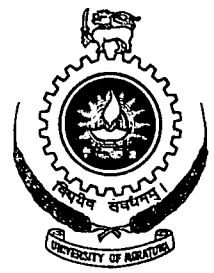


LB 1000.101.2011

LIBRARY
UNIVERSITY OF MORATUWA, SRI LANKA
MORATUWA



WASTE ELIMINATION AND PRODUCTIVITY IMPROVEMENT IN NUT & BOLT MANUFACTURING INDUSTRY IN SRI LANKA



University of Moratuwa, Sri Lanka.
by
Electronic Theses & Dissertations
www.lib.mrt.ac.lk
Gallage, K.G.R

Supervised by

Dr. Piyasena Samarakoon

This thesis was submitted to the Department of Mechanical Engineering of the University of Moratuwa in partial fulfilment of the requirements for the Degree of Master of Engineering in Manufacturing Systems Engineering

University of Moratuwa



96401

Department of Mechanical Engineering
University of Moratuwa
Sri Lanka
December 2009

96401

Handwritten notes and signatures at the bottom right corner.

DECLARATION

This Dissertation paper contains no material which has been accepted for the award of any other degree or diploma in any University or equivalent institution in Sri Lanka or abroad, and that to the best of my knowledge and belief, contains no material previously published or written by any other person, except where due reference is made in the text of this Dissertation.

I carried out the work described in this Dissertation under the supervision of Dr. S.M. Piyasena

Signature :



Date : 2009.12.29

Name of Student :

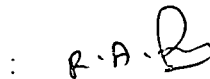


University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

Gallage, K. G.R.

Registration No : 05/8654

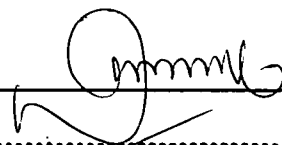
Signature :



Date : 26/08/2010

for

Name of Supervisor : Dr. S.M. Piyasena



.....
Director
National Cleaner Production Centre,
Sri Lanka.

Abstract

This Project provides the possible ways to sustain the Hexagonal Nut and Bolt manufacturing Industry in Sri Lanka.

When the London Metal Exchange figures and graphs are analyzed it is clearly shown that the steel prices are in a hike. And also China and India are trying to acquire Sri Lankan market. Hence, the steel manufacturers have been facing many difficulties with the price competition and the rising costs. Therefore, waste elimination and productivity improvement methods needed to be introduced to the Hexagonal Nut and Bolt manufacturing Industries in Sri Lanka. This report contains a successful case study carried out at Company X Ltd which represents this industry and shows how to apply these methods to other factories for their future protection.

This also contains a literature survey carried out regarding waste elimination, productivity improvement and Nut and Bolts and their manufacturing.

Interviews were carried out at Company X Ltd and found out the major problems to the organization which relevant to the industry. Then wastes and losses were found out with the support of Cleaner production Techniques. After that made a suitable questionnaire and got the details from the other companies. Then found the most important problems to be solved and solutions given with the technical knowledge and with the help of external expertise.

Appreciable results were obtained as an overall improvement of 33% while reducing the damaging the cold forging dies of the heading machine by 33%;reducing the rework at lubrication process by 60%; reducing the water consumption at the lubrication process by 50%; reducing the electricity consumption in the lubrication process by 25%; reducing the scrap iron collection by 20%; reducing the consumption of chaser dies by 33%; reducing the buffer stocks in the process by 10% and reducing the labour idling by 30%

As the other Hexagonal Nut and Bolt manufacturing companies in Sri Lanka showed the similar issues in their processes they can use this methodology to solve their issues and face the critical situation successfully.

With the success of this Hexagonal Nut and bolt manufacturing industries, all hardware manufacturing industries and also industries other than hardware manufacturing can follow this with the necessary further studies

Acknowledgement

Words are insufficient to express my sincere gratitude to Dr. S. Piyasena who guided me to carryout this literature survey and complete the report. It is a great pleasure to convey my heartiest gratitude and respect to my external supervisor Eng. Sena Peiris, Director of NCPC who consulted me on carrying out the practical activities.

I acknowledge all those who assisted me for the Getting the observations at USS Engineering (Pvt) ltd. specially, Managing Director, Former Factory Manager, Production Manager as well as the Senior Technical Officer. And also I must thank the members of the other organizations who answered my questionnaire.

Special thank should go to the officers in the Department of Mechanical Engineering, University of Moratuwa, Sri Lanka Standards Institute and National Cleaner Production Center for the assistance corporation and the guidance provided through out.

Finally, I should thank many individuals, including my parents, wife, relatives, friends and colleagues in making this process a success. May be I could not have made it without your supports.



University of Moratuwa, Sri Lanka
Electronic Theses & Dissertations
www.lib.mrt.ac.lk



List of Content

Title	i
Declaration	ii
Abstract	iii
Acknowledge	iv
List of contents	v
Notation	vi
List of tables	vii
List of figures	viii
Chapter 1 - Introduction to the Project	1
1.1 Introduction	1
1.2 Objective	5
1.3 Methodology	6
Chapter 2 - Literature Survey and observations at Company X	8
2.1 Waste Elimination, Productivity and tools	8
2.2 Hexagonal Nut and Bolts Manufacturing	19
2.3 Washing methods	28
Chapter 3 - Implementation of methodology in Company X	29
3.1 Issue Finding	29
3.2 Cause analysis and Solutions	38
3.3 Results	43
3.4 Discussion	44
Chapter 4 - conclusion of the report	
4.1 Area for further study	45
4.2 Conclusion	45
References (Bibliography)	46
Annex A: Productivity improvement tools	A1 – A5
Annex B: Bolt details	B1 – B2
Annex C: Questionnaire and results	C1 - C9

Notation

ASTM	-	American Society for Testing Materials
°C	-	Degree Celsius
CEB	-	Ceylon Electricity Board
CP	-	Cleaner Production
Fig	-	Figure
LECO	-	Lanka Electricity Company Limited
LME	-	London Metal Exchange
MEng	-	Master of engineering
MT	-	Metric Ton
NaNO ₂	-	Sodium Nitrite
NCPC	-	National Cleaner Production Center
PG	-	Post Graduate
SLR	-	Sri Lankan Rupees
SLT	-	Sri Lanka Telecom
TPM	-	Total Productive Maintenance
TQM	-	Total Quality Management
UNEP	-	United Nation's Environment Programme
UNIDO	-	United Nations Industrial Development Organization
USD	-	Dollar of United States America
Zn	-	Zinc



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mtu.ac.lk



LIST OF TABLES

Table 01: Level of difficulties at each step in Cold Forged Nut & Bolt Manufacturing Process

Table 02: The Percentages of answers Received for the questionnaire for Cold Forging Nut and Bolts

Table 03: The Percentages of answers Received for the questionnaire for Hot Forging Nut and Bolts

Table 04: The Percentages of answers Received for the questionnaire for Common Questions

Table 05: Causes for the wastes and losses for Cold Forging Nut and Bolts

Table 06: Causes for the wastes and losses for Hot Forging Nut and Bolts

Table 07: Scrap value of the bar in mm

Table 08: Results obtained for Cold Forging Nut and Bolts

Table 09: Results obtained for Hot Forging Nut and Bolts

Table 10: The questionnaire for Cold Forging Nut and Bolts

Table 11: The Percentages of answers Received for the questionnaire for Hot Forging Nut and Bolts

Table 12: The Percentages of answers Received for the questionnaire for Common Questions

Table 13: The Percentages of answers Received for the questionnaire with weighted average for Cold Forging Nut and Bolts

Table 14: The Percentages of answers Received for the questionnaire with weighted average for Hot Forging Nut and Bolts

Table 15: The Percentages of answers Received for the questionnaire with weighted average for Common Questions

Table 17: The Percentages of answers Received for the questionnaire with weighted average for Hot Forging Nut and Bolts

Table 18: The Percentages of answers Received for the questionnaire with weighted average for Common Questions

LIST OF FIGURES

Figure 1.1: Quoted price for Bolts and Nuts for the year 2009

Figure 1.2: LME Steel Billet prices in year 2009

Figure 1.3: LME Zinc prices in year 2009

Fig 2.1: 5S Cycle

Fig 2.2 Kaizen Cycle

Fig 2.3 TQM Cycle

Fig 2.4 Hex Bolt

Fig 2.5 measuring Hex bolt

Fig 3.1 The lubrication process of Cold Forging Nut & Bolt Manufacturing Process

Fig B.1 Hex Head Cap Screws-Bolts Grade 5 Coarse

Fig B.2 Hex Head Cap Screws-Bolts Grade 8 Coarse

Fig B.3 Hex Head Cap Screws-Bolts Grade 8 Fine



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk