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Prioritised Improvement Plan – Basic Quality Tools

Quality & Business Improvement

(ACMA4004)

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1 Introduction

This report will include and discuss how different types of quality improvement tooling can be utilised to analyse and improve processes in an engineering environment. In particular the report will focus on a Westmills blanking and forming tool that is refurbished often, and the process of dialling in the finished product to it meets the correct dimensions. This process is often completed by experienced toolmakers without any data collection, it is therefore a perfect example of how data collection and basic quality tools could improve efficiencies in creating the correct setup without wasting unnecessary time.

2 Aims

The aim of this report is to collect data and analyse using quality improvement tools changes can be implemented to improve efficiencies. From this, a prioritised improvement plan can be created and implemented.

2.1 Objectives

Collect current data from trialling a tool without using a quality improvement processes.

Create a prioritised improvement plan using data driven quality improvement tools.

Implement the prioritised improvement plan.

Determine how future improvements will be measured and tracked.

3 Root Cause Analysis

In order to identify potential issues with the trialling process a Root Cause Analysis was used to determine what issues hold more weight. Understanding the contributing factors or causes of a system failure can help develop actions that sustain the correction. Waste in production may be caused by issues that keep occurring. (Nazmi et al.) Root cause analysis gives a visual aid on the most important issues that should be prioritised based on how often the issue occurs and the severity of the incident, this then gives a risk priority number. Higher risk priority numbers may require action sooner than other potential issues. Companies will often operate with a RPN limit that is predetermined. Using an RPN threshold may cause team members to spend excessive time trying to reduce the Detection, Occurrence, and Severity rankings for lowering the RPN. This situation sometimes places the organization and its customers in danger. (Hartwell, J. 2017)

Root Cause Analysis (RCA)															
Item: Oil Drum Forming/Cutting Tool				Responsibility: Thomas James				RCA number: Page: FMEA Date (Orig): 09/11/2024 Rev: 1							
Model: Base Tool (Tool A)				Prepared by: Thomas James											
Core Team: Bench Section															
Process / Function	Identified Issue	Potential Effect(s) of Failure	Severity	Cause(s)	Potential Cause(s)/ Mechanism(s) of Failure	Occurrence	Current Controls	Detection	RPN	Recommended Action(s)	Responsibility and Target Completion Date	Action Results			
												Actions Taken	Severity	Occurrence	RPN
Producing blank	Punching and forming oil drum base blank	Component does not meet outside diameter specification	7	Component is not being drawn/cut with correct speed/forces	Material is not flowing correctly in the form.	8	Standardising height of tooling	1	56	All components to be checked by the Quality Assurance department prior to installation.	Both the bench section and QA department hold similar responsibility to ensure the components are at the same height.	QA check to be added to route card.	7	8	56
	Imperfections spotted on material	Component will be rejected by customer	5	Clamping faces impressing imperfections on blank.	Waste material being trapped in the forms. Forming faces require re-polishing.	6	Visual inspection of tooling and components	1	30	Forms/clamping faces to be visually checked before installation and repolished if required. Tooling to be blown out with compressed air between each sample.	Operator of the press.	Check sheet to be issued to operator.	5	6	30
	Punch/die chipping/rubbing	Life expectancy of tool is undesirable	7	Edges of components showing burrs.	Punch/die are not the correct O.D. Punch/die are running out or parallel with each other.	2	Components are checked by the QA department to determine appature sizes.	2	28	Tooling to run a small batch of components then visually checked.	Operator of the press.	Check sheet to be issued to operator.	7	2	28
	Press tonage is higher than expected.	Excessive wear on press and tooling	2	Potential downtime while repairs are undertaken.	Spring pressure is too high.	2	The press will show an alarm when unexpected tonage is detected	2	8	Replace springs for new at every refurbishment of tool.	Toolmaker.	Standard operating procedure to be followed at each refurbishment.	2	2	8
	Component getting stuck in form	Tooling cannot run at standard cycle speed	4	Knockout ejector not performing correctly	Ejector stem has excessive wear or play. Ejector spring is fatigued	1	Spring to be changed at each refurb.	2	8	Ensure spring is changed each refurb, check the ejector stem visually for wear marks.	Toolmaker.	Standard operating procedure to be followed at each refurbishment.	4	1	8

Figure 1- RCA Report

The information from the Root Cause Analysis shows numerous potential issues with undesirable outcomes. This information can then be used to improve current workshop processes such as standardising tooling heights/levels to reduce variables that could be contributing factors.

4 Data Collection

It is important that good quality data is gathered to make informed decisions about potential corrective measures to the trialling process. One of the most concise and proven ways to collect data is to follow the 7 basic tools for quality improvement and use the appropriate methods to improve the current process. It is evident that a continuous improvement process cannot be realized without quality tools, techniques and methods. These tools also help the engineer to use accessible data in decision processes. (Soković, M, 2009)

One of the 7 basic quality tools that would be suitable for collecting data on this process would be check sheets/tally charts. This is because data can be collected in real time while the process is running, in a simple structured format that is easy to analyse. Another benefit in using a check sheet for this particular process is that the data set isn't very large and would therefore not be as suitable to some of the other basic quality methods for data collection.

Data collected using check sheets needs to be meaningfully classified. Such classification helps gaining a preliminary understanding of relevance and dispersion of the data so that further analysis can be planned to obtain a meaningful output. (Magar, 2014)

The data collected in the tally chart shows the issues that the operator encountered with the trialling process over multiple runs. All tooling follows the same design, however some differences such as tooling wear, tooling life and compounding factors such as level heights due to multiple refurbishments means that every tool shows different reoccurring issues.

Trial Component Sample Check Sheet (Historic Data)							
Data Recorder: Thomas James							
Location: FSG Tool & Die							
Defects/Issues	Tool Number						Total
	B Tool 001	B Tool 002	T Tool 001	T Tool 002	T A	T B	
Out of Tolerance	IIII	I	I	II	III	II	13
Showing whispers		I		IIII		I	6
Material rupture	I		III		III		7
Imperfections in material	III				III	II	8
Excessive wear on cut edges		III		IIII			7
Component out of ovality			II	I			3
Rough edges	I	II	IIII	IIII	II	IIII	18
Excessive Clamping	III		IIII	I			8

Figure 2- Check Sheet

In order to further stratify the data collected in the check sheet and determine the main issues, a Pareto analysis is perfect. The Pareto principle (also known as the 80-20 rule, the law of the vital few and the principle of factor sparsity) states that for many phenomena, 80% of the consequences stem from 20% of the causes. (Abyad, A., 2020)

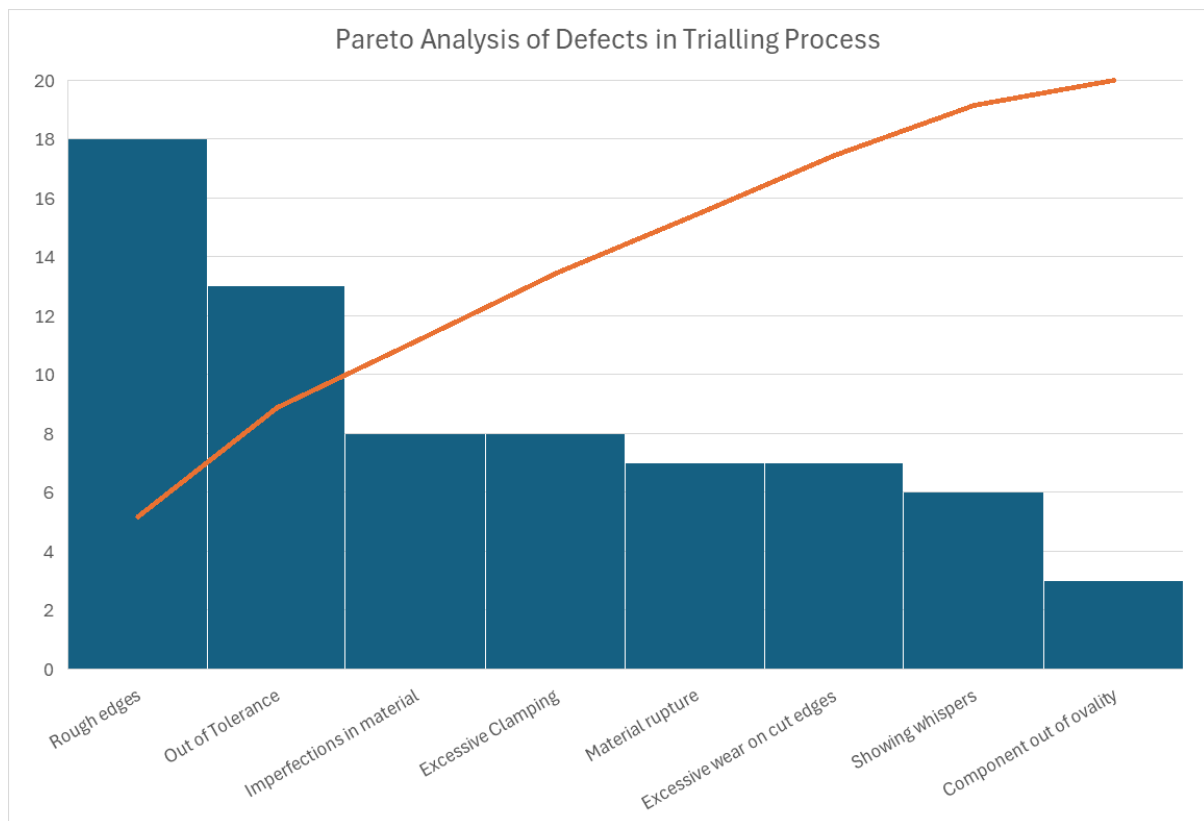


Figure 3- Pareto Analysis

Using the data collected from the check sheet in a Pareto analysis it is clear that the two main issues are rough edges on the circumference of the blank and that the overall diameter of the blank is out of spec. Now that the pareto analysis has been performed it has helped to focus on the main issues that should be addressed first.

To further examine the potential causes of these two issues another basic quality tool that can be implemented is a cause and effects diagram. Common uses of the Ishikawa diagram are defect prevention to identify potential input factors causing an overall negative effect on an output. Each cause or reason for imperfection is a source of variation. Causes are usually

grouped into major categories to identify and classify these sources of variation. (Lean Six Sigma Institute, 2021)

The use of a cause and effects diagram somewhat subjective, therefore multiple members of the department were encouraged to give their opinion on potential causes of the two main issues.

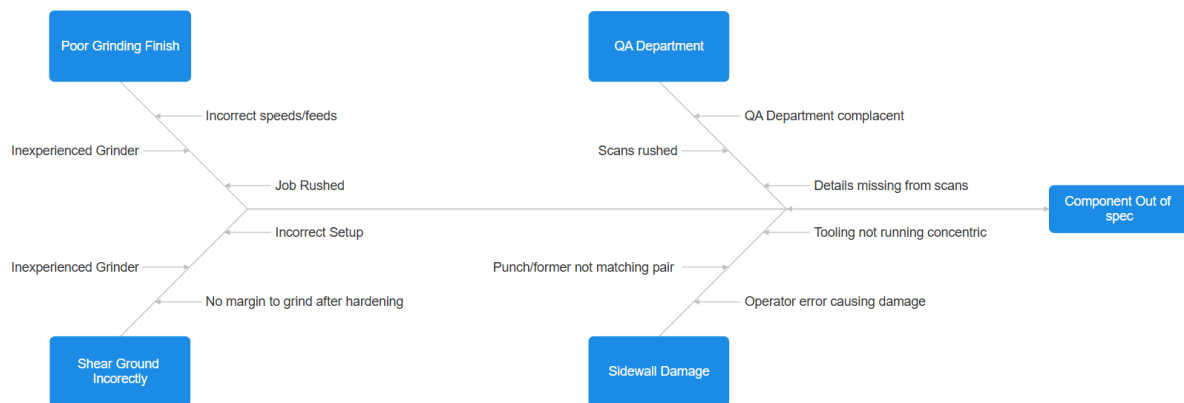


Figure 4- Ishikawa diagram

The main issues discussed while gathering opinion of the potential causes of the imperfections in the samples involved three different departments, bench, Quality Assurance and grinding. The fishbone diagram has also allowed the company to easily display current issues brought up in an easy to read graphic that all members of the company can view.

5 Improvement Plan

In order to improve current processes in these areas an improvement plan would be beneficial for all departments involved. A Quality Improvement Plan includes essential information about how your organization will design, implement, manage, and assess quality. All aspects of the Quality Improvement Plan correlate to the identified root cause.

Current Issues Grinding Section.

Grinding Section: Westmills QIP				
Issues/Actions	Lead Person	Timeline	Evidence	Resources
Improve Surface Finish	Grinding Lead	1-3 months	Test surface finish	Surface finish tester.
Adequate Time to complete.	Planning department/workshop manager	1 month	Adapting route card to allow adequate time.	Modify document in redthorne.
Ensure correct sheer on component.	Grinding Lead	1-6 months	Create jig to aid grinding repeatability.	Milling department to create jig.
No margin to grind after hardening.	Grinding lead	1-6 months	Lack of witness marks in grinding.	Allow adequate material to account for warping in hardening.

Figure 5- Grinding QIP

Current issues Quality Assurance Section:

Quality Assurance Section: Westmills QIP				
Issues/Actions	Lead Person	Timeline	Evidence	Resources
All components to be scanned.	QA Lead	1month	Scans organised and published on shared documents.	CMM and access to shared folder.
All details to be scanned.	QA Lead	1month	Scans to be published and accessible to toolmaker.	CMM and access to shared folder.

Figure 6- QA QIP

Current issues Bench Section:

Bench Section: Westmills QIP				
Issues/Actions	Lead Person	Timeline	Evidence	Resources
Tooling to be engraved with matching ID codes.	Toolmaker	1-6months	Tooling ID's to be documented.	Shared folder.
Tooling checked to be running true	Toolmaker	1-6mnths	Tooling clearances to be checked, work with QA if required.	Engineers blue, CMM machine.
Ensure shut heights are correct.	Toolmaker	1 month	Use shut height that is required for each tool.	Engrave shut height on side of tool.

Figure 7- Bench QIP

The main issues that plague refurbishments of the Westmills tools and should therefore be priority in improving are the inconsistencies in the grinding of the cutting surfaces. Rework of tooling currently costs the company £70 per hour on machine/labour time with grinding rework taking 4 hours on average. In order to guarantee that all components are to spec the QA department will be required to scan components before they are given to the bench section, this prevents instances where the tool is complete and issues are only found while trialling, currently 20% of tooling is split after finding issues while trialling to be reworked.

All issues identified can be rectified by following a structured approach to refurbishing a Wesmills tool, to ensure that these processes are implemented the planning department should aim to produce a standard operating procedure document that can be distributed to all sections.

Currently the company is aiming to improve all tooling refurbishment costs to the company by reducing overall costs by 30%, this will be a key metric that the Westmills improvement plan can be

compared against. Improvements to the refurbishment costs to the company include reducing processes, improving turnaround time and reducing rework.

Potential issues that could arise from the implementation of changes include the resistance for change in the company, lack of communication between departments and complacency over time. To overcome these issues, it is important that team meetings are arranged where all aspects of the changes can be discussed.

6 Conclusion

Through the use of basic quality tools in this report we have identified areas for improvement within the current refurbishment process of the Wesmills tool. By implementing 3 quality tools, the report has simplified historical data into a concise improvement plan that the company can implement to reduce refurbishment costs.

The Root Cause Analysis section helped to clearly lay out all potential issues and their potential causes. The historic data collected via a check sheet also helped in backing up the findings from the root cause analysis. In order to stratify the data, a pareto analysis was used to determine the priority for change in processes, this determined that the main two issues that the company should aim to improve involved the rough edges around the circumference of the blanks and overall dimensions of the blank. To further discuss these two issues and their potential causes a fishbone diagram was created by discussing with multiple members of the refurbishment team.

By implementing the improvements highlighted in this report, including the specific improvement plans the refurbishment process should see significant changes. These changes can be monitored by the reduction in cost to the company.

7 References

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