www.ijemr.net ISSN (ONLINE): 2250-0758, ISSN (PRINT): 2394-6962

Volume-8, Issue-3, June 2018

International Journal of Engineering and Management Research

Page Number: 201-207

Case Study
Applications of Six Sigma in Mild Steel and Stainless-Steel Light Fabrication Processes

Viraj V Atre

Assistant Professor, Operations, Institute for Future Education, Entrepreneurship and Leadership, Pune, Maharashtra, INDIA

Corresponding Author: Viraj.atre@ifeel.edu.in

ABSTRACT

The Paper Discusses about Applications of Six Sigma Quality Tools in a light fabrication industry manufacturing mild steel and stainless steel modular kitchen cabinets and furniture products as per made to order and standardized sizes for the Indian consumers. The paper explores all the processes through which raw material has to undergo right from the unloading stage to finished goods shipped to the customer premises. It does not discuss assembly and mounting or installation processes.

Keywords--- Six Sigma, QC Tools, Fabrication Process, Quality Control

Organization: Aims Engineering Fabrication Industries, Pune.

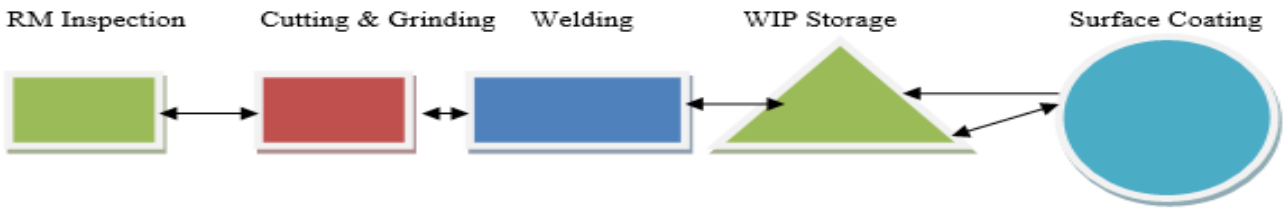
I. INTRODCUTION

Mild Steel (Popularly known as M.S.) and Stainless Steel (Popularly Known as S.S.) are widely used in the furniture industry for making household as well as industrial furniture products. There are various grades of M.S. & S.S. materials used for applications and as per strength requirements of consumer's needs. Mild Steel used is of broadly two main categories: HRC & CRC: Hot Rolled Cold Annealed and Cold Rolled Cold Annealed Categories respectively. Stainless Steel prominently used in the furniture industry (domestic) is of SS304 and SS316 category, whereas Industrial Applications use SS316 necessarily, which is of a high marine grade anti corrosive steel. Most of the SS304/SS316 fabricated parts are also Ni-Cr (Nickel – Chromium) Plated for Long Lasting Shine, Anti-Oxidation and Superfine Finish Outlook.

II. THE MANUFACTURING PROCESS

The Manufacturing Process starts from the stage of Raw Material unloading which is sent by the Vendor / Supplier. The Vendor / Supplier is appointed after stringent Quality Control Checks at his premises after undergoing an SQA (Supplier Quality Assurance) process as prescribed by ISO 9001 Quality Management Systems. Usually all Vendors/Suppliers are Certified in Quality Management Systems ISO 9001.

The Manufacturing Process is summarized in the following diagram



ISSN (ONLINE): 2250-0758, ISSN (PRINT): 2394-6962

Applications of Quality Tools

Stage 1: Raw materials Stage

Application of Quality Assurance stringently starts at the input stage itself. As it is rightly said, what goes in comes out; a good quality raw material will go in and come out with a good quality finished product. MS & SS Sections are stringently checked at the raw material input stage while degreasing and cleaning for the diameter, thickness, wall thickness, ID (Internal Diameter) and OD (Outer Diameter) of each section. Sections come in a size of 20 feet in length (standard 6-meter tube / bars in square / round shape) and in different gauges. The Company uses 16 SWG (Standard Wire gauge) thickness tubes in round and / or square shapes for making its furniture products. 16 SWG is 1.6mm wall thickness of the sections on all sides. Each Cross Section of a Tube (Squared / Rounded) is checked for Wall Thickness of 16 SWG at three different locations: Bottom, Centre and Top Surface.

Stage 2: Rejections

Rejected Tubes / Parts are stored in rejection area stores and are returned back to the supplier for necessary replacements. This is the first stage of quality assurance. Rejections of approximate 15% have been accounted for by the company and a detailed **Pareto analysis** is done. Pareto is the First Quality Assurance Tool used; further the same is shared with the raw material supplier to ensure no repeated rejections in the future.

Pareto Analysis revealed the following results

Rejection Reason	Number of Rejections	Action taken	Rejections before Improvements	
Tube Bend	15/200	Straighten	15/100	100/100
Thickness Uniformity	25/200	Replace	25/100	100/100
Finish Rough	10/100	Replace	10/100	100/100
Total	50/500	SQA/VMS*	50/500	500/500
Cumulative (%)	10%	SQA/VMS*	10%	100%
*SQA/VMS – Supplier Quality Assurance / Vendor Management System Applied				
Data Courtesy: Aims Engineering Fabrication Industries, Pune.				

Stage 3: Cutting

The Accepted raw material is then cut into the required dimensions in terms of length and breadth.

The Ends of the cut material are superfine grinded for further stage (welding)

An HU14 Industrial Metal Cutter (Portable) is used with a cutting wheel of 14" OD.

Hitachi CC14STD 14 inch 2200-Watt Cut-off Machine (Green)

This machine is calibrated for an accuracy cut of +/- 1mm.

Quality Assurance Check

The Cross Sections Cut is measured (100% Inspection) for Length and Breadth of the sections for accuracy of the Customer Specification Limits with a tolerance as given by the customer. The wrongly Cut Material is further given for Grinding (If Oversize) or rejected (if undersize)

Customer Specifications and Standardized Measurements

MS & SS Sections are standardized with mutual understanding of the customers of the following sizes (all dimensions in mm)

Sr.No.		Cut Section		Length		Breadth		Tolerance	Type
1		Square Tube		675		NA		+/- 1mm	MS
2		Round Tube		675		NA		+/- 1mm	MS
3		Square Tube		NA		610		+/- 1mm	MS
4		Round Tube		NA		610		+/- 1mm	MS
5		Square Tube		710		NA		+/- 1mm	SS304
6		Round Tube		NA		610		+/- 1mm	SS304
7		Square Tube		NA		610		+/- 1mm	SS304
8		Round Tube		710		NA		+/- 1mm	SS304

Data Courtesy: Aims Engineering Fabrication Industries, Pune.

Stage 4: Grinding

The Cut parts as described in Stage 3 above are checked for their end to end measurements and further given for grinding (so as to remove the steel bur) and make superfine end surface finish for welding. The Grinding stage is carried out with the following machine

Hitachi G10SR3 4-Inch Angle Grinder

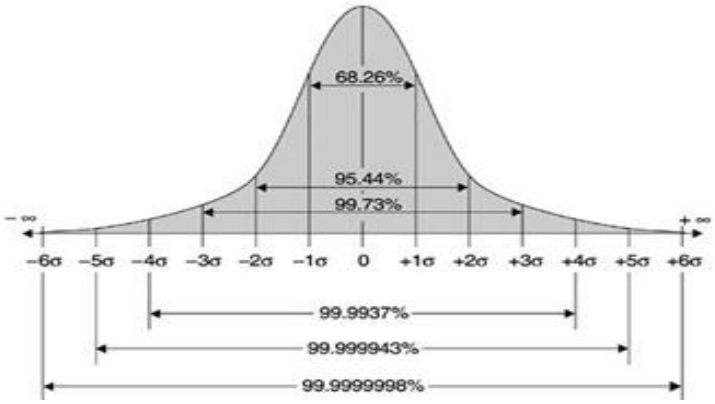
Grinded Cut Sections

Cut Section Tube

Grinding Tolerance: +/- 1mm end – to – end

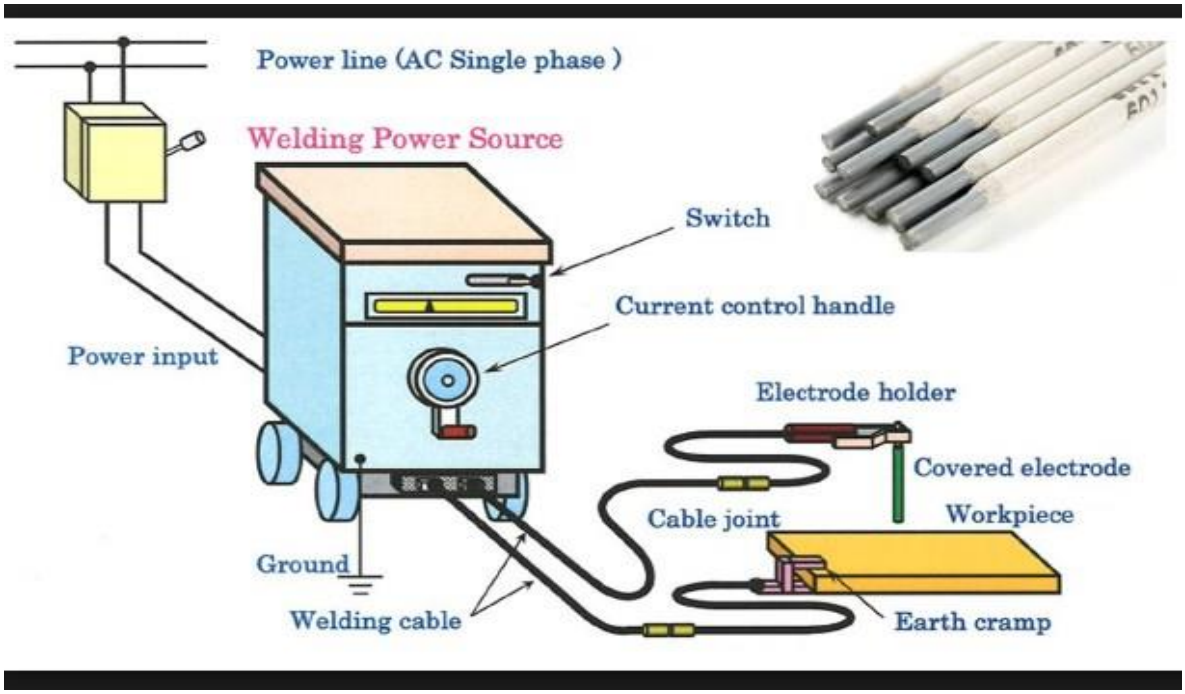
Graph of Grinded Surfaces (3 Sigma Accuracy)

ISSN (ONLINE): 2250-0758, ISSN (PRINT): 2394-6962



Stage 5: Welding

Metal Arc Welding Technology is used for all welding processes except stainless steel welding process.



Shielded Metal Arc Welding Machine Parts and Process

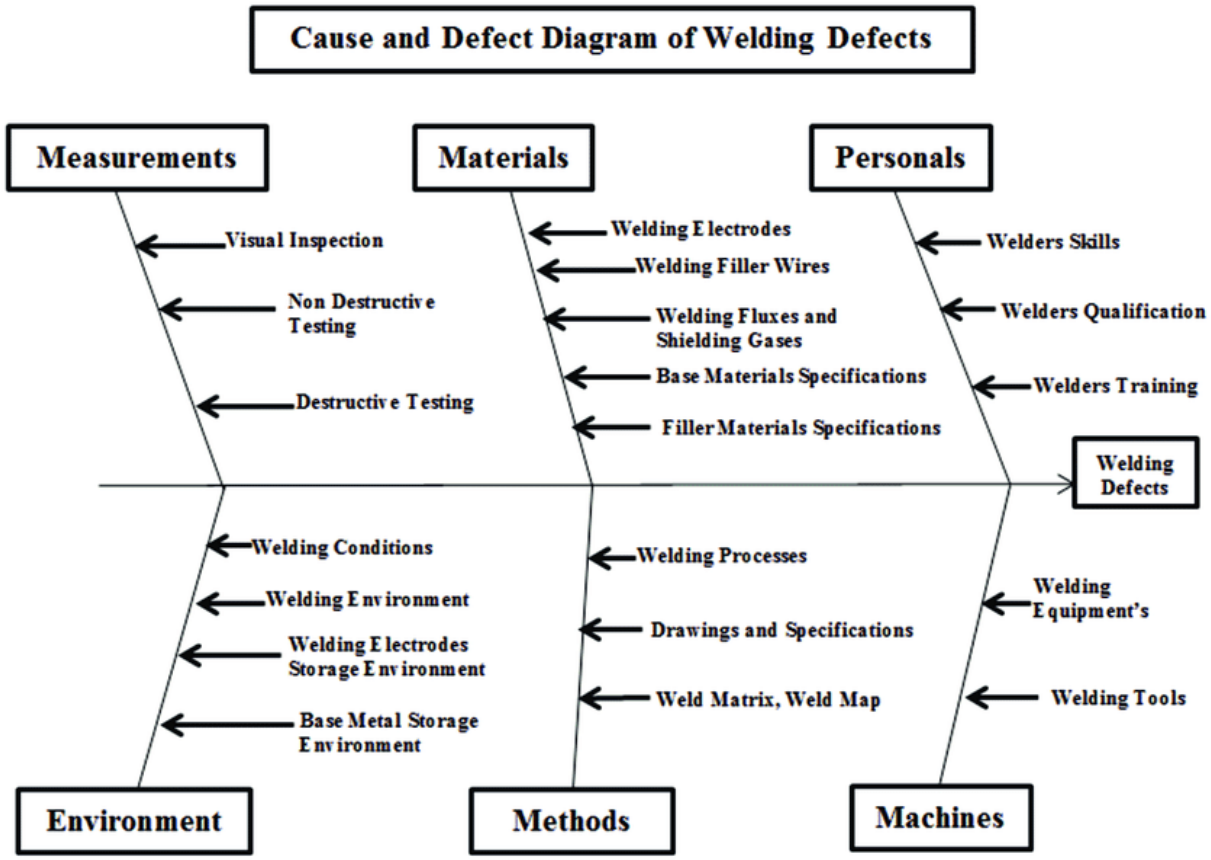
ISSN (ONLINE): 2250-0758, ISSN (PRINT): 2394-6962

Identified Welding Problems & Quality Control

Following Problems are identified in Welding Process (Metal Arc Welding)

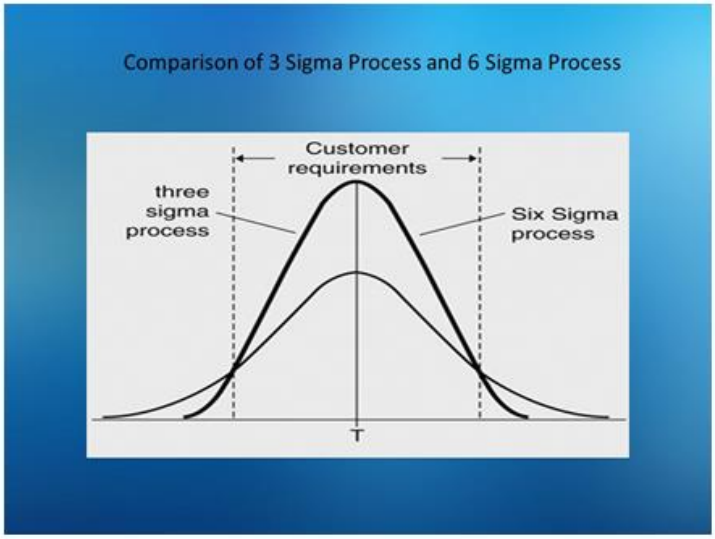
Sr.No	Type of Fault	Remedy	Improvement (%)
1	Weak Joint	Check Electrode	25%
2	Holes	Adjust Current	15%
3	Crack	Adjust Current	10%
4	Bubbles	Check Electrode	10%

3- Sigma methodology applied to welding process to cover at least 99.73% of the total population within 3 standard deviation limits.



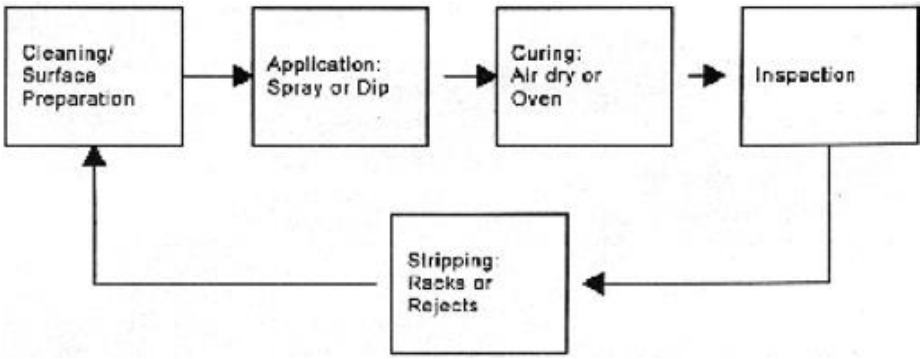
Through Cause and Effect Analysis, Welding Defects were brought down to 99.73% Accuracy.

ISSN (ONLINE): 2250-0758, ISSN (PRINT): 2394-6962



Stage 6: Surface Coating Process

Figure 1. Overview of the Coating Process



Observed Defects

1. Over Coating
2. Paint blisters
3. Bubbles
4. Thin Coating Resulting in Faded Finish
5. Scaling
6. Nonuniformity of Paint Thickness

The Defects were categorized as per Pareto analysis and reduced substantially.

Surface Coating Defects Analysis through Pareto / Cause and Effect Analysis			
Defect Type	Before	After	Improvement
Over Coating	15/100	5/100	10%
Paint blisters	20/100	5/100	15%
Bubbles	15/100	5/100	15%
Thin Coating - Faded Finish	10/100	5/100	5%
Scaling	5/100	0/100	5%
Nonuniformity of Paint Thickness	5/100	0/100	5%
Grand Total	70/100	20/100	55%

ISSN (ONLINE): 2250-0758, ISSN (PRINT): 2394-6962

III. CONCLUSION

Six Sigma methodologies has been proven and successful methodology to improve defect percentages and reveal fantastic results, thereby improving customer satisfaction. Various numbers of tools in quality analysis like why why analysis, Pareto analysis cause and effect diagram were used and a detailed analysis was done. Impact Creating factors were minimized for creating defects.

In this case study substantial improvements to the level of 50% and above have been achieved.

The Following Six Sigma Methodology Was Used at all stages of the process

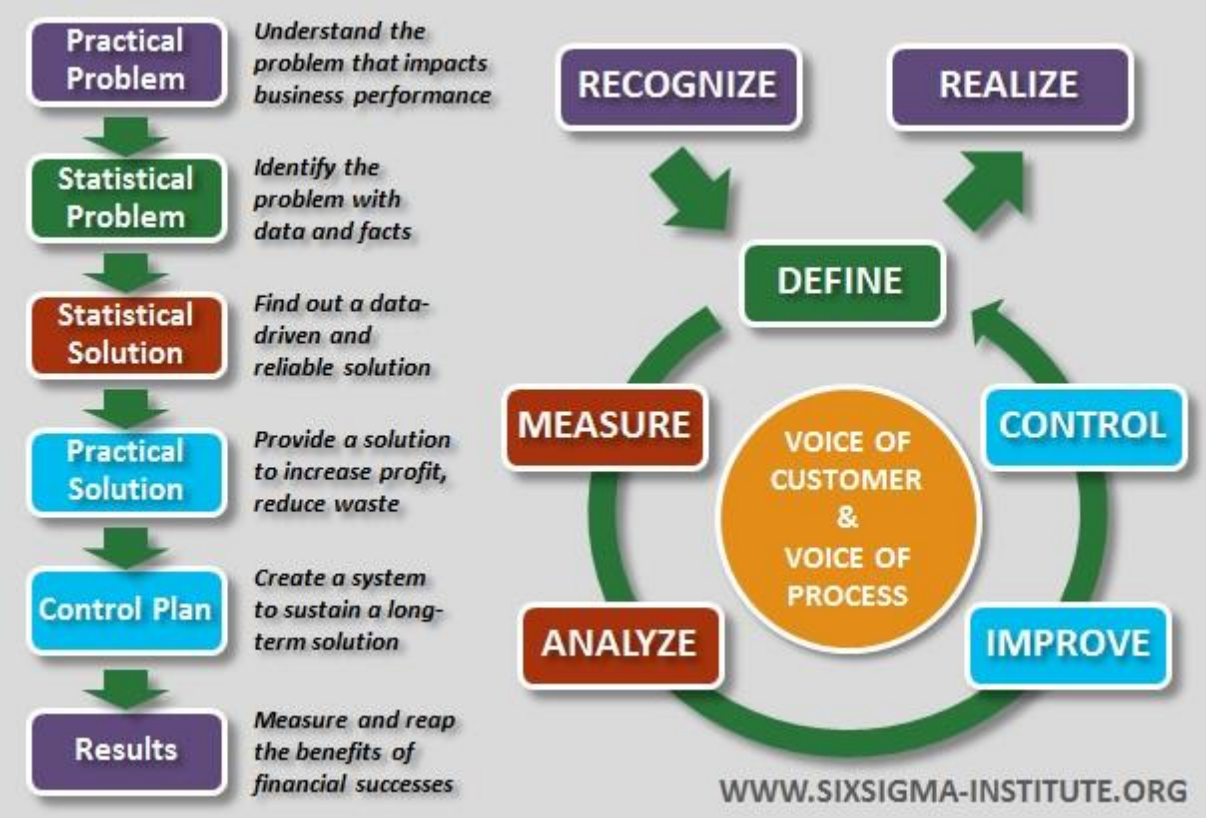


Image Courtesy: International Six Sigma Institute, Germany.

REFERENCES

[1] Aims Engineering Fabrication industries Kothrud Pune 411038
[2] Photo Courtesy: International Six Sigma Institute Germany
[3] Hitachi Machine Tools Company