Quality in a Lean World

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From the implementation of cellular concepts and Demand Flow Technology, to today's Lean Office initiatives, Southco has been aggressively implementing Lean Manufacturing concepts for the past five years. Perhaps you recall past improvement initiatives such as Zero-Defects, Quality Circles, TQM, SPC, ISO-9000, QS-9000 and now TS-16949 that were focused on quality improvement and wonder, "Is Quality now taking a back seat to Lean?" Well, I'm here to tell you that Quality is up in the front seat with Safety and Delivery, and is a key driver on our Lean journey.

A Historical View of Quality

A *product orientation* toward quality dominated the world economy for hundreds of years. These were the days where products were produced by skilled craftsmen such as carpenters and blacksmiths. In many cases, workers communicated directly with suppliers and customers, having first hand knowledge of customer needs and expectations. During the industrial revolution, *mass production* increased efficiencies. However, under such systems, the worker became less connected to the customer and became a small cog in a large, complex production machine. U.S. industry began to adopt a focus on process control by applying SPC techniques developed in the 1920's and 30's by Walter Shewhart at General Electric. Many U.S. industries were using SPC during World War II. In fact, one of the reasons that Japan became interested in the American management philosophies as taught by W. Edwards Deming and Joseph Juran was that they were impressed with the quality and reliability of American aircraft. Following WWII, with European and Japanese manufacturing in ruins, most American manufacturers returned to a mass production focus that tended to breed complacency. However, competition from Japan in the mid '80's forced American industry to shift back to a process control mentality and led many to adopt a *Total Quality Management (TQM)* approach. This was also the time that global quality standards such as ISO-9000 became prominent. Today, in an effort to become more responsive to ever more demanding customers, Southco and many other companies are integrating TQM methodologies with Lean Manufacturing.

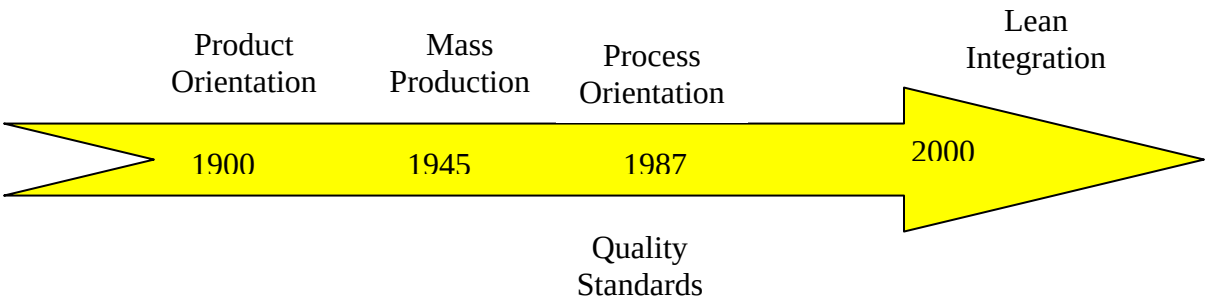

Figure 1: History of Quality

Why get Lean?

Customer expectations are continually increasing. Every customer expects a higher quality product at a lower cost in less time than ever. If a company cannot meet these expectations, there is plenty of excess industry capacity in the world, and customers with will find someone else who can meet those expecations. The overriding goal of Lean Manufacturing is to reduce the amount of time required to process and fill a customer's order. This is accomplished by eliminating waste from all non-value added activities. In a Lean environment. there is little or no work between work centers and as a result, any quality errors create disruptions that can shut down production lines and work cells. Therefore, in a Lean environment, quality is more important than ever.

Quality at the Source

One of the key principles of Lean is to control quality at the source. This allows us to catch problems at the earliest point in the production cycle and minimize disruptions and costs. Take the example of producing a "56-60" spring-loaded plunger at Southco's Brandywine plant as shown in Figure 2. Let's say you have a defect in the stud that was created at the Cold Heading operation. If you find the defect while doing your hourly checks as defined on the Control Plan or Operations Methods Sheet, you have produced, at most, an hour's worth of parts. It's probably cheaper to scrap them out than to try and rework or sort them. Also, the time to recover from the error is minimal and the customer is not impacted. If you run the whole job and the problem is detected at the next operation, Thread Rolling, you now have an entire lot's worth of parts to scrap (10,000+ pieces) and your recovery time increases because you have to set up your Cold Header again and run the replacement order. This means the delivery date to the customer may be impacted. Now, consider the example where the stud makes it all the way through Heat Treating, and Plating, and Assembly. You now will end up scrapping the entire lot of assemblies and have to start all over again. Since it will take a long time to recover, you have missed the delivery date. The worst case is if the problem is not detected until it has reached the customer. This leads to a product recall that will cost the company thousands in warranty claims, scrap,

customer goodwill and damaged reputation. The costs associated with production errors increase exponentially as a defective product passes from one operation to the next as shown in Figure 3.

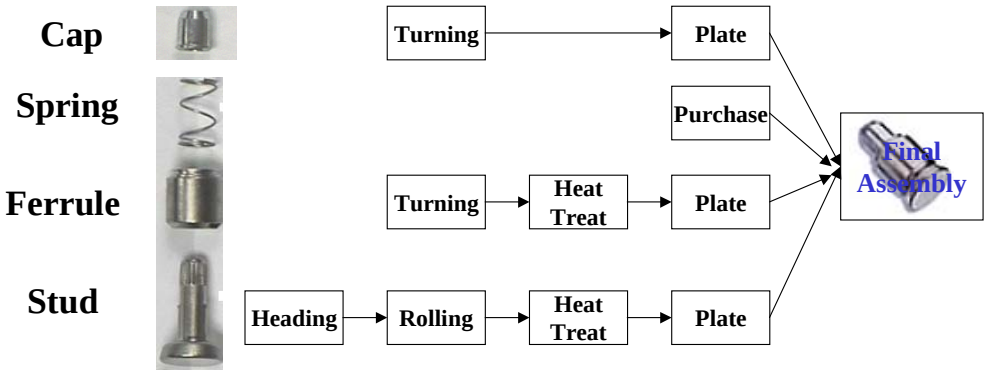

Figure 2: 56-60 Process Flow

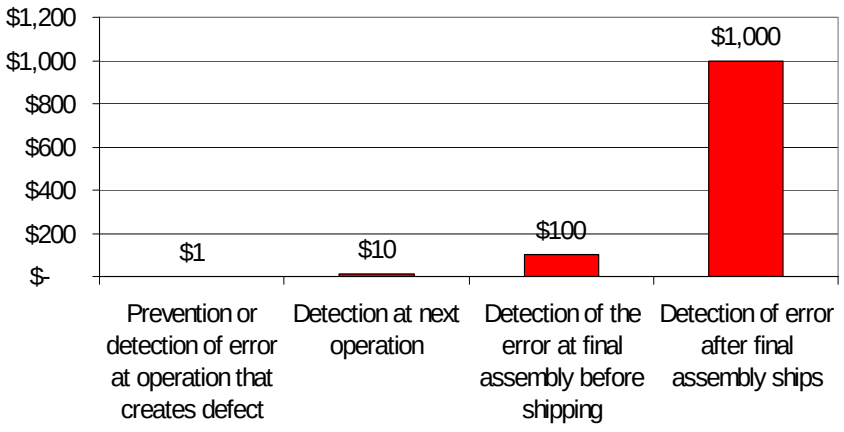

Figure 3: Costs of Production Errors

7 Forms of Waste

Lean Manufacturing targets the following forms of waste as the enemy.

- Overproduction
- Waiting
- Transportation
- Extra Processing
- Inventory
- Unnecessary Motion
- Defects

Each of these forms of waste can have an adverse effect on quality. Overproduction leads to storage problems. Where do you put all the stuff? This can lead to product damage. Materials that are waiting (not progressing toward the next operation) are not adding value. They are collecting dust and debris, rusting, or otherwise deteriorating. The number of material handling operations (transportation) is inversely proportional to quality. Long distances discourage communication between operations at the expense of quality. Extra processing provides another chance to make a mistake. Cleaning and Tumbling and similar operations, are essentially re-work. A better approach is to improve the quality of the upstream operation instead of adding these types of operations. Unnecessary motion describes the importance of ergonomics for quality and productivity. If a task is difficult to perform, it will be done poorly or not done at all. The bottom line is: Defects cost money and inspection operations are non-valued (waste). We must relentlessly strive to solve our quality problems instead of living with them.

5S

We are all familiar with 5S. It seems like such a simple concept, "Keep my work area organized and clean." Its importance, however, should not be minimized. No improvements, quality or otherwise, can be sustained in an environment that lacks order and discipline. The 2nd Law of Thermodynamics dictates that without order and effort, chaos will reign. With this in mind, every improvement initiative, whether it is a problem solving effort, set up reduction or TPM event should include 5S. Here's a quick overview of 5S and how it will help quality.

- **Sort.** Get rid of items not needed.
    - Prevents the use of wrong information, materials, gages or tools that are not best suited for the job.
    - Allows you to focus on what's important.

- **Set in Order.** Put items where you need them, and label them.
    - Can easily find the correct information, materials, gages or tools.

- Tools, materials and gages are stored in a way that they won't get damaged.

- **Shine.** Thorough cleaning.
  - Contamination is a leading cause of defects.
  - Sources of contamination and oil leaks can now be detected and fixed / eliminated before machine performance and product quality is compromised.

- **Standardize.** Keep it orderly and clean through daily routine.
  - Gets everyone to do it the same way, reducing variation.
  - Allows us to maintain the 1st three S's.

- **Sustain**. Management commitment to maintain order and cleanliness.
  - Nothing happens in business without management support.

Total Productive Maintenance

Total Production Maintenance (TPM) targets elimination of contamination, and the maintenance of proper lubrication. This is because 75% of all equipment breakdowns are caused by contamination and improper lubrication. These are also common causes of quality defects as shown by the following examples.

Case 1. A customer received Southco "47" Captive Screws where the metal in the crimped area of the knob was peeling.

1. Why is the knob peeling?
   - *Lack of lubrication* during the crimping operation.
2. Why did we not have enough lubrication?
   - The reservoir for the lubricant ran dry.
3. Why did the reservoir run dry?
   - The operator did not notice that it went dry.
4. Why didn't the operator notice?
   - The reservoir did not hold enough oil to run the entire shift.

Solution: Replace the small reservoir with one large enough to last the whole shift. Check that it is full at the start of the shift as part of the daily TPM checks.

Case 2. A Southco sister-plant reports that Studs they received from us for use in a "37" Latch did not have threads.

1. Why didn't the studs have threads?
    - Because the threading die head was not closed when the stud was in the threading position on the screw machine.

2. Why wasn't the die head closed?
    - Metal fines, chips, and sludge in the threading cartridge prevented it from locking properly in the closed position.

3. How did the *contamination* get into the threading cartridge?
    - The coolant that flows through the cartridge is full of metal fines, chips and sludge.

4. Why is the coolant flowing through the die head contaminated?
    - The coolant is not filtered.

Solution: Add a filter before the coolant gets to the threading cartridge. Monitor the pressure differential before and after the filter to detect when it is clogged. Use daily TPM checks to minimize the total amount of contamination in the coolant.

Conclusion

Quality, Cost, and Delivery can be considered the legs of a three-legged stool that must be firmly in place in every manufacturing environment. If a company fails to meet customer expectations in any of these three areas, the stool will tip over and customers will seek other suppliers. The overriding goal of Lean Manufacturing is to reduce cycle time by eliminating non-value added activities. This improves delivery and reduces costs. Lean methods also improve quality, which minimizes disruptions and allows the whole system to function smoothly. The result is satisfied customers who get what they want, when they want it.