

CHAPTER 4

Conclusion

4.1 Further Study

Further study should be carried out to ensure the sustainability of the solutions given. Capital investment can be done for a hoist system after necessary appraisals for the cold forging Nut and Bolt's lubrication process.

Other than in manufacturing side in following areas improvements can be done

- Optimizing the financial facilities
- Optimizing the transport resources
- Systemization of the documentation

However further studies can be carried out on how these methods can be implemented to other Hardware manufacturing Industries and finally to Industries other than Hardware items manufacturing



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4.2 Conclusion

According to the market situation it is a must to reduce wastes and improve productivity in Hexagonal Nut and Bolt Manufacturing Industry in Sri Lanka. By applying the methodology described, Company X achieved 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%

And 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.

And also other than the Nut and Bolt Industry the companies can use this methodology with the relevant changes and further study.

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ANNEXURE

Annex A01



CP for production processes

For production processes, CP aims:

- (a) To reduce the consumption of raw materials and energy used in the production of one unit of product;
- (b) To eliminate as far as possible the use of toxic and dangerous materials;
- (c) To reduce at source the quantity and toxicity of all emissions and wastes generated and released.

CP for products

For products, Cleaner Production aims to reduce the environmental, health and safety impacts of products:

- Over their entire life cycles
- From raw materials extraction, through manufacturing and use, to the ultimate disposal of the product.



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CP for services

For services, Cleaner Production implies incorporating environmental concerns into the design and delivery of services.

The design of a service is crucial: not just, “Are we doing things right?” but rather, “Are we doing the right things?” and, “Are we doing them the right way?”

Annex A02

The 5S management program facilitates an excellent performance:

Safety: a well organized and orderly workplace is a safer workplace. 5S activities remove clutter, visual indicators alarm people for hazardous situations.

Improving production efficiency: 5S supports a smooth production process in various ways.

Searching for tools is eliminated, flow principles are applied, and tools storage is done where they are needed most. Location indicators visualize how things have been organized, and non conformities are seen at once.

Quality improvement: Daily activities like inspection help to keep the production process in the right condition. Defects are prevented, because deviations are spotted before they result into defects.



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Controlling your workplace: 5S helps to control the workplace by:

- determining what is needed, and where it is needed.
- defining the appropriate location for tools and other materials.

maintaining these standards.

Annex 03

KAIZEN Concept in Our Individual Life

KAIZEN, as you could learn from the definition, is a common word and very natural to individual, continuous improvement in personal life, home life, social life and working life. Everybody deserves to and should be willing to improve himself/herself for the better continually. "If a man has not been seen for three days, his friends should take a good look at him to see what changes have befallen him" quoted from the old Japanese saying, describes how natural KAIZEN is.

Maintenance, Innovation, and KAIZEN

In our concepts, three functions should happen simultaneously within any organizations: Maintenance, Innovation, and KAIZEN. By maintenance, we refer to maintaining the current status, the procedures are set and the standards are implemented. People in the lower level of organization mostly do that, they maintain their standards.

By Innovation, we refer to breakthrough activities initiated by top management, buying new machines, new equipment, developing new markets, directing R&D, change of strategy etc.

In the middle there is KAIZEN, small steps but continuing improvement. KAIZEN should be implemented by the lower/middle management and the workers, with the encouragement and direction of the top. The top management responsibility is to cultivate a KAIZEN working climates and cultures in the organization.

KAIZEN Attitude

The kaizen attitude makes our firm so adept at exploiting new technology, even when we are not its originator. Kaizen-driven firms do not suffer from "not invented here" syndrome. Ideas are not the exclusive preserve of R&D, corporate planning, or market research; every new idea is welcomed and "channels" are forsaken.

Kaizen Technologies, Inc is built on the above concept and "Kaizen" is part of our name, heart, work and is clearly reflected in our solution deliverables.

Annex 04

TQM Process Thinking

TQM requires a new process thinking mindset. We must realize that everything we do is part of a process. Our focus shifts from managing outcomes to managing and improving processes; from what to do to how to do the processes better. Quality performance expands to include how well each part of the process works and the relationship of each part to the process. Also, process improvement focuses on continuously achieving the greatest potential benefit for our customers.

Annex A05

Availability losses:

Breakdowns and changeovers indicate situations where the line is not running while it should be.

Performance losses:

Speed losses and small stops/idling/empty positions indicate the line is running, but is not providing the quantity it should.

Yield losses:

Additionally, when the line producing products, there are losses due to rejects and start-up quality losses.

These losses lead to the Overall Equipment Effectiveness (OEE) indicator, which tells you how efficiently you produce when you have planned to produce. TPM helps you to improve your OEE by providing a structure to quantify these losses, and by subsequently giving priority to the most important ones. TPM provides concepts and tools to achieve both short and longer term improvements.

Annex B01

Hex Head Cap Screws-Bolts Grade 5 Coarse



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

Hex Head Cap Screws-Bolts Grade 8 Coarse



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

Hex Head Cap Screws-Bolts Grade 8 Fine



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

Steel grade 2

Zinc plated low carbon steel. Best for general hardware use where high strength is not required.

Steel grade 5

Made from medium carbon steel, tempered and zinc plated. Best for automotive use and other areas where higher strength is desired.

Steel grade 8

Made from medium carbon alloy steel, tempered, and zinc plated. Best suited for applications where high strength and hardness is required.

Stainless steel 18-8

Stainless steel 18-8 is an alloy of steel with high corrosion resistance. Stainless has become the material of choice for exterior and most marine applications.

Silicon Bronze

Bronze is an alloy of copper with greater strength and corrosion resistance than brass. Most commonly used in wood boat building and restoration.

Hot dipped galvanized

Hot dipped galvanized fasteners are much more corrosion resistant than zinc plated fasteners.

Due to the thickness of the galvanized coating, galvanized bolts will only work with galvanized nuts. For exterior and coastal area use. (ASTM A153)

Grade 5 chrome

A grade 5 fastener with a bright mirror-like finish providing sharp looks for a variety of applications

Annex B02

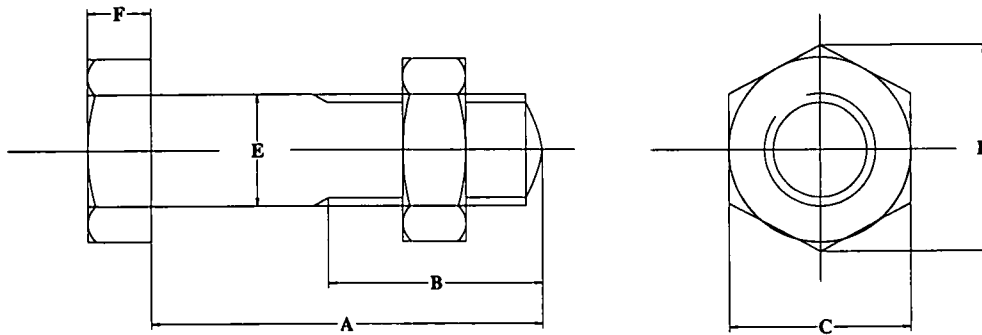



Fig B4: Measurements of the Hexagonal Bolts and Nuts

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- A - Length of the Bolt
 - B - Thread Length
 - C - Width across Flats
 - D - Width across Corners
 - E - Shank Diameter
 - F - Height of the Head

Annex C01

Table 10: The questionnaire for Cold Forging Nut and Bolts

Index	Question	High	Moderate	Low
1.1	What is the Average No of dies damaged in the Heading machine?	100%	0%	0%
1.2	What is the frequency of rework at Lubrication?	100%	0%	0%
1.3	What is the water consumption per each week?	100%	0%	0%
1.4	What is the Electricity consumption at the lubrication process?	100%	0%	0%
1.5	What is the machine breakdown frequency?	50%	0%	50%
1.6	What is the amount of scrap iron collected weekly?	0%	0%	100%
1.7	What is the amount of reworks at Galvanizing?	0%	0%	0%

Annex C02

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

Index	Question	High	Moderate	Low
2.1	What is the frequency of breaking chaser dies?	60%	40%	0%
2.2	What is the amount of scrap iron collected each week?	100%	0%	0%
2.3	Are there machine hours idling?	20%	60%	20%
2.4	Are there labor idling hours?	40%	60%	
2.5	What is the frequency machine breakdown?	40%	40%	20%
2.6	Are there Buffer stocks in the process?	60%	40%	0%
2.7	What is the amount of reworks at Galvanizing?	0%	0%	0%

Annex C03

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

3.1	Does the profit margin becoming a problem for you?	100%	0%	0%
3.2	Are there documentation system problems?	40%	40%	20%
3.3	Are there problems in optimum utilization of transport resource?	60%	20%	20%
3.4	Do you fail to optimize the financial facilities and minimize the finance cost	80%	20%	0%

Annex C04

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

Index	Question	High	Moderate	Low	Weighted average
1.1	What is the Average No of dies damaged in the Heading machine?	100%	0%	0%	3
1.2	What is the frequency of rework at Lubrication?	100%	0%	0%	3
1.3	What is the water consumption per each week?	100%	0%	0%	3
1.4	What is the Electricity consumption at the lubrication process?	100%	0%	0%	3
1.5	What is the machine breakdown frequency?	50%	0%	50%	2
1.6	What is the amount of scrap iron collected weekly?	0%	0%	100%	1
1.7	What is the amount of reworks at Galvanizing?	0%	0%	0%	0

Annex C05

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

Index	Question	High	Moderate	Low	Weighted average
2.1	What is the frequency of breaking chaser dies?	60%	40%	0%	2.6
2.2	What is the amount of scrap iron collected each week?	100%	0%	0%	3
2.3	Are there machine hours idling?	20%	60%	20%	2
2.4	Are there labor idling hours?	40%	60%		2.4
2.5	What is the frequency machine breakdown?	40%	40%	20%	2.2
2.6	Are there Buffer stocks in the process?	60%	40%	0%	2.6
2.7	What is the amount of reworks at Galvanizing?	0%	0%	0%	0

Annex C06

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

Index	Question	High	Moderate	Low	Weighted average
3.1	Does the profit margin becoming a problem for you?	100%	0%	0%	3
3.2	Are there documentation system problems?	40%	40%	20%	2.2
3.3	Are there problems in optimum utilization of transport resource?	60%	20%	20%	2.4
3.4	Do you fail to optimize the financial facilities and minimize the finance cost	80%	20%	0%	2.8

Annex C07

Table 16: The Percentages of answers Received for the questionnaire with sorted weighted average for Cold Forging Nut and Bolts of Moratuwa, Sri Lanka.

Index	Question	High	Moderate	Low	Weighted average
1.1	What is the Average No of dies damaged in the Heading machine?	100%	0%	0%	3
1.2	What is the frequency of rework at Lubrication?	100%	0%	0%	3
1.3	What is the water consumption per each week?	100%	0%	0%	3
1.4	What is the Electricity consumption at the lubrication process?	100%	0%	0%	3
1.5	What is the machine breakdown frequency?	50%	0%	50%	2
1.6	What is the amount of scrap iron collected weekly?	0%	0%	100%	1
1.7	What is the amount of reworks at Galvanizing?	0%	0%	0%	0

Annex C08

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

Index	Question	High	Moderate	Low	Weighted average
2.2	What is the amount of scrap iron collected each week?	100%	0%	0%	3
2.1	What is the frequency of breaking chaser dies?	60%	40%	0%	2.6
2.6	Are there Buffer stocks in the process?	60%	40%	0%	2.6
2.4	Are there labor idling hours?	40%	60%		2.4
2.5	What is the frequency machine breakdown?	40%	40%	20%	2.2
2.3	Are there machine hours idling?	20%	60%	20%	2
2.7	What is the amount of reworks at Galvanizing?	0%	0%	0%	0

Annex C09



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

Index	Question	High	Moderate	Low	Weighted average
3.1	Does the profit margin becoming a problem for you?	100%	0%	0%	3
3.4	Do you fail to optimize the financial facilities and minimize the finance cost	80%	20%	0%	2.8
3.3	Are there problems in optimum utilization of transport resource?	60%	20%	20%	2.4
3.2	Are there documentation system problems?	40%	40%	20%	2.2

