

**QUALITY IMPROVEMENT THROUGH IMPLEMENTATION OF POKA
YOKE AND SIX SIGMA METHODOLOGY IN THERMAL INTERFACE
MATERIAL COATING INDUSTRY**

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A project report submitted in partial fulfillment of the
requirements for the award of the degree of
Master of Engineering (Industrial)

Faculty Of Mechanical Engineering

Universiti Teknologi Malaysia

MAY, 2010

ACKNOWLEDGEMENT

In preparing this thesis, I was in contact with many people, engineers, academicians and employees of BY Technology. They have contributed towards my understanding and thoughts. In particular, I wish to express my sincere appreciation to my supervisor, Associate Professor Dr. Muhamad Zameri Mat Saman, for encouragement, guidance, critics and friendship. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space. I am grateful to all my family members as well.

ABSTRACT

This research is to study the effectiveness of implementing the Lean Manufacturing techniques to reduce process yield loss and scrap cost in Thermal Interface Material (TIM) Coating Industry. Before this research was done, the TIM coating industry always faced the problem of poor process yield and also high scrap cost. This has contributed to losses in the operation. This process yield loss and high scrap cost were due to the fact that the products produced did not meet the coating thickness specification that was set by the customers. The coating thickness is one of the most important critical to quality (CTQ) parameter. Due to this problem, this research has used Lean technique particularly Poka Yoke devices to solve this problem. The methods used are by applying Visual Management Technique and ANDON light together with laser sensors to detect and trigger the operator when the coating thickness is out of specification. The process yield and scrap cost data was taken before the implementation of Poka Yoke devices and after the implementation of Poka Yoke devices. There are then compared to see the improvements from the implementation of Poka Yoke devices. The implementation of these techniques had managed to help improve on the process yield and also in reducing the scrap cost associated with coating thickness.

ABSTRAK

Kajian ini dilakukan bertujuan untuk mengkaji keberkesanan pelaksanaan teknik “*Lean Manufacturing*” untuk mengurangkan masalah pembaziran produk dan juga kos pelupusan dalam industri penyalutan Bahan Pengantara Thermal (*Thermal Interface Material*) / TIM. Sebelum kajian ini dilaksanakan, industri penyalutan TIM sering menghadapi masalah pembaziran produk yang serius dalam pembuatan dan juga kos pelupusan produk yang tinggi yang menyebabkan kerugian pada industri tersebut. Pembaziran produk ini disebabkan oleh ketebalan penyalutan yang tidak menepati piawaian atau spesifikasi yang ditetapkan oleh pelanggan. Ketebalan penyalutan merupakan salah satu parameter kritikal kualiti yang amat penting. Berikutan ini, kajian ini telah menggunakan salah satu konsep “*Lean*” untuk menyelesaikan masalah tersebut. Konsep yang digunakan adalah dengan mengaplikasikan pengurusan visual dan teknik lampu ANDON bersama dengan sensor laser untuk mengesan ketebalan penyalutan dengan serta merta semasa pembuatan produk dilakukan. Data pengeluaran dan kos pelupusan sebelum pelaksanaan Poka Yoke dan selepas pelaksanaan Poka Yoke telah dikumpulkan dan dibandingkan bagi mengenalpasti penambahbaikan yang diperolehi. Ini seterusnya telah berjaya mengurangkan kos and kerugian disebabkan oleh ketebalan penyalutan yang gagal menepati piawaian pelanggan.

TABLE OF CONTENT

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	ACKNOWLEDGEMENT	iii
	ABSTRACT	iv
	ABSTRAK	v
	TABLE OF CONTENTS	vi
	LIST OF TABLES	x
	LIST OF FIGURES	xi
	LIST OF SYMBOLS	xiv
	LIST OF APPENDICES	xv
1	INTRODUCTION	1
	1.1 Overview	1
	1.2 Background Of Problem	2
	1.3 Statement Of Research Problem	3
	1.4 Objective	4
	1.5 Scope Of Study	4
	1.6 Importance Of The Project	5
	1.7 Organization Of The Report	5

2	LITERATURE REVIEW	7
2.1	Overview	7
2.2	Lean Manufacturing	8
2.3	Tools And Techniques Use In Lean Manufacturing	10
2.3.1	5S System	10
2.3.2	Poka Yoke (Mistake Proofing)	12
2.3.3	Kaizen (Continuous Improvement)	13
2.3.3.1	Kaizen For Quality	14
2.3.4	Value Stream Mapping (VSM)	18
2.3.5	Total Productive Maintenance (TPM)	19
2.3.6	Just In Time (JIT)	21
2.3.6.1	Introduction Phase For JIT	22
2.3.7	Kanban	24
2.3.8	SMED (Single Minute Exchange Of Die)	25
2.3.8.1	SMED (Current Theory And Practice)	27
2.4	Six Sigma	28
2.5	Differences Between Lean And Six Sigma	29
2.6	Integrating Lean And Six Sigma	32
2.7	Summary	34

3	METHODOLOGY	35
3.1	Overview	35
3.2	Identify OOS Customer CTQ Parameter	36
3.3	Form A Team To Solve The Process Problem	38
3.4	Measure The Customer CTQ Output	38
3.4.1	Determining Operational Definition	38
3.4.2	Develop Measurement Plan	39
3.5	Analyze And Select The Correct Lean Tools	41
3.6	Monitor CTQ After Improvement	43
3.7	Summary	43
4	PROBLEM IDENTIFICATION	44
4.1	Overview	44
4.2	KOR Coating Process	44
4.3	Quality Defects in KOR Coating	48
4.4	Data Collection And Analysis	49
4.5	Process Yield	50
4.6	Scrap Cost	52
4.7	Summary	54

5	COUNTER MEASURE DEVELOPMENT	56
5.1	Overview	55
5.2	Counter Measure	55
5.3	ANDON Light And Visual Management System	59
5.4	Summary	63
6	DISCUSSION	64
6.1	Overview	64
6.2	Improvement On Process Yield	64
6.3	Improvement On Scrap Cost	68
6.4	Summary	69
7	CONCLUSION	70
	REFERENCES	72
	Appendices A-B	78 -80

LIST OF TABLES

TABLE NO.	TITLE	PAGE
2.1	Fundamental differences between Six Sigma and Lean Methodologies	30

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.1	Lean concept	17
2.2	SMED conceptual changes	26
2.3	Improvements over time with Six Sigma or Lean alone	33
2.4	Nature of competitive advantage	34
3.1	Methodology for Lean Six Sigma in this research	36
3.2	KOR coating process	37
3.3	Performance measure for coating thickness	38
3.4	Laser gauge sensor	39
3.5	A digital micrometer	40
3.6	Coating in process and outgoing record	41
3.7	Pareto for TIM coating defects	42
3.8	Cause and effect diagram for TIM coating thickness	42
4.1	KOR Coater standard web diagram	46
4.2	Coating pan setup	46
4.3	Coating from coating pan	47

4.4	Laser gauge to detect coating thickness	47
4.5	Web direction passing the coating machine	49
4.6	Web portion for samples	50
4.7	Comparison of KOR coating product yields	51
4.8	Yield data for KOR coating before implementation of Poka Yoke	52
4.9	Web size for scrap cost calculation	53
4.10	Price Per Square Yard (In US \$) For Different KOR Products	54
4.11	The scrap cost for KOR before lean implementation	54
5.1	Conceptual framework to improve TIM coating process	58
5.2	ANDON visual management system	58
5.3	Digital readings to check on coating thickness	60
5.4	Left and right side laser sensor	60
5.5	ANDON light out of spec indicator	61
5.6	ANDON light within spec indicator	61
5.7	KOR coating process yield after Poka Yoke implementation	62
5.8	KOR coating process scrap cost after Poka Yoke implementation	62
6.1	X Bar and R control chart for KOR coating thickness before Poka Yoke implementation	66
6.2	X Bar and R control chart for KOR coating thickness after Poka Yoke implementation	67

6.3	KOR coating thickness process yield tracking	68
6.4	Scrap Cost (\$) for KOR coated TIM gap filler	69

LIST OF SYMBOLS

CCR	-	Critical customer requirement
CTQ	-	Critical to quality
DMAIC	-	Define, measure, analyze , control and improve
KOR	-	Knife over roll
OOS	-	Out of specification
SMED	-	Single minute exchange of die
TIM	-	Thermal interface material

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Work Instruction of KOR Coater Operating	78
B	KOR Coater Setup and Operating Specifications	79

CHAPTER 1

INTRODUCTION

1.1 Overview

In today's competitive market many firms have tried to improve their performance using various continuous improvement methodologies such as Lean Six Sigma, Total Quality Management and Theory Of Constraints. Currently Lean Six Sigma is the most popular one. Lean Six Sigma consists of two main elements which are Lean Manufacturing and also Six Sigma. Lean Manufacturing focuses on the goal to eliminate non-value added activities in a process with the aim of waste elimination, process cycle time reduction, on-time delivery improvement and cost reduction. Six Sigma on the other hand focuses on reducing variation and improving process yield by following a problem-solving approach using statistical tools (Bertels, 2009).

1.2 Background Of Problem

Lean and Six Sigma are two systems that have been applied comprehensively in different industries from manufacturing to service industries. However, organizations that have embraced either Six Sigma or Lean Management might find that they eventually reached a point of diminishing returns even after re-engineered their operating and supporting systems by solving major problems and resolving key inefficiencies. Further improvements have stalled or no longer easy to generate after this point of diminishing returns (Arnheiter and Maleyeff, 2005).

To overcome the limitation of only one system, be it Six Sigma or Lean Management, a method of integrating these two are used. Six Sigma and Lean component complements each other and the integration is made by combining the waste reduction from Lean and statistical approach from Six Sigma. Lean-Sigma brings in the perspectives of customer needs, performance measures, and engineering and statistical tools during the stages of constraints identification and exploitation. (Ehie and Sawhney, 2005).

In this research, Lean Six Sigma is focused on its implementation in manufacturing facilities specifically coating of Thermal Interface Materials (TIM) industries. Previous case studies have been done on the supplier of vehicular components (Ehie and Sawhney,2005) and in insurance service provider (Rath and Strong, 2009).

1.3 Statement Of Problem

The Lean Six Sigma tools which are used in the TIM coating line consist of tools from Lean and also tools from Six Sigma. The tools from Lean include Poka Yoke, value stream mapping and also cause and effect diagram . Tools from Six Sigma include X bar and R chart.

The tracking of the process yield prior to Lean Six Sigma methodologies implementation and post implementation are used to quantify the improvements. Monetary values in terms of waste due to scrap are also used to track on the cost savings from Lean Six Sigma implementation.

To improve process yield performance, several Lean methods have been used. This include Poka Yoke by installing Andon light to provide visual and sound indicator when the process critical parameter (thickness of coating) is out of specification.

The tracking on scrap cost savings is done through the yield tracking. For each yield loss, the scrap cost is quantified based on the length of yards of material scrapped. Since the end product cannot be salvaged or reworked, any yards of materials which is out of the critical customer requirements (CCR) specification would have to be scrapped.

1.4 Objective

This research is aimed at establishing a Lean Six Sigma methodology for coating manufacturing line, improving the manufacturing process yield by 20% and to reduce waste in terms of scrap cost by 10%. The process yield data will be analyzed quantitatively by comparing the results prior to implementation of Lean Six Sigma to post-implementation results.

1.5 Scope Of Study

The scope of this research only focuses on the Thermal Interface Material (TIM) coating with BY Technology as the case study. It does not cover all other coating manufacturing industries. Due to time constraints, the scope is also limited to one Lean improvement projects implemented at TIM coating which is ANDON light for thickness tracking improvement. It utilizes the Poka Yoke concept. The output studied in this research are the manufacturing process yield and also scrap cost incurred due to yield loss. The output data performance are measured using a X bar and R chart and trend chart to analyze the stability of the process over time.

1.6 Importance Of The Project

The research findings will enable manufacturing facilities specifically TIM coating industries to comprehend the importance and benefits obtained from integrating Lean and Six Sigma together. The implementation of single program in isolation, be it Six Sigma or Lean will have limitation once they reach the point of diminishing returns. Thus, with this knowledge and information available, organizations will be able to improve their process capability and robustness which in turn improve their competitive advantage.

In addition by improving process stability and robustness, the organizations will also be able to reduce wastages due to scrap and reduce variation in the product critical parameter. This will reduce non value-added activities for the manufacturing process, improve on the quality yield which will translate to generate more sales and businesses for the organizations.

1.7 Organization Of The Report

The report will be divided into seven chapters which are introduction, literature review, methodology, problem identification, counter measure development, discussion and conclusion.

Chapter one gives some some introduction and understandings on the problem statement such as the defects faced in the TIM coating industries.

The second chapter will explain about what is Lean and what is Six Sigma and the benefits obtained in integrating these two methodologies together to achieve better savings in term of cost and quality improvements.

The third chapter will touch about the methodology used in this research such as the application of DMAIC (Define, measure, Analyze, Improve and Control) which is part of Six Sigma tools used to improve the TIM coating out of specification quality issue.

The fourth chapter which is problem identification will explain on KOR coating process, quality defects in KOR coating, data collection and analysis, process yield and scrap cost data before Poka Yoke implementation.

The fifth chapter which is counter measure development will explain ANDON light implementation and visual management system and also process yield and scrap cost data after Poka Yoke implementation..

The sixth chapter which is the discussion will present the data and comparison between before and after Poka Yoke implementation.

The seventh or the last chapter which is conclusion will conclude and summarize the whole research on the benefits and advantages from the implementation of Poka Yoke on processs yield and scrap cost and also on the future plan for the research.