating teams. While tests are being completed with the new glass, processes will be documented and analyzed. Using this information a standard operating procedure will be created and documented.

As a result of this project and the support of those involved, the bottling lines affected in the proposed change will gain the ability to run at their normal pace with little to no new inconvenience to operators and mechanics. The changeover process created will ensure bottling lines have the capability of running with little to no error. This process will include helpful guides to ensure the repeatability of settings as well as an organization of tools for efficient use.

Process for Completion

In looking into the different bottling lines at Gallo there are existing problems within the bottling room. In the process of bringing a new glass type to the bottling room many of these existing problems became more evident on the lines affected by the change. This project will look into these issues in order to find a resolution to them, but the closure of the project will not depend on the resolution of the existing problems found. The process for the completion of this project will include line testing, as well as coordination between operators, line team members, mechanics, and other stakeholders, all of which will be explained in more detail within the following sections.

Literature Review

Presented through the following literature review is a compilation of knowledge associated with the understanding, completion, and analysis of the present report. The following articles presented in this review further examine key manufacturing systems that have greatly impacted manufacturing industries over time.

“How to make American manufacturing competitive again in the world market has become a very popular topic in the media recently” (Duncan, 1988).

This quote written by William Duncan in 1988 is still relevant today, as product variety continues to increase, industries are experiencing competitive pressures from every angle. To maintain a competitive edge, companies engaged in manufacturing products face the difficulty of reducing costs and improving their quality levels (Hernandez, 1990). In order for a company to succeed among the rest, there is a high demand to maximize throughput and gain a substantial advantage over fellow competitors. One way to accomplish these goals is to reduce the labor and material cost required to build the product (Hernandez, 1990). In order to achieve this competitive advantage, many notable manufacturing systems have been created to give industries the organization they need to succeed.

Dating back to the mid 1890s the movement towards an ideal industry began. Frederick W. Taylor began this process by looking at individual workers and their work methods, focusing on

the ideas of standardized work. Frank and Lillian Gilberth expanded Taylor's ideas to incorporate concepts of non-value added work and psychological effects of workers on different processes. Moving to the 1900s, Henry Ford introduced his continuous system for manufacturing through the Ford Motor Company, again revolutionizing the movement towards an ideal industry. In observing Ford's successful approach to manufacturing, Taichii Ohno and Shigeo Shingo strived to continuously improve previous work by conceptualizing the ideas of Lean Manufacturing and Just-In-Time systems through the Toyota Production System (Sun, 2011). The work of these individuals has laid the foundation for all succeeding industries dating back to the creation of the Ford Motor Company and the Toyota Production System.

Lean Manufacturing

Lean manufacturing encompasses all the activities needed by industries to accomplish their goals of shorter lead times, lower defect rates, less inventory, and a flexible work force (Sun, 2011). Most organizations pursue lean in response to their need to fundamentally improve business competitiveness by reducing costs, while increasing quality and responsiveness to customer needs (e.g., delivery time). These business competitiveness needs can manifest through increase in direct global competition or from evolving customer or supply chain expectations (Sun, 2011).

Toyota Production System

As previously mentioned, the perfection of the best manufacturing processes has been on the minds of many industries for many years. Most notable of these processes is the Toyota Production System created by Taichii Ohno and Shigeo Shingo. Over the past few decades, the

Toyota Production System has laid the groundwork for other competing manufacturing organizations based on the scientific approach of continually asking why until the real causes of problems are found (Ohno, 1988). The iconic Toyota Production system not only introduced ideas of single minute exchange dies (SMED) and just in time processes (JIT), but also led way to other manufacturing process innovations and new ways of thinking.

Underlying Concepts

The Japanese define waste as anything other than the minimum amount of equipment, material, parts, space and worker's time which are absolutely essential in producing the product (Duncan, 1988). Accompanying JIT and SMED, another underlying concept in the Toyota Production System is the complete analysis of waste. In order to accomplish this, concepts of pull systems and check systems are incorporated into every aspect of the system.

Pull Systems:

There are two types of manufacturing systems: push and pull. Within a push system materials are pushed through the system based on supply, while demand will pull materials through a system (Hernandez, 1990). By combining the best features of both systems, a company can implement an effective Just-In-Time system that will plan, forecast, and control the materials requirements in the factory (Hernandez, 1990).

Characteristics of a Pull system also tie in principles of continuous and synchronized flow within an industry. In a continuous flow factory, the assembly area is like the ocean. As parts are

consumed, assembly must be replenished, so internal and external suppliers are signaled to produce new parts (Guerindon, 1995). This idea of flow within an industry implies resources are used with high efficiency, little effort, and minimal waste.

Check Systems:

There are two types of check systems incorporated within the Toyota Production System; standard work sheets and "Poka Toke". Standard work sheets act as a visual check to ensure a process is completed the same way by everyone, reducing variation and complexity from operations. Poka Toke is a Japanese term referring to assembly procedures being "foolproof" due to operators checking previous work as well as their own (Guerindon, 1995).

Single Minute Exchange Die (SMED)

"The SMED system is a process of systematic machine setup analysis that clearly distinguishes every step in order to introduce timesaving changes. The goal of SMED is to increase the productivity of machines by reducing their idle time and to reduce machine setup from hours to minutes" (Hernandez, 1990).

The techniques applied within the SMED process include three stages. To start the process, internal and external setups must be defined. After the defining stage has been completed, the next task is to convert as many setups from being internal to external. Once these two tasks are completed, the final stage focuses on streamlining all aspects included in these setups to greatly reduce the time needed to complete the final setup.

Internal setups consist of tasks that can be accomplished while a machine is not operating; likewise, external setups consist of tasks that can be accomplished while a machine is operating. For instance, an operator is able to gather all change parts but will be unable to install these parts until the machine has completed operating. As described in Shingeo Shingo's book, A Revolution in Manufacturing: The SMED System, the revelation of the distinction between internal and external setups occurred while observing Toyo Kogyo's Mazda plant. During this time Shingo watched as a worker spent over an hour trying to find missing pieces needed to change over a certain machine. After watching a substantial amount of time wasted in setting up the machine, it was clear that this process could easily be avoided. From this point, Shingo formed the realization that preparing outside operations could be completed congruently with the machine running (Shingo 1985).

Just-In-Time (JIT)

Unlike SMED, JIT is more of an influential concept rather than a procedure. There are three underlying principles of JIT: ongoing continuous improvements, synchronization or balance of production allowing productions to occur at common rates, and finally simplicity of procedures through the use of fewer resources (Duncan, 1988). The incorporation of these principles will give way to a continual improvement within any industry. Companies which have embarked on JIT have rarely attained all they wish to do, but they are much better off than if they had decided not to try it at all (Duncan, 1988).

Theory of Constraints (TOC)

Theory of constraint (TOC) also presents another system used to increase throughput and flow through an industry's production cycle. Although not as popularized, this theory presents parallel discussion to Just-In-Time principles, bringing another approach to the issue. Dr. Eliyahi Godratt introduced the idea of TOC in 1984; today the methodology now comprises three main streams that can be considered as operations strategy tools, performance measurement systems, and thinking process (TP) tools (Kim et al., 2008).

"The theory of constraints views manufacturing processes/organizations as "chains" wherein the entire system is only as strong as its weakest link" (Pegels, 2005).

The simplified explanation of the goal of the TOC is to identify the bottleneck operations within an industry and then proceed to remove the bottleneck characteristics of the operation (Pegels, 2005).

David Cook presents the advantages of TOC over JIT through his article "A Simulation comparison of tradition, JIT, and TOC manufacturing systems in a flow shop with bottlenecks." Through simulation, Cook concluded TOC outperforms JIT in three main ways: TOC produces a larger amount of product compared to that of JIT, TOC produces goods with a lower standard deviation of flow time, and TOC requires less inventory (Cook 1994). Although TOC is no longer in the forefront it continues to be actively used in industry because of its considerable potential to: identify throughput problems; serve as a guide to correct the throughput problems; and generate considerable improvements in productivity and efficiency (Pegels, 2005).

Standardization

Both Shingo and Ohno state the importance of creating and using standard work through their writings on the Toyota Production System. For a production person to be able to write a standard work sheet that other workers can understand, he or she must be convinced of its importance (Ohno 1988). Encompassing the same principles of Lean manufacturing and the Toyota Production System, standardization is an important tool in reducing waste within a company. Standard processes allow for greater accuracy and the reduction of duplicated or unnecessary efforts (Claunch, 1996).

Have the operators, manufacturing engineers and supervisors develop a standard method to be followed by all employees during setups to ensure consistency and reduce duplication of effort (Claunch, 1996). In order to guarantee standardization is implemented across a facility, standard work documents should be put in place. These documents include step-by-step information on machine settings, standard methodology, and standard procedures needed to complete an operation. Standardization reduces the number of tools required, and those that are still needed are organized more functionally (Shingo, 1985).

Changeover Process

"Setup/changeover time is defined as all of the elapsed time from production of the last good piece on the old setup until the production of the first good piece on the new setup" (Duncan, 1988).

To maintain the competitive advantage mentioned before, it is highly important for industries to meet customer demands by having the ability to change between production runs as efficiently as possible. In manufacturing environments, waste may appear in many forms, including… setup and changeover times (Duncan, 1988). Over time, the concept of efficiently setting up and changing over machines has been impacted by both the Toyota Production System's Just-In-Time and Single Minute Exchange Die Systems as well as Lean Manufacturing methodology.

There are two key factors in ensuring a successful reduction in setup and changeover times. First, it is important to have all members of a team on board and on the same page, ready for a change to be created and implemented. Second is streamlining all the aspects of the setup and changeover operation.

Organizing the Team

"Implementing a new philosophy is like changing a lifestyle. Top management must be thoroughly committed to implementing the philosophy, the workforce must be educated in the new philosophy, and there must be a corporate willingness to change" (Cook 1994).

Improvements to changeover processes may occur on a daily basis, but in order for the changes to be used regularly by all teams, coordination between the shop floor and top management must be implemented (Mileham et al., 1999). In the novel Set-Up Time Reduction, Jerry Claunch brings up the concept of having steering committees. The purpose of these committees is to grasp the vision for change, establish team charters, staff team members, hold

monthly reviews, and give recognition. Claunch also discusses the importance of getting employees from all levels to work together, drawing on their past experiences, and implementing change that helps everyone (Claunch, 1996).

The Changeover

"The rate at which change occurs is as important as change itself" (Claunch, 1996).

Changeover reduction initiatives have been used in industry for more than a decade. Many researchers and consultants have worked in this area and the majority, including Shingo (1985), have recommended an implementation strategy based mainly on organizational improvement, (widely known as Shingo's "SMED" or single minute exchange of dies system) (Mileham et al., 1999). In looking back at Shingo's novel, the third stage of the SMED process is to streamline all aspects of the setup operation. In order to accomplish this stage, the following tasks may be completed: improving storage and transportation of dies, etc.; implementing parallel operations; using functional clamps; eliminating adjustments, least common multiple system, mechanization (Shingo 1985).

Design and Methodology

Due to the differences in packaging and dimensions, Gallo requires the new glass to go through a thorough testing process to ensure its ability to run through the machinery on the bottling lines. The completion of this project will follow the three phase testing procedure designed by

the Packaging Engineer assigned to the project. These three phases will accomplish the following tasks:

- Troubleshooting of all potential problems through the coordination of team leads, mechanics, and operators.
- Statistical analysis and comparison of baseline quality compared to the quality produced with the new glass type.
- The creation of a changeover document using the insights of operators, mechanics, and team leads to gain an understanding of the steps involved in the changeover process.

Testing Process at E&J Gallo

The Packaging Systems Engineering group at Gallo is responsible for the qualification of new packages at the facility. This group works with all of the materials used to bring a product to the shelves; from the glass bottle to the carton the bottles are shipped out in. In qualifying a new glass supplier all forms of testing are required to ensure a successful transition. There were many package redesigns due to the glass change, since the bottle being brought in does not match the exact dimensions of what is currently run in the facility. Material items needing to be changed include; Cartons, Partitions, and Capsules. Due to these material changes, mechanical adjustments must be made to account for the new materials.

To ensure a successful transition, a three phase testing process is followed:

Phase 1: Informative and planning phase

Phase 2: Testing phase

Phase 3: Production phase

In each of these phases certain protocols are followed to ensure all those needed are included and informed.

Phase 1: The Informative Phase

Once a project concerning any packaging changes moves past the idea stage it is brought to the Packaging Systems Engineering group, where an individual will become the manager of the project. During this time it is the role of the engineer to put together all the driving forces and background information needed to communicate this project to fellow groups within the facility, also known as the PMQ (Packaging Materials Qualification) Stakeholders. This stakeholders group is made up of lead members of the different business units within the facility. The presentation to the different business units includes a background and scope of the project, and a test plan defining a timeline for what needs to be accomplished. The test plan will include specific areas of concern relating to the project, a detailed description of what machinery tests must be accomplished, and finally the defining success criteria for the project.

Phase 2: Testing

After stakeholders give their approval on the proposed project details, testing begins. Depending on the complexity of the package redesign multiple water tests can take place. At this time key members of the line team are brought together to expand upon the existing test

plan. The Packaging Engineer will proceed to create a schedule detailing the execution of when and how events will take place on the day of the test. This schedule will identify what settings need to be collected on which machines, what types of audits will take place, and call attention to any foreseen concerns on the bottling line.

Mechanics and line team members are a crucial contribution during the time before the test and through its completion. During the test these people along with the Packaging Engineer are responsible for documenting all events that take place during the test. Once a test is completed this group of individuals will analyze the new knowledge gained from the test. If another test is scheduled, preparations will be made to prepare the line for future changes. If a test has the potential to move to production this team will discuss what is needed for a successful transition.

Results and proposed changes are also presented to the different business units to verify the progress of the project is in line with their goals for the company. This presentation will include results on quality outcomes as well as how any set backs were rectified. If the project needs more time to work out uncertainties another water test will take place. If the line team and business units feel the quality of water test products have met their standards and all potential issues have been addressed, the project will move to production.

If a project is moving from water testing to production it is important to discuss any special circumstances needed for the initial run. These special circumstances could include; additional

set up time, ramp up production rates, or additional support such as mechanics to oversee setting changes. The coordination of these needs will take place during the stakeholders meeting.

Phase 3: The Production Run

When all testing has been completed and all stakeholders involved are prepared to accept the implications of the new project testing moves into a full production run. The phase three of a project is meant to ensure all modifications made during the water tests are capable of withstanding full production runs. Since these runs are substantially larger than water tests the bottling will run at faster speeds for a longer amount of time, usually over multiple shifts. With these new factors it is important to ensure the success seen during the water tests is apparent while running real product. As previously stated certain measures can be taken to ensure this success. In most cases the time allotted for the production run will include extra time to set up the line, call out the need for extra mechanical support, and include a ramp up of production rates (the bottling line will slowly increase in speed as it progresses through shifts).

The first production run will generally follow the same format as a water test. The same group of people will be on the line documenting the events. The Packaging Engineer will monitor all or most of the products and conduct audits to ensure quality levels are being upheld, as well as recording final settings, and monitoring all modifications. For larger scale projects multiple production runs will be monitored ensuring not only the bottling line is running as expected but to also ensure the bottling line is capable of changing in and out of the new bottling settings.

After monitoring the production runs and conducting audits on quality, the final report out is given to the stakeholders. At this point the presentation acts as a hand off between engineering support and bottling line team leads. The final modifications are presented and the expected quality standard is created. From this point on all stakeholders are able to implement this project into their daily procedures and the bottling line team is now capable of running the new package when it appears on the schedule.

Project Management

With all phases of testing project management techniques were utilized to ensure the progress of the project remained on track and all deliverables were met. The timeline of this project followed a traditional five phase approach. After the project was initiated, test were planned and designed to ensure all foreseen concerns were addressed. Once the test plans were created the water tests were executed. Bottling Line X was then monitored during and after the water tests prior to wrapping the project up with a successful transition and changeover documentation. The goals and objectives of this project were reached by gaining the support of line team members, contractors, and mechanics. By engaging these groups as well as well as other business units involved in the projects execution, a all deliverables were achieved.

Results

The timeline for the completion of this project transpired over a three month period, beginning in late August of 2013. Ideally it was projected this project would require two water test

followed by a close watch on the initial production runs of the brands transitioning into the new glass. The initial water test took place September 10th 2013 and was approved by September 25th. Following this the second water test took place on October 1st 2013 and presented out on October 9th. The production run of products began on November 1st 2013 and carried through November 18th 2013. Finally the project was completed and moved past engineering on November 27th. The following sections will detail the events from the initial project formation to its final hand off from engineering.

Phase 1 Test Plan

Project Background for Glass Company B:

Gallo Glass, which is Gallo's main glass supplier will be shutting down and renovating one of their furnaces. With this renovation Gallo Glass will not be able to meet Gallo's demand for a certain glass bottle type. Gallo decided to move their business to Glass Company B due to their quality products and reliable service. The proposal of this project is to expand the use of Glass Company B's products to Line X. Since line X is one of the few lines in the bottling room that does not perform a full line changeover, the new glass will not only affect machinery but will also impact all those who work on the bottling line.

Potential Concerns:

In moving through with the test plan there are many potential concerns with the transition of glass types. These concerns are associated with dimensions in the bottle deign, the quality and packaging of incoming goods, and the implementation of a new process for the effected line.

Dimensional Concerns:

- No label panel and effects on label types
- Use of a 68mm capsule (new to line machinery)
- All machinery has the potential of needing new settings and possibly change parts

Incoming Good Concerns:

- Pallets packaged on wooden pallets and cardboard tear sheets instead of the traditional plastic pallets and tear sheets
- Both new pallets and new tear sheets must be stored separate from current pallets and tear sheets therefore there must be a new designated area for waste

Current Procedure Concerns:

- Line X does not change between products
- A changeover process must be created and documented for Line X and operators must be trained
- New settings need to be easily repeatable

Test Plan:

Two water tests will be needed in order to examine the quality of Pressure Sensitive front/ Cold Glue back labels (PS/CG) labels as well as Cold Glue front/ Cold Glue back (CG/CG).

In response to Dimensional concerns multiple measures will take place:

- 68mm capsules will be tested to ensure the machinery is capable of running the new length
- A rinser validation will take place to ensure sanitary conditions are not obstructed by the new design
- All other settings will be collected on remaining machinery to give a starting point for the following tests
- Samples of bottles will be collected at key points on the line to check for label quality

In response to concerns relating to the change in incoming material the follow measures will take place:

- Depaletizer vendors and line mechanics will be stationed at the Depaletizer to ensure all mechanical and electrical adjustments are made allowing the machinery to handle the new bottle
- An area designated for the new waste and signs have been created

All settings and procedure changes will be documented and communicated out to the line team and other Stakeholders to ensure their inclusion in future testing. The second water test will implement these changes as well as improve upon them. During the second test the same amount of support will be expected to ensure any problems are resolved. Following the completion of the second test procedures will be documented and made available for their implantation during future production runs.

For both PS/CG and CG/CG testing a visual label and capsule audit will take place in the Packaging lab. The label audit will consist of a complete visual examination of bubbles, tears, pushes, wrinkles, and flags. Capsules will be examined in the Packaging Lab for fisheye and under shrink defects.

Phase 2 Testing

Water Test 1:

The first water test was completed in hopes of qualifying Glass Company B's glass model on Bottling Line X while also ensuring the quality of Pressure Sensitive front/ Cold Glue back labels on the glass. Key areas of focus included the depaletizer, rinser validation, capsule quality, and finally label quality.

Depaletizer:

Figure 1

Figure 2

Since the new glass was packaged differently new areas were designated to ensure the waste materials were staged properly. Figures 1 and 2 show the new areas which clearly call out how and where the materials should be placed. A majority of time during the test was spent on creating the adjustments for the depaletizer. Mechanical and programming settings were created and documented. During the next test these settings will be repeated and fine tuned. This machinery will need the most attention in creating Line X's changeover document. In order to have an operator change over the machine instead of a

mechanic, procedures and tools will need to be modified due to safety. With the completion of this test, a blueprint for a specialized tool for operators to safely adjust hard to reach settings on the machine was created.

Rinser Validation:

Figure 3

Objective

To test the efficacy of the [redacted] Rinser on line X with respect to removal of glass, fiber, and insects from the [redacted] bottle type.

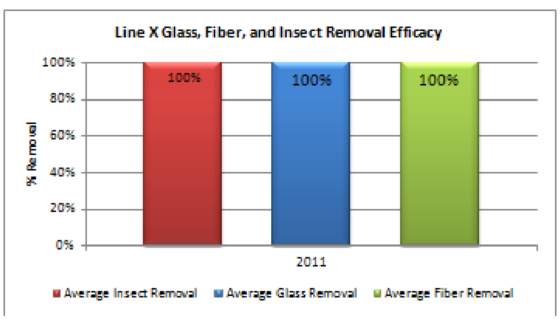
Overall Rinser Performance

Overall Score:	**100% Removal Glass** **100% Removal of Fiber** **100% Removal of Insects**

Seeding of Samples

1. Samples consist of 50 bottles seeded with glass pieces ranging in size from 3 to 15mm, fiber and insects.

3mm x 10 bottles	7mm x 10 bottles
10mm x 10 bottles	15mm x 10 bottles
Fiber x 5 bottles	Insects x 5 bottles



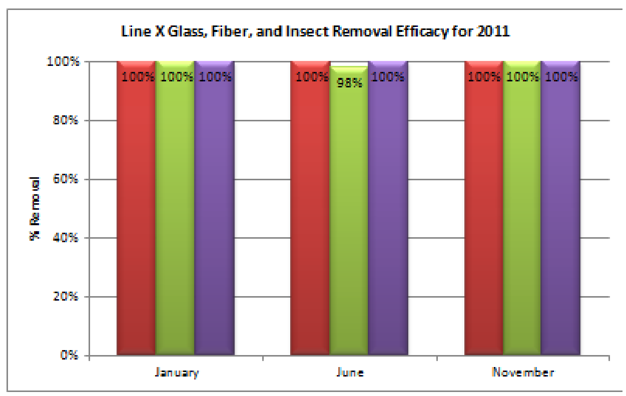
Comments:

1. One finding of 0.5 mm piece of glass in a 7mm seeded bottle.
2. Bottles per minute (BPM) was at 400.
3. Rinser Pressure was at 66 PSI.
4. Residual water had an average of 1.8 mL, minimum of 1.7 mL, and maximum of 1.9 mL.

Bottle Type:

Rinser

Rinser Performance History



Next Steps

- Line X [redacted] Rinser will be validated again in 2013.

As seen in Figure 3 Company B's glass type was able to successfully complete the rinsing processes. This completion verifies the rinser's ability to guarantee any glass, fiber, or insect material will be removed when the glass bottle moves through this section of the line. The line was capable of removing 100% of the material which meets the expectation of Gallo's standards as well as meeting the current capabilities of Line X while running previous products.

Capsules:

Currently all products run on Line X use a 65mm capsule with their bottles. With the transition in bottle types this standard must change. Due to a specific brands specifications the capsule length must be extended to ensure the fill height of the bottle is covered. During this water test the 68mm capsule was used and adjustments were made to test to capability of the machine in producing the same quality capsules. After running a few bottles it was apparent adjustments would be needed. A majority of the bottles were observed to have a defect classified as "undershrink". Since the capsule was longer the height of the heat tunnel on the capsular machine was lowered. Samples were then collected and analyzed further. The results of this audit were far from passing. As seen in Table 1 defects were seen in almost all of the bottles collected

Table 1

Test 1 Visual Capsule Audit of 68mm capsules(Sample Size = 60)			
Defect Level	Fisheyes	Undershrink	% of bottles with defects*
Minor	76.67 %	45.00%	81.67%
Major	8.33%	6.67%	8.33%
Critical	0.00%	0.00%	0.00%
*Bottles with undershrink defects also had the presence of fisheyes			

For this type of audit Minor, Major, and Critical defects are determined by the number and size of the defect. Resulting from this project the ambiguity in capsule auditing became apparent. Therefore all capsule audits done for this project were conducted by the same person in the same conditions each time. The two defects seen on the bottles included the undersrhinking and fisheyes.

Fisheyes: This type of defect occurs if water is present on the neck of the bottle when a capsule is placed on it.

Undershrinking: This type of defect occurs when the bottom of the capsule does not adhere to the entire neck of the bottle. This occurs when the heat tunnel on the capsular is unable to reach the bottom of the capsule.

In order to visualize how the line currently runs capsules, a baseline audit was completed on the current 65mm capsules running on the line with the older bottles type. These results, presented in Table 2 clearly show the line has an ongoing problem with the fisheye defect.

Table 2

Test 2 Baseline Visual Capsule Audit of 65mm capsules (Sample Size = 60)			
Defect Level	Fisheyes	Undershrink	% of bottles with defects
Minor	40.83 %	0.00%	40.83%
Major	17.50%	0.00%	17.50%
Critical	0.00%	0.00%	0.00%

After reviewing these results the line was examined further in order to find a solution to these problems. As mentioned previously the height of the heat tunnel on the capsular was lowered in order the account for the change in length of the capsules. Since this action did not solve the problem, further examination and research concluded the machine could increase in temperature without damaging the capsules. For the next test it was proposed the temperature of the machine should be increased by 50 degrees.

Since defects of fisheyes were apparent on both 65mm and 68mm capsules it was concluded that this defect was not caused by the change in length. In examining the line it was noticed that the cleanliness of the line might be a major contributor with this defect. Before entering the capsular the bottles go through a blower as they exit the filling machine. Over time the blowers tend to build up liquid especially when the line is moving at speeds over 300 bottles per minute. During the next test is was proposed the blowers be cleaned before the run in order to see if this build up of liquid was contributing to the amount of fisheyes.

Label Quality:

Table 3

Collection Plan	
Location	**Number of bottles collected**
North Labeler	60
South Labeler	60
Before the Packer (location where bottles were hitting one another)	60
Directly after being packed into a case	120
Warehouse (after being moved through facility – simulating transportation)	120
Total Collected	**420 Bottles**

In regards to quality, label examination was the most crucial audit completed during testing. Due to the lack of a label panel many were concerned with how the label would be placed on the bottle, how it would move through the line (in regards to hitting other bottles) and finally how the label would withstand being packed into cases and moved throughout the facility. Therefore in order to simulate the quality of labels for these different scenarios cases of bottles were collected at the different locations seen in Table 3.

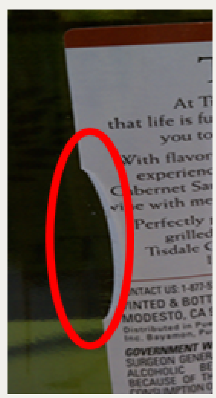
Tables 4 of the following page, displays the resulting visual label audit of the 420 bottles collected throughout the line. In comparison to the visual audit done on capsules there was a

greater distinction between the different defect levels. Minor defects are found to be below 3mm, Major range between 3mm and 6mm, and final Critical are greater than 6mm and are found on critical areas of the label such as bar codes. Examples of the some of the common defects can be found in Table 5.

Table 4

Test 1 Visual Label Audit Results for PS/ CG Labels (Sample size = 420)															
	Face Label							Back Label							% Defects
Defect Level	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	
Minor	0	6	0	0	3	0	0	2	1	0	0	2	3	2	4.52%
Major	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.24%
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%

Table 5

Defect Examples		
Bubbling	Scuffing	Pushing
		

To ensure the quality produced during the test was comparable to the current quality produced on Line X, a baseline set of data was collected from a previous product run on Line X. This data can be seen in Table 6 on the next page. In comparing the overall % defects between the two audits it is apparent the new bottle design was capable of running the PS front/ GC back labels with the new bottle design.

Table 6

Test 1 Baseline Visual Label Audit Results for PS/ CG Labels (Sample size = 120)														
	Face Label							Back Label						% Defects
Defect Level	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	
Minor	0	3	0	0	1	0	0	0	0	0	0	0	0	0	4.00%
Major	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.83%
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%

Recommendations:

The information collected and the recommendations decided on by both the line team and engineering support was proposed to the other stakeholders within the company. In this presentation specific attention was addressed towards the depaletizer adjustments, rinser validation results, capsule audit results, label audit results, and a proposal for a changeover process. All results regarding the rinser, capsular and labeler were accepted and concerns were addressed in regards to the depaletizer. As previously mentioned Line X does not have a standard procedure for changing between bottle types on the line. During the first water test all adjustments made to the depaletizer were not suitable for an operator to complete. Therefore when creating the changeover procedure there would need to be a high focus on gearing the adjustments to an operator as opposed to a mechanic. With these concerns being addressed, engineering support along with the other business units decided the results of the test proved satisfactory for the project to continue progressing forward. Following this meeting all open items created by the first water test will be resolved and ready to implement the changes for the second water test.

Water test 2:

Since PS/CG labels were approved after the initial testing, the second water test was meant to approve CG/CG labels, as well as implement recommendations from the previous test, and finalize a changeover process. The coordination of this test followed the same format as the first test, and the same team members were involved.

Depaletizer

Again more attention was addressed towards the depaletizer. For this test settings collected during test one were implemented and all procedures were documented to create an operator friendly changeover. The tool extension proposed during the initial test was implemented successfully; although mechanic assistance was still necessary to perform the changeover to ensure all settings were accurate. During this second test contractors from the machinery company were present to make adjustments to internal settings. Unexpectedly there were many controls issues during this second test. The profile initially set up for the new bottle began to have many glitches. These glitches involved all aspects of the machinery from bringing pallets from the first floor to the second, sweeping the glass off the pallets, and the placement of pallet frames and tear sheets once they were finished.

At the completion of the test most of these issues were resolved but this did create a concern for when the bottle would run again. Resulting from this test, the controls team at Gallo would investigate where the error occurred to ensure it would not be repeated. A new set of more accurate settings and procedures were documented.

Fill Heights

Since the tests were completed using water instead on wine, data on fill heights and capacities could not accurately be collected. In order to gain an estimate of the size of fill tubes that might be needed settings and fill lengths were tested. The results of this gave the impression that fill tubes would most likely need to be changed out when changing between the two bottle designs.

Capsule Quality

Results of test one proved the capabilty of the capsuler to be insufficent in applying the 68mm capsules. During the second test the heat tunnel on the capsular was lowered again and the temperature was increased. Based on the oponions of operators and mechanics on the line the quality of products being produced with these changes closeley resembled the quality they were used to seeing. Tables 7 and 8 display the resutls of test two capsules as well as the baseline used in the test one comparison. Again these results show a high level of fisheye defects, but the amount of undershrinking defects has drasticaly decreased.

Table 7

Test 2 Visual Capsule Audit of 68mm capsules (Sample Size = 120)			
Defect Level	Fisheyes	Undershrink	% of bottles with defects*
Minor	51.67 %	2.50%	51.67%
Major	34.17%	0.00%	34.17%
Critical	0.00%	0.00%	0.00%
*Bottles with undershrink defects also had the presence of fisheyes			

Table 8

Test 2 Baseline Visual Capsule Audit of 65mm capsules (Sample Size = 60)			
Defect Level	Fisheyes	Undershrink	% of bottles with defects
Minor	40.83 %	0.00%	40.83%
Major	17.50%	0.00%	17.50%
Critical	0.00%	0.00%	0.00%

Since these results were still not satisfactory, recommendations were presented to the other business units to gain an understanding of what direction they would like to proceed with.

Option 1: Approve 68mm capsules on Line X

Moving forward with this option meant all business units were accepting the higher rate of defects on the capsules. This also meant the fill heights on the bottles would be covered which was a high concern for the specific product line involved in this change.

Option 2: Not moving forward with 68mm Capsules

This option meant the line would continue to work on their current quality problems, and the new products would have a lesser defect rate. This also meant the products transitioning would no longer be able to cover the fill height of their bottles.

Decision

Resulting from the discussion between engineering and brand consultants, the decision to move forward with the 68mm capsules was chosen. This decision was based on the fact that and unacceptable amount of defects will be apparent on either size capsule. Although there

are slightly more defects on the 68mm capsule, the brands request can still be met in regards to fill height. This discussion also moved towards talk of understanding the causes resulting in such poor capsule quality. Other bottling lines were brought up at this time and it was apparent multiple issues have been seen across the facility. Therefore resulting from this discussion the potential of creating a specific project to improve capsules was suggested for future improvements.

Label Quality

CG/CG labels have a reputation across all lines to be more difficult in regards to upholding a desired quality. With PS/CG labels only one label deals with using a glue adhesive creating fewer problems in the long run. In going into this second test this risk was known and lower quality products were expected in comparison to test one, but capability with the new bottle still needed to be tested. Tables 9 through 11, display the visual audit results from the water test as well as a baseline to compare these results with.

As a result of the second water tests label defects proved to be very high, especially when comparing these results to current CG/CG label quality on the line. Since these results were so different a second baseline was taken. Within the facility Bottling Line Y currently runs the new bottle design with CG/CG labels. In comparing the two baselines, the second collected showed a much higher defect rate than seen on Line X.

Table 9

Test 2 Visual Label Audit Results for CG/ CG Labels (Sample size = 660)															
	Face Label							Back Label							% Defects
Defect Level	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	
Minor	0	8	0	3	4	5	2	0	1	0	1	4	11	0	5.91%
Major	0	0	1	0	0	1	0	0	0	13	0	0	2	0	2.58%
Critical	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.15%

Table 10

Test 2 Baseline2 Visual Label Audit Results for CG/ CG Labels (Sample size = 120)															
	Face Label							Back Label							% Defects
Defect Level	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	
Minor	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4.00%
Major	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%

Table 11

Test 2 Baseline1 Visual Label Audit Results for CG/ CG Labels (Sample size = 228)															
	Face Label							Back Label							% Defects
Defect Level	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	Tear	Scuff	Flag	Wrinkle	Bubbles	Horiz Push	Vert Push	
Minor	0	3	0	0	0	0	1	0	0	0	0	0	0	0	1.39%
Major	0	3	0	0	0	2	2	0	1	0	3	0	0	0	3.82%
Critical	0	0	0	0	0	0	2	0	1	0	0	0	0	0	1.04%

Based on these results recommendations to move forward with CG/CG labels were not approved. It was felt that introducing a new addition to the line expecting a low standard of quality would not be beneficial to Line X or the business as a whole. Since the current defect rate found on Line Y is higher than current products on Line X but is more closely related to the results seen during testing, the decision was made to move these products to this Line Y. This decision also initiated new projects to improve defects seen on Line Y in regards to the CG/CG package. Since PS/CG labels were approved in test one, the transition to Glass Company B will still move forward for these lables, but CG/CG labeled products will not be approved to move forward on Line X.

Changeover Procedure

With the completion of this test, a changeover choreography was created by engineering and the line team. This procedure took into account the time needed to transition all settings on the line to prepare for all mechanical and product changes. In addition to the choreography of the changeover, a standard work document was created to ensure a standard operating procedure was followed in changing machinery that required multiple steps and setting changes.

Resulting from the two tests, the proposed changeover would require two hours initially and would potentially be decreased depending on filler requirements. Table 12 illustrates the events taking place during the two hours estimated for the changeover. Table 16 and Figures 6 and 7 in the Appendix of this paper provide examples of images found on the standard work document implemented for Line X.

Table 12

<table>
<tr><td>While current order is finishing</td><td colspan="2">Line operators will stage all new materials and load them if possible</td></tr>
<tr><td>Hour 1</td><td>With the assistance of the filler operator, a mechanic will change out the fill tubes</td><td rowspan="2">Operators perform all other machine settings</td></tr>
<tr><td>Hour 2</td><td>45 minute wine change
15 minute back up time (due to uncertainty with depaletizer)</td></tr>
</table>

Phase 3 Production

Based on the feedback gained from line team members and other business units within the facility, this project was approved to move to a production run, provided only PS/PS labels were to be run with the new glass. In order to ensure all products transitioning into the new bottle were consistent with the data collected during testing three different brands were observed and audited before the project was able to move completely past the engineering group. Although most issues were accounted for during testing, additional requirements were requested by engineering as well as the line team to ensure the success of the first production run.

For the first couple product runs, scheduling decreased the amount of products expected from Line X. This meant the line could run at slower speeds to verify all setting changes were completed successfully. Also to ensure the success of the first couple production runs, additional mechanic and contractor support was requested.

Specific areas of interest during the production runs included ensuring depaletizing operations were functioning properly, narrowing in the fill heights and capacities, ensuring label quality was consistent with testing, and finally all adjustments were easy to understand and implement by the operating team.

Depalitizer

During the production runs the depalitizing area presented the most concern based on issues found during testing. As a result of this controls support was present for the initial production run ensuring all changes were successfully implemented. Mechanic support was also present for the production runs ensuring operators were properly following the new standard operating procedures and assisting in any training needed.

Since the production runs were occurring over multiple shifts, many more loads of glass were being run through the line. This increase in pallets brought light to an issue unseen during testing. Many of the pallets being brought to the line began to show signs of leaning, causing the glass to be unsteady. Since the glass was unsteady while moving through the line, there were many instances of glass breakage before the glass was put on the bottling line. Examples of the poorly constructed pallets can be seen in Figures 4 and 5.

Figure 5

Figure 4

With the increase in glass breakage there was a negative impact on the operating efficiency of the line. In order to quickly resolve this issue, procedures were put in place to trace the loads experiencing difficulties. With this information a new project was put in place incorporating Supplier Relations and Warehouse management to ensure the examination of all incoming goods.

Fill Heights

As previously mentioned fill heights and capacities were looked at during the water test but needed to be reassessed during a run using wine instead of water. Since the density between water and wine is different the capacity and fill height results were only an estimate and could not be used as an accurate judge for the line's capabilities. Based on the results from the water test it looked like new fill tubes would need to be changed for the new bottle design. After running a couple different fill tube lengths and adjusting the correction rate an even balance was found. This balance meant fill tubes would not have to be adjusted when changing between the two bottle types, thus eliminating an hour of changeover time.

Label Quality

As previously said three production runs were observed to verify the three different brands transitioning to the new bottle generated the same quality seen during water testing. During testing a general set of settings were created to ensure labels would behave similar with the new bottle dimensions. For each production run these settings were dialed in further to account for measurement changes and defects were also tracked as they were during testing. Table 13 gives a summary of the defect percentages found in each of the production runs as well as the defects found during the original water test.

For each production run measurements were taken in regards to label placement. These results were analyzed using a statistical capability analysis. Table 14 then gives a summary of the machinery capabilities for the label measurements and supporting analysis is located in

Figures 8 through 26 located in the Appendix of this paper. Overall the label quality results are close to what was expected through testing.

Table 13

Production Run (PS/ CG) Visual Label Audit Summary				
	(Baseline) Water test 9/10 /2012 N = 420	Production Run 1 11/1/2012 N = 120	Production Run 2 11/3/2012 N = 120	Production Run 3 11/18/2012 N = 120
Minor	4.25%	5.83%	2.05%	2.50%
Major	0.24%	0.83%	0.00%	0.00%
Critical	0.00%	0.83%	0.00%	0.00%

Table 14

Production Run (PS CG) Label Measurement Audit Summary						
	Production Run 1 N = 60		Production Run 2 N = 60		Production Run 3 N = 60	
	CP	CPK	CP	CPK	CP	CPK
Label Reg. Offset	5.66	5.40	1.70	1.28	.80	.54
Back Label Skew	2.19	2.18	1.22	1.05	1.48	1.19
Face Label Skew	2.44	2.00	1.90	1.63	.69	.63
Back Label Height	3.03	2.47	2.98	2.25	2.66	2.25
Face Label Height	1.25	1.13	1.80	1.80	2.24	2.05

Production Run 1

During initial testing line team members did not express concern with different paper stocks. Therfore during both water tests a generic paper stock was used based on its popularity among brands. When production began during the first run concern was voiced in regards to the sensitivity of the certain paper stock being used. When labels were analyzed a higher rate of defects were found. In order to verify the results found were consistent with past performances, older products were pulled from inventory and analyzed. The results from this

test confirmed the increase in defects when Line X ran this certain label type, therefore the increase in defects for the new production run did not create any new concerns.

The capability anaysis copmleted for the first production run resulted in CP and CPK values ranging between one and five. Since these numbers are all well above the value of one it can be determined the machinery is capable of repeatibly placing the labels correctly.

Production Run 2

The results of this production run were very successful. Results of the visual label audit revealed fewer defects than were seen during testing and measurement results provided satisfactory CP and CPK values.

Production Run 3

Production run three also provided a decrease in label defects, although there were some inconsistencies with label measurements. Label registration as well as face label skew did not present desirable results when looking at the CP and CPK values.   These errors were most likely caused by bottles moving around while moving through the labeler. The label measurement specifications for production runs one and two are very similar. Therefore these measurement errors may be due to an inexperienced operator or a random glitch with the labeling machinery. Since results were not ideal, a proposal to double check the production run of this brand was noted.

Resulting Outcomes

Aside from the qualification of the three label types the testing procedures executed during this project had other affects on the facility and the line team as a whole.

Changeover Process

The original proposed changeover process was estimated to require two hours. In that time the line equipment would change settings, materials would be staged, and wine would be prepared. With the different initiatives taking place during testing, this time was reduced to forty-five minutes. They reason for this large decrease in time resulted from the findings in regards to the filler. Since fill tubes no longer needed to be changed between bottle types much of the time needed became obsolete. By eliminating this portion of the changeover process, the assistance from mechanic support was also eliminated.

The standard operating procedure for the changeover plan gave a detailed step by step presentation of how to change all the necessary settings for Bottling Line X. On this document settings that could remain the same were identified to decrease any potential confusion for operators. All machine settings were color coded to follow the document and gauges were put in place where necessary to eliminate any measurement errors. Tools were created allowing operators to fully changeover the line eliminating the need for assistance from mechanics. Since a mechanic was not needed at the filler, this person now had the ability to move around the line addressing any potential issues, eliminating the fifteen minute time back up time originally factored into the plan. The new choreography is presented in Table 15 below.

Table 15

While current order is finishing	Line operators will stage all new materials and load them if possible	
45 Minutes	45 minute wine change	Operators perform all other machine settings

Implications on the Facility

Along with generating solutions for the proposed problem this project also had other impacts on the bottling line and the facility as a whole. Since this project required Line X to complete two water tests normal production rates were decreased. Once production runs began the line was required to go through a ramp up. Meaning the normal amount of production numbers would be decreased from their normal amounts. Slowly each production run began to increase in speed and efficiency, increasing the overall operating efficiency of the line. After running for a few months the newly implemented bottle and the original bottle perform at equal operating efficiencies.

Since the completion of this project required the assistance of not only line team members but contractors from outside companies and multiple mechanics the actual cost impact of this project cannot be determined at this time. All costs associated with the testing of Line X ended as soon as the project moved out of the second phase of testing. Therefore as soon as production runs began during phase 3 profit rates began to increase to their normal amounts. In order to ensure testing and ramp up time did not drastically effect production numbers, the

schedule created for the entire bottling room factored in the loss in time to ensure all production numbers were met.

With the close examination of quality this project sparked initiatives to better the quality of products currently running in the facility. On Line X the new bottle design identified quality issues previously unknown to the operating team. By adjusting settings for the new bottle design, settings were also improved for the current bottle design. In regards to the other line mentioned during this project, initiatives were taken to improve the label quality so it would better match the level set by Line X.

Finally the creation of a standard operating procedure has now led the way for any future plans E&J Gallo has for Line X. Line X now has an initial document outlining the standard work needed for any future bottle design changes. Also if Glass Company B's products were to be transitioned to other bottling lines in the facility this document may be implemented on those lines as a starting point for specific settings related to the bottle design

Conclusion

E&J Gallo is one of the world largest wine industries as well as the largest family owned winery in the US. Due to the extensive size of the business, Gallo Glass was created as a main supplier to Gallo's production facility. Recently Gallo glass became aware they would no longer be able to meet the demands of a certain glass type within the facility. Therefore, Glass Company B has

been contracted in to meet the needs of Gallo Glass; the bottle type being transitioned into the facility will eventually replace the bottle type produced by Gallo Glass.

Since Bottling Line X only runs the glass bottle being transitioned out, it is important to verify the functionality of the new glass on this production line. Resulting from this project there were two challenges needing to be addressed. First quality could not be ensured when using the current machinery and settings with the new glass model made by Glass Company B. Second operators on Bottling Line X did not have experience or instruction in completing a changeover process between bottle types for this bottling line.

Resulting from this project these initial challenges were addressed and the following solutions have been created and implemented.

- Glass Company B’s bottle type was successfully transitioned to Bottling Line X using PS/CG labels.
- Since products using CG/CG labels were unable to be qualified on Line X they were transitioned to Line Y.
- Future projects have been examined in regards to CG/CG label quality on Bottling Line Y as well as capsule quality within the entire facility.
- Standard operating procedures were put in place ensuring operators could successfully transition Bottling Line X between different products.

- Predicted changeover time was substantially decreased from two hours to forty-five minutes.

Through the execution of multiple tests and implementation of standard operating procedures the operating team involved with Bottling Line X is now capable of running the new bottle design with most brands and is able to change between bottle types when needed.

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Streamlining Maintenance Operations for a Highly Automated Consumer-Products Manufacturer – Chris J. Olsen: 1993 Proceedings Annual Reliability and Maintainability Symposium

Appendices

Changeover Documentation

Table 16

Depal Settings			
HMI Parameters	Container Series	___ Series	___ Series
	Container Height	11.76 in.	11.875 in.
	Dunnage Selection	Top Frames	Top Sheets * Do NOT select "Leave last tear sheet on"
Square Settings	North	2 7/8	3 7/8
	South	2 7/8	3 7/8
Wing Settings	Front and Back	Out to the BLUE Line	In to the RED Line
Compression Plate Settings		2 1/2	3

Figure 6

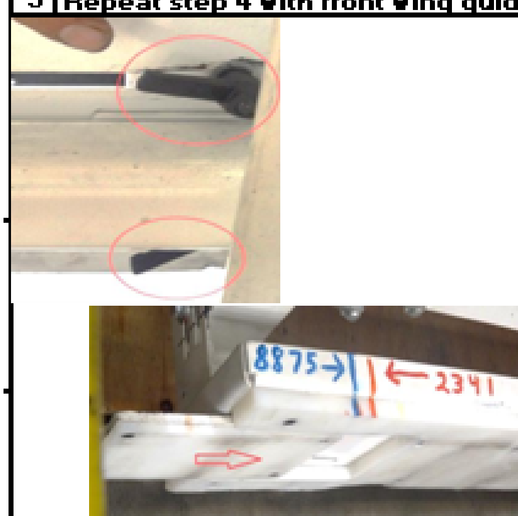
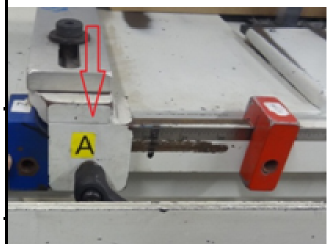
5 Repeat step 4 with front wing guid		
	Work sequence Seconds	1. Loosen adjustment handles 2. Move wing to correct line 3. Tighten handles - make sure in the horizontal position
	Vital Point	Measurements for bottle codes located on set up sheet
	Quality vital point	Handles need to be in **horizontal** position

Figure 7

5 Partition Inserter (3/7)		
	Work sequence Seconds	Loosen outer rail handles
	Vital Point	
	Quality vital point	
6 Partition Inserter (4/7)		
	Work sequence Seconds	Move rails **out** to **Blue Line**
	Vital Point	
	Quality vital point	

Production Run Label Measurement Results

Production Run 1 (11/12012)

Figure 8

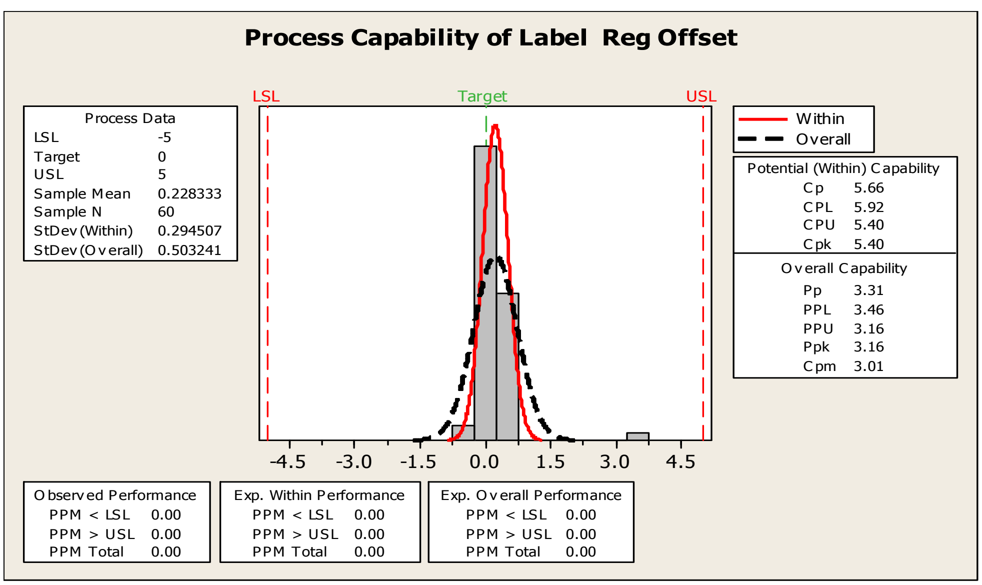


Figure 9

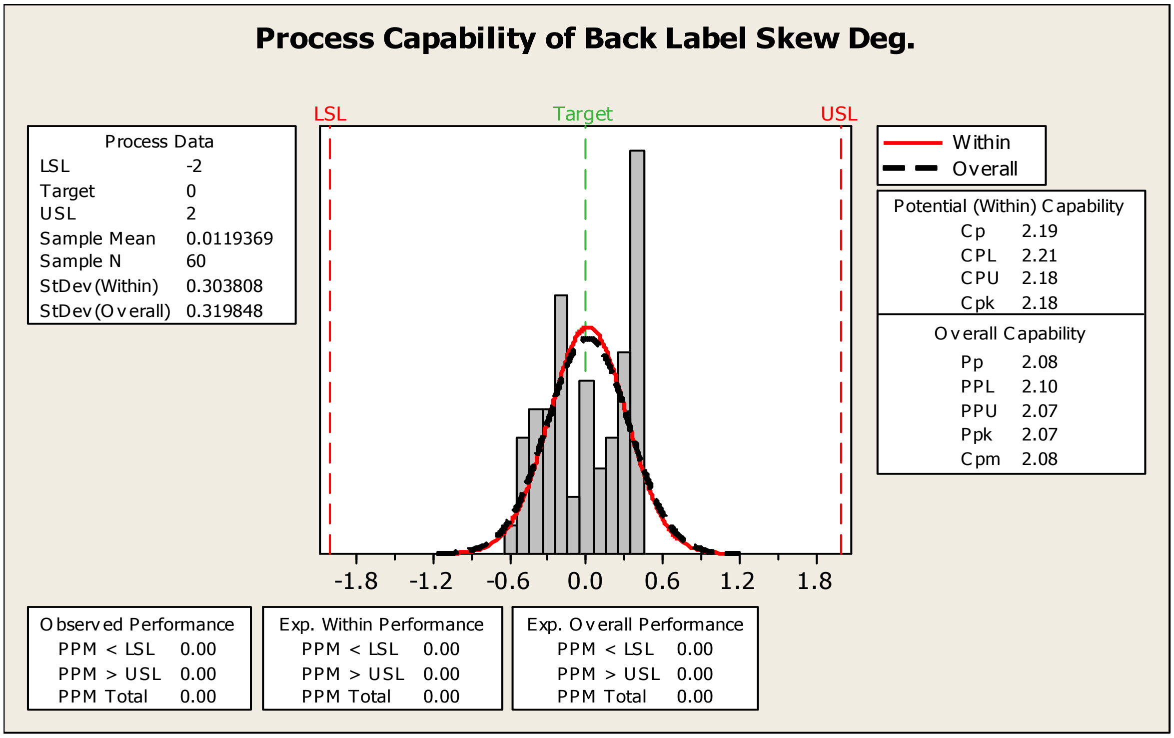


Figure 10

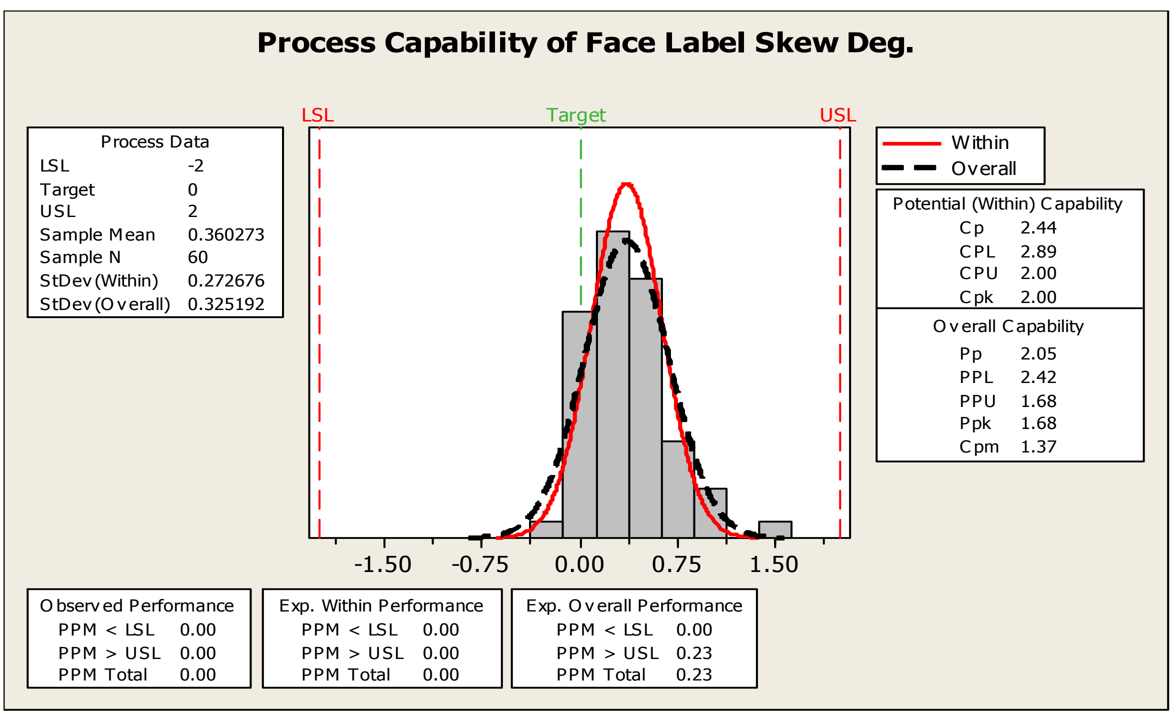


Figure 11

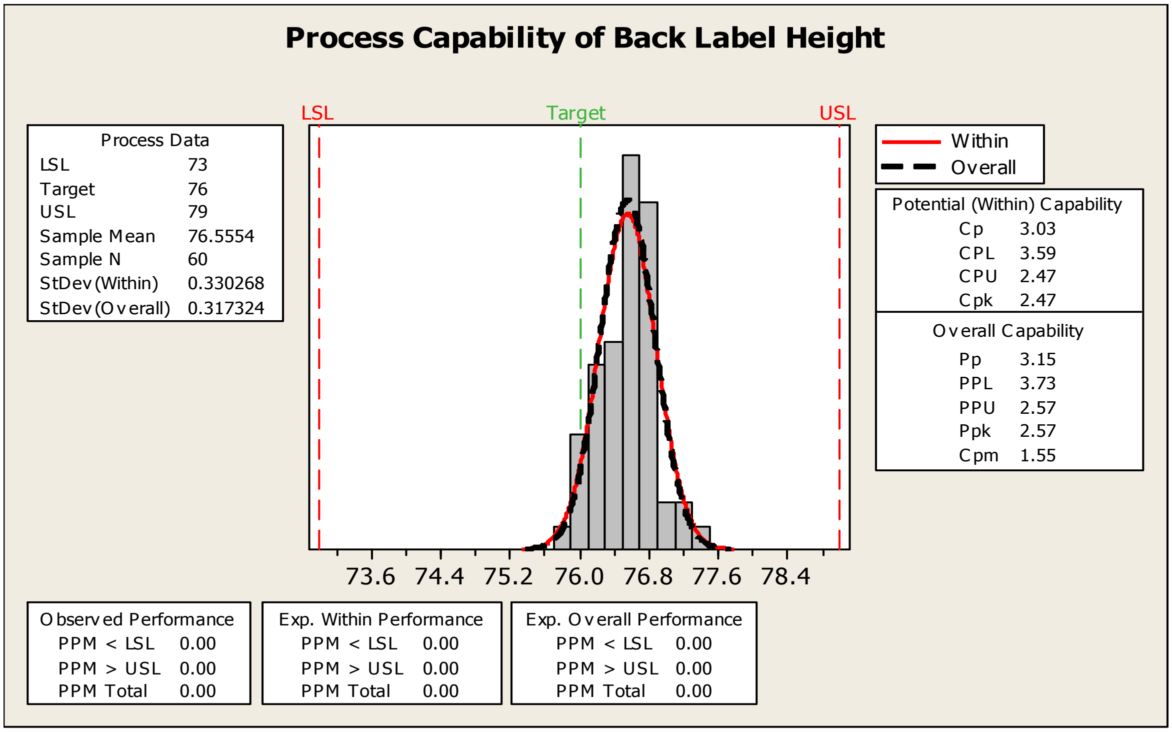
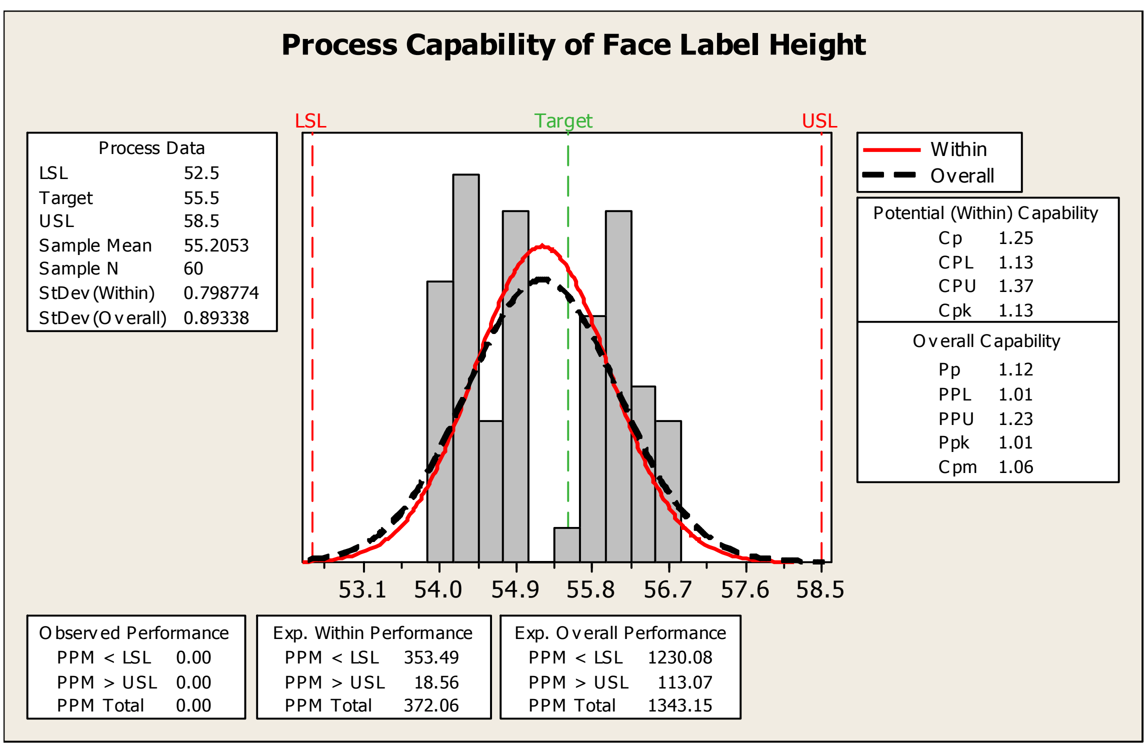


Figure 12



Production Run 2 (11/3/2012)

Figure 13

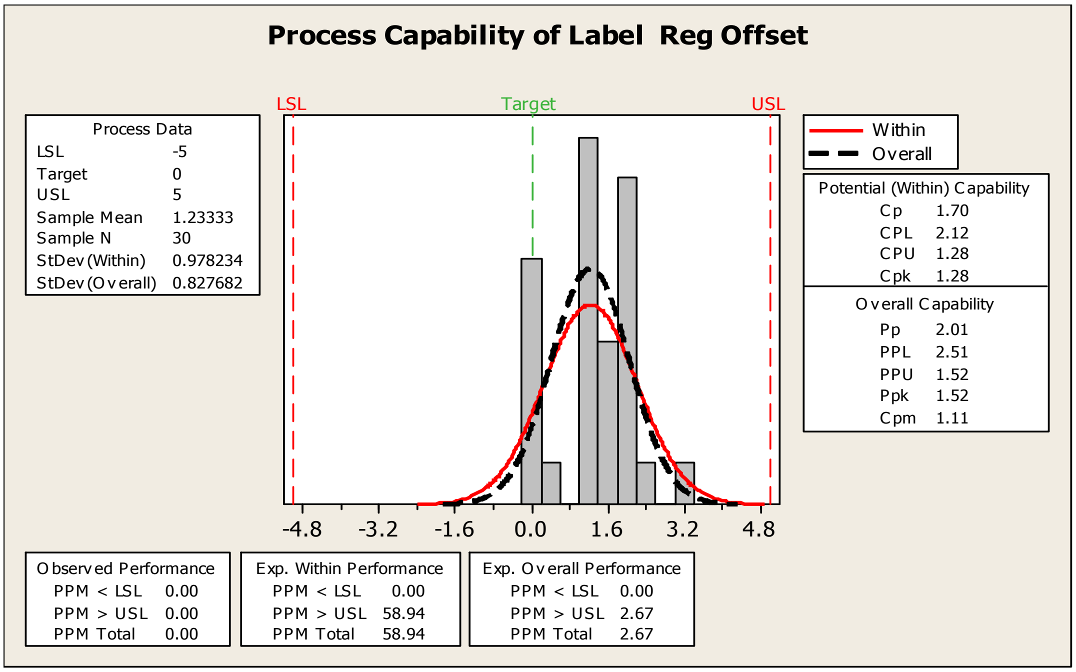


Figure 14

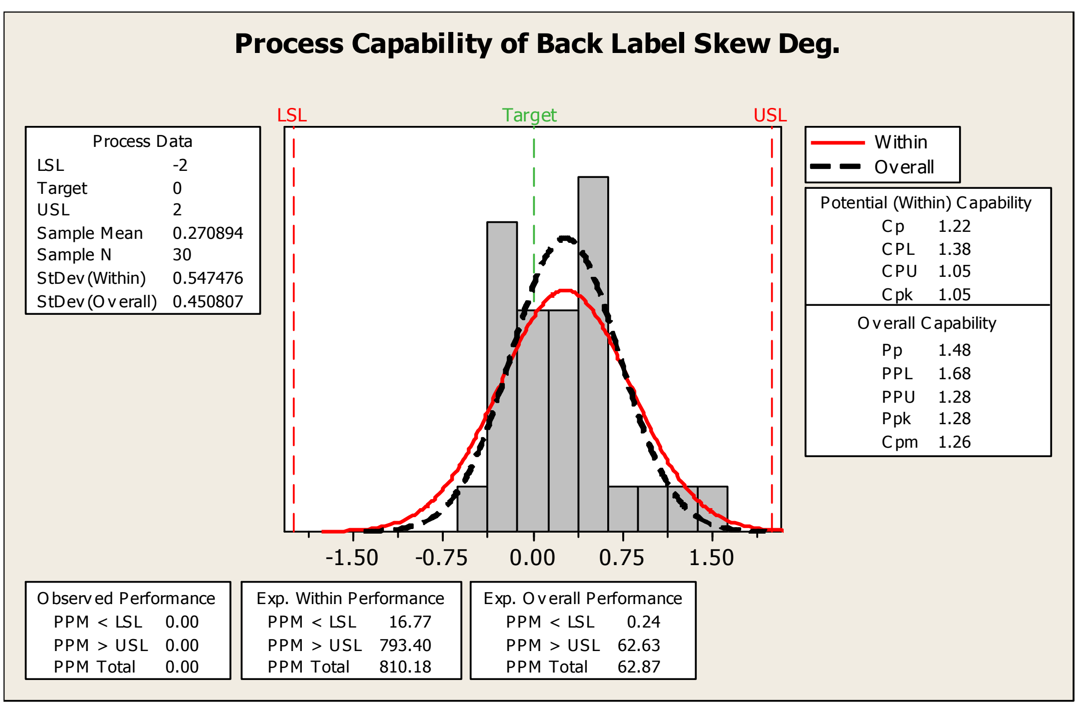


Figure 15

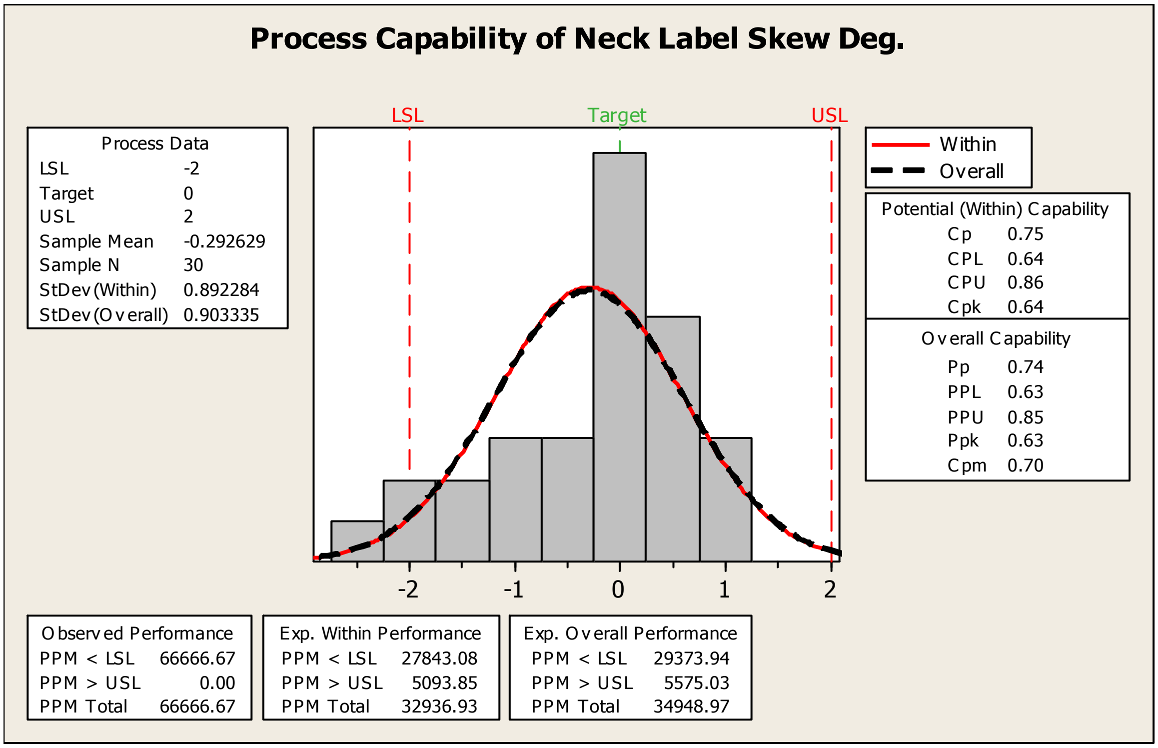


Figure 16

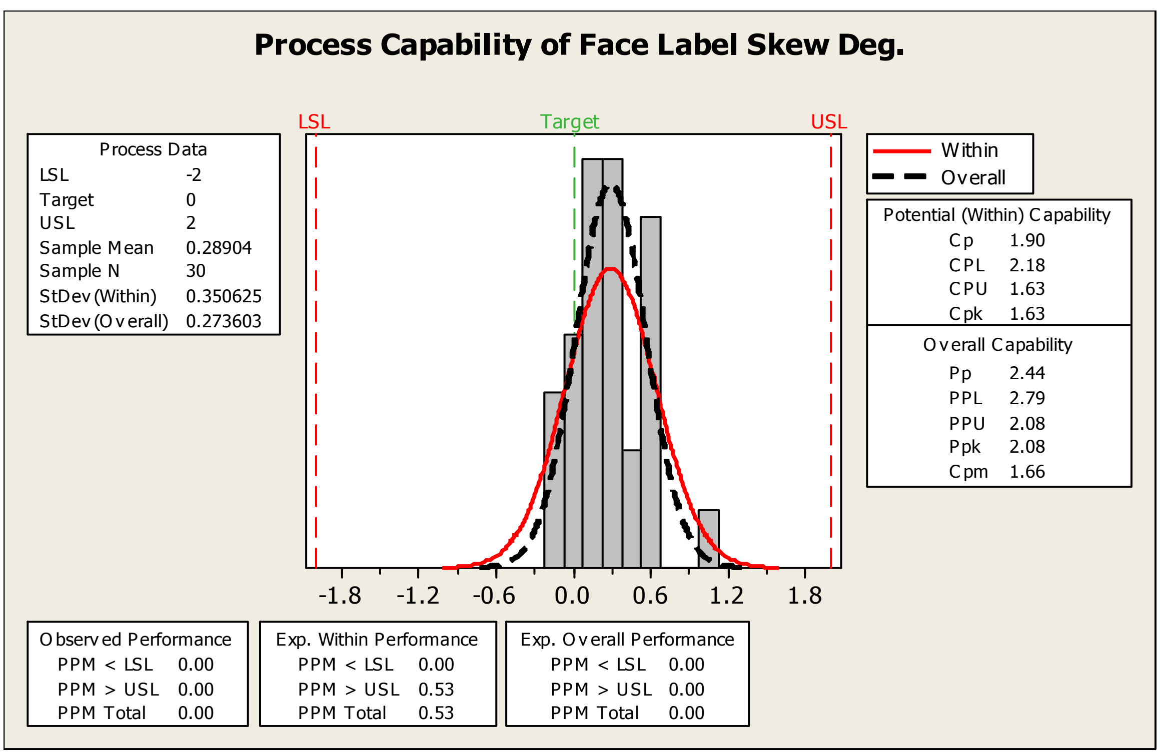


Figure 17

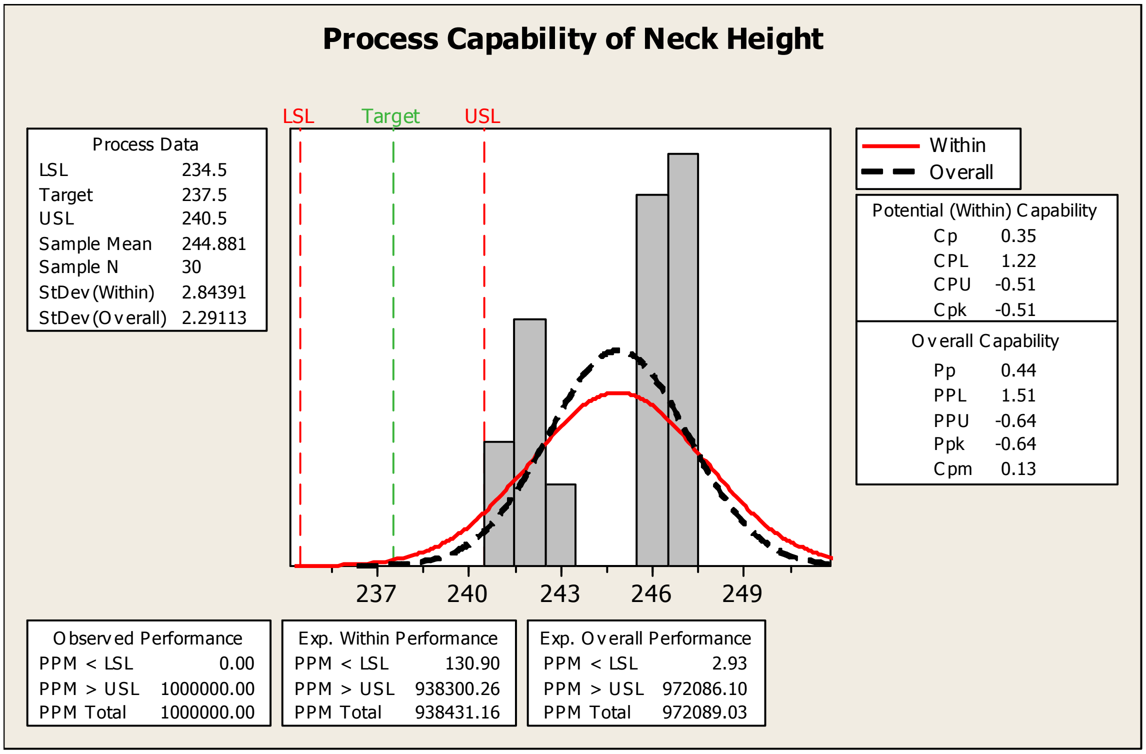


Figure 18

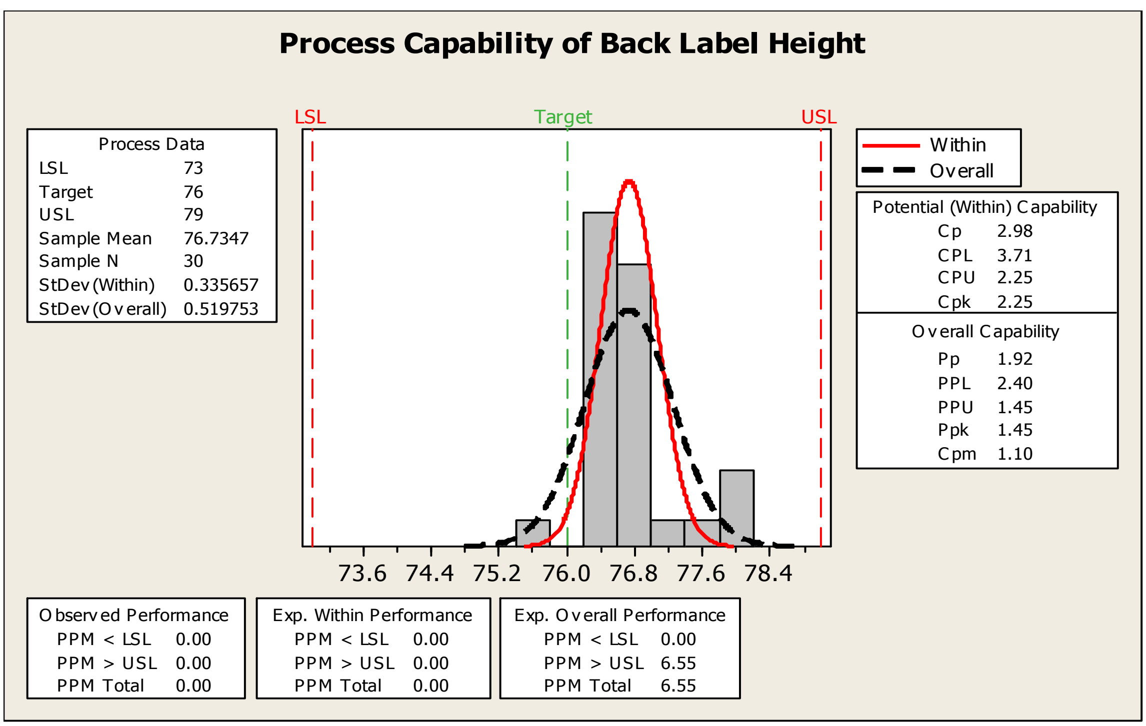
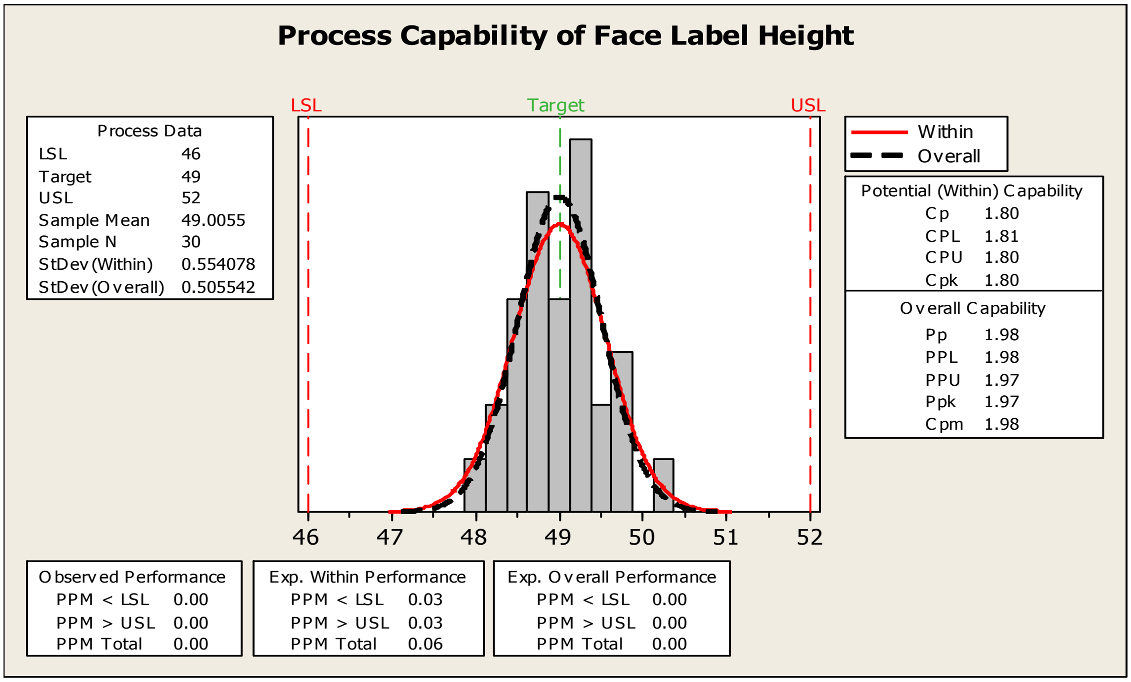


Figure 19



Production Run 3 (11/18/2012)

Figure 20

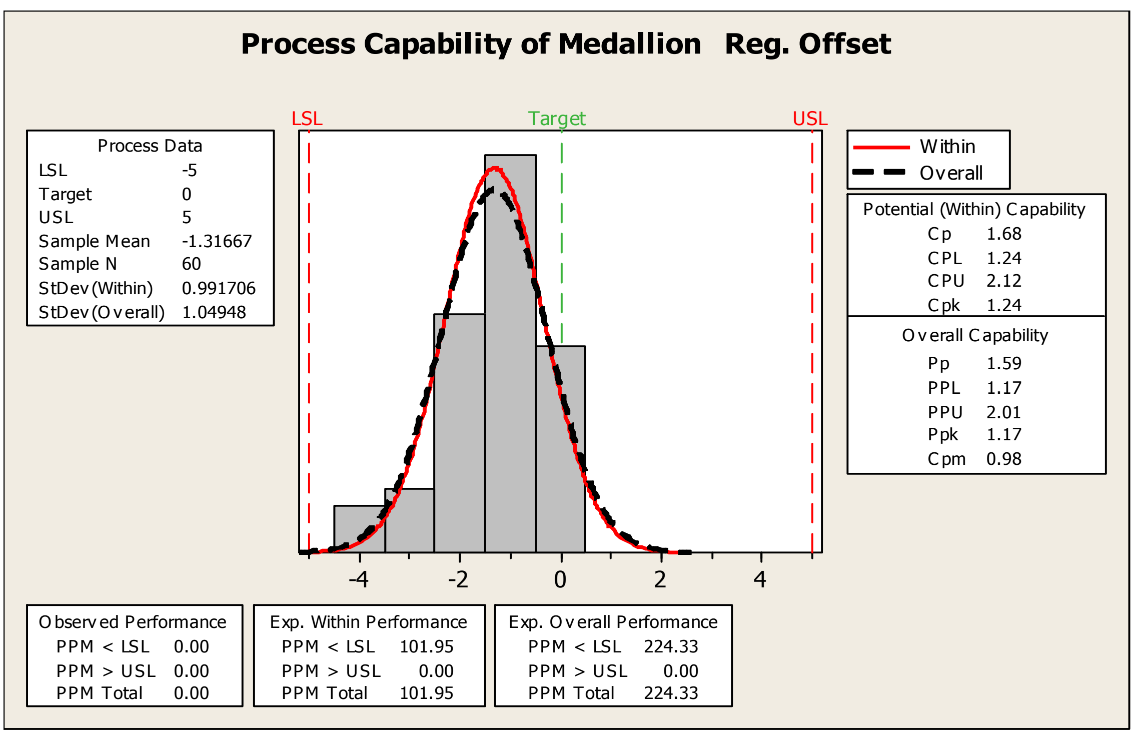


Figure 21

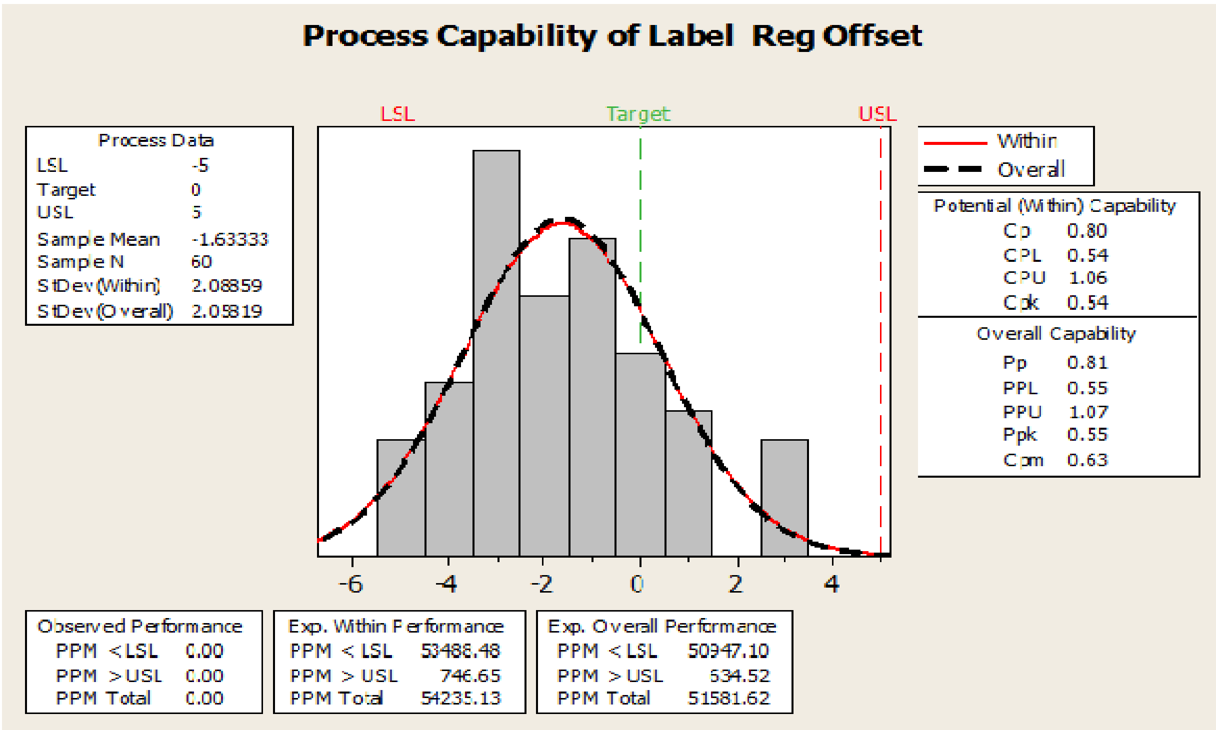


Figure 22

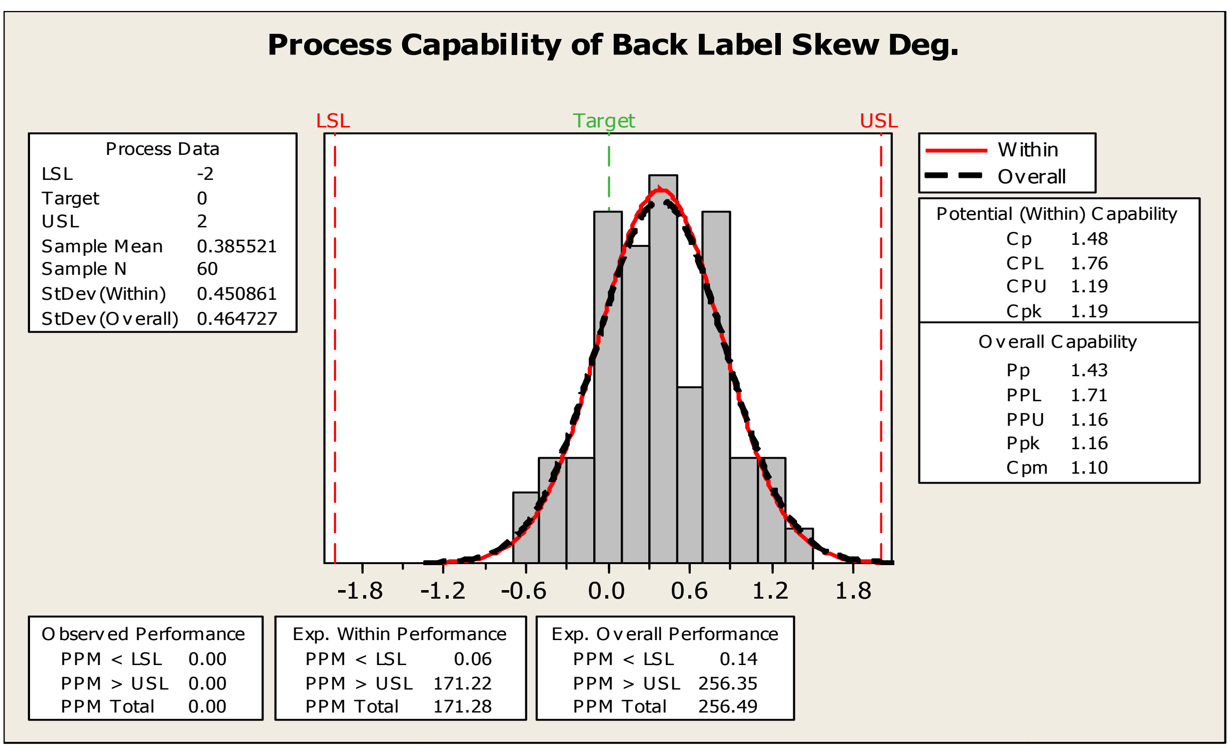


Figure 23

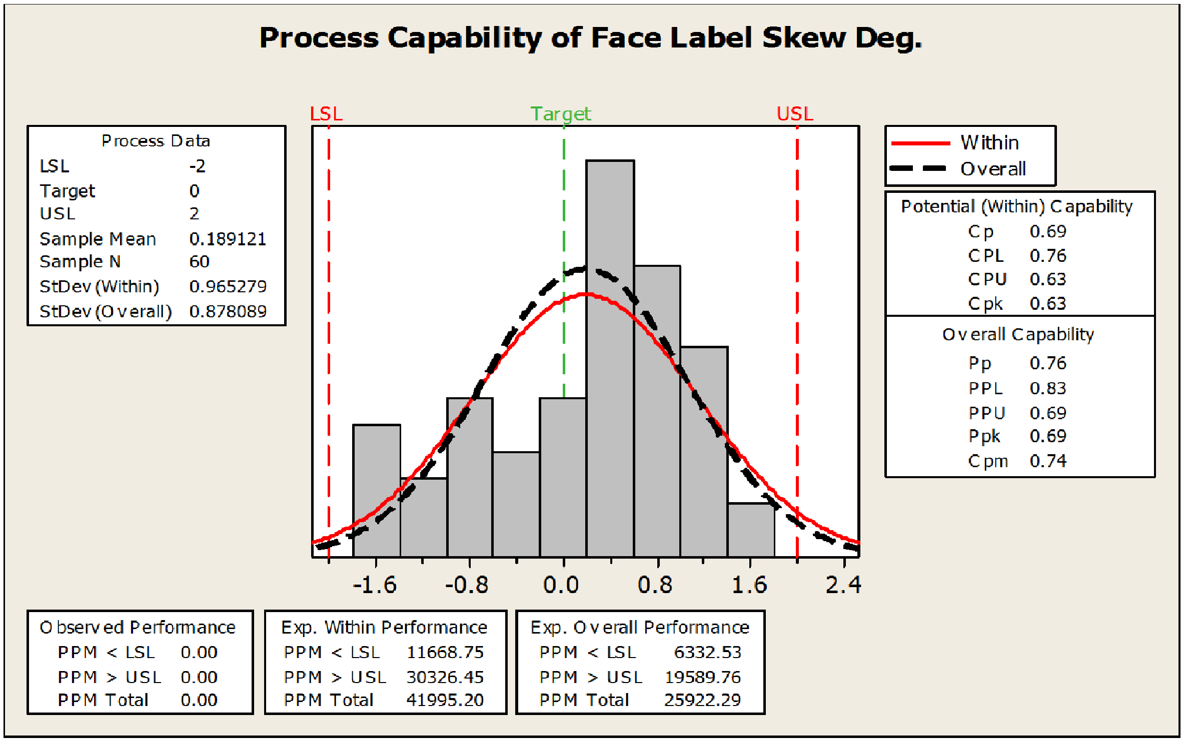


Figure 24

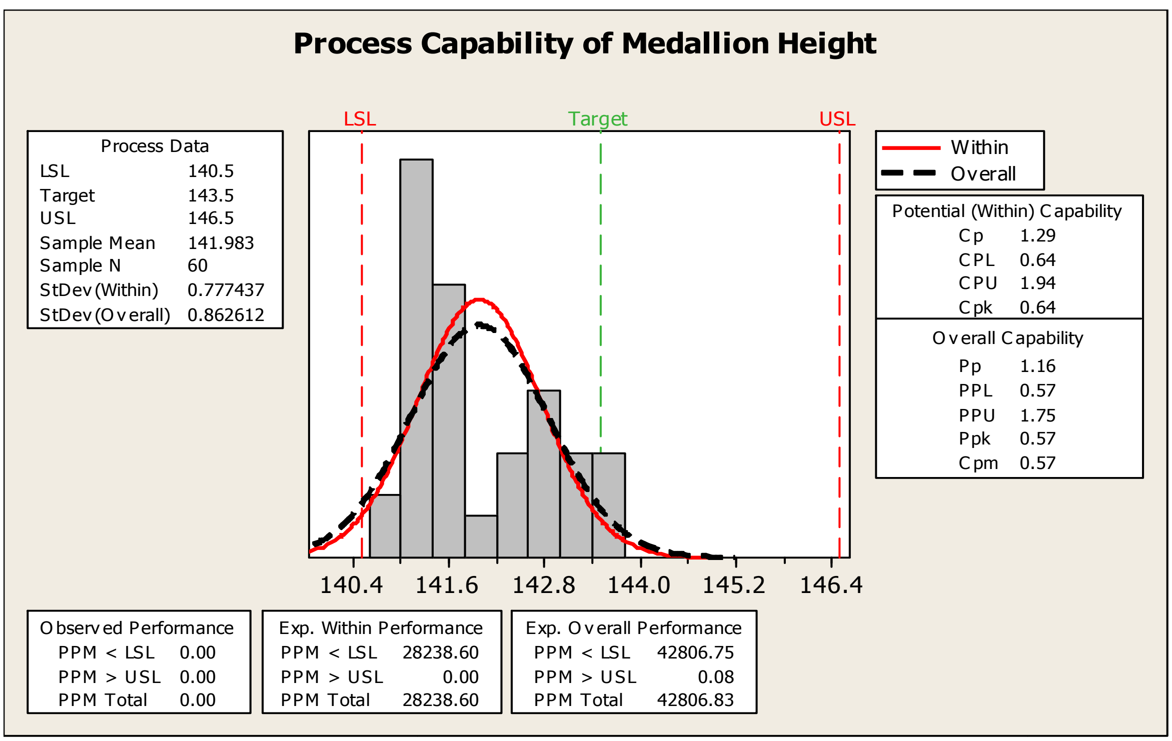


Figure 25

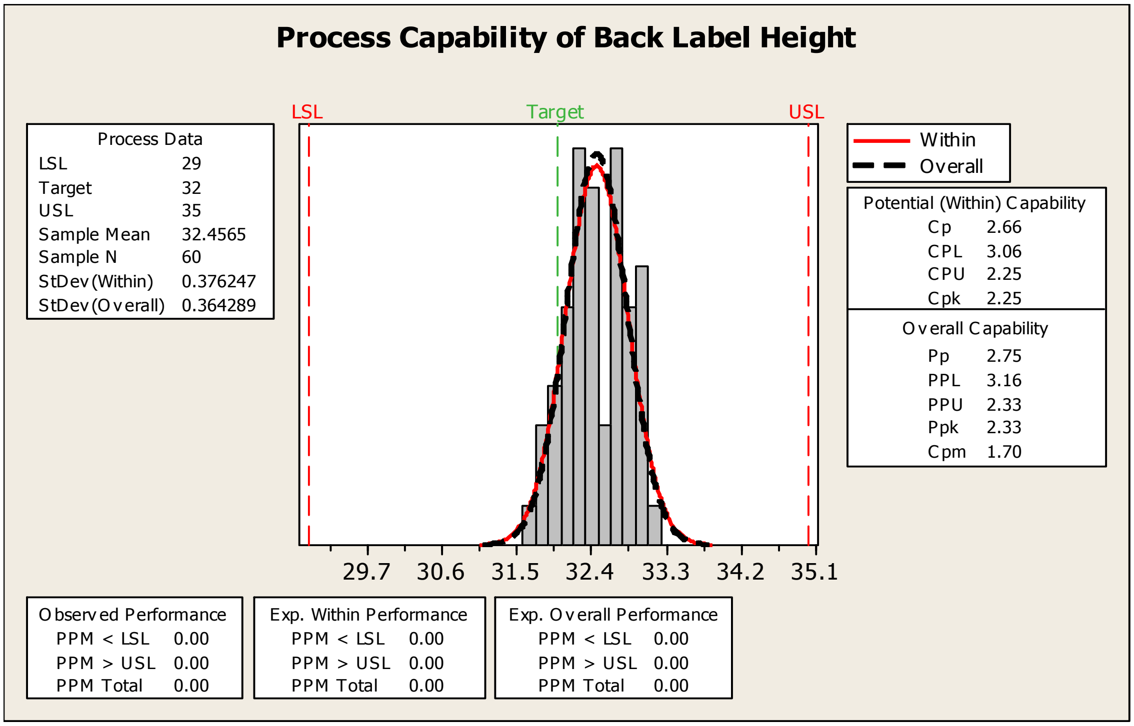


Figure 26