

# The Innovation of Quality Development in the Deceptions Department to Minimise Weld Imperfections Using Six Sigma Methods

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**Abstract—** Major approach in this project was deployments of DMAIC concept and its principles to understand the various process variables and its effect resulting into final product deliverables. This Project describes about the various cause affected by 4M principles resulting into inferior quality of welding in aspect related to critical defects. With Root cause analysis (RCA) various process defined variables were validated with 3W(Why Why) analysis methodology, the identified Gap was taken for improvement by process mapping with standardisation and control techniques used to ensure sustenance of action defined to be followed at all Micro and Macro level of process input stage.

**Keywords--** MAIC, 4M, 3W, VOC, RCA, Genba, NVA.

## 1.0 Introduction

In this scientific era of changing customer needs and demand of highly reliable quality products, every organisation strive to improve the quality and operational performance continuously to survive and grow in the highly competitive business world. This study aims to improve and sustain level as an important aspect. Quality of Fabrications in the every Critical assemblies should be maintained with a good visual and functional in order to assure that product quality life cycle. The main component of Hydro/Automobiles consists of three components, such as turbine, condenser, and generator, Front axle, Brackets is widely used due to high efficiency, economic cost, and operational flexibility. The main process of fabrication is welding the materials. Six Sigma is one of comprehensive framework to provide solutions to the industrial problems using a set of qualitative tools. It is designed to reduce process variation by DMAIC principle, defining, measuring, analysing, improving, and controlling processes.

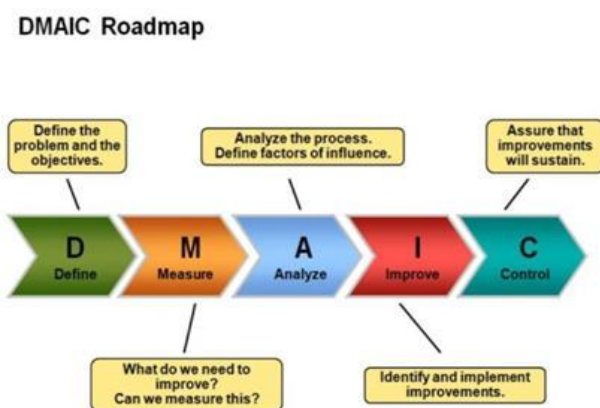


Figure 1 DMAIC map

The Six sigma methodology is a quality improvement approach used in operations management. It seeks to find and eliminate defects in manufacturing and business processes. The Six sigma approach in operations management is data-driven and relies on statistical methods to identify and correct process defects. Six Sigma aims to reduce process variation and improve process quality.

## 1.1 Types of Welding Equipment Involved In Fabrication- (Major)

- 1) Metal Inert Gas (MIG welding)
- 2) Arc welding process.
- 3) Gas tungsten arc welding process
- 4) Resistance welding

## 1.2 Concept of MIG welding.

Metal Inert Gas MIG welding uses a constant voltage power supply to create an electric arc that fuses the base metal with a filler wire that is continuously fed through the welding torch. At the same time, an inert shielding gas is also fed through the gun, to protect the weld pool from atmospheric contamination. MIG welding is generally used for heavy duty fabrication projects such as Heavy strength required Parts. Compared to TIG welding, it is much faster resulting in less lead times and cheaper lower production costs. However, TIG will always be the first choice where precise, strong and very clean welds are primary concerns but MIG is much Cheaper in all aspects if basic welding process is adopted and Complied accordingly.

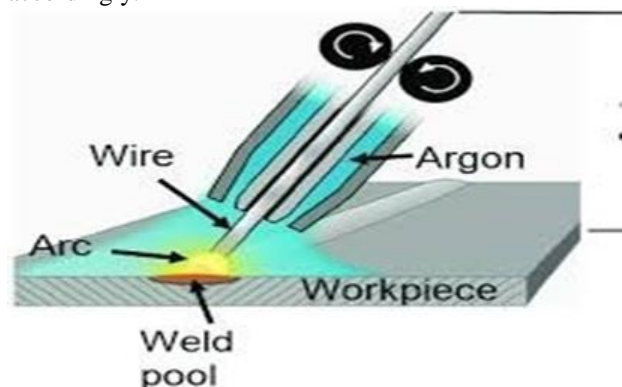


Figure 2 MIG Welding  
2.0 Literature Review

Boby John & Abdulrahiman Areshankar et al. This paper presents a case study on the implementation of Six Sigma technique to reduce the number of bearing end plates transforms in a machining procedure. The goal of the study is to minimise rework brought on by variations in thickness and diameter. Two factors—tool type and antifreeze pH—are

shortlisted as the primary causes from the list of probable causes that have been found. Taguchi's loss function method and the design of trials are used to determine the optimal values of tool kind and coolant pH that would optimise both the thickness and diameter at the same time.

Alessandro Brun et al This paper presents the findings from a study project conducted at Milan's Politecnico di Milano with the goal of examining the peculiarities of Six Sigma deployments in Italian businesses. The study specifically tackles the following research issues about how Italian businesses handle Six Sigma: are they applying the methodology precisely as Motorola initially intended, or is there another way that Italian businesses approach Six Sigma? A review of the literature revealed a dearth of information about Six Sigma application in Italian businesses. The study of Six Sigma applied in a real-world Italian company and the conversations that resulted from a series of workshops with Six Sigma specialists held at the University of Milan's Politecnico served as the foundation for the research.

Arup RanjanMukhopadhyay et al The implementation of Lean Six Sigma technique for reducing the cycle time of settling claims in the insurance industry is presented in this article. Results: It has been shown that implementing process modifications using Lean Six Sigma greatly shortens process cycle times in the insurance industry. Lean Six Sigma is an excellent example of how combining quantitative and analytical methods may speed up processes for service organisations.

Jiju Antony, Maneesh Kumar, Christian N. Madu et al. Over the past two to three decades, six sigma for medium-sized organisations (SMEs) has gained popularity among academia and six sigma practitioners. There aren't many studies that discuss how well six sigma has been applied in SMEs. This paper's goal is to analyse the application of six sigma in UK small and medium-sized enterprises.

Barrie G. Dale, Ton van der Wiele, David Bamford et al. This well-known and incredibly effective book on quality control has been completely updated and reworked to take into account the most recent advancements in the industry. Timely coverage of expanding markets, agile development, product research, decisions based on evidence, and quality assurance is added to the sixth edition. In order to keep the book up to date, some of the information has been rearranged and terminology has been updated. New co-author David Bamford's contributions provide perspectives from an experienced educator and entrepreneur.

Syafwiratam, O.S., Hamsal, M., & Purba, et al. This study describes how to reduce the number of products that don't conform in Indonesian polyester short cut fibre manufacturing by applying the Six Sigma method. From Jan to May 2015, a rise in inconsistent goods in the manufacturing procedure for shortcut fibre led to some quality issues. The processes of define, measure, analyse, improve, and control (DMAIC) were , Every stage of DMAIC on the Six Sigma method will be carried out continuously. At this stage, the first step is to determine the project to be carried out based on a predetermined priority scale, problem definition, and determine the CTQ. Here is the project charter for this study. Table 1. Project Charter.

The second step in the DMAIC stage is measure. Table shows

used to identify the underlying causes of the issues and to enhance the manufacturing process through the application of statistical methods.

### 3. METHODOLOGY AND DATA COLLECTION

The primary objective of this six sigma project is reducing the process variations for zero defect approach and improving the customer satisfaction. Six Sigma is proven to provide solutions to eliminate the defect of products in the industrial sector

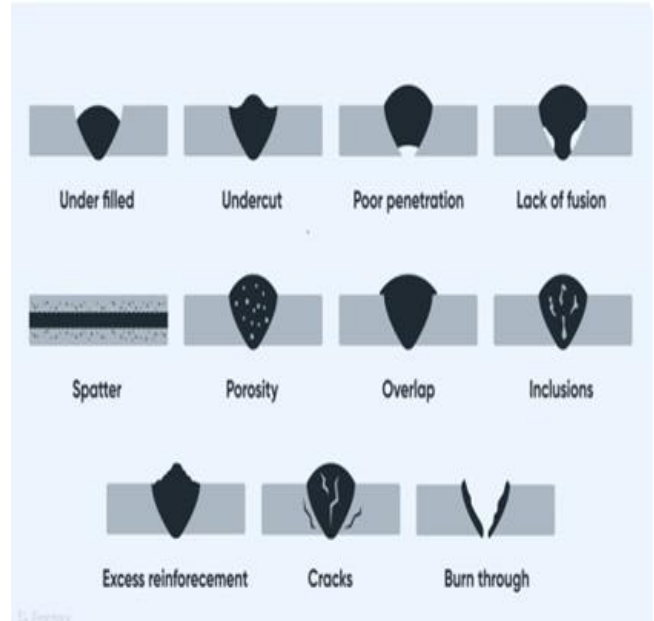


Figure 3 six sigma for medium-sized organisations (SMEs)

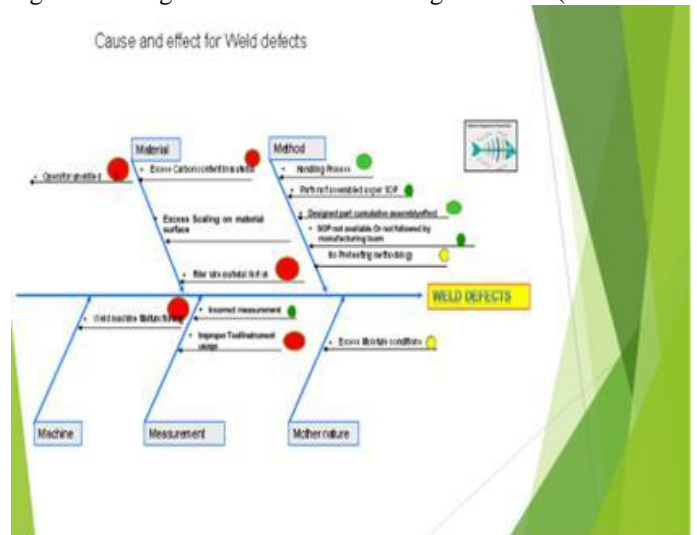


Figure 4 six sigma flow Methodology diagram

the number of defects and current sigma level from welding results of joints headers to headers, headers to end caps, and tubes to tubes by NDT methodology.

Table 1. Project Charter

Validation of Prioritized Causes for Occurrences and Detection			
Note: Put "Yes" for Significant Causes, which are correlating with The Problem, Unless put "No".			
S. No.	Possible Causes	Validation Details and its effects	Significant (Yes/No)
1	Operator unskilled	Found Welders as per standard operating procedures	No
2	Excess Carbon content in material	Material Tr found with excess Carbon resulting into Blow holes/porosity	Yes
3	Excess Scaling on material surface	Resulting into material burnt and fumes resulting into blowholes	Yes
4	Filler wire material Not oil (Storage conditions Moisture)	Not Maintained found temperature above 30 Celsius results into porosity	Yes
5	Improper Tool/Instrument usage	Peacock Gauge not available for size measurement which will give incorrect readings	Yes
6	Weld machine Malfunctioning	No Maintenance schedules found, Varying temp output found results into cracks	Yes
7	No Preheating methodology	Found within specifications	No
8	Excess Moisture conditions	Humidity/moisture as per Gauge found oil	No



Figure 5 Welding Results of the process  
The average sigma level is 4.1 which could explain the productivity and financial condition of the company

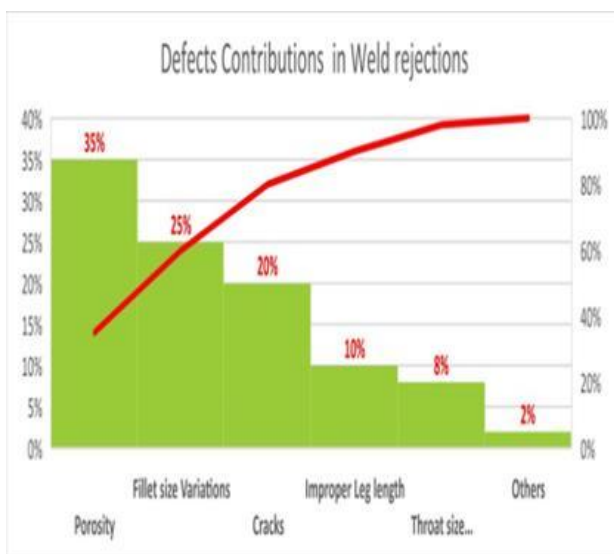


Figure 6 evaluation curve

Cause and Effect diagram should be validated by using san-gen shugi methods San-gen shugi means principle of three realities, i.e. genba (real place), genbutsu (real part), genjitsu (real facts). On the basis of the Cause-and-Effect matrix, Project team concluded three critical that influence the output variables the most. These three variables are welder skill, welding fluxes gas, and welding condition.

#### 4. Conclusion

An approach of improvement of quality acceptance level by systematic approach by DMAIC approach will enhance and reduce the Cost of poor quality. The experimental results confirm that this approach is simple, effective and efficient for simultaneous optimization of multi-response characteristics. From the result of confirmation, it was concluded that for every cases of quality sustenance we need to use various Tools to attain 6 sigma approach with Complete Control Plan approach.

- Identified critical process with performance index during customer survey.
- Categorized the customer expectations (VOC).
- Quantified the various deliverables.
- Data stratifications with qualitative approach.
- Directly linked with Business objectives
- Defines /Identifies various probable causes with 4P approach with Brain storming approach.
- Demonstrate the solutions to optimise the out put and validate results on Full scale and define controls to sustain Growth.

#### 4.1 Future Scope

The present work in this thesis is not the end. In future, this thesis work can be modified by using robust quality analytical tools to understand the effects various parameters and its effects on sustenance in attaining the sound welding at meeting the all relevant standards as per ASME Sections

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